Department of Environmental Engineering (DTU Environment) works at the highest international level to develop new environmentally friendly & sustainable technologies and disseminate this knowledge to society and new generations of engineers. Our activities in research, teaching and innovation is focused on:

- Air, Land & Water Resources
- Environmental Fate & Effect of Chemicals
- Residual Resource Engineering
- Urban Water Systems
- Water Technologies

Read more about the department and its activities at the department homepage.
Head of Department: Professor Thomas Højlund Christensen
Organisational unit: Department

Publications:

**Column leaching from a Danish forest soil amended with wood ashes: fate of major and trace elements**

Application of wood ashes onto two Danish forest soil horizons (A- and O-horizons) was investigated through a series of column experiments for ash dosages of 3, 9 and 30 Mg ha\(^{-1}\). Developments in the composition of the percolating soil solutions were investigated both in a short- (below 0.5 m\(^3\) m\(^{-2}\) of infiltrating water) and long-term perspective (until 2.0 m\(^3\) m\(^{-2}\) of infiltrating water). The higher the ash dosage, the higher the percolation of readily soluble elements (K, Cl, Mg and S) occurred within a short-term perspective. This initial washout of soluble elements resulted in the exchange of ions in the soil, thereby causing other soil bound elements to be released and the pH to decrease temporarily. Wood ash application also promoted an increase in the long-term leaching of As, Cu, K, P and Si beyond the O-horizon layer (until ∼2.0 m\(^3\) m\(^{-2}\)), while the migration of trace elements through this soil horizon appeared to be of limited concern compared with Danish groundwater quality criteria. Relatively similar effects were observed for both the use of 3 and 9 Mg ha\(^{-1}\) dosages on the composition of the percolating soil solutions. Low mobility of Cd, Co, Cr, Cu, Mo, Ni, Pb, Se, V and Zn was observed. The released amounts were generally limited to a few percentage points of their total contents in the columns. The potential
accumulation of trace elements within the forest soil should be evaluated with respect to the specific case, if high ash dosages are intended for spreading.

**General information**

State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering, University of Copenhagen
Authors: Maresca, A. (Intern), Hansen, M. (Ekstern), Ingerslev, M. (Ekstern), Fruergaard Astrup, T. (Intern)
Pages: 91-99
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Main Research Area: Technical/natural sciences

**Publication information**

Journal: Biomass and Bioenergy
Volume: 109
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Ratings:
- BFI (2018): BFI-level 2
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 2
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 3.71 SJR 1.188 SNIP 1.368
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 1.521 SNIP 1.615 CiteScore 4.03
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 1.888 SNIP 1.985 CiteScore 4.36
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 1.678 SNIP 1.823 CiteScore 4.42
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 1.545 SNIP 1.743 CiteScore 3.66
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 1.793 SNIP 2.283 CiteScore 4.74
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 1.931 SNIP 2.254
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 1.743 SNIP 2.187
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 1.609 SNIP 2.073
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 1.454 SNIP 1.77
- Web of Science (2007): Indexed yes
- Scopus rating (2006): SJR 1.292 SNIP 1.954
- Web of Science (2006): Indexed yes
- Scopus rating (2005): SJR 1.226 SNIP 1.398
- Scopus rating (2004): SJR 1.037 SNIP 1.637
A call for action: Improve reporting of research studies to increase the scientific basis for regulatory decision-making

This is a call for action to scientific journals to introduce reporting requirements for toxicity and ecotoxicity studies. Such reporting requirements will support the use of peer-reviewed research studies in regulatory decision-making. Moreover, this could improve the reliability and reproducibility of published studies in general and make better use of the resources spent in research.

General information
State: Accepted/In press
Organisations: National Food Institute, Research Group for Molecular and Reproductive Toxicology, Department of Environmental Engineering, Division of Risk Assessment and Nutrition
Number of pages: 3
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Applied Toxicology
ISSN (Print): 0260-437X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.04 SJR 0.897 SNIP 0.95
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.018 SNIP 1.068 CiteScore 3.02
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.947 SNIP 1.017 CiteScore 2.85
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.807 SNIP 1.074 CiteScore 2.78
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.81 SNIP 1.055 CiteScore 2.61
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Acclimation to extremely high ammonia levels in continuous biomethanation process and the associated microbial community dynamics

Acclimatized anaerobic communities to high ammonia levels can offer a solution to the ammonia toxicity problem in biogas reactors. In the current study, a stepwise acclimation strategy up to 10 g NH4+-N L⁻¹, was performed in mesophilic (37 ± 1 °C) continuously stirred tank reactors. The reactors were co-digesting (20/80 based on volatile solid) cattle slurry and microalgae, a protein-rich, 3rd generation biomass. Throughout the acclimation period, methane production was stable with more than 95% of the uninhibited yield. Next generation 16S rRNA gene sequencing revealed a dramatic microbiome change throughout the ammonia acclimation process. Clostridium ultunense, a syntrophic acetate oxidizing bacteria, increased significantly alongside with hydrogenotrophic methanogen Methanoculleus spp., indicating strong hydrogenotrophic methanogenic activity at extreme ammonia levels (>7 g NH4+-N L⁻¹). Overall, this study demonstrated for the first time that acclimation of methanogenic communities to extreme ammonia levels in continuous AD process is possible, by developing a specialised acclimation AD microbiome.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Zagazig University, IMDEA Energy
Pages: 616-623
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Bioresource Technology
Volume: 247
ISSN (Print): 0960-8524
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
Assessing PCB pollution in the Baltic Sea - An equilibrium partitioning based study

Sediment cores and bottom water samples from across the Baltic Sea region were analyzed for freely dissolved concentrations (C_free), total sediment concentrations (C_T) and the dissolved aqueous fraction in water of seven indicator
PCBs. Ex-situ equilibrium sampling of sediment samples was conducted with polydimethylsiloxane (PDMS) coated glass fibers that were analyzed by automated thermal desorption GC-MS, which yielded PCB concentrations in the fiber coating (CPDMS). Measurements of CPDMS and CT were then applied to determine (i) spatially resolved freely dissolved PCB concentrations; (ii) baseline toxicity potential based on chemical activities (a); (iii) site specific mixture compositions; (iv) diffusion gradients at the sediment water interface and within the sediment cores; and (vi) site specific distribution ratios (KD). The contamination levels were low in the Gulf of Finland and moderate to elevated in the Baltic Proper, with the highest levels observed in the western Baltic Sea. The SPME method has been demonstrated to be an appropriate and sensitive tool for area surveys presenting new opportunities to study the in-situ distribution and thermodynamics of hydrophobic organic chemicals at trace levels in marine environments.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Hamburg University of Applied Sciences, University of the West of Scotland, Helmholtz-Zentrum Geesthacht, Leibniz-Institute for Baltic Sea Research
Authors: Lang, S. (Ekstern), Mayer, P. (Intern), Hursthouse, A. (Ekstern), Kötzke, D. (Ekstern), Hand, I. (Ekstern), Schulz-Bull, D. (Ekstern), Witt, G. (Ekstern)
Pages: 886-894
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**Publication information**

Journal: Chemosphere
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
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Scopus rating (2016): CiteScore 4.39 SJR 1.417 SNIP 1.606
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.51 SNIP 1.57 CiteScore 4.04
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.593 SNIP 1.651 CiteScore 3.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.724 SNIP 1.767 CiteScore 3.92
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.818 SNIP 1.623 CiteScore 3.5
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.961 SNIP 1.515 CiteScore 3.61
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.867 SNIP 1.421
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.836 SNIP 1.573
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.651 SNIP 1.591
ASTA - A method for multi-criteria evaluation of water supply technologies to Assess the most Sustainable Alternative for Copenhagen

Utilities in larger cities have to make complex decisions planning future investments in urban water infrastructure. Changes are driven by physical water stress or political targets for environmental water flows e.g. through the implementation of the European water framework directive. To include these environmental, economic and social sustainability dimensions we introduce a novel multi-criteria assessment method for evaluation of water supply technologies. The method is presented and demonstrated for four alternatives for water supply based on groundwater, rain- & stormwater or seawater developed for augmenting Copenhagen's current groundwater based water supply. To identify the most sustainable technology, we applied rank order distribution weights to a multi-criteria decision analysis to combine the impact assessments of environment, economy and society. The three dimensions were assessed using 1) life-cycle assessment, 2) cost calculations taking operation and maintenance into account and 3) the multi-criteria decision analysis method Analytical hierarchy process. Specialists conducted the life-cycle assessment and cost calculations and the multi-criteria decision analyses were based on a stakeholder workshop gathering stakeholders relevant for the specific case. The workshop reached consensus on three sets of ranked criteria. Each set represented stakeholder perspectives with first priority given to one of the three sustainability dimensions or categories. The workshop reached consensus and when the highest weight was assigned to the environmental dimension of sustainability then the alternative of 'Rain- & stormwater harvesting' was the most sustainable water supply technology; when the highest weight was assigned to the economy or society dimensions then an alternative with 'Groundwater abstraction extended with compensating actions' was considered the most sustainable water supply technology. Across all three sets of ranked weights, the establishment of new well fields is considered the least sustainable alternative.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Department of Management Engineering, Quantitative Sustainability Assessment
Authors: Godskesen, B. (Intern), Hauschild, M. Z. (Intern), Albrechtsen, H. (Intern), Rygaard, M. (Intern)
Number of pages: 10
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Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Science of the Total Environment
Volume: 618
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.09 SJR 1.621 SNIP 1.849
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.674 SNIP 1.642 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.635 SNIP 1.847 CiteScore 4.2
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.527 SNIP 1.759 CiteScore 3.73
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.773 SNIP 1.811 CiteScore 3.7
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.798 SNIP 1.681 CiteScore 3.61
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.644 SNIP 1.513
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.571 SNIP 1.602
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.463 SNIP 1.501
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.407 SNIP 1.491
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.515 SNIP 1.605
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.442 SNIP 1.508
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.123 SNIP 1.305
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.164 SNIP 1.369
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.168 SNIP 1.352
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.063 SNIP 1.081
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.98 SNIP 1.071
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.925 SNIP 0.937

Original language: English
Analytical hierarchy process, Desalination, Economic assessment, Freshwater withdrawal impact, Groundwater abstraction, Life-cycle assessment, Multi-criteria decision analysis, Rain- and stormwater harvesting, Ranked order distribution, Water supply
Bio-Electro-Fenton process for the degradation of Non-Steroidal Anti-Inflammatory Drugs in wastewater

Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are ubiquitous municipal wastewater pollutants of which several are resistant to degradation in conventional wastewater treatment, and represent a major environmental health concern worldwide. An alternative treatment, the bio-electro-Fenton process, has received increasing attention in past years. In this process the strong oxidant \( \cdot \text{HO} \) is formed using the electrons derived from bacterial oxidation of organic substrate. In this work, a laboratory scale microbial electrolysis cell based bio-electro-Fenton process was developed for the treatment of four different NSAIDs. The system was demonstrated to remove low concentration NSAIDs from water and wastewater and all tested parameters (cathode pH, cathode air-flow, cathode Fe\(^{2+} \) concentration, applied voltage, NSAIDs concentration and reaction time) were found to affect the apparent first order rate constant and removal efficiency for NSAIDs. Optimum parameter values were found to be pH = 2, Fe\(^{2+} \) = 7.5 mM, air-flow = 8 mL min\(^{-1} \), applied voltage = 0.3 V; the apparent rate constant was higher for higher NSAIDs initial concentration. For reaction times of 5 hours removal efficiencies were 59%-61% for Ketoprofen, 87%-97% for Diclofenac, 80%-86% for Ibuprofen and 75%-81% for Naproxen. Prolonged reaction times lead to substantial increase in removal efficiencies for Ketoprofen and Naproxen. Finally results obtained with real wastewater show lower removal rate constants than with distilled water matrices suggesting interference from wastewater components in the NSAIDs oxidation process. The results offer insight into future developments of an efficient platform for wastewater treatment technology targeting micropollutants.

General information
State: Accepted/In press
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Water Technologies, University of Aveiro
Authors: Nadais, H. (Ekstern), Li, X. (Intern), Alves, N. (Ekstern), Couras, C. (Ekstern), Andersen, H. R. (Intern), Angelidaki, I. (Intern), Zhang, Y. (Intern)
Number of pages: 48
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Journal: Chemical Engineering Journal
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Ratings:
BFI (2018): BFI-level 2
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BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.34
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 5.68
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.92
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 4.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.92
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Biogas upgrading and utilization: Current status and perspectives

Biogas production is an established sustainable process for simultaneous generation of renewable energy and treatment of organic wastes. The increasing interest of utilizing biogas as substitute to natural gas or its exploitation as transport fuel opened new avenues in the development of biogas upgrading techniques. The present work is a critical review that summarizes state-of-the-art technologies for biogas upgrading and enhancement with particular attention to the emerging biological methanation processes. The review includes comprehensive description of the main principles of various biogas upgrading methodologies, scientific and technical outcomes related to their biomethanation efficiency, challenges that have to be addressed for further development and incentives and feasibility of the upgrading concepts.

General information
State: Accepted/In press
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Padua, Fudan University, University of Southern Denmark
Authors: Angelidaki, I. (Intern), Treu, L. (Intern), Tsapekos, P. (Intern), Luo, G. (Ekstern), Campanaro, S. (Ekstern), Wenzel, H. (Ekstern), Kougias, P. (Intern)
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Biotechnology Advances
ISSN (Print): 0734-9750
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 11.05 SJR 2.681 SNIP 3.146
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.919 SNIP 3.432 CiteScore 10.56
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.922 SNIP 3.757 CiteScore 10.24
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.936 SNIP 4.028 CiteScore 10.71
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Co-digestion and model simulations of source separated municipal organic waste with cattle manure under batch and continuously stirred tank reactors

This study investigates the co-digestion of source separated municipal organic waste (SSMOW), pretreated using a biopulper, and cattle manure both in batch and continuous stirred tank reactors. The optimum co-digestion feeding mixture was consisted of 90% SSMOW and 10% cattle manure on organic matter basis, yielding 443 mLCH4/gVS. The high performance of the co-digestion was explained by the fact that the efficient pulping pretreatment boosted the methane production from SSMOW and that the added livestock slurry provided the buffer capacity to avoid inhibition occurred by intermediates’ accumulation. Moreover, batch assays focused on the effect of inoculum to substrate ratio (ISR) were performed. Results showed that the reduction of ISR had slight impact on extending the lag phase, without affecting the rest kinetic parameters. The efficiency of the codigestion process in continuously fed reactor was comparable with the results obtained from the batch assay (i.e. <95% of the maximum expected value). Finally, the outputs from an applied mathematical model were in good agreement with the experimental data obtained from the continuous reactor operation, demonstrating that the BioModel can serve as a reliable tool to predict the process performance under real-scale conditions.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark
Authors: Tsapekos, P. (Intern), Kougias, P. (Intern), Kuthiala, S. (Ekstern), Angelidaki, I. (Intern)
Pages: 1-6
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Energy Conversion and Management
Volume: 159
Compositional analysis of seasonal variation in Danish residual household waste
Seasonal variations are considered one of the key factors affecting the generation and composition of residual waste. Despite this importance, attempts have not been made to characterize residual household waste consistently by accounting for seasonal variations in waste disposal patterns. To assess differences between seasons and within individual households, we collected residual household waste from the same 101 households in summer, autumn and winter. The waste bags were sorted individually, and residual household waste data (mass and composition) were generated for each household. In total, 3 t of waste were collected, weighed and manually sorted into nine (9) waste fractions. The result of mixed linear model indicated that for this study area, seasonal variations may introduce no significant difference to the mass and composition of residual household waste. However, residual waste generation within a household may change significantly between the seasons. The result also showed that while household size may significantly influence the generation of residual household, the difference in residual household waste composition was not significantly different between household sizes.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Edjabou, M. E. (Intern), Boldrin, A. (Intern), Astrup, T. F. (Intern)
Number of pages: 10
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Publication date: 2018
Main Research Area: Technical/natural sciences

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Journal: Resources, Conservation and Recycling
Volume: 130
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.73 SJR 1.16 SNIP 1.709
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.275 SNIP 1.915 CiteScore 3.98
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.339 SNIP 2.089 CiteScore 3.7
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.432 SNIP 2.184 CiteScore 3.34
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.262 SNIP 1.811 CiteScore 2.91
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.119 SNIP 1.848 CiteScore 2.62
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.163 SNIP 1.82
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.143 SNIP 1.647
Concentrating molasses distillery wastewater using biomimetic forward osmosis (FO) membranes

Treatment of sugarcane molasses distillery wastewater is challenging due to the presence of complex phenolic compounds (melanoidins and polyphenols) having antioxidant properties. Due to zero liquid discharge regulations, Indian distilleries continue to explore effective treatment options. This work examines the concentration of distillery wastewater by forward osmosis (FO) using aquaporin biomimetic membranes and magnesium chloride hexahydrate (MgCl2.6H2O) as draw solution. The operational parameters viz. feed solution and draw solution flow rate and draw solution concentration were optimized using 10% v/v melanoidins model feed solution. This was followed by trials with distillery wastewater. Under the conditions of this work, feed and draw flow rates of 1 L/min and draw solution concentration of 2M MgCl2.6H2O for melanoidins model solution and 3M MgCl2.6H2O for distillery wastewater were optimal for maximum rejection. Rejection of 90% melanoidins, 96% antioxidant activity and 84% COD was obtained with melanoidins model feed, with a corresponding water flux of 6.3 L/m2h. With as-received distillery wastewater, the rejection was similar (85–90%) to the melanoidins solution, but the water flux was lower (2.8 L/m2h). Water recovery from distillery wastewater over 24 h study period was higher with FO (70%) than reported for RO (35–45%). Repeated use of the FO membrane over five consecutive 24 h cycles with fresh feed and draw solutions and periodic cleaning showed consistent average water flux and rejection of the feed constituents.
Converting mesophilic upflow sludge blanket (UASB) reactors to thermophilic by applying axenic methanogenic culture bioaugmentation

The application of thermophilic conditions in anaerobic digesters leads to higher methane production rates and better sanitation of the effluents compared to mesophilic operation. However, an increase in operational temperature is challenging due to the tremendous selective pressure imposed on the microbial consortium. The adaptation of microbial community to a new environment or condition can be accelerated by a process known as “bioaugmentation” or “microbial
community manipulation”, during which exogenous microorganisms harbouring specific metabolic activities are introduced to the reactor. The aim of the current study was to rapidly convert the operational temperature of up-flow anaerobic sludge blanket (UASB) reactors from mesophilic to thermophilic conditions by applying microbial community manipulation techniques. Three different bioaugmentation strategies were compared and it was proven that the injection of axenic methanogenic culture was the most efficient approach leading to improved biomethanation process with 40% higher methane production rate compared to the control reactor. Microbial community analyses revealed that during bioaugmentation, the exogenous hydrogenotrophic methanogen could be encapsulated in granular structures and concomitantly promote the growth of syntrophic fatty acid oxidizing bacteria. The results derived from the current study indicated that microbial community manipulation is an efficient alternative method to speed up transition of UASB reactors from mesophilic to thermophilic conditions.
Coordinating rule-based and system-wide model predictive control strategies to reduce storage expansion of combined urban drainage systems: The case study of Lundtofte, Denmark

The environmental benefits of combining traditional infrastructure solutions for urban drainage (increasing storage volume) with real time control (RTC) strategies were investigated in the Lundtofte catchment in Denmark, where an expensive traditional infrastructure expansion is planned to comply with environmental requirements. A coordinating, rule-based RTC strategy and a global, system-wide risk-based dynamic optimization strategy (model predictive control), were compared using a detailed hydrodynamic model. RTC allowed a reduction of the planned storage volume by 21% while improving the system performance in terms of combined sewer overflow (CSO) volumes, environmental impacts, and utility costs, which were reduced by up to 10%. The risk-based optimization strategy provided slightly better performance in terms of reducing CSO volumes, with evident improvements in environmental impacts and utility costs, due to its ability to prioritize among the environmental sensitivity of different recipients. A method for extrapolating annual statistics from a limited number of events over a time interval was developed and applied to estimate yearly performance, based on the simulation of 46 events over a five-year period. This study illustrates that including RTC during the planning stages reduces the infrastructural costs while offering better environmental protection, and that dynamic risk-based optimisation allows prioritising environmental impact reduction for particularly sensitive locations.
Deciphering the microbial ecology in bio-gas reactors for optimizing the anaerobic digestion process

Anaerobic digestion (AD) is a microbial mediated process where organic compounds are degraded to biogas (CH4 and CO2). AD occurs in many natural anoxic environments and is an essential step for global carbon circle. Engineered AD systems, i.e. biogas reactors, enhance methanogenic activity by applying empirical operational conditions, in order to accelerate the methane production for energetic purposes. In Denmark, biogas produced from AD has a considerable share in renewable energy with the expectation to expand. Thus, the more effective operation of biogas plants will significantly benefit Denmark’s sustainable development. As AD relies on complex microbial activity, a more comprehensive understanding of the AD microbial consortia and their activity provides the fundamental knowledge for process control and optimization.

In AD, the microbial metabolisms are mostly thermodynamically constrained and the obligatory syntrophy is an essential intermediary step. Thus, the majority of AD microbiota remains uncharacterized since in the past it was mainly investigated using cultivated-based methods. The advent of more powerful sequencing technology (i.e. next generation sequencing, NGS) and newly developed bioinformatic methods enable researchers to perform in-situ analyses on uncharacterized microbial communities. The applications of NGS technology were proved to be effective tools to reveal AD microbial ecology. However, the detailed mechanisms of microbial activity are still far from fully elucidated due to the intricacy of AD process.

This Ph.D. project relied on comprehensive investigations of microbial communities in order to optimize the AD process and elucidate the fundamental metabolisms. Specifically, in the case of process optimization, 16S rRNA amplicon sequencing was used to identify, analyse and solve the operational challenges during the start-up of thermophilic up-flow anaerobic sludge blanket (UASB) reactors. To elucidate the microbial metabolisms, genome-centric metagenomics was applied to characterize methanogenic communities degrading a set of defined substrates. In addition, the Ph.D. study also expands the understanding of AD microbial ecology by proposing and characterizing a novel Candidatus species ubiquitously present in AD systems. The start-up of thermophilic UASB reactors was investigated in lab-scale reactors inoculated with mesophilic granules. After increasing the operational temperature from mesophilic to thermophilic, volatile fatty acids (VFAs) and alcohols were found as the main digestion products. Methane production, on the other hand, only initiated after bicarbonate addition as external pH control. The dynamicity of microbial community composition in the granules during the temperature shift suggested that the majority of the mesophilic microbes could not tolerate the thermophilic conditions. Moreover, it was demonstrated that the fermentative thermophiles first evolved in the liquid phase of UASB reactor and then were encapsulated in the granular structure of the sludge. The growth of these bacteria rapidly restored the hydrolysis, acidogenesis and acetogenesis in the reactor. On the contrary, the thermophilic methanogens grew much slower than fermentative bacteria leading to severe process imbalance (i.e. accumulation of VFAs and alcohols). Thus, the evolution of thermophilic methanogens was recognized as the biological ‘bottleneck’ during the temperature transition. To overcome the identified obstacle, bioaugmentation, i.e. provision of exogenous microbes, was proposed to accelerate the microbial community adaptation. The best strategy found to perform bioaugmentation was the injection of axenic methanogenic cultures. This practice significantly increased the thermophilic methane production rate by 40% compared with the control reactor (i.e. without bioaugmentation). The enhancement of methane production was attributed to the evolvement of exogenous Methanothermobacter thermotrophicus and the concomitant growth of its syntrophic partners in the granular structure. The positive effects brought by bioaugmentation were persistent in UASB reactor due to the retention of the microbes in the granular sludge.

For the investigation of the basic microbial metabolism and ecology, methanogenic microbial communities were enriched in a lab-scale continuous stirred-tank reactor (CSTR) fed with synthetic feedstocks. In the experiment, the substrates used were stepwise simplified (i.e. polysaccharide, monosaccharide, short chain fatty acids, acetate) to mimic the four steps of AD process. During the continuous operation, the microbial community was substantially simplified, because the microbes that could not metabolize the specific compounds were washed out. The overall microbial community consisted of only 35 metagenome assembled genomes (MAGs) (31 bacterial and 4 archaeal). The abundance of these MAGs dramatically...
varied in the communities adapted to different substrates. The shifts in microbial community composition indicate that MAGs have specific functional roles in AD food chain and their roles cannot always be physiologically defined in accordance with 4 AD steps. Moreover, the explicit degradation pathways were reconstructed from the functional annotation of MAGs. It is notable that, a novel glucose degradation model was proposed with the syntrophic activity of Clostridiaceae sp. and Methanoculleus thermophilus. In this model, acetate is not produced as intermediate compound. The genome-centric metagenomics reveals a considerable number of MAGs that could not be taxonomically assigned to characterized species. A MAG extracted from co-assembly of 8 AD metagenomes was especially emphasized due to its ubiquity in AD system and its high abundance under specific conditions. From the functional annotation and gene expression profile, it is confirmed that this MAG performs hydrogenotrophic methanogenesis in AD system and is found dominant in the reactors where H2 was added. This genome is present in 40 different samples from both full-scale and lab-scale AD reactors. The MAG was found in higher abundance during thermophilic reactor operations with relatively short hydraulic retention times. The phylogenetic assignment was based on 400 conserved genes and on 16S rRNA genes. The two methods concordantly showed that this MAG is closely related to Methanoculleus bourgensis MS2T. However, the average nucleotide identity between M. bourgensis MS2T and the selected MAG was only 89%, which is too low similarity to assign the MAG at the species level. Thus, we propose a novel Candidatus species inside the Methanoculleus genus. According to the metabolic traits, it is named as Candidatus Methanoculleus thermohydrogenotrophicum, sp. nov.

Overall, the results from this Ph.D. study bring new knowledge on the AD process based on NGS technology. Practically, the gained information regarding microbial community composition and dynamicity was directly used to solve technical challenges in AD operations. Fundamentally, deeper insights into the microbial metabolisms and ecology substantially expanded the current understanding of AD. The revealed knowledge provides pivotal prerequisites for future AD process control and optimization.

General information
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Disaggregation of SMOS soil moisture over West Africa using the Temperature and Vegetation Dryness Index based on SEVIRI land surface parameters
The overarching objective of this study was to produce a disaggregated SMOS Soil Moisture (SM) product using land surface parameters from a geostationary satellite in a region covering a diverse range of ecosystem types. SEVIRI data at 15 minute temporal resolution were used to derive the Temperature and Vegetation Dryness Index (TVDI) that served as SM proxy within the disaggregation process. West Africa (3 N, 26 W; 28 N, 26 E) was selected as a case study as it presents both an important North-South climate gradient and a diverse range of ecosystem types. The main challenge was to set up a methodology applicable over a large area that overcomes the constraints of SMOS (low spatial resolution) and TVDI (requires similar atmospheric forcing and triangular shape formed when plotting morning rise temperature versus fraction of vegetation cover) in order to produce a 0.05 degree resolution disaggregated SMOS SM product at sub-continental scale. Consistent cloud cover appeared as one of the main constraints for deriving TVDI, especially during the rainy season and in the southern parts of the region and a large adjustment window (105x105 SEVIRI pixels) was therefore deemed necessary. Both the original and the disaggregated SMOS SM products described well the seasonal dynamics observed at six locations of in situ observations. However, there was an overestimation in both products for sites in the humid southern regions; most likely caused by the presence of forest. Both TVDI and the associated disaggregated SM product was found to be highly sensitive to algorithm input parameters; especially of conditions of high fraction of vegetation cover. Additionally, seasonal dynamics in TVDI did not follow the seasonal patterns of SM. Still, its spatial heterogeneity was found to be a good proxy for disaggregating SMOS SM data; main river networks and spatial patterns of SM extremes (i.e. droughts and floods) not seen in the original SMOS SM product were revealed in the disaggregated SM product for a test case of July-September 2012. The disaggregation methodology thereby successfully increased the spatial resolution of SMOS SM, with potential application for local drought/flood monitoring of importance for the livelihood of the population of West Africa.

General information
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Precipitation constitutes a major contribution to the flow in urban storm- and wastewater systems. Forecasts of the anticipated runoff flows, created from radar extrapolation and/or numerical weather predictions, can potentially be used to optimize operation in both wet and dry weather periods. However, flow forecasts are inevitably uncertain and their use will ultimately require a trade-off between the value of knowing what will happen in the future and the probability and consequence of being wrong.

In this study we examine how ensemble forecasts from the HIRLAM-DMI-S05 numerical weather prediction (NWP) model subject to three different ensemble post-processing approaches can be used to forecast flow exceedance in a combined sewer for a wide range of ratios between the probability of detection (POD) and the probability of false detection (POFD). We use a hydrological rainfall-runoff model to transform the forecasted rainfall into forecasted flow series and evaluate three different approaches to establishing the relative operating characteristics (ROC) diagram of the forecast, which is a plot of POD against POFD for each fraction of concordant ensemble members and can be used to select the weight of evidence that matches the desired trade-off between POD and POFD. In the first approach, the rainfall input to the model is calculated for each of 25 ensemble members as a weighted average of rainfall from the NWP cells over the catchment where the weights are proportional to the areal intersection between the catchment and the NWP cells. In the second approach, a total of 2825 flow ensembles are generated using rainfall input from the neighbouring NWP cells up to approximately 6 cells in all directions from the catchment. In the third approach, the first approach is extended spatially by successively increasing the area covered and for each spatial increase and each time step selecting only the cell with the highest intensity resulting in a total of 175 ensemble members. While the first and second approaches have the disadvantage of not covering the full range of the ROC diagram and being computationally heavy, respectively, the third approach leads to both a broad coverage of the ROC diagram range at a relatively low computational cost. A broad coverage of the ROC diagram offers a larger selection of prediction skill to choose from to best match to the prediction purpose.

The study distinguishes itself from earlier research in being the first application to urban hydrology, with fast runoff and small catchments that are highly sensitive to local extremes. Furthermore, no earlier reference has been found on the highly efficient third approach using only neighbouring cells with the highest threat to expand the range of the ROC diagram. This study provides an efficient and robust approach to using ensemble rainfall forecasts affected by bias and misplacement errors for predicting flow threshold exceedance in urban drainage systems.
Urban hydrology, Numerical Weather Prediction (NWP), Ensemble Prediction System (EPS), Probability of Detection (POD), Probability of False Detection (POFD), Relative operating characteristic (ROC)

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Effect of different ammonia sources on aceticlastic and hydrogenotrophic methanogens

Ammonium chloride (NH₄Cl) was usually used as a model ammonia source to simulate ammonia inhibition during anaerobic digestion (AD) of nitrogen-rich feedstocks. However, ammonia in AD originates mainly from degradation of proteins, urea and nucleic acids, which is distinct from NH₄Cl. Thus, in this study, the inhibitory effect of a "natural" ammonia source (urea) and NH₄Cl, on four pure methanogenic strains (aceticlastic: Methanosarcina thermophila, Methanosarcina barkeri; hydrogenotrophic: Methanoculleus bourgensis, Methanoculleus thermophilus), was assessed under mesophilic (37°C) and thermophilic (55°C) conditions. The results showed that urea hydrolysis increased pH significantly to unsuitable levels for methanogenic growth, while NH₄Cl had a negligible effect on pH. After adjusting initial pH to 7 and 8, urea was significantly stronger inhibitor with longer lag phases to methanogenesis compared to NH₄Cl. Overall, urea seems to be more toxic on both aceticlastic and hydrogenotrophic methanogens compared to NH₄Cl under the same total and free ammonia levels.

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Enantiomeric profiling of chiral illicit drugs in a pan-European study

The aim of this paper is to present the first study on spatial and temporal variation in the enantiomeric profile of chiral drugs in eight European cities. Wastewater-based epidemiology (WBE) and enantioselective analysis were combined to evaluate trends in illicit drug use in the context of their consumption vs direct disposal as well as their synthetic production routes. Spatial variations in amphetamine loads were observed with higher use in Northern European cities. Enantioselective analysis showed a general enrichment of amphetamine with the R-(−)-enantiomer in wastewater indicating its abuse. High loads of racemic methamphetamine were detected in Oslo (EF = 0.49 ± 0.02). This is in contrast to other European cities where S-(+)-methamphetamine was the predominant enantiomer. This indicates different methods of methamphetamine synthesis and/or trafficking routes in Oslo, compared with the other cities tested. An enrichment of MDMA with the R-(−)-enantiomer was observed in European wastewaters indicating MDMA consumption rather than disposal of unused drug. MDA’s chiral signature indicated its enrichment with the S-(+)-enantiomer, which confirms its origin from MDMA metabolism in humans. HMMA was also detected at quantifiable concentrations in wastewater and was found to be a suitable biomarker for MDMA consumption. Mephedrone was only detected in wastewater from the United Kingdom with population-normalised loads up to 47.7 mg 1000 people−1 day−1. The enrichment of mephedrone in the R-(−)-enantiomer in wastewater suggests stereoselective metabolism in humans, hence consumption, rather than direct disposal of the drug. The investigation of drug precursors, such as ephedrine, showed that their presence was reasonably ascribed to their medical use.

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Evaluation of direct membrane filtration and direct forward osmosis as concepts for compact and energy-positive municipal wastewater treatment

Municipal wastewater treatment commonly involves mechanical, biological and chemical treatment steps to protect humans and the environment from adverse effects. Membrane technology has gained increasing attention as an alternative to conventional wastewater treatment due to increased urbanization. Among the available membrane technologies, microfiltration (MF) and forward osmosis (FO) have been selected for this study due to their specific characteristics, such as compactness and efficient removal of particles. In this study, two treatment concepts were evaluated with regard to their specific electricity, energy and area demands. Both concepts would fulfill the Swedish discharge demands for small- and medium-sized wastewater treatment plants at full scale: (1) direct MF and (2) direct FO with seawater as the draw solution. The framework of this study is based on a combination of data obtained from bench- and pilot-scale experiments applying direct MF and FO, respectively. Additionally, available complementary data from a Swedish full-scale wastewater treatment plant and the literature were used to evaluate the concepts in depth. The results of this study indicate that both concepts are net positive with respect to electricity and energy, as more biogas can be produced compared to that using conventional wastewater treatment. Furthermore, the specific area demand is significantly reduced. This study demonstrates that municipal wastewater could be treated in a more energy- and area-efficient manner with techniques that are already commercially available and with future membrane technology.
Evaluation of moving-bed biofilm sequencing batch reactor (MBSBR) in operating A2O process with emphasis on biological removal of nutrients existing in wastewater

In this study, the performance of moving-bed biofilm sequencing batch reactor in operating the anaerobic/anoxic/oxic (A2O) process for treatment of wastewaters containing nitrogen and phosphorous was evaluated. For this purpose, a pilot system with two bench-scale sequencing batch reactors with a total volume of 30 L and functional volume of 10 L was used. The installation was elaborated using plexiglass, in which 60% of the functional volume consisted of PVC suspended carriers (Kaldnes K3) with a specific surface area of 560 m²/m³. The independent variables used in this study were hydraulic retention time (HRT) (1.5, 2, 2.5, 3, and 3.5 h) and the initial organic load (300, 500, 800, 1000 mg O₂/L). The results showed impressive performance in the case of an initial organic load of 300 mg O₂/L and HRT of 3 h with maximum removal of COD and TN, respectively, by 95.1 and 89.8%. In the case of an initial organic load of 1000 mg O₂/L and HRT of 3.5 h, the maximum total phosphorus removal was 72.3%. Therefore, according to the analysis of data obtained by different HRTs, it was revealed that the system of A2O has greater efficiency in removing organic matter from wastewater in the shortest possible time.

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Organisations: Department of Environmental Engineering, Water Technologies, Islamic Azad University, Guilan University of Medical Sciences, University of Pablo de Olavide, Ryerson University, Kar Higher Education Institute, Isfahan University of Technology
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Evaluation of multi-mode CryoSat-2 altimetry data over the Po River against in situ data and a hydrodynamic model

Coverage of in situ observations to monitor surface waters is insufficient on the global scale, and decreasing across the globe. Satellite altimetry has become an increasingly important monitoring technology for continental surface waters. The ESA CryoSat-2 altimetry mission, launched in 2010, has two novel features. (i) The radar altimeter instrument on board of CryoSat-2 is operated in three modes; two of them reduce the altimeter footprint by using Delay-Doppler processing. (ii) CryoSat-2 is placed on a distinct orbit with a repeat cycle of 369 days, leading to a drifting ground track pattern. The drifting ground track pattern challenges many common methods of processing satellite altimetry data over rivers. This study evaluates the observation error of CryoSat-2 water level observations over the Po River, Italy, against in situ observations. The average RMSE between CryoSat-2 and in situ observations was found to be 0.38 meters. CryoSat-2 was also shown to be useful for channel roughness calibration in a hydrodynamic model of the Po River. The small across-track distance of CryoSat-2 means that observations are distributed almost continuously along the river. This allowed resolving channel roughness with higher spatial resolution than possible with in situ or virtual station altimetry data. Despite the Po River being extensively monitored, CryoSat-2 still provides added value thanks to its unique spatio-temporal sampling pattern.

General information

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Evidence of co-metabolic bentazone transformation by methanotrophic enrichment from a groundwater-fed rapid sand filter

The herbicide bentazone is recalcitrant in aquifers and is therefore frequently detected in wells used for drinking water production. However, bentazone degradation has been observed in filter sand from a rapid sand filter at a waterworks with methane-rich groundwater. Here, the association between methane oxidation and removal of bentazone was investigated with a methanotrophic enrichment culture derived from methane-fed column reactors inoculated with that filter sand. Several independent lines of evidence obtained from microcosm experiments with the methanotrophic enrichment culture, tap water and bentazone at concentrations below 2 mg/L showed methanotrophic co-metabolic bentazone transformation: The culture removed 53% of the bentazone in 21 days in presence of 5 mg/L of methane, while only 31% was removed in absence of methane. Addition of acetylene inhibited methane oxidation and stopped bentazone removal. The presence of bentazone partly inhibited methane oxidation since the methane consumption rate was significantly lower at high (1 mg/L) than at low (1 μg/L) bentazone concentrations. The transformation yield of methane relative to bentazone normalized by their concentration ratio ranged from 58 to 158, well within the range for methanotrophic co-metabolic degradation of trace contaminants calculated from the literature, with normalized substrate preferences varying from 3 to 400. High-resolution mass spectrometry revealed formation of the transformation products (TPs) 6-OH, 8-OH, isopropyl-OH and di-OH-bentazone, with higher abundances of all TPs in the presence of methane. Overall, we found a suite of evidence all showing that bentazone was co-metabolically transformed to hydroxy-bentazone by a methanotrophic culture enriched from a rapid sand filter at a waterworks.

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Scopus rating (2014): SJR 2.957 SNIP 2.727 CiteScore 6.13
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The whole genome sequence of Enterococcus mundtii strain EM01 is reported here. The isolate proved to be the cause of flacherie in Bombyx mori. To date, the genomes of 11 other E. mundtii strains have been sequenced. EM01 is the only strain that displayed active pathological effects on its associated animal species.
Greenhouse gas emissions from wastewater treatment plants: measurements and carbon footprint assessment

The anthropogenic emissions of greenhouse gases (GHGs) into the atmosphere are of great concern, due to their effect on climate change. To curb the increased accumulation of GHGs in the atmosphere, the United Nations Framework Convention on Climate Change promotes the reporting of national anthropogenic GHG emissions. Wastewater treatment plants (WWTPs) emit two potent GHGs, namely methane (CH4) and nitrous oxide (N2O), but also carbon dioxide (CO2), which is not accounted as a GHG, due to its biogenic origin (IPCC, 2006). Currently, CH4 and N2O emissions from WWTPs are estimated according to national and international guidelines. However, it is unknown how well these estimated emissions resemble actual plant-specific CH4 and N2O emissions; therefore, CH4 and N2O emission quantifications are needed to assure the reliable accounting of GHG emissions on the plant scale. Quantifying GHG emissions from WWTPs is a challenging undertaking, since emissions are fugitive, and are occurring across a large area consisting of several smaller sources at different emission heights and physical shapes. In the last two decades, this challenge has been addressed mainly by using on-site point measurements, namely measuring directly on individual emitting sources identified inside the facility. Usually, a single source is either completely encapsulated or partially covered, in order to measure GHG concentration in a known air volume or through a known air flow, i.e. the flux chamber techniques. Complete encapsulation of a single emitting source usually occurs when measuring leakages from biogas bearing process units, while partial coverage usually is used when measuring emissions from surfaces such as open basins surface. In the last few years, plant-integrated measurements have also been performed at WWTPs, using the mobile tracer gas dispersion method (MTDM). This method uses a ground-based remote sensing approach combining the controlled release of tracer gas from the WWTP with atmospheric plume concentration measurements. Since facilities having different plant layouts, and using different process units and technologies could require different applications of the method, further investigations are needed to identify how MTDM can be best applied at WWTPs. In addition to fugitive emissions of CH4 and N2O, WWTPs indirectly emit GHGs, mainly CO2, due to the consumption of chemicals and energy. The carbon footprint assessment allows the quantification of the overall contribution of a WWTP to climate change. The principal aim of this PhD thesis was to implement the MTDM application at WWTPs, in order to quantify plant-integrated CH4 and N2O emissions. Additionally, the influence of analytical instrument characteristics and tracer gas release on MTDM results was investigated. GHG emissions were quantified at six WWTPs, using the MTDM. At two facilities, plant-integrated and on-site point measurement approaches were compared. Finally, the PhD thesis assesses the importance of fugitive GHG emissions in the carbon footprint evaluation of WWTPs. Fair agreement of the plant-integrated CH4 emission rates was obtained when three analytical instruments, with different detection frequencies and precisions, were used in a simultaneous MTDM application at a WWTP. Emission rates differed between 1 and 18% from the mean emission rate quantified by all instruments. In the same campaign, the importance of a high plume signal within a plume traverse was shown, as this resulted in more reliable plant-integrated emission quantifications. An estimation of the MTDM detection limit was introduced by using inverse Gaussian plume modelling. Estimating the lowest detectable emission rate by MTDM was useful when little GHG was emitted from a large area, forcing measurements at a distance so far away that the analytical instrument, due to high atmospheric dilution, could not distinguish the plume from background concentrations within the plume traverse. The introduction of an indicator called “Underestimation due to Tracer Height release” (UTH) was useful in documenting that a potential vertical misplacement of the tracer gas had little influence on the final emission rate quantification. Information provided by UTH is relevant when the plume is traversed relatively close to a facility with emissions occurring from elevated heights, which incurs risk of underestimating the CH4 emission, because tracer gas released from the ground does not mix completely with CH4 potentially emitted from the top of a CH4-bearing process unit. The relevance of correct target gas simulation using proper tracer gas placement was demonstrated by applying MTDM for plant-integrated CH4 quantification. A minor emission rate overestimation was caused by a sideward
Incorporating diffuse radiation into a light use efficiency and evapotranspiration model: An 11-year study in a high latitude deciduous forest

The fraction of diffuse photosynthetic active radiation (PAR) reaching the land surface is one of the biophysical factors regulating carbon and water exchange between terrestrial ecosystems and the atmosphere. This is especially relevant for high-latitude ecosystems, where cloudy days are prevalent. Without considering impacts of diffuse PAR, traditional ‘top-down’ models of ecosystem gross primary productivity (GPP) and evapotranspiration (ET), which use satellite remote sensing observations, are biased towards clear sky conditions. This study incorporated a cloudiness index (CI), an index for the fraction of diffuse PAR, into a joint ‘top-down’ model that uses the same set of biophysical constraints to simulate GPP and ET for a high latitude temperate deciduous forest. To quantify the diffuse PAR effects, CI along with other environmental variables derived from an eleven-year eddy covariance data set were used to statistically explore the independent and joint effects of diffuse PAR on GPP, ET, incident light use efficiency (LUE), evaporative fraction (EF) and ecosystem water use efficiency (WUE). The independent and joint effects of CI were compared from global sensitivity analysis of the ‘top-down’ models. Results indicate that for independent effects, CI increased GPP, LUE, ET, EF and WUE. Analysis of joint effects shows that CI mainly interacted with the radiation intercepted in the canopy (PAR, net radiation and leaf area index) to influence GPP, ET and WUE. Moreover, Ta and vapor pressure saturation deficit played a major role for the joint influence of CI on LUE and ET. In the growing season from May to October, variation in CI accounts for 11.9%, 3.0% and 7.8% of the total variation of GPP, ET and transpiration, respectively. As the influence of CI on GPP is larger than that on ET, this leads to an increase in WUE with CI. Joint GPP and ET model results showed that when including CI, the root mean square errors (RMSE) of daily GPP decreased from 1.64 to 1.45 g C m⁻² d⁻¹ (11.7% reduction) and ET from 15.79 to 14.50 W m⁻² (8.2% reduction). Due to the interaction of diffuse PAR with plant canopies, the largest model improvements using CI for GPP and ET occurred during the growing season and for the transpiration component, as suggested by comparisons to sap flow measurements. Furthermore, our study suggests a potential biophysical mechanism, not considered in other studies: under high diffuse PAR conditions, due to the increased longwave emission from clouds, canopy temperature gets higher and enhances GPP and transpiration in this temperature-limited high latitude ecosystem.
Life cycle assessment of sewage sludge management options including long-term impacts after land application

A life cycle assessment (LCA) was performed on five commonly applied sewage sludge treatment practices: dewatering of mixed sludge (DMS), lime stabilisation of dewatered sludge (LIMS), anaerobic digestion of mixed sludge (ADS), dewatering of anaerobically-digested sludge (DADS) and incineration of dewatered anaerobically-digested sludge (INC).

In the first four scenarios, the sludge residues were applied on agricultural land, while in the fifth scenario ash from sludge incineration was landfilled. It was found that the sludge treatment technology influenced in which processes C and N emissions happened. In general, the INC scenario performed better than or comparably to the scenarios with land application of the sludge. Human toxicity (non-carcinogenic) and eco-toxicity showed the highest normalised impact potentials for all the scenarios with land application. In both categories, impacts were dominated by the application of zinc and copper to agricultural soil. For the eutrophication potentials, different scenarios appeared beneficial depending on the receiving compartment in focus. The fate of P dominated freshwater eutrophication, while the fate of N had a profound effect on all non-toxic impact categories other than freshwater eutrophication. The sensitivity analysis showed that the results were sensitive to soil and precipitation conditions. The ranking of scenarios was affected by local conditions for marine eutrophication. Overall, the present study highlighted the importance of including all sludge treatment stages and conducting a detailed N flow analysis, since the emission of reactive N into the environment is the major driver for almost all non-toxic impact categories.
Fish early life stage (FELS) tests (OECD test guideline 210) are widely conducted to estimate chronic fish toxicity. In these tests, fish are exposed from the embryonic to the juvenile life stage. In order to analyse whether certain modes of action are related to high toxic ratios (TR, i.e., ratios between experimental effect and baseline toxicity) and/or acute-to-chronic ratios (ACR) in the FELS test effect concentrations for 183 compounds were extracted from the US EPA ecotoxicity database. Analysis of effect concentration of narcotic compounds indicated that baseline toxicity could be observed in the FELS test at similar concentrations as in acute fish toxicity test. All non-narcotic modes of action were associated with higher TRs with median values ranging from 4 to 9.3*10^4 (uncoupling<reactivity<neuromuscular toxicity<methemoglobin formation<endocrine disruption<extracellular matrix formation inhibition). Four modes of action (were also found to be associated with high ACRs: (1) lysyl oxidase inhibition leading to notochord distortion, (2) putative methemoglobin formation or haemolytic anemia, (3) endocrine disruption, and (4) compounds with neuromuscular toxicity. It was discussed that for the prediction of effect concentrations in the FELS test with alternative test systems, endpoints targeted to the modes of action of compounds with enhanced TR or ACR could be used to trigger FELS tests or even replace these tests.
Microbial degradation of pesticides in rapid sand filters used for drinking water treatment

Groundwater is used as drinking water source all over the world. However, large parts are contaminated by pesticides at low concentrations (sub µg/L), due to anthropogenic activities. These pesticides can adversely impact human health, and have legal implications. Thus, it is important to identify sustainable methods to remove pesticides from polluted water sources. Aeration of anaerobic groundwater, followed by biological rapid sand filtration is a widespread technology in drinking water treatment. Even though these systems are not designed for removal of trace contaminants, they have shown potential for microbial degradation of pesticides and their degradation products. If pesticides can be removed in rapid sand filters, it is of large commercial interest due to the importance in maintaining a simple, sustainable water treatment. To take advantage of the microbial pesticide degradation and identify associated risks, it is necessary to understand the extent of pesticide degradation and the governing microbial processes in the water treatment.

The objective of this PhD thesis was to investigate the potential for microbial pesticide degradation at waterworks treating groundwater and to investigate, which microbial processes govern the degradation, in order to suggest how pesticide degradation can be stimulated in water treatment systems.

In a full-scale waterworks the rapid sand filters removed a phenoxy acid (herbicide) contamination from drinking water and investigations showed a potential for removing several pesticides in filter sand from different waterworks. The largest biological pesticide removal was observed in filter sand from a waterworks characterised by methane-rich groundwater. Thus, it was investigated for a connection between pesticide degradation and methane oxidation.

In an enrichment culture, methanotrophs contributed to the degradation of phenoxy acids. However, a phenoxy acid was degraded in filter sand from 10 different waterworks receiving groundwater with varying concentrations and absence of methane. The omnipresent phenoxy acid degradation demonstrated, that degradation in rapid sand filters was not associated with methane oxidation. Based on the present investigations and literature, it was suggested that phenoxy acid degradation in rapid sand filters is due to primary metabolism, and that degradation might be stimulated by enriching naturally occurring specific degraders in the sand filters upon exposure to phenoxy acid contaminated groundwater.

Transformation yields describing the bentazone removal versus the methane oxidation were in same order of magnitude for all investigated media: methanotrophic enrichment cultures, filter sand and biomass from aeration tanks, which strongly indicated that the same degradation process governed bentazone removal in the different media. It was suggested that full-scale waterworks operates like a sequential reactor system, where methanotrophs are grown in the aeration tanks and transported to the rapid sand filters where they can perform co-metabolic pesticide biodegradation. It was suggested that bentazone removal can be stimulated at waterworks, by stimulating growth of methanotrophs.

Overall, this PhD demonstrated a substantial potential for biological pesticide degradation in drinking water treatment systems. While the omnipresent phenoxy acid degradation potential was probably due to specific degraders, bentazone degradation was connected with the methane oxidation. Based on the present investigations and literature, it was suggested that phenoxy acid degradation can be stimulated by enrichment of naturally occurring degraders in filter sand, and that bentazone degradation can be stimulated by stimulating growth of methanotrophs in the water treatment.
Microbial electrochemical separation of CO₂ for biogas upgrading

Biogas upgrading to natural gas quality has been under focus the recent years for increasing the utilization potential of biogas. Conventional methods for CO₂ removal are expensive and have environmental challenges, such as increased emissions of methane in the atmosphere with serious greenhouse impact. In this study, an innovative microbial electrochemical separation cell (MESC) was developed to in-situ separate and regenerate CO₂ via alkali and acid regeneration. The MESC was tested under different applied voltages, inlet biogas rates and electrolyte concentrations. Pure biomethane was obtained at 1.2 V, inlet biogas rate of 0.088 mL/h/mL reactor and NaCl concentration of 100 mM at a 5-day operation. Meanwhile, the organic matter of the domestic wastewater in the anode was almost completely removed at the end. The study demonstrated a new sustainable way to simultaneously upgrade biogas and treat wastewater which can be used as proof of concept for further investigation.
Monitoring and modeling of nitrogen conversions in membrane-aerated biofilm reactors: Effects of intermittent aeration

Nitrogen can be removed from sewage by a variety of physicochemical and biological processes. Due to the high removal efficiency and relatively low costs, biological processes have been widely adopted for treating nitrogen-rich wastewaters. Among the biological technologies, biofilm processes show great advantages as compared to suspended growth processes, allowing for biomass accumulation and retention without the need of external solid separation devices. The decoupling of solids retention from hydraulic retention is especially useful for slow-growing microorganisms, such as nitrifying bacteria, e.g. ammonium-oxidizing bacteria (AOB) and nitrite-oxidizing bacteria (NOB), and anaerobic ammonium-oxidizing bacteria (AnAOB), which are involved in ammonium (NH4+) removal process.

Stability of engineered biological processes requires an appropriate balance between activities of the main microbial groups involved in the system. However, finding proper operational conditions is especially challenging in bio-films. On the one hand, the existence of strong spatial chemical gradients within biofilms increases the difficulty to prescribe environmental conditions that favor any desired biological process. On the other hand, the presence of multiple simultaneous chemical gradients complicates the performance optimization. Mathematical modeling offers a way to describe and analyze multi-ple processes that occur simultaneously in time and space in biofilm systems.

This PhD project investigated NH4+ removal process in membrane-aerated biofilm reactors (MABRs), focusing on intermittent aeration, especially the application of intermittent aeration. Compared to conventional biofilms which are characterized by co-diffusion, MABRs display counter-diffusion fluxes of substrates: oxygen is supplied through the membrane, whilst NH4+ is provided from the bulk liquid phase. The counter substrate supply not only offers flexible aeration control, but also supports the development of a unique microbial community and spatial structure inside the biofilm. In this study, lab-scale MABRs were operated under two types of aeration control: continuous versus intermittent aeration. Long-term reactor performance was monitored. Based on bulk measurements of NH4+, nitrite (NO2-) and nitrate (NO3-), microbial activities of individual functional guilds were evaluated. It was found that NOB suppression occurred under intermittent aeration, but not under continuous aeration. Relative aeration duration and aeration intermittency were two effective operational factors in regulating MABR performance under intermittent aeration. Besides daily bulk monitoring, in situ microprofiles of dissolved oxygen (DO), pH, and nitrous oxide (N2O) were performed. The significant temporal fluctuations in local biofilm pH (not DO) during aeration control suggested that pH-related effects drive the changing microbial activities under intermittent aeration, as compared to continuous aeration. Total N2O emissions were dramatically reduced at the onset of intermittent aeration, due to the development of an anoxic N2O reduction zone by hetero-trophic bacteria (HB).
To further investigate the causal link between NOB suppression and aeration regime change, a 1-dimensional (1-D) multispecies nitrifying biofilm model was developed in Aquasim software, incorporating a pH calculation. Kinetic parameters to be estimated were chosen based on a local sensitivity analysis, and were estimated from in situ microprofiles. With the calibrated model, I identified that the periodically varying free ammonia inhibition, which was associated with transient pH variations, was the likely key factor causing NOB suppression in intermittently-aerated nitrifying MABRs.

To further investigate the mechanisms of N2O mitigation under aeration control, the 1-D biofilm model was extended to a partial nitritation-anammox (PNA) biofilm model, including description of all relevant biological N2O production pathways. Sensitive kinetic parameters were estimated with long-term bulk performance data. With the calibrated model, roles of HB and AnAOB were discussed and evaluated in mitigating N2O emissions in auto-trophic nitrogen removal MABRs. Moreover, I developed a 1-D biofilm model in Matlab software describing the counter-diffusion PNA process, aiming at an improved model calibration/evaluation for the highly variable N2O emissions. Overall, a combination of experimental and modeling efforts were implemented to study nitrogen conversions in MABRs. The results showed that intermittent aeration was an efficient strategy to regulate microbial activities in counter-diffusion biofilms, achieving an energy-efficient NH4+ removal process with low N2O emissions.

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Authors: Ma, Y. (Intern), Smets, B. F. (Intern)
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Monitoring and modeling of nitrogen conversions in membrane-aerated biofilm reactors: Effects of intermittent aeration Publication: Research › Ph.D. thesis – Annual report year: 2018

Nitrous oxide production in intermittently aerated Partial Nitritation-Anammox reactor: oxic N₂O production dominates and relates with ammonia removal rate
Emissions of the greenhouse gas nitrous oxide from the Partial Nitritation-Anammox process are of concern and can determine the carbon footprint of the process. In order to reduce nitrous oxide emissions intermittent aeration regimes have been shown to be a promising mode of operation, possibly due to an effective control of accumulation of nitrogen intermediates. However, due to frequent changes of redox conditions under intermittent aeration regimes, nitrous oxide production and emissions are dynamic. In this study the production and emission dynamics of nitrous oxide in an intermittently aerated sequencing batch reactor were monitored in high temporal resolution, the contribution of different redox conditions to overall nitrous oxide production was quantified and the most relevant factors for nitrous oxide production were identified. The average fraction of nitrous oxide produced (per unit ammonium removed) was 1.1 ± 0.5%. Cycle-averaged approx. 80% of nitrous oxide was produced during aerated phases, the remaining 20% were produced during non-aerated phases. Yet, the intra-cycle dynamics of nitrous oxide were substantial. The net-production rate of nitrous oxide during aerated phases correlated with the ammonia removal rate, whereas the concentration of nitrite determined the production during non-aerated phases. While aerated phases contributed predominantly at the beginning of reactor cycles, non-aerated phases became the dominant source of nitrous oxide at the end. Particularly low net-production rates were observed at ammonia removal rates below 5 mg NH3-N*gVSS−1*L−1, when the fraction of nitrous oxide produced was 0.011 ± 0.004% (per ammonia removed). Based on the nitrous oxide dynamics and correlations, reactor operation at relatively low nitrogen loadings (below 100 mg NH4+-N*L−1), ammonia removal rates of approx. 5 mg NH3-N*gVSS−1*L−1 and nitrite concentrations below 1 mg NO2−1-N*L−1 appears as beneficial for low emission of nitrous oxide.

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Novel method reveals a narrow phylogenetic distribution of bacterial dispersers in environmental communities exposed to low hydration conditions

In this study, we developed a method that provides community-level surface dispersal profiles under controlled hydration conditions from environmental samples and enables us to isolate and uncover the diversity of the fastest bacterial dispersers. The method expands on the Porous Surface Model (PSM), previously used to monitor dispersal of individual bacterial strains in liquid films at the surface of a porous ceramic disc. The novel procedure targets complex communities and captures the dispersed bacteria on a solid medium for growth and detection. The method was first validated by distinguishing motile Pseudomonas putida and Flavobacterium johnsoniae strains from their non-motile mutants. Applying
the method to soil and lake water bacterial communities showed that community-scale dispersal declined as conditions became drier. However, for both communities, dispersal was detected even under low hydration conditions (matric potential: -3.1 kPa), previously proven too dry for P. putida KT2440 motility. We were then able to specifically recover and characterize the fastest dispersers from the inoculated communities. For both soil and lake samples, 16S rRNA gene amplicon sequencing revealed that the fastest dispersers were substantially less diverse than the total communities. The dispersing fraction of the soil microbial community was dominated by Pseudomonas which increased in abundance at low hydration conditions, while the dispersing fraction of the lake community was dominated by Aeromonas and, under wet conditions (-0.5 kPa), also by Exiguobacterium. The results gained in this study bring us a step closer to assessing the dispersal ability within complex communities under environmentally relevant conditions. IMPORTANCE Dispersal is a key process of bacterial community assembly. Yet, very few attempts have been made at assessing bacterial dispersal at the community level as focus has previously been on pure culture studies. A crucial factor for dispersal in habitats where hydration conditions vary, such as soils, is the thickness of the liquid films surrounding solid surfaces, but little is known on how the ability to disperse in such films varies within bacterial communities. Therefore, we developed a method to profile community dispersal and identify fast dispersers on a rough surface resembling soil surfaces. Our results suggest that within the motile fraction of a bacterial community only a minority of the bacterial types are able to disperse in the thinnest liquid films. During dry periods, these efficient dispersers can gain a significant fitness advantage through their ability to colonize new habitats ahead of the rest of the community.

General information
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Organisations: Department of Environmental Engineering, Water Technologies, University of Copenhagen, Geological Survey of Denmark and Greenland
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On the contribution of reclaimed wastewater irrigation to the potential exposure of humans to antibiotics, antibiotic resistant bacteria and antibiotic resistance genes - NEREUS COST Action ES1403 position paper
Antibiotic resistance (AR) is becoming a worldwide threat due to the increasing occurrence of antibiotic-resistant pathogenic bacterial strains. There is a general consensus about the potential implications of the use of antibiotics in livestock on the onset of antibiotic resistant bacteria (ARB), mainly through meat consumption. However, the ever-increasing use of reclaimed wastewater (RWW) in agriculture may also contribute significantly to the non-accounted exposure to antibiotics, ARB, and antibiotic resistance genes (ARGs). This position paper aims at evaluating the current knowledge concerning the occurrence of antibiotics, ARBs, and ARGs in edible parts of different common crops irrigated with RWW. We will discuss which regulations on the use of RWW may contribute to the minimization of the prevalence of these contaminants in crops, and provide recommendations on how to minimize the impact of these practices.

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Organisations: Department of Environmental Engineering, Environmental Chemistry, CSIC, Ministry of Agriculture and Natural Resources Cyprus, University of Cyprus, Universite de Reims Champagne-Ardenne, Aristotle University of Thessaloniki
Optical technologies applied alongside on-site and remote approaches for climate gas emission quantification at a wastewater treatment plant

Plant-integrated and on-site gas emissions were quantified from a Swedish wastewater treatment plant by applying several optical analytical techniques and measurement methods. Plant-integrated CH4 emission rates, measured using mobile ground-based remote sensing methods, varied between 28.5 and 33.5 kg CH4 h−1, corresponding to an average emission factor of 5.9% as kg CH4 (kg CH4production) −1, whereas N2O emissions varied between 4.0 and 6.4 kg h−1, corresponding to an average emission factor of 1.5% as kg N2O-N (kg TN influent) −1. Plant-integrated NH3 emissions were around 0.4 kg h−1, corresponding to an average emission factor of 0.11% as kg NH3-N (kg TN removed) −1. On-site emission measurements showed that the largest proportions of CH4 (70%) and NH3 (66%) were emitted from the sludge treatment line (mainly biosolid stockpiles and the thickening and dewatering units), while most of the N2O (82%) was emitted from nitrifying trickling filters. In addition to being the most important CH4 source, stockpiles of biosolids exhibited different emissions when the sludge digesters were operated in series compared to in parallel, thus slightly increasing substrate retention time in the digesters. Lower CH4 emissions and generally higher N2O and NH3 emissions were observed when the digesters were operated in series. Loading biosolids onto trucks for off-site treatment generally resulted in higher CH4, N2O, and NH3 emissions from the biosolid stockpiles. On-site CH4 and N2O emission quantifications were approximately two-thirds of the plant-integrated emission quantifications, which may be explained by the different timeframes of the approaches and that not all emission sources were identified during on-site investigation.
Off-site gas emission quantifications, using ground-based remote sensing methods, thus seem to provide more comprehensive total plant emissions rates, whereas on-site measurements provide insights into emissions from individual sources.

**General information**

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Organisations: Department of Environmental Engineering, Air, Land & Water Resources, FluxSense AB, Gryaab AB
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Scopus rating (2012): SJR 2.966 SNIP 2.456 CiteScore 5.15
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ISI indexed (2011): ISI indexed yes
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Scopus rating (2010): SJR 2.582 SNIP 2.196
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Scopus rating (2009): SJR 2.319 SNIP 2.225
Web of Science (2009): Indexed yes
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Scopus rating (2008): SJR 2.065 SNIP 2.19
Web of Science (2008): Indexed yes
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Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.895 SNIP 2.214
Web of Science (2006): Indexed yes
Ozonation control and effects of ozone on water quality in recirculating aquaculture systems

To address the undesired effect of chemotherapeutants in aquaculture, ozone has been suggested as an alternative to improve water quality. To ensure safe and robust treatment, it is vital to define the ozone demand and ozone kinetics of the specific water matrix to avoid ozone overdose. Different ozone dosages were applied to water in freshwater recirculating aquaculture systems (RAS). Experiments were performed to investigate ozone kinetics and demand, and to evaluate the effects on the water quality, particularly in relation to fluorescent organic matter. This study aimed at predicting a suitable ozone dosage for water treatment based on daily ozone demand via laboratory studies. These ozone dosages will be eventually applied and maintained at these levels in pilot-scale RAS to verify predictions. Selected water quality parameters were measured, including natural fluorescence and organic compound concentration changes during ozonation. Ozone reactions were described by first order kinetics. Organic matter, assessed as chemical oxygen demand and fluorescence, decreased by 25% (low O3), 30% (middle O3) and 53% (high O3), while water transmittance improved by 15% over an 8-day period. No fish mortality was observed. Overall, this study confirms that ozone can improve RAS water quality, provides a better understanding of the ozone decay mechanisms that can be used to define further safe ozone treatment margins, and that fluorescence could be used as a monitoring tool to control ozone. This study might be used as a tool to design ozone systems for full-scale RAS by analysing water sample from the specific RAS in the laboratory.

**General information**

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**Organisations:** Department of Environmental Engineering, Water Technologies, National Institute of Aquatic Resources, Section for Aquaculture, Water ApS
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Pesticide use in the wheat-maize double cropping systems of the North China Plain: Assessment, field study, and implications

In the North China Plain (NCP), rising inputs of pesticides have intensified the environmental impact of farming activities in recent decades by contributing to surface water and groundwater contamination. In response to this, the Chinese
government imposed stricter regulations on pesticide approval and application, and better monitoring strategies are being
developed. However, sufficient and well-directed research on the accumulation and impact of different pesticides is
needed for informed decision-making. In this study, current pesticide use, and recent and current research on water
contamination by pesticides in the NCP are reviewed and assessed. Additionally, a small-scale field study was performed
to determine if residuals from currently-used pesticides in the NCP can be detected in surface water, and in connected
shallow groundwater. The contaminants of interest were commonly used pesticides on winter wheat-summer maize fields
(the dominant cropping system in the NCP), such as 2,4-D and atrazine. Sampling took place in May, July, and October
2013; and March 2014. Results from our literature research showed that sampling is biased towards surface water
monitoring. Furthermore, most studies focus on organic chlorinated pesticides (OCPs) like the isomers of
dichlorodiphenyltrichloroethane (DDT) and hexachlorocyclohexane (HCH), which were banned in China in 1983. However,
currently-used herbicides like 2,4-D and atrazine were detected in river water and groundwater in all samplings of our field
study. The highest concentrations of 2,4-D and atrazine were found in the river water, ranging up to 3.00 and 0.96μg/L,
respectively. The monitoring of banned compounds was found to be important because several studies indicate that they
are still accumulating in the environment and/or are still illegally in use. However, supported by our own data, we find that
the monitoring in groundwater and surface water of currently permitted pesticides in China needs equal attention, and
should therefore be increased.

**General information**

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Organisations: Department of Environmental Engineering, Water Resources Engineering, Geological Survey of Denmark
and Greenland, Chinese Academy of Sciences
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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 5.09 SJR 1.621 SNIP 1.849
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.674 SNIP 1.642 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.635 SNIP 1.847 CiteScore 4.2
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.527 SNIP 1.759 CiteScore 3.73
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ISI indexed (2012): ISI indexed yes
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Scopus rating (2010): SJR 1.644 SNIP 1.513
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Phytoscreening for vinyl chloride in groundwater discharging to a stream

This study applies an optimized phytoscreening method to locate a chlorinated ethene plume discharging into a stream. To evaluate the conditions most suitable for successful phytoscreening, trees along the stream bank were monitored through different seasons with different environmental conditions and hence different uptake/loss scenarios. Vinyl chloride (VC) as well as cis-dichloroethylene (cis-DCE), trichloroethylene (TCE), and tetrachloroethylene (PCE) were detected in the trees, documenting that phytoscreening is a viable method to locate chlorinated ethene plumes, including VC, discharging to streams. The results reveal, that phytoscreening for VC is more sensitive to environmental conditions affecting transpiration than for the other chlorinated ethenes detected. Conditions leading to higher groundwater uptake by transpiration than contaminant loss by diffusion from the tree trunks are optimal (e.g., low relative humidity, plentiful hours of sunshine and an intermediate air temperature). Additionally, low precipitation prior to the sampling event is beneficial, as uptake of infiltrating precipitation dilutes the concentration in the trees. All chlorinated ethenes were sensitive to dilution by clean precipitation and in some months, this resulted in no detection of contaminants in the trees at all. Under optimal environmental conditions the tree cores allowed detection of chlorinated solvents and their metabolites in the underlying groundwater. Whereas, for less ideal conditions there was a risk of no detection of the more volatile VC. This study is promising for the future applicability of phytoscreening to locate shallow groundwater contamination with the degradation products of chlorinated solvents.

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Organisations: Department of Environmental Engineering, Water Resources Engineering, Environmental Chemistry
Authors: Ottosen, C. B. (Intern), Rønde, V. K. (Intern), Trapp, S. (Intern), Bjerg, P. L. (Intern), Broholm, M. M. (Intern)
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Three distinctive start-up strategies of biogas reactors fed with source-sorted organic fraction of municipal solid waste were investigated to reveal the most reliable procedure for rapid process stabilization. Moreover, the experimental results were compared with mathematical modeling outputs. The initial inoculations to start-up the reactors were 10, 50 and 100% of the final working volume. While a constant feeding rate of 7.8gVS/d was considered for the control reactor, the organic loading rate for fed-batch reactors with 10 and 50% inoculation was progressively increased during a period of 60 and 13 days, respectively. The results clearly demonstrated that an exponentially feeding strategy, considering 50% inoculation relative to final volume, can significantly decrease the alternatively prolonged period to reach steady conditions, as observed by high biogas and methane production rates. The combination of both experimental and modelling/simulation succeeded in optimizing the start-up process for anaerobic digestion of biopulp under mesophilic conditions.
TiO2 is ubiquitously present in a wide range of everyday items, both as an intentionally incorporated additive and naturally occurring constituent. It can be found in a wide range of consumer products, including personal care products, food contact materials, and textiles. Normal use of these products may lead to consumer and/or environmental exposure to TiO2, possibly in form of nanoparticles. The aim of this study is to perform a leaching test and apply state-of-the-art methods to investigate nano-TiO2 and total Ti release from five types of commercially available conventional textiles: table placemats, wet wipes, microfiber cloths, and two types of baby bodysuits, with Ti contents ranging from 2.63 to 1448 μg/g. Released particle analysis was performed using conventional and single particle inductively coupled plasma mass spectrometry (ICP-MS and spICP-MS), in conjunction with transmission electron microscopy (TEM), to measure total and particulate TiO2 release by mass and particle number, as well as size distribution. Less than 1% of the initial Ti content was released over 24 h of leaching, with the highest releases reaching 3.13 μg/g. The fraction of nano-TiO2 released varied among fabric types and represented 0–80% of total TiO2 release. Particle mode sizes were 50–75 nm, and TEM imaging revealed particles in sizes of 80–200 nm. This study highlights the importance of using a multi-method approach to obtain quantitative release data that is able to provide an indication regarding particle number, size distribution, and mass concentration, all of which can help in understanding the fate and exposure of nanoparticles.

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**Organisations:** Department of Environmental Engineering, Environmental Chemistry

**Authors:** Mackevica, A. (Intern), Olsson, M. E. (Intern), Hansen, S. F. (Intern)

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- Scopus rating (2016): CiteScore 1.74 SJR 0.485 SNIP 0.555
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.569 SNIP 0.689 CiteScore 1.97
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.663 SNIP 0.868 CiteScore 2.17
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.749 SNIP 1.013 CiteScore 2.54
Regulating combined sewage discharges to support EU Water Framework Directive ambitions in natural water bodies

General information
State: Published
Authors: Vezzaro, L. (Intern), Brudler, S. (Intern), McKnight, U. S. (Intern), Rasmussen, J. J. (Ekstern), Arnbjerg-Nielsen, K. (Intern)
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Publication information
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Original language: English
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
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Remediation of incomplete nitrification and capacity increase of biofilters at different drinking water treatment plants through copper dosing
Drinking water treatment plants based on groundwater may suffer from incomplete ammonium removal, which deteriorates drinking water quality and constrains water utilities in the operation of their plants. Ammonium is normally removed through nitrification in biological granular media filters, and recent studies have demonstrated that dosing of copper can stimulate the removal of ammonium. Here, we investigated if copper dosing could generically improve ammonium removal of biofilters, at treatment plants with different characteristics. Copper was dosed at ≤1.5μg Cu/L to biofilters at 10 groundwater treatment plants, all of which had displayed several years of incomplete nitrification. Plants exceeded the Danish national water quality standard of 0.05mg NH₄+/L by a factor of 2–12. Within only 2-3 weeks of dosing, ammonium removal rates increased significantly (up to 150%). Nitrification was fully established, with ammonium effluent concentrations of <0.01mg NH₄+-N/L at most plants, regardless of the differences in raw water chemistry, ammonium loading rates, filter design and operation, or treatment plant configuration. However, for filters without primary filtration, it took longer time to reach complete ammonium removal than for filters receiving prefiltered water, likely due to sorption of copper to iron oxides, at plants without prefiltration. With complete ammonium removal, we subjected two plants to short-term loading rate upshifts, to examine the filters’ ability to cope with loading rate variations. After 2 months of dosing and an average loading rate of 1.0g NH₄+-N/m³ filter material/h, the loading rate was upshifted by 50%. Yet, a filter managed to completely remove all the influent ammonium, showing that with copper dosing the filter had extra capacity to remove ammonium even beyond its normal loading rates. Depth sampling revealed that the ammonium removal rate of the filter's upper 10cm increased more than 7-fold from 0.67 to 4.90g NH₄+-N/m³/h, and that nitrite produced from increased ammonium oxidation was completely oxidized further to nitrate. Hence, no problems with nitrite accumulation or breakthrough occurred. Overall, copper dosing generically enhanced nitrification efficiency and allowed a range of quite different plants to meet water quality standards, even at increased loading rates. The capacity increase is highly relevant in practice, as it makes filters more robust towards sudden ammonium loading rate variations.

**General information**

State: Published

Organisations: Department of Environmental Engineering, Urban Water Systems, Krüger A/S

Authors: Wagner, F. B. (Intern), Borch Nielsen, P. (Ekstern), Boe-Hansen, R. (Ekstern), Albrechtsen, H. (Intern)

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Scopus rating (2016): CiteScore 7.49 SJR 2.629 SNIP 2.558

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 2

Scopus rating (2015): SJR 2.689 SNIP 2.507 CiteScore 6.63

Web of Science (2015): Indexed yes

BFI (2014): BFI-level 2

Scopus rating (2014): SJR 2.957 SNIP 2.727 CiteScore 6.13

Web of Science (2014): Indexed yes

BFI (2013): BFI-level 2

Scopus rating (2013): SJR 2.956 SNIP 2.693 CiteScore 6.02

ISI indexed (2013): ISI indexed yes

Web of Science (2013): Indexed yes

BFI (2012): BFI-level 2

Scopus rating (2012): SJR 2.966 SNIP 2.456 CiteScore 5.15

ISI indexed (2012): ISI indexed yes

Web of Science (2012): Indexed yes

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Scopus rating (2011): SJR 2.867 SNIP 2.374 CiteScore 5.43

ISI indexed (2011): ISI indexed yes

Web of Science (2011): Indexed yes
Testing lagoonal sediments with early life stages of the copepod Acartia tonsa (Dana): An approach to assess sediment toxicity in the Venice Lagoon

The early-life stages of development of the calanoid copepod Acartia tonsa from egg to copepodite I is proposed as an endpoint for assessing sediment toxicity by exposing newly released eggs directly onto the sediment-water interface. A preliminary study of 5 sediment samples collected in the lagoon of Venice highlighted that the larval development rate (LDR) and the early-life stages (ELS) mortality endpoints with A. tonsa are more sensitive than the standard amphipod mortality test; moreover LDR resulted in a more reliable endpoint than ELS mortality, due to the interference of the sediment with the recovery of unhatched eggs and dead larvae. The LDR data collected in a definitive study of 48 sediment samples from the Venice Lagoon has been analysed together with the preliminary data to evaluate the statistical performances of the bioassay (among replicate variance and minimum significant difference between samples and control) and to investigate the possible correlation with sediment chemistry and physical properties. The results showed that statistical performances of the LDR test with A. tonsa correspond with the outcomes of other tests applied to the sediment-water interface (Strongylocentrotus purpuratus embryotoxicity test), sediments (Neanthes arenaceodentata survival and growth test) and porewater (S. purpuratus); the LDR endpoint did, however, show a slightly higher variance as compared with other tests used in the Lagoon of Venice, such as 10-d amphipod lethality test and larval development with sea urchin and bivalves embryos. Sediment toxicity data highlighted the high sensitivity and the clear ability of the larval development to discriminate among sediments characterized by different levels of contamination. The data of the definitive study evidenced that inhibition of the larval development was not affected by grain-size and the organic carbon content of the sediment; in contrast, a strong correlation between inhibition of the larval development and the sediment concentrations of some metals (Cu, Hg, Pb, Zn), acid-volatile sulphides (AVS), polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs) was found. No correlation was found with DDTs, hexachlorobenzene and organotin compounds.

General information
State: Published
Organisations: Department of Environmental Engineering, Ca' Foscari University of Venice
Authors: Picone, M. (Ekstern), Bergamin, M. (Ekstern), Delaney, E. (Ekstern), Ghirardini, A. V. (Ekstern), Kusk, K. O. (Intern)
Use of Forward Osmosis to Harvest Methane Oxidizing Bacteria Producing Single Cell Protein

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Water Technologies, Technical University of Denmark
Authors: Pape, M. L. (Ekstern), Valverde Pérez, B. (Intern), Schneider, C. (Intern), Kjeldgaard, A. F. (Intern), Zachariae, A. A. (Ekstern), Hélix-Nielsen, C. (Intern), Zarebska, A. (Intern), Smets, B. F. (Intern)
Number of pages: 1
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Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2018

Estimation of caffeine intake from analysis of caffeine metabolites in wastewater
Caffeine metabolites in wastewater were investigated as potential biomarkers for assessing caffeine intake in a population. The main human urinary metabolites of caffeine were measured in the urban wastewater of ten European cities and the metabolic profiles in wastewater were compared with the human urinary excretion profile. A good match was found for 1,7-dimethyluric acid, an exclusive caffeine metabolite, suggesting that might be a suitable biomarker in wastewater for assessing population-level caffeine consumption. A correction factor was developed considering the percentage of excretion of this metabolite in humans, according to published pharmacokinetic studies. Daily caffeine intake estimated from wastewater analysis was compared with the average daily intake calculated from the average amount of coffee consumed by country per capita. Good agreement was found in some cities but further information is needed to standardize this approach. Wastewater analysis proved useful to providing additional local information on caffeine use.

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State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS, University of South Australia, University of Oslo, University of Antwerp, Swiss Federal Institute of Aquatic Science and Technology (Eawag), Universidade do Porto, University of Queensland, University of Amsterdam, Universitat Jaume I, Istituto di Ricerche Farmacologiche Mario Negri, University of Bath, Chemical Water Quality and Health, Norwegian Institute for Water Research
Authors: Gracia-Lor, E. (Ekstern), Rousis, N. I. (Ekstern), Zuccato, E. (Ekstern), Bade, R. (Ekstern), Baz-Lomba, J. A. (Ekstern), Castrignanó, E. (Ekstern), Causanilles Llanes, A. (Ekstern), Hernández, F. (Ekstern), Kasprzyk-Hordern, B. (Ekstern), Kinyua, J. (Ekstern), McCall, A. (Ekstern), van Nuijs, A. L. N. (Ekstern), Plósz, B. G. (Intern), Ramin, P. (Intern), Ryu, Y. (Ekstern), Santos, M. M. (Ekstern), Thomas, K. V. (Ekstern), de Voogt, P. (Ekstern), Yang, Z. (Ekstern), Castiglioni, S. (Ekstern)
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Scopus rating (2015): SJR 1.674 SNIP 1.642 CiteScore 4.33
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Scopus rating (2013): SJR 1.527 SNIP 1.759 CiteScore 3.73
ISI indexed (2013): ISI indexed yes
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ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.798 SNIP 1.681 CiteScore 3.61
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.644 SNIP 1.513
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.571 SNIP 1.602
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Scopus rating (2008): SJR 1.463 SNIP 1.501
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.407 SNIP 1.491
Web of Science (2007): Indexed yes
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Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.442 SNIP 1.508
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.123 SNIP 1.305
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.164 SNIP 1.369
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.168 SNIP 1.352
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.063 SNIP 1.081
Web of Science (2001): Indexed yes
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Scopus rating (1999): SJR 0.925 SNIP 0.937

Original language: English
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Publication: Research - peer-review › Journal article – Annual report year: 2017
Multi-criteria assessment tool for sustainability appraisal of remediation alternatives for a contaminated site

Purpose: In order to improve and support decision-making for the selection of remedial techniques for contaminated sites, a multi-criteria assessment (MCA) method has been developed. The MCA framework is structured in a decision process actively involving stakeholders, and compares the sustainability of remediation alternatives by integrating environmental, societal, and economic criteria in the assessment. Materials and methods: The MCA includes five main decision criteria: remedial effect, remediation cost, remediation time, environmental impacts, and societal impacts. The main criteria are divided into a number of sub-criteria. The environmental impacts consider secondary impacts to the environment caused by remedial activities and are assessed by life-cycle assessment (LCA). The societal impacts mainly consider local impacts and are assessed in a more qualitative manner on a scale from 1 to 5. An overall score is obtained by calculating a weighted sum with criteria weights determined by stakeholders. The MCA method was applied to assess remediation alternatives for the Groyne 42 site, one of the largest contaminated sites in Denmark. Results and discussion: The compared remediation alternatives for the site were: (1) excavation of the site followed by soil treatment; (2) in situ alkaline hydrolysis; (3) in situ thermal remediation; and (4) continued encapsulation of the site by sheet piling. Criteria weights were derived by a stakeholder panel. The stakeholders gave the highest weighting to the remedial effect of the methods and to the societal impacts. For the Groyne 42 case study, the excavation option obtained the lowest overall score in the MCA, and was therefore found to be the most sustainable option. This was especially due to the fact that this option obtained a high score in the main categories Effect and Social impacts, which were weighted highest by the stakeholders. Conclusions: The developed MCA method is structured with five main criteria. Effect and time are included in addition to the three pillars of sustainability (environment, society, and economy). The remedial effect of remediation is therefore assessed and weighted separately from the main criteria environment. This structure makes interpretation of criteria scores more transparent and emphasizes the importance of effect and time as decision parameters. This also facilitated an easier weighting procedure for the stakeholders in the case study, who expressed a wish to weigh the remedial effect independently from the secondary environmental impacts.
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State: Published
Organisation: Department of Environmental Engineering, Urban Water Systems
Authors: Arnbjerg-Nielsen, K. (Intern)
Publication date: 9 Feb 2017

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Links:
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Authors: Arnbjerg-Nielsen, K. (Intern)
Publication date: 26 Jan 2017

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Links:
http://www.altinget.dk/forsyning/artikel/professor-om-kystsikring-koebenhavn-er-vigtigere-end-jylland?ref=newsletter&refid=22991&SNSubscribed=true&utm_source=Nyhedsbrev&utm_medium=e-
Hygge-stormfloden og den falske sikkerhed

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Authors: Arnbjerg-Nielsen, K. (Intern)
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Main Research Area: Technical/natural sciences
Electronic versions:
Hygge_stormfloden_og_den_falske_sikkerhed_POV.pdf
Links:
http://pov.international/hygge-stormfloden-og-den-falske-sikkerhed/
Publication: Research › Internet publication – Annual report year: 2017

A 3-D numerical model of the influence of meanders on groundwater discharge to a gaining stream in an unconfined sandy aquifer

Groundwater discharge to streams depends on stream morphology and groundwater flow direction, but are not always well understood. Here a 3-D groundwater flow model is employed to investigate the impact of meandering stream geometries on groundwater discharge to streams in an unconfined and homogenous sandy aquifer at the reach scale (10–200 m). The effect of meander geometry was examined by considering three scenarios with varying stream sinuosity. The interaction with regional groundwater flow was examined for each scenario by considering three groundwater flow directions. The sensitivity of stream morphology and flow direction to other parameters was quantified by varying the stream width, the meander amplitude, the magnitude of the hydraulic gradient, the hydraulic conductivity, and the aquifer thickness. Implications for a real stream were then investigated by simulating groundwater flow to a stream at a field site located in Grindsted, Denmark. The simulation of multiple scenarios was made possible by the employment of a computationally efficient coordinate transform numerical method. Comparison of the scenarios showed that the geometry of meanders greatly affect the spatial distribution of groundwater flow to streams. The shallow part of the aquifer discharges to the outward pointing meanders, while deeper groundwater flows beneath the stream and enters from the opposite side. The balance between these two types of flow depends on the aquifer thickness and meander geometry. Regional groundwater flow can combine with the effect of stream meanders and can either enhance or smooth the effect of a meander bend, depending on the regional flow direction. Results from the Grindsted site model showed that real meander geometries had similar effects to those observed for the simpler sinuous streams, and showed that despite large temporal variations in stream discharge, the spatial pattern of flow is almost constant in time for a gaining stream.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Office for Study Programmes and Student Affairs, Technical University of Denmark, University of Bergen
Authors: Balbarini, N. (Intern), Boon, W. M. (Ekstern), Nicolajsen, E. (Ekstern), Nordbotten, J. M. (Ekstern), Bjerg, P. L. (Intern), Binning, P. J. (Intern)
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Source-ID: 2372181933
Publication: Research - peer-review › Journal article – Annual report year: 2017
Accelerated anaerobic hydrolysis rates under a combination of intermittent aeration and anaerobic conditions

Anaerobic hydrolysis in activated return sludge was investigated in laboratory scale experiments to find if intermittent aeration would accelerate anaerobic hydrolysis rates compared to anaerobic hydrolysis rates under strict anaerobic conditions. The intermittent reactors were set up in a 240 h experiment with intermittent aeration (3h:3h) in a period of 24 h followed by a subsequent anaerobic period of 24 h in a cycle of 48 hours which was repeated 5 times during the experiment. The anaerobic reactors were kept under strict anaerobic conditions in the same period (240 h). Two methods for calculating hydrolysis rates based on soluble COD were compared. Two-way ANOVA with the Bonferroni post-test was performed in order to register any significant difference between reactors with intermittent aeration and strictly anaerobic conditions respectively. The experiment demonstrated a statistically significant difference in favor of the reactors with intermittent aeration showing a tendency towards accelerated anaerobic hydrolysis rates due to application of intermittent aeration. The conclusion of the work is thus that intermittent aeration applied in the activated return sludge process (ARP) can improve the treatment capacity further in full scale applications.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, EnviDan A/S, Technical University of Denmark
Authors: Jensen, T. R. (Ekstern), Lastra Milone, T. (Ekstern), Petersen, G. (Ekstern), Andersen, H. R. (Intern)
Pages: 1944-1951
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Scopus rating (2016): CiteScore 1.3 SJR 0.394 SNIP 0.621
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Scopus rating (2014): SJR 0.587 SNIP 0.685 CiteScore 1.14
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BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.568 SNIP 0.7 CiteScore 1.3
ISI indexed (2013): ISI indexed yes
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BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.601 SNIP 0.669 CiteScore 1.13
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.591 SNIP 0.626 CiteScore 1.25
ISI indexed (2011): ISI indexed yes
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BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.522 SNIP 0.602
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.589 SNIP 0.686
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.579 SNIP 0.697
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.749 SNIP 0.781
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.693 SNIP 0.796
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.763 SNIP 0.85
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.877 SNIP 0.904
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.882 SNIP 0.902
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.903 SNIP 0.888
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.759 SNIP 0.967
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.76 SNIP 0.885
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.889 SNIP 0.936
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Acclimation of ammonia tolerant methanogenic consortia using different bioreactor types

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Mancini, E. (Intern), Fotidis, I. (Intern), Tian, H. (Intern), Angelidaki, I. (Intern)
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Acclimation to extremely high ammonia levels during continuous biomethanation process

General information
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A continuous hyperspatial monitoring system of evapotranspiration and gross primary productivity from Unmanned Aerial Systems

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Authors: Wang, S. (Intern), Bandini, F. (Intern), Jakobsen, J. (Intern), Zarco Tejada, P. J. (Ekstern), Köppl, C. J. (Ekstern), Olesen, D. H. (Intern), Ibrom, A. (Intern), Bauer-Gottwein, P. (Intern), Garcia, M. (Intern)
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Electronic versions:
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A Critical Analysis of the Environmental Dossiers from the OECD Sponsorship Programme for the Testing of Manufactured Nanomaterials

In 2015, the OECD finally published the findings of its seven year testing programme for manufactured nanomaterials. Here, we present the first in-depth analysis of the published OECD dossiers with regards to data on physical and chemical properties, environmental fate and ecotoxicology. Each individual study in the dossiers was reviewed with regard to, among other, which OECD Test Guidelines (TG) were used, and the reliability assigned to the study. We furthermore analyzed in detail the suspension methods used, how media quality was quantified and physical and chemical characterization performed prior, during and/or at the end of the study. We find that the information in the dossiers present an incomplete portfolio of nanomaterial ecotoxicological evaluations that are difficult to draw substantive conclusions from and that most of the studies were not designed to investigate the validity of the OECD Test Guidelines. We acknowledge the effort of the OECD WP MN and recommend that a follow-on program is established with well-defined goals, end-points and direct funding to qualified research laboratories to ensure valid, rigorous, reproducible and efficient research.

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Acute and semi-chronic toxicity of vanadium tested on copepods of the species Temora longicornis

General information
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Authors: Kristiansen, M. H. (Ekstern), Iversen, N. H. (Ekstern), Koski, M. (Intern), Trapp, S. (Intern)
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ABSTRACT BOOK
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Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Acute toxicity of copper oxide nanoparticles to Daphnia magna under different test conditions

The acute toxicity of monodispersed 6 nm and <100 nm poly-dispersed copper oxide nanoparticles toward Daphnia magna was assessed using 48 h immobilization tests. CuSO₄ was used as a reference. Four different exposure conditions were tested, to study whether the toxicity of the nanoparticle suspensions changed in a way similar to what is known for dissolved Cu: first in ISO standard test conditions (pH 7.8), second with slight acidity (pH 6.5), third in the presence of citric acid, and fourth in the presence of humic acid. For all four exposure conditions, the toxicity of Cu employed in the three forms followed the same sequence, i.e., CuSO₄ > monodispersed 6 nm CuO > poly-dispersed CuO. The toxicity of all Cu forms decreased from pH 6.5, > pH 7.8, > pH 7.8 + citric acid, to > pH 7.8 + humic acid. This pattern is in agreement with concentrations of Cu²⁺ calculated using the equilibrium model MINTEQ. These findings show that the acute toxicity of copper oxide nanoparticles is governed by test water composition and the chemical species Cu²⁺.

General information
State: Published
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Number of pages: 15
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Publication date: 2017
Adaptation to flood risk: Results of international paired flood event studies

As flood impacts are increasing in large parts of the world, understanding the primary drivers of changes in risk is essential for effective adaptation. To gain more knowledge on the basis of empirical case studies, we analyze eight paired floods, that is, consecutive flood events that occurred in the same region, with the second flood causing significantly lower damage. These success stories of risk reduction were selected across different socioeconomic and hydro-climatic
contexts. The potential of societies to adapt is uncovered by describing triggered societal changes, as well as formal measures and spontaneous processes that reduced flood risk. This novel approach has the potential to build the basis for an international data collection and analysis effort to better understand and attribute changes in risk due to hydrological extremes in the framework of the IAHSs Panta Rhei initiative. Across all case studies, we find that lower damage caused by the second event was mainly due to significant reductions in vulnerability, for example, via raised risk awareness, preparedness, and improvements of organizational emergency management. Thus, vulnerability reduction plays an essential role for successful adaptation. Our work shows that there is a high potential to adapt, but there remains the challenge to stimulate measures that reduce vulnerability and risk in periods in which extreme events do not occur.

A data assimilation system combining CryoSat-2 data and hydrodynamic river models

There are numerous hydrologic studies using satellite altimetry data from repeat-orbit missions such as Envisat or Jason over rivers. This study is one of the first examples for the combination of altimetry from drifting-ground track satellite missions, namely CryoSat-2, with a river model. CryoSat-2 SARIn Level 2 data is used to improve a 1D hydrodynamic model of the Brahmaputra River in South Asia, which is based on the Saint-Venant equations for unsteady flow and set up in the MIKE HYDRO River software. After calibration of discharge and water level the hydrodynamic model can accurately and bias-free represent the spatio-temporal variations of water levels. A data assimilation framework has been developed and linked with the model. It is a flexible framework that can assimilate water level data which are arbitrarily distributed in time and space. The setup has been used to assimilate CryoSat-2 water level observations over the Assam valley for the years 2010 to 2015, using an Ensemble Transform Kalman Filter (ETKF). Performance improvement in terms of discharge forecasting skill was then evaluated. For experiments with synthetic CryoSat-2 data the continuous ranked probability score (CRPS) was improved by up to 32%, whilst for experiments assimilating real data it could be improved by up to 10%. The developed methods are expected to be transferable to other rivers and altimeter missions. The model setup and calibration is based almost entirely on globally available remote sensing data.
Advancing from underground to above-ground model predictive control in urban drainage

**General information**
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Lund, N. S. V. (Intern), Borup, M. (Intern), Halvgaard, R. F. (Intern), Falk, A. K. V. (Intern), Mark, O. (Ekstern), Madsen, H. (Ekstern), Mikkelsen, P. S. (Intern)
Number of pages: 4
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A fast surrogate model tailor-made for real time control

A surrogate model of a detailed hydraulic urban drainage model is created for supplying inflow forecasts to an MPC model for 31 separate locations. The original model is subdivided into 66 relationships extracted from the original model. The surrogate model is 9000 times faster than the original model, with just a minor deviation from the original model results.

**General information**
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Borup, M. (Intern), Thrysøe, C. (Intern), Arnbjerg-Nielsen, K. (Intern), Righetti, F. (Intern), Mikkelsen, P. S. (Intern)
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A gain-loss framework based on ensemble flow forecasts to switch the urban drainage-wastewater system management towards energy optimization during dry periods

Precipitation is the cause of major perturbation to the flow in urban drainage and wastewater systems. Flow forecasts, generated by coupling rainfall predictions with a hydrologic runoff model, can potentially be used to optimize the operation of integrated urban drainage-wastewater systems (IUDWSs) during both wet and dry weather periods. Numerical weather prediction (NWP) models have significantly improved in recent years, having increased their spatial and temporal resolution. Finer resolution NWP are suitable for urban-catchment-scale applications, providing longer lead time than radar extrapolation. However, forecasts are inevitably uncertain, and fine resolution is especially challenging for NWP. This uncertainty is commonly addressed in meteorology with ensemble prediction systems (EPSs). Handling uncertainty is challenging for decision makers and hence tools are necessary to provide insight on ensemble forecast usage and to support the rationality of decisions (i.e. forecasts are uncertain and therefore errors will be made; decision makers need tools to justify their choices, demonstrating that these choices are beneficial in the long run).

This study presents an economic framework to support the decision-making process by providing information on when acting on the forecast is beneficial and how to handle the EPS. The relative economic value (REV) approach associates economic values with the potential outcomes and determines the preferential use of the EPS forecast. The envelope curve of the REV diagram combines the results from each probability forecast to provide the highest relative economic value for a given gain-loss ratio. This approach is traditionally used at larger scales to assess mitigation measures for adverse events (i.e. the actions are taken when events are forecast). The specificity of this study is to optimize the energy consumption in IUDWS during low-flow periods by exploiting the electrical smart grid market (i.e. the actions are taken when no events are forecast). Furthermore, the results demonstrate the benefit of NWP neighbourhood post-processing methods to enhance the forecast skill and increase the range of beneficial uses.

**General information**
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Organisations: Department of Environmental Engineering, Urban Water Systems, Krüger A/S
Algal Biomass for Bioenergy and Bioproducts Production in Biorefinery Concepts

The fast population growth is increasing the demand for energy and resources. However, the reserves of oil are diminishing and greenhouse emissions associated to its combustion are affecting the global climate causing global warming. Therefore the need for alternative resources and processes is becoming imperative.

Macro- and microalgae have the ability to transform nutrients into valuable biomass. Being a good source of vitamins, minerals, lipids, proteins and pigments, they represent a promising source of various products. However these biomasses are still very little explored as biorefinery feedstocks.

Biorefinery represents an important tool towards the development of a sustainable economy. Within the biorefinery framework several bioproducts, such as food, feed and biofuels, can be produced from biomass. The specific composition of the biomass feedstock determines the potential final product that can be obtained.

In this thesis, micro- and macroalage were investigated as biorefinery feedstocks. The main aim of this work was developing different biorefinery strategies for the production of high value products, such as proteins or pigments, to be employed in the pharmaceutical or nutraceutical industry. The macroalgae used in this work were Laminaria digitata and Saccharina latissima, while the microalgae were Chlorella sorokiniana, Chlorella vulgaris and Chlorella protothecoides. Moreover, an evaluation of the effect of the harvesting season and location on the composition of high value products such as total phenolics and on the biogas potential for L. digitata and S. latissima was done. Both these factors had a significant impact on the accumulation of total phenolics in the algal biomass and on the biogas production. In particular, samples harvested in summer, because of the high content of sugars, showed to be the most promising feedstock in the development of biorefinery processes, containing 0.5 mgTPC gDM-1 and having a biomethane potential of 343.7 NmLCH4 g VS-1.

Moreover, proteins being an interesting valuable product to be used as food and feed supplement, diverse industrial methods to produce amino acids and proteins were analyzed. Innovative techniques to increase the protein content in the final biomass, such as microalgae or microorganisms to be used as single cell proteins (SCP), were also investigated. The combination of phototropic growth of C. sorokiniana with Methyllococcus capsulatus led to an innovative solution where two products rich in proteins (up to 43 %DM) were obtained.

Another strategy developed in this thesis work was based on the combination of micro- and macroalgae to enhance protein production. Indeed, the microalgae C. protothecoides was grown heterotrophically in the macroalgae L. digitata hydrolyzed. The final composition of the microalgal biomass showed that the protein content was increased from 0.07 ± 0.01 gProtein gDM-1 to 0.44 ± 0.04 gProtein DM-1. The results obtained show that this solution may represent an interesting strategy to be applied in a biorefinery approach.

Finally, a microalgae biorefinery strategy was developed. Lutein represents a very important pigment present in the macular region of the human eye. It is crucial in the protection against light-induced retinal damages and responsible for maintaining human bone health and preventing some diseases. Lutein and proteins were extracted by developing innovative methods specifically designed for microalgae species. From the initial algal biomass were extracted 0.8 ± 0.1 mg Lutein gDM-1 with a purity of 92.5 ± 1.2% and a calculated yield of 95%. Moreover, the final protein content in the fraction was 82.7 ± 3.1% w w-1with a protein yield of 55%. Finally, from the residues of this extraction processes, 372.7 ± 19.0 NmLCH4 g VS-1 of biogas were produced.

The results obtained in this thesis work show that macro- and microalgae are promising biomasses for the development of the future biorefineries.
Algal toxicity of the alternative disinfectants performic acid (PFA), peracetic acid (PAA), chlorine dioxide (ClO₂) and their by-products hydrogen peroxide (H₂O₂) and chlorite (ClO₂⁻)

Environmental effect evaluation of disinfection of combined sewer overflow events with alternative chemical disinfectants requires that the environmental toxicity of the disinfectants and the main by-products of their use are known. Many disinfectants degrade quickly in water which should be included in the evaluation of both their toxicity as determined in standardized tests and their possible negative effect in the water environment. Here we evaluated according to the standardized ISO 8692 test the toxicity towards the green microalgae, Pseudokirchneriella subcapitata, of three disinfectants: performic acid (PFA), peracetic acid (PAA) and chlorine dioxide (ClO₂) as well as two by-products of their use: hydrogen peroxide (H₂O₂) and chlorite. All of the five chemicals investigated showed clear toxicity to the algae with well-defined dose response curves. The EC₅₀ values ranged from 0.16 to 2.9 mg/L based on nominal concentrations leading to the labeling of the chemicals as either toxic or very toxic. The five investigated chemicals decreased in toxicity in the order chlorine dioxide, performic acid, peracetic acid, chlorite and hydrogen peroxide. The stability of the chemicals increased in the same order as the toxicity decrease. This indicates that even though ClO₂ has the highest environmental hazard potential, it may still be suitable as an alternative disinfectant due to its rapid degradation in water.

General information
State: Published
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BFI (2011): BFI-level 1
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ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.236 SNIP 1.453
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.869 SNIP 1.193
A local freshwater impact – proposing a groundwater indicator AGWaRe

Currently there are several world maps showing the water stress in regions or nations. They give a good indication of water stress on a larger scale, but do not have information on a local scale that may assist a water utility in their prioritization of well fields to lower the overall pressure on the water resource. Furthermore a local water stress indicator is necessary for benchmarking regional water supplies against each other.

AWaRe is the freshwater impact recommended by the Lifecycle Initiative (developed by WULCA). It is defined as the inverse function of Availability Minus Demand (AMD) which is compared to the world average AMD. The AMD represents the water remaining after human consumption and environmental requirements. This is done for a grid of 50x50km worldwide, but it does not give sufficient information on a local scale. Therefore we modified the AWaRe indicator so that it can account for differences at the local scale and termed it AWaRe*. We have applied AWaRe* on four different demarcations for three public water supplies of the largest cities in Denmark.

The results of the local scales will be presented and compared with the results from the AWaRe found for non agricultural water use (found by WULCA). The AWaRe* differs between different demarcations. For the four locale scales water supply C ranks as the most water stressed. This fits well with the water stress experienced by the three water supplies. For two out of four demarcations, the ranking between the cases are the same. As expected for the local scales we see the highest impact factor for the smallest scale. For the water stress found by WULCA, the water stress is lowest for water supply C and case A and B have similar water stress, which is opposite of the ranking from the local scales. For the AWaRe scale, we obtain results that do not comply with the expected outcome from the water supply. Further work should be given to increase resolution of AWaRe data.

Not only is the applied method crucial to the outcome, but also the scale applied and the data used. The locale scale shows the highest water stress at water supply C, which is the city with most inhabitants and a water supply that experience water stress. AWaRe* on the locale scale represents the expected water stress for the water supplies.

General information
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Amino acids production focusing on fermentation technologies – A review

Amino acids are attractive and promising biochemicals with market capacity requirements constantly increasing. Their applicability ranges from animal feed additives, flavour enhancers and ingredients in cosmetic to specialty nutrients in pharmaceutical and medical fields.

This review gives an overview of the processes applied for amino acids production and points out the main advantages and disadvantages of each.

Due to the advances made in the genetic engineering techniques, the biotechnological processes, and in particular the fermentation with the aid of strains such as Corynebacterium glutamicum or Escherichia coli, play a significant role in the industrial production of amino acids. Despite the numerous advantages of the fermentative amino acids production, the process still needs significant improvements leading to increased productivity and reduction of the production costs.

Although the production processes of amino acids have been extensively investigated in previous studies, a comprehensive overview of the developments in bioprocess technology has not been reported yet. This review states the importance of the fermentation process for industrial amino acids production, underlining the strengths and the weaknesses of the process. Moreover, the potential of innovative approaches utilizing macro and microalgae or bacteria are presented.

General information
State: Accepted/In press
Organisations: Department of Environmental Engineering, Residual Resource Engineering
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Scopus rating (2016): CiteScore 11.05 SJR 2.681 SNIP 3.146
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BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.922 SNIP 3.757 CiteScore 10.24
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.936 SNIP 4.028 CiteScore 10.71
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.552 SNIP 5.178 CiteScore 11.65
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.126 SNIP 4.726 CiteScore 10.75
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.928 SNIP 3.953
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Ammonia tolerant inocula provide a good base for anaerobic digestion of microalgae in third generation biogas process

This study investigated the ability of an ammonia-acclimatized inoculum to digest efficiently protein-rich microalgae for continuous 3rd generation biogas production. Moreover, we investigated whether increased C/N ratio could alleviate ammonia toxicity. The biochemical methane potential (BMP) of five different algae (Chlorella vulgaris)/manure (cattle) mixtures showed that the mixture of 80/20 (on VS basis) resulted in the highest BMP value (431 mL CH\textsubscript{4} g VS\textsuperscript{-1}), while the BMP of microalgae alone (100/0) was 415 mL CH\textsubscript{4} g VS\textsuperscript{-1}. Subsequently, anaerobic digestion of those two substrates was tested in continuous stirred tank reactors (CSTR). Despite of the high ammonium levels (3.7-4.2 g NH\textsubscript{4}\textsuperscript{+} N L\textsuperscript{-1}), CSTR reactors using ammonia tolerant inoculum resulted in relatively high methane yields (i.e. 77.5% and 84% of the maximum expected, respectively) These results demonstrated that ammonia tolerant inocula could be a promising approach to successfully digest protein-rich microalgae and achieve a 3rd generation biogas production.

General information

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Zagazig University, Technical University of Denmark, Environment and Technology (CIEMAT)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.94 SJR 2.191 SNIP 1.91
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.255 SNIP 1.908 CiteScore 5.47
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.41 SNIP 2.104 CiteScore 5.3
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Anaerobic granular sludge for simultaneous biomethanation of synthetic wastewater and CO with focus on the identification of CO-converting microorganisms

CO is a main component of syngas, which can be produced from the gasification of organic wastes and biomass. CO can be converted to methane by anaerobic digestion (AD), however, it is still challenging due to its toxicity to microorganisms and limited knowledge about CO converting microorganisms. In the present study, anaerobic granular sludge (AGS) was used for the simultaneous biomethanation of wastewater and CO. Batch experiments showed that AGS tolerated CO partial pressure as high as 0.5 atm without affecting its ability for synthetic wastewater degradation, which had higher tolerance of CO compared to suspended sludge (less than 0.25 atm) as previously reported. Continuous experiments in upflow anaerobic sludge blanket (UASB) reactors showed AGS could efficiently convert synthetic wastewater and CO into methane by applying gas-recirculation. The addition of CO to UASB reactor enhanced the hydrogenotrophic CO-oxidizing pathway, resulted in the increase of extracellular polymeric substances, changed the morphology of AGS and significantly altered the microbial community compositions of AGS. The microbial species relating with CO conversion and their functions were revealed by metagenomic analysis. It showed that 23 of the 70 reconstructed genome bins (GBs), most of which were not previously characterized at genomic level, were enriched and contained genes involved in CO conversion upon CO addition. CO-converting microorganisms might be taxonomically more diverse than previously known and have
multi-functions in the AD process. The reductive tricarboxylic acid (TCA) cycle in combination with the oxidation of the CO was probably crucial for CO utilization by the majority of the GBs in the present study.
An assessment of the importance of exposure routes to the uptake and internal localisation of fluorescent nanoparticles in zebrafish (Danio rerio), using light sheet microscopy

A major challenge in nanoecotoxicology is finding suitable methods to determine the uptake and localisation of nanoparticles on a whole-organism level. Some uptake methods have been associated with artefacts induced by sample preparation, including staining for electron microscopy. This study used light sheet microscopy (LSM) to define the uptake and localisation of fluorescently labelled nanoparticles in living organisms with minimal sample preparation. Zebrafish (Danio rerio) were exposed to fluorescent gold nanoparticles (Au NPs) and fluorescent polystyrene NPs via aqueous or dietary exposure. The in vivo uptake and localisation of NPs was investigated using LSM at different time points (1, 3 and 7 days). A time-dependent increase in fluorescence was observed in the gut after dietary exposure to both Au NPs and polystyrene NPs. No fluorescence was observed within gut epithelia regardless of the NP exposure route indicating no or limited uptake via intestinal villi. Fish exposed to polystyrene NPs through the aqueous phase emitted fluorescence signals from the gills and intestine. Fluorescence was also detected in the head region of the fish after aqueous exposure to polystyrene NPs. This was not observed for Au NPs. Aqueous exposure to Au NPs resulted in increased relative swimming distance, while no effect was observed for other exposures. This study supports that the route of exposure is essential for the uptake and subsequent localisation of nanoparticles in zebrafish. Furthermore, it demonstrates that the localisation of NPs in whole living organisms can be visualised in real-time, using LSM.
An environmental assessment of landfill gas mitigation, using a biocover system

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark
Authors: Møller, J. (Ekstern), Kjeldsen, P. (Intern), Scheutz, C. (Intern)
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An MFA-based optimization model for increased resource efficiency: Phosphorus flows in Denmark
Phosphorus (P) is present in large amounts in agricultural residues and organic wastes from human consumption, from which it can be recovered as fertiliser, reducing dependence on primary P. Crucial for a secondary resource is its ability to fulfil the functions of the resource intended to be substituted. This quality of secondary resources is not captured well by material flow analysis (MFA). A static MFA of the Danish anthropogenic P cycle was adapted for optimization via linear programming to minimize primary P imports. The MFA system was adapted to reflect typical nutrient availability from various secondary-P fertilisers, to allow for exchange of secondary-P fertilisers between regions (sewage sludge incineration ash and composted organic household waste), and to reflect the system's development over 3 annual time steps. Since P accumulating in agricultural soil gradually becomes available for plants over time, the outcome showed both a gradual decline of mineral P fertiliser inputs and net additions to soil P stocks stabilising at distinctly lower levels than evident from the static MFA. The optimization model's outcome, accounting for the dynamic aspects of transport and P availability to crops over time, suggests a substitution potential of over 80% (9.8 Gg primary P) by P recovered from sewage sludge and household biowaste, compared to 35% in the static MFA.
A novel archaean species belonging to Methanoculleus genus identified via de-novo assembly and metagenomic binning process in biogas reactors

Recently, a first comprehensive catalogue of microbial genomes populating biogas reactors treating manure and agro-industrial residues was determined by sequencing samples collected from 22 biogas reactors including laboratory and full scale. Among the archaean community, one of the most abundant methanogens belongs to Methanoculleus genus and for this reason it was provisionally named Methanoculleus sp. DTU006. Its full length 16S rRNA sequence is 97% similar to Methanoculleus marisnigri JR1 and to Methanoculleus palmolii DSM 4273. Despite the high similarity of the 16S gene sequence, Average Nucleotide Identity calculation (ANI) calculated on all protein encoding genes indicated that the two most similar species, Methanoculleus bourgensis MS2T and Methanoculleus sp. MAB1, are divergent enough to define Methanoculleus sp. DTU006 as a new archaean species. Its genome (2.15 Mbp) has an estimated completeness around 93%. Analysis of the metabolic pathways using KEGG confirmed that it is a hydrogenotrophic methanogen and therefore it is proposed the Candidatus status by naming it as "Candidatus Methanoculleus thermohydrogenotrophicum".

**General information**

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Padua
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Scopus rating (2012): SJR 0.98 SNIP 0.943 CiteScore 2.48
ISI indexed (2012): ISI indexed yes
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Scopus rating (2011): SJR 0.899 SNIP 0.95 CiteScore 2.48
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.872 SNIP 1.052
An overview of electron acceptors in microbial fuel cells

Microbial fuel cells (MFC) have recently received increasing attention due to their promising potential in sustainable wastewater treatment and contaminant removal. In general, contaminants can be removed either as an electron donor via microbial catalyzed oxidization at the anode or removed at the cathode as electron acceptors through reduction. Some contaminants can also function as electron mediators at the anode or cathode. While previous studies have done a thorough assessment of electron donors, cathodic electron acceptors and mediators have not been as well described. Oxygen is widely used as an electron acceptor due to its high oxidation potential and ready availability. Recent studies, however, have begun to assess the use of different electron acceptors because of the (1) diversity of redox potential, (2) needs of alternative and more efficient cathode reaction, and (3) expanding of MFC based technologies in different areas. The aim of this review was to evaluate the performance and applicability of various electron acceptors and mediators used in MFCs. This review also evaluated the corresponding performance, advantages and disadvantages, and future potential applications of select electron acceptors (e.g., nitrate, iron, copper, perchlorate) and mediators.

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Authors: Ucar, D. (Ekstern), Zhang, Y. (Intern), Angelidaki, I. (Intern)
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Antibiotic Resistance Genes and Correlations with Microbial Community and Metal Resistance Genes in Full-Scale Biogas Reactors As Revealed by Metagenomic Analysis

Digested residues from biogas plants are often used as biofertilizers for agricultural crops cultivation. The antibiotic resistance genes (ARGs) in digested residues pose a high risk to public health due to their potential spread to the disease-causing microorganisms and thus reduce the susceptibility of disease-causing microorganisms to antibiotics in medical treatment. A high-throughput sequencing (HTS)-based metagenomic approach was used in the present study to investigate the variations of ARGs in full-scale biogas reactors and the correlations of ARGs with microbial communities and metal resistance genes (MRGs). The total abundance of ARGs in all the samples varied from $7 \times 10^{-3}$ to $1.08 \times 10^{-1}$ copy of ARG/copy of 16S-rRNA gene, and the samples obtained from thermophilic biogas reactors had a lower total abundance of ARGs, indicating the superiority of thermophilic anaerobic digestion for ARGs removal. ARGs in all the samples were composed of 175 ARG subtypes; however, only 7 ARG subtypes were shared by all the samples. Principal component analysis and canonical correspondence analysis clustered the samples into three groups (samples from manure-based mesophilic reactors, manure-based thermophilic reactors, and sludge-based mesophilic reactors), and substrate, temperature, and hydraulic retention time (HRT) as well as volatile fatty acids (VFAs) were identified as crucial environmental variables affecting the ARGs compositions. Procrustes analysis revealed microbial community composition was the determinant of ARGs composition in biogas reactors, and there was also a significant correlation between ARGs composition and MRGs composition. Network analysis further revealed the co-occurrence of ARGs with specific microorganisms and MRGs.
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.26 SJR 2.538 SNIP 1.889
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.584 SNIP 1.828 CiteScore 5.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.103 CiteScore 5.52
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.146 SNIP 2.056 CiteScore 5.17
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.178 SNIP 1.953 CiteScore 5.16
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.964 SNIP 1.729
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.835 SNIP 1.803
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.943 SNIP 1.942
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.8 SNIP 1.927
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.541 SNIP 1.901
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.604 SNIP 2.014
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.863 SNIP 2.046
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.545 SNIP 2.071
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.353 SNIP 1.953
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.419 SNIP 1.977
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.474 SNIP 2.334
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 3.466 SNIP 2.359
Original language: English
DOIs:
10.1021/acs.est.6b05100
Source: FindIt
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Publication: Research - peer-review › Journal article – Annual report year: 2017
Application of a Mechanistic Model as a Tool for On-line Monitoring of Pilot Scale Filamentous Fungal Fermentation Processes - The Importance of Evaporation Effects: Mechanistic model for pilot scale monitoring

A mechanistic model-based soft sensor is developed and validated for 550L filamentous fungus fermentations operated at Novozymes A/S. The soft sensor is comprised of a parameter estimation block based on a stoichiometric balance, coupled to a dynamic process model. The on-line parameter estimation block models the changing rates of formation of product, biomass, and water, and the rate of consumption of feed using standard, available on-line measurements. This parameter estimation block, is coupled to a mechanistic process model, which solves the current states of biomass, product, substrate, dissolved oxygen and mass, as well as other process parameters including kLa, viscosity and partial pressure of CO2. State estimation at this scale requires a robust model including evaporation, which is a factor not often considered at smaller scales of operation. The model is developed using a historical dataset of eleven batches from the fermentation pilot plant (550L) at Novozymes A/S. The model is then implemented on-line in 550L fermentation processes operated at Novozymes A/S in order to validate the state estimator model on fourteen new batches utilizing a new strain. The product concentration in the validation batches was predicted with an average root mean sum of squared error (RMSSE) of 16.6%. In addition, calculation of the Janus coefficient for the validation batches shows a suitably calibrated model. The robustness of the model prediction is assessed with respect to the accuracy of the input data. Parameter estimation uncertainty is also carried out. The application of this on-line state estimator allows for on-line monitoring of pilot scale batches, including real-time estimates of multiple parameters which are not able to be monitored on-line. With successful application of a soft sensor at this scale, this allows for improved process monitoring, as well as opening up further possibilities for on-line control algorithms, utilizing these on-line model outputs. This article is protected by copyright. All rights reserved

General information
State: Published
Organisations: Department of Chemical and Biochemical Engineering, CAPEC-PROCESS, Department of Environmental Engineering, Novozymes AS
Authors: Mears, L. (Intern), Stocks, S. M. (Ekstern), Albæk, M. O. (Ekstern), Sin, G. (Intern), Gernaey, K. V. (Intern)
Pages: 589–599
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Main Research Area: Technical/natural sciences

Publication information
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Scopus rating (2016): CiteScore 4.14 SJR 1.411 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.613 SNIP 1.37 CiteScore 4.44
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
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Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.621 SNIP 1.425 CiteScore 4.44
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.639 SNIP 1.366 CiteScore 4.04
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.668 SNIP 1.483 CiteScore 4.08
Fermentation, Modelling, Monitoring, Pilot scale, Filamentous fungus, Soft sensor

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Application of a new point measurement to estimate groundwater-surface water exchange
The StreamBed Point Velocity Probe (SBPVP), a new point measurement device, measures in situ groundwater velocities at the groundwater-surface water interface (GWSWI, based on a mini-tracer test on the probe surface. This device yields velocities without reliance on estimations of hydraulic conductivity (K), porosity (n), or hydraulic gradients. The SBPVP was applied to a meander of the Grindsted stream (Denmark) to determine patterns of groundwater-surface water exchange (GWSWE). Analysis of the spatial distribution of velocity values suggests the sediments in the Grindsted streambed are highly heterogeneous. Calculated discharges were combined with geochemical data to determine the mass discharge of specific solutes (PCE, TCE, cis-DCE, and VC). Total mass discharge of the contaminants was found to be concentrated in several “hot spots” that occurred in locations determined by both magnitudes of concentrations and velocities. Given these localized hot spots, detailed information about flow at the GWSWI could be vital to understanding solute, and, by extension, nutrient, movement in ecosystems affected by exchange. Such information could be crucial to effective remediation design.

General information
State: Published
Application of CryoSat-2 altimetry data for river analysis and modelling

Availability of in situ river monitoring data, especially of data shared across boundaries, is decreasing, despite growing challenges for water resource management across the entire globe. This is especially valid for the case study of this work, the Brahmaputra Basin in South Asia. Commonly, satellite altimeters are used in various ways to provide information about such river basins. Most missions provide virtual station time series of water levels at locations where their repeat orbits cross rivers. CryoSat-2 is equipped with a new type of altimeter, providing estimates of the actual ground location seen in the reflected signal. It also uses a drifting orbit, challenging conventional ways of processing altimetry data to river water levels and their incorporation in hydrologic–hydrodynamic models. However, CryoSat-2 altimetry data provides an unprecedentedly high spatial resolution. This paper suggests a procedure to (i) filter CryoSat-2 observations over rivers to extract water-level profiles along the river, and (ii) use this information in combination with a hydrologic–hydrodynamic model to fit the simulated water levels with an accuracy that cannot be reached using information from globally available digital elevation models (DEMs) such as from the Shuttle Radar Topography Mission (SRTM) only. The filtering was done based on dynamic river masks extracted from Landsat imagery, providing spatial and temporal resolutions high enough to map the braided river channels and their dynamic morphology. This allowed extraction of river water levels over previously unmonitored narrow stretches of the river. In the Assam Valley section of the Brahmaputra River, CryoSat-2 data and Envisat virtual station data were combined to calibrate cross sections in a 1-D hydrodynamic model of the river. The hydrologic–hydrodynamic model setup and calibration are almost exclusively based on openly available remote sensing data and other global data sources, ensuring transferability of the developed methods. They provide an opportunity to achieve forecasts of both discharge and water levels in a poorly gauged river system.
Applying LCA in decision making- the need and the future perspective

General information
State: Published
Organisations: Department of Management Engineering, Quantitative Sustainability Assessment, Department of Civil Engineering, Centre for Oil and Gas - DTU, Transport DTU, Transport Modelling, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Department of Environmental Engineering, Urban Water Systems, National Food Institute, Research Group for Genomic Epidemiology, Section for Structural Engineering
Authors: Dong, Y. (Intern), Miraglia, S. (Intern), Manzo, S. (Intern), Georgiadis, S. (Intern), Sørup, H. J. D. (Intern), Boriani, E. (Intern), Hald, T. (Intern), Thøns, S. (Intern), Hauschild, M. Z. (Intern)
Number of pages: 1
Publication date: 2017
Main Research Area: Technical/natural sciences
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Applying LCA in decision making- the need and the future perspective

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10.5194/hess-21-751-2017
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Source-ID: 2306037934
Publication: Research - peer-review › Journal article – Annual report year: 2016
A probabilistic approach to urban flooding from sea surges in Copenhagen

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Department of Environmental Engineering, Urban Water Systems
Authors: Georgiadis, S. (Intern), Sørup, H. J. D. (Intern), Nielsen, B. F. (Intern), Arnbjerg-Nielsen, K. (Intern)
Pages: 658-662
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A pumping and tracer test in a limestone aquifer and impacts on contaminated site risk assessment and management

**General information**
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, GEO, Region Hovedstaden
Authors: Mosthaf, K. (Intern), Brauns, B. (Intern), Broholm, M. M. (Intern), Rohde, M. M. (Ekstern), Kerrem-Jespersen, H. (Ekstern), Bjerg, P. L. (Intern)
Number of pages: 2
Publication date: 2017
Main Research Area: Technical/natural sciences
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Aquaporin based biomimetic membrane in forward osmosis: Chemical cleaning resistance and practical operation
Aquaporin plays a promising role in fabricating high performance biomimetic forward osmosis (FO) membranes. However, aquaporin as a protein also has a risk of denaturation caused by various chemicals, resulting in a possible decay of membrane performance. The present study tested a novel aquaporin based biomimetic membrane in simulated membrane cleaning processes. The effects of cleaning agents on water flux and salt rejection were evaluated. The membrane showed a good resistance to the chemical agents. The water flux after chemical cleaning showed significant increases, particularly after cleaning with NaOCl and Alconox. Changes in the membrane structure and increased hydrophilicity in the surrounding areas of the aquaporin may be accountable for the increase in water permeability. The membrane shows stable salt rejection up to 99% after all cleaning agents were tested. A 15-day experiment with secondary wastewater effluent as the feed solution and seawater as the draw solution showed a stable flux and high salt rejection. The average rejection of the dissolved organic carbon from wastewater after the 15-day test was 90%. The results demonstrated that the aquaporin based biomimetic FO membrane exhibits chemical resistance for most agents used in membrane cleaning procedures, maintaining a stable flux and high salt rejection.

**General information**
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Organisations: Department of Environmental Engineering, Water Technologies, Northwest Agriculture and Forestry University, King Abdullah University of Science and Technology, Clemson University
Authors: Li, Z. (Ekstern), Linares, R. V. (Ekstern), Bucs, S. (Ekstern), Fortunato, L. (Ekstern), Hélix-Nielsen, C. (Intern), Vrouwenvelder, J. S. (Ekstern), Ghaffour, N. (Ekstern), Leiknes, T. (Ekstern), Amy, G. (Ekstern)
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Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
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ISI indexed (2013): ISI indexed yes
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Scopus rating (2012): SJR 1.517 SNIP 1.506 CiteScore 2.97
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.109 SNIP 1.276 CiteScore 2.93
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.897 SNIP 1.076
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.883 SNIP 1.043
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.817 SNIP 1.023
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.727 SNIP 0.954
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.635 SNIP 0.962
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.067 SNIP 1.231
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.057 SNIP 1.09
Scopus rating (2003): SJR 0.684 SNIP 0.993
Scopus rating (2002): SJR 0.383 SNIP 0.652
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.513 SNIP 1.575
Scopus rating (2000): SJR 0.445 SNIP 0.985
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Original language: English
Biomimetic membrane, Aquaporin, Desalination, Forward osmosis, Chemical stability
DOIs:
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Aquatic Ecotoxicity of Microplastics and Nanoplastics: Lessons Learned from Engineered Nanomaterials

The widespread occurrence of microplastics in the aquatic environment is well documented through international surveys and scientific studies. Further degradation and fragmentation, resulting in the formation of nanosized plastic particles – nanoplastics – has been highlighted as a potentially important issue. In the environment, both microplastics and nanoplastics may have direct ecotoxicological effects, as well as vector effects through the adsorption of co-contaminants. Plastic additives and monomers may also be released from the polymer matrix and cause adverse effects on aquatic organisms. Although limited information regarding the ecotoxicological effects of nano- and microplastics is available at present, their small size gives rise to concern with respect to the adverse effects and dislocation of these particles inside organisms – similar to issues often discussed for engineered nanomaterials. In the same way, transport of co-contaminants and leaching of soluble substances are much debated issues with respect to the ecotoxicology of nanomaterials.

Aquatic toxicity testing of liquid hydrophobic chemicals – Passive dosing exactly at the saturation limit

The aims of the present study were (1) to develop a passive dosing approach for aquatic toxicity testing of liquid substances with very high Kow values and (2) to apply this approach to the model substance dodecylbenzene (DDB, Log Kow = 8.65). The first step was to design a new passive dosing format for testing DDB exactly at its saturation limit. Silicone O-rings were saturated by direct immersion in pure liquid DDB, which resulted in swelling of >14%. These saturated O-rings were used to establish and maintain DDB exposure exactly at the saturation limit throughout 72-h algal growth inhibition tests with green algae Raphidocelis subcapitata. Growth rate inhibition at DDB solubility was 13 ± 5% (95% CI) in a first and 8 ± 3% (95% CI) in a repeated test, which demonstrated that improved exposure control can lead to good precision and repeatability of toxicity tests. This moderate toxicity at chemical activity of unity was higher than expected relative to a reported hydrophobicity cut-off in toxicity, but lower than expected relative to a reported chemical activity range for baseline toxicity. The present study introduces a new effective approach for toxicity testing of an important group of challenging chemicals, while providing a basis for investigating toxicity cut-off theories.
Aquavalsens Project - Report on the evaluation of data in comparison to "classical" data: Deliverable D10.5

General information
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Organisations: Department of Environmental Engineering, Urban Water Systems, Water Technologies
Number of pages: 104
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Aquavalsens Project - Report on the results of the analysis in the distribution network: Deliverable D10.4

General information
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Organisations: Department of Environmental Engineering, Urban Water Systems, Water Technologies
Number of pages: 78
Publication date: 2017

Aquavalsens Project - Report on the results of the analysis in the DWTP: Deliverable D10.3

General information
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Organisations: Department of Environmental Engineering, Urban Water Systems, Water Technologies
Number of pages: 155
Publication date: 2017
Aquavalens Project - Report on the selected DWTPs and distribution networks and control points for instrument installation: Deliverable D10.1

General information
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Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Puigdomenech, C. (Ekstern), Juarez, R. (Ekstern), Saucedo, G. (Ekstern), Arnedo, M. J. (Ekstern), Hambsch, B. (Ekstern), Kannegiesser, M. (Ekstern), Hügler, M. (Ekstern), Fischeder, R. (Ekstern), Lindhardt, B. (Ekstern), Albrechtsen, H. (Intern), Pitchers, R. (Ekstern), Barber, J. (Ekstern)
Number of pages: 103
Publication date: 2017

Aquavalens Project - Report on the selection of the newly developed tools and experimental plan: Deliverable D10.2

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Hambsch, B. (Ekstern), Hügler, M. (Ekstern), Kannegiesser, M. (Ekstern), Puigdomenech, C. (Ekstern), Juarez, R. (Ekstern), Saucedo, G. (Ekstern), Arnedo, M. J. (Ekstern), Lindhardt, B. (Ekstern), Christiansen, M. P. (Ekstern), Albrechtsen, H. (Intern), Tatari, K. (Intern), Pitchers, R. (Ekstern), Barber, J. (Ekstern), Appels, J. (Ekstern), Martinez-Murcia, A. (Ekstern), Mühlhahn, P. (Ekstern)
Number of pages: 41
Publication date: 2017

A regional and nonstationary model for partial duration series of extreme rainfall

Regional extreme value models for estimation of extreme rainfall intensities are widely applied, but their underlying assumption of stationarity is challenged. Many recent studies show that the rainfall extremes worldwide exhibit a nonstationary behavior. This paper presents a spatiotemporal model of extreme rainfall. The framework is built on a partial duration series approach with a nonstationary, regional threshold value. The model is based on generalized linear regression solved by generalized estimation equations. It allows a spatial correlation between the stations in the network and accounts furthermore for variable observation periods at each station and in each year. Marginal regional and temporal regression models solved by generalized least squares are used to validate and discuss the results of the full spatiotemporal model. The model is applied on data from a large Danish rain gauge network for four durations ranging from 10 min to 24 h. The observation period differs between stations, and the number of stations with more than 10 years of observations has increased over the years. A spatiotemporal model for the threshold is suggested, applying the mean annual precipitation and time as the explanatory variables in the regional and temporal domain, respectively. Further analysis of partial duration series with nonstationary and regional thresholds shows that the mean exceedances also exhibit a significant variation in space and time for some rainfall durations, while the shape parameter is found to be constant.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Urban Water Systems, DHI Denmark
Authors: Gregersen, I. B. (Intern), Madsen, H. (Ekstern), Rosbjerg, D. (Intern), Arnbjerg-Nielsen, K. (Intern)
Pages: 2659-2678
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<td>2001</td>
<td>BFI-level 2</td>
<td>SJR 1.596</td>
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A review of the potential to establish a global, operational river monitoring based on Sentinel-3 water surface elevation observations

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering
Authors: Kittel, C. M. M. (Intern), Bauer-Gottwein, P. (Intern)
Number of pages: 2
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Main Research Area: Technical/natural sciences
Electronic versions:
MOXXI_Abstract2017_Kittel_Bauer_Gottwein.pdf
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Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

A review on prospects and challenges of biological H2S removal from biogas with focus on biotrickling filtration and microaerobic desulfurization

The production of biogas from sulfate-rich materials under anaerobic digestion results in the formation of hydrogen sulfide (H2S). The recommended level of H2S in the produced biogas for direct combustion purposes is in the range of 0.02 to 0.05% w/w (200 to 500 ppm), therefore, desulfurization is required to avoid damages to combustion equipment and prevent the formation of sulfur dioxide (SO2) which is an acid rain precursor. It has been well documented that physical, thermal, and chemical desulfurization approaches suffer from high operation costs as well as waste production needing to be disposed of. Accordingly, a great deal of efforts has been put into biological methods because of being more environmentally friendly and more economically advantageous in comparison with the other techniques. Biotrickling filtration (BTF) and microaerobic desulfurization have shown a high potential for H2S removal at pilot- and large-scale plants. Despite all the progress made and the promising aspects keeping these methods at the core of interest, there are still challenges to be addressed. The present article attempts to briefly review and discuss the challenges and future prospects of BTF and microaerobic desulfurization.
Assessing the chemical contamination dynamics in a mixed land use stream system

Traditionally, the monitoring of streams for chemical and ecological status has been limited to surface water concentrations, where the dominant focus has been on general water quality and the risk for eutrophication. Mixed land use stream systems, comprising urban areas and agricultural production, are challenging to assess with multiple chemical stressors impacting stream corridors. New approaches are urgently needed for identifying relevant sources, pathways and potential impacts for implementation of suitable source management and remedial measures. We developed a method for risk assessing chemical stressors in these systems and applied the approach to a 16-km groundwater-fed stream corridor (Grindsted, Denmark). Three methods were combined: (i) in-stream contaminant mass discharge for source quantification, (ii) Toxic Units and (iii) environmental standards. An evaluation of the chemical quality of all three stream compartments – stream water, hyporheic zone, streambed sediment – made it possible to link chemical stressors to their respective sources and obtain new knowledge about source composition and origin. Moreover, toxic unit estimation and comparison to environmental standards revealed the stream water quality was substantially impaired by both geogenic and diffuse anthropogenic sources of metals along the entire corridor, while the streambed was less impacted. Quantification of the contaminant mass discharge originating from a former pharmaceutical factory revealed that several 100 kgs of chlorinated ethenes and pharmaceutical compounds discharge into the stream every year. The strongly reduced redox conditions in the plume result in high concentrations of dissolved iron and additionally release arsenic, generating the complex contaminant mixture found in the narrow discharge zone. The fingerprint of the plume was observed in the stream several km downgradient, while nutrients, inorganics and pesticides played a minor role for the stream health. The results emphasize future investigations should include multiple compounds and stream compartments, and highlight the need for holistic approaches when risk assessing these dynamic systems.

General information

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Organisations: Department of Environmental Engineering, Water Resources Engineering
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Assessing the impact of groundwater contamination on stream water quality by multiple approaches at the groundwater-surface water interface (Invited Presentation)

Contaminants such as chlorinated solvents and pesticides, as well as new classes of compounds or emerging micropollutants are extensively produced, utilized and then discarded in society and subsequently released to streams from multiple point and diffuse sources. Sustainable management of water resources requires assessment of multiple contamination sources within a watershed in order to assess their direct impact on water quality. Determination of flow paths and groundwater fluxes are essential for evaluating the transport, fate and potential impact of contaminant plumes discharging to streams. This implies that investigators have the tools to evaluate the governing parameters, including an appreciation of the scale of variability, as well as conceptual and numerical models that incorporate the various mechanisms affecting flow and transport.

A major multidisciplinary field scale investigation of the Grindsted stream area including geology, hydrogeology, geophysics, environmental chemistry, ecology and environmental engineering was carried out in 2012-2017, to develop the scientific basis for conducting risk assessments for contaminated sites impacting surface waters. The Grindsted stream area is a well-studied site, affected by many polluting sources including the plume from a former pharmaceutical factory. Our overall aim of the field investigations was to (i) test the applicability of different methods for mapping groundwater pollution as it enters streams at a complex site, and (ii) perform a source identification and risk assessment of the stream’s chemical and ecological status.

The study included development of a geological and hydrogeological model, numerical modeling of the flow and transport, mapping of the contaminant plume, and detailed field investigations at the main entry point of the plume. We quantified the
contaminant mass discharge and attenuation of the plume at the groundwater-surface interface by different approaches (control planes at stream bank, in the hyporheic zone and in the stream using traditional and innovative tools and models for determination of flow and contaminant fluxes).

The field methods and key findings regarding contaminant mass discharge, and challenges with respect to multiple stressor impact on streams will be discussed in the presentation.

Assessing the importance of spatio-temporal RCM resolution when estimating sub-daily extreme precipitation under current and future climate conditions

The increase in extreme precipitation is likely to be one of the most significant impacts of climate change in cities due to increased pluvial flood risk. Hence, reliable information on changes in sub-daily extreme precipitation is needed for robust adaptation strategies. This study explores extreme precipitation over Denmark generated by the regional climate model (RCM) HIRHAM-ECEARTH at different spatial resolutions (8, 12, 25 and 50km), three RCM from the RiskChange project at 8km resolution and three RCMs from ENSEMBLES at 25km resolution at temporal aggregations from 1 to 48h. The performance of the RCM simulations in current climate as well as projected changes for 2081-2100 is evaluated for non-central moments of order 1-3 and for the 2- and 10-year events. The comparison of the RCM simulations and observations shows that the higher spatial resolution simulations (8 and 12km) are more consistent across all temporal aggregations in the representation of high-order moments and extreme precipitation. The biases in the spatial pattern of extreme precipitation change across temporal and spatial resolution. The hourly extreme value distributions of the HIRHAM-ECEARTH simulations are more skewed than the observational dataset, which leads to an overestimation by the higher spatial resolution simulations. Nevertheless, in general, under current conditions RCM simulations at high spatial resolution represent extreme events and high-order moments better. The changes projected by the RCM simulations depend on the global climate model (GCM)-RCM combination, spatial resolution and temporal aggregation. The simulations disagree on the magnitude and spatial pattern of the changes. However, there is an agreement on higher changes for lower temporal aggregation and higher spatial resolution. Overall, the results from this study show the influence of the spatial resolution on the precipitation outputs from RCMs. The biases of the RCM simulations increase, and the projected changes decrease for decreasing spatial resolution of the simulations. This points towards the need for high spatial and temporal resolution RCMs to obtain reliable information on changes in sub-daily extreme precipitation.
Assessment of a combined dry anaerobic digestion and post-composting treatment facility for source-separated organic household waste, using material and substance flow analysis and life cycle inventory

The fate of total solids, volatile solids, total organic carbon, fossil carbon, biogenic carbon and 17 substances (As, Ca, CaCO3, Cd, Cl, Cr, Cu, H, Hg, K, Mg, N, Ni, O, P, Pb, S, Zn) in a combined dry anaerobic digestion and post-composting facility were assessed. Mass balances showed good results with low uncertainties for non-volatile substances, while balances for nitrogen, carbon, volatile solids and total organic carbon showed larger but reasonable uncertainties, due to volatilisation and emissions into the air. Material and substance flow analyses were performed in order to obtain transfer coefficients for a combined dry anaerobic digestion and post-composting facility. All metals passed through the facility and ended up in compost or residues, but all concentrations of metals in the compost complied with legislation. About 23% of
the carbon content of the organic waste was transferred to the biogas, 24% to the compost, 13% to residues and 40% into the atmosphere. For nitrogen, 69% was transferred to the compost, 10% volatilised to the biofilter, 11% directly into the atmosphere and 10% to residues. Finally, a full life cycle inventory was conducted for the combined dry anaerobic digestion and post-composting facility, including waste received, fuel consumption, energy use, gaseous emissions, products, energy production and chemical composition of the compost produced.
Assessment of a Danish sludge treatment reed bed system and a stockpile area, using substance flow analysis

Sludge treatment reed bed (STRB) systems combine dewatering, stabilisation and long-term storage of sludge. The main objective of this study was to investigate how substance concentrations change in the sludge residue during treatment and to conduct substance flow analyses covering the flow of substances in an STRB system over a 12-year treatment period, followed by three months' post-treatment in a stockpile area (SPA). Samples of sludge, reject water and sludge residue of different ages were collected at two Danish STRB system facilities and analysed for content of relevant substances.

Concentrations of carbon and nitrogen in the sludge residue residing in an STRB system changed as a function of treatment time, mainly due to mineralisation; only a negligible part was lost to reject water. Considering metals and phosphorus, the main share was accumulated in the sludge residue; only minor fractions were lost to mineralisation or reject water. Post-treatment in an SPA resulted in an increase in dry matter content from 24% to 32%. After treatment, the concentrations of heavy metals (lead, cadmium, nickel, zinc, copper and chromium) in the sludge residue met the threshold values stated by the Danish Environmental Protection Agency and the EU.
Assessment of groundwater contamination impacting stream ecosystems

General information
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Assessment of methane production from shredder waste in landfills: The influence of temperature, moisture and metals

In this study, methane (CH4) production rates from shredder waste (SW) were determined by incubation of waste samples over a period of 230 days under different operating conditions, and first-order decay kinetic constants (k-values) were calculated. SW and sterilized SW were incubated under different temperatures (20-25°C, 37°C, and 55°C), moisture contents (35% and 75% w/w) and amounts of inoculum (5% and 30% of the samples wet weight). The biochemical methane potential (BMP) from different types of SW (fresh, old and sieved) was determined and compared. The ability of metals (iron, aluminum, zinc, and copper) contained in SW to provide electrons for methanogens resulting in gas compositions with high CH4 contents and very low CO2 contents was investigated. The BMP of SW was 1.5-6.2 kg CH4/ton waste. The highest BMP was observed in fresh SW samples, while the lowest was observed in sieved samples (fine fraction of SW). Abiotic production of CH4 was not observed in laboratory incubations. The biotic experiments showed that when the moisture content was 35% w/w and the temperature was 20-25°C, CH4 production was extremely low. Increasing the temperature from 20-25°C to 37°C resulted in significantly higher CH4 production while increasing the temperature from 37°C to 55°C resulted in higher CH4 production, but to a lower extent. Increasing the moisture and inoculum content also increased CH4 production. The k-values were 0.033-0.075 yr(-1) at room temperature, 0.220-0.429 yr(-1) at 37°C and 0.235-0.488 yr(-1) at 55°C, indicating that higher temperatures resulted in higher k-values. It was observed that H2 can be produced by biocorrosion of iron, aluminum, and zinc and it was shown that produced H2 can be utilized by hydrogenotrophic methanogens to convert CO2 to CH4. Addition of iron and copper to SW resulted in inhibition of CH4 production, while addition of aluminum and zinc resulted in higher CH4 production. This suggested that aluminum and zinc contribute to high CH4 production from SW by providing H2 for hydrogenotrophic methanogens. Gas compositions with higher CH4 and lower CO2 observed in landfilled SW are thus most likely due to the consumption of existing CO2 in the produced biogas and the produced H2 by biocorrosion of aluminum and zinc by methanogens.
Assessment of Urban Pluvial Flood Risk and Efficiency of Adaptation Options Through Simulations – A New Generation of Urban Planning Tools

We present a new framework for flexible testing of flood risk adaptation strategies in a variety of urban development and climate scenarios. This framework couples the 1D-2D hydrodynamic simulation package MIKE FLOOD with the agent-based urban development model DAnCE4Water and provides the possibility to systematically test various flood risk adaptation measures ranging from large infrastructure changes over decentralised water management to urban planning policies. We have tested the framework in a case study in Melbourne, Australia considering 9 scenarios for urban development and climate and 32 potential combinations of flood adaptation measures. We found that the performance of adaptation measures strongly depended on the considered climate and urban development scenario and the other implementation measures implemented, suggesting that adaptive strategies are preferable over one-off investments. Urban planning policies proved to be an efficient means for the reduction of flood risk, while implementing property buyback and pipe increases in a guideline-oriented manner was too costly. Random variations in location and time point of urban development could have significant impact on flood risk and would in some cases outweigh the benefits of less efficient adaptation strategies. The results of our setup can serve as an input for robust decision making frameworks and thus support the identification of flood risk adaptation measures that are economically efficient and robust to variations of climate and urban layout.
A Stochastic Method to Manage Delay and Missing Values for In-Situ Sensors in an Alternating Activated Sludge Process

In the alternating activated sludge process with rule-based control, online N-measurements are of great importance for maintaining good control. These measurements can be delayed due to sensor processing time, turbulence at the location in the aeration tank where the sensor is placed, etc. The measurements may also be temporarily unavailable because of recalibration, communication faults or other errors. Here we present a method that handles such delay and missing observations. The model is based on zero order hold stochastic differential equations which use binary signals for influent flow and aeration to determine the state of the alternating process. It also uses measured ammonium and nitrate concentrations, which are shifted to account for delay. The method is developed and tested with data from a WWTP located in Kolding, Denmark. Results indicate that even though the model is simple, the model residuals and parameters are uncorrelated and the model predictions are 60% closer to the true values (measurements shifted to account for delay) than the delayed measurements are.

General information
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Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Department of Environmental Engineering, Urban Water Systems, Krüger A/S
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A systematic methodology to extend the applicability of a bioconversion model for the simulation of various co-digestion scenarios

Detailed simulation of anaerobic digestion (AD) requires complex mathematical models and the optimization of numerous model parameters. By performing a systematic methodology and identifying parameters with the highest impact on process variables in a well-established AD model, its applicability was extended to various co-digestion scenarios. More specifically, the application of the step-by-step methodology led to the estimation of a general and reduced set of parameters, for the simulation of scenarios where either manure or wastewater were co-digested with different organic substrates. Validation of the general parameter set involved the simulation of laboratory-scale data from three continuous co-digestion experiments, treating mixtures of different organic residues either at thermophilic or mesophilic conditions. Evaluation of the results showed that simulations using the general parameter set fitted experimental data quite well, indicating that it offers a reliable reference point for future simulations of anaerobic co-digestion scenarios.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
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Scopus rating (2008): SJR 1.734 SNIP 2.732
Web of Science (2008): Indexed yes
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Web of Science (2005): Indexed yes
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Web of Science (2004): Indexed yes
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Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.541 SNIP 1.208
A systematic model identification method for chemical transformation pathways – the case of heroin biomarkers in wastewater

This study presents a novel statistical approach for identifying sequenced chemical transformation pathways in combination with reaction kinetics models. The proposed method relies on sound uncertainty propagation by considering parameter ranges and associated probability distribution obtained at any given transformation pathway levels as priors for parameter estimation at any subsequent transformation levels. The method was applied to calibrate a model predicting the transformation in untreated wastewater of six biomarkers, excreted following human metabolism of heroin and codeine. The method developed was compared to parameter estimation methods commonly encountered in literature (i.e., estimation of all parameters at the same time and parameter estimation with fix values for upstream parameters) by assessing the model prediction accuracy, parameter identifiability and uncertainty analysis. Results obtained suggest that the method developed has the potential to outperform conventional approaches in terms of prediction accuracy, transformation pathway identification and parameter identifiability. This method can be used in conjunction with optimal experimental designs to effectively identify model structures and parameters. This method can also offer a platform to promote a closer interaction between analytical chemists and modellers to identify models for biochemical transformation pathways, being a prominent example for the emerging field of wastewater-based epidemiology.
A taste of plastic - quantifying micro- and nanoplastic ingestion and interactions with feeding in Daphnia magna (E)

Aquatic ecosystems worldwide are polluted by microplastics and they are ingested by a broad range of organisms. Although research so far mainly focused on marine ecosystems, freshwater organisms are just as affected. Approaches to study microplastic ingestion are predominantly qualitative since quantitative measures are analytically challenging. The aim of this study was to develop and apply a quantitative approach to measure particle body burden to study uptake and depuration of micro- and nanoplastics in the freshwater flea Daphnia magna, using fluorescent polystyrene beads. The animals were first exposed to a particle concentration of 1 mg/l for 24 h (uptake) and thereafter transferred to clean medium for another 24 h (depuration). During both phases animals were sampled and particle body burdens were determined by measuring particle fluorescence in the dissolved tissue. To analyze the influence of particle size, the study was done with beads of 2 µm and 100 nm. It was furthermore analyzed how the processes are affected by food availability and how the particles in turn affect the feeding rate of D. magna. Both particle sizes were readily taken up and body burdens increased with exposure time. The 2 µm beads were taken up in a higher quantity. Likewise, depuration was more efficient for the bigger particles. Smaller particles remain in the organism for a longer time, potentially increasing their hazard. Food availability strongly influenced particle body burdens, with lower levels in the presence of food. In turn, the particles can potentially alter the animals’ feeding rate, which could lead to impairments of physiology and fitness.

General information
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Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Rist, S. (Intern), Baun, A. (Intern), Hartmann, N. B. (Intern)
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Atmospheric deposition, CO2, and change in the land carbon sink
Concentrations of atmospheric carbon dioxide (CO2) have continued to increase whereas atmospheric deposition of sulphur and nitrogen has declined in Europe and the USA during recent decades. Using time series of flux observations from 23 forests distributed throughout Europe and the USA, and generalised mixed models, we found that forest-level net ecosystem production and gross primary production have increased by 1% annually from 1995 to 2011. Statistical models indicated that increasing atmospheric CO2 was the most important factor driving the increasing strength of carbon sinks in these forests. We also found that the reduction of sulphur deposition in Europe and the USA lead to higher recovery in ecosystem respiration than in gross primary production, thus limiting the increase of carbon sequestration. By contrast, trends in climate and nitrogen deposition did not significantly contribute to changing carbon fluxes during the studied period. Our findings support the hypothesis of a general CO2-fertilization effect on vegetation growth and suggest that, so far unknown, sulphur deposition plays a significant role in the carbon balance of forests in industrialized regions. Our results show the need to include the effects of changing atmospheric composition, beyond CO2, to assess future dynamics of carbon-climate feedbacks not currently considered in earth system/climate modelling.

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Automatiseret simplificering af 1D hydraulisk model – med hensyn til 1D-2D oversvømmelsesberegninger

General information
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Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Löwe, R. (Intern), Davidsen, S. (Intern), Thrysøe, C. (Intern), Arnbjerg-Nielsen, K. (Intern)
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Bacteria from Wheat and Cucurbit Plant Roots Metabolize PAHs and Aromatic Root Exudates: Implications for Rhizodegradation

The chemical interaction between plants and bacteria in the root zone can lead to soil decontamination. Bacteria which degrade PAHs have been isolated from the rhizospheres of plant species with varied biological traits, however, it is not known what phytochemicals promote contaminant degradation. One monocot and two dicotyledon plants were grown in PAH-contaminated soil from a manufactured gas plant (MGP) site. A phytotoxicity assay confirmed greater soil decontamination in rhizospheres when compared to bulk soil controls. Bacteria were isolated from plant roots (rhizobacteria) and selected for growth on anthracene and chrysene on PAH-amended plates. Rhizosphere isolates metabolized 3- and 4-ring PAHs and PAH catabolic intermediates in liquid incubations. Aromatic root exudate compounds, namely flavonoids and simple phenols, were also substrates for isolated rhizobacteria. In particular, the phenolic compounds - morin, caffeic acid, and protocatechuic acid - appear to be linked to bacterial degradation of 3- and 4- ring PAHs in the rhizosphere.
**Batch, fed-batch and CSTR reactors as cultivation systems to acclimate ammonia tolerant methanogenic consortia**

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State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Fotidis, I. (Intern), Tian, H. (Intern), Mancini, E. (Intern), Angelidaki, I. (Intern)
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Bioaugmentation with hydrolytic microbes to improve the anaerobic biodegradability of lignocellulosic agricultural residues

Bioaugmentation with hydrolytic microbes was applied to improve the methane yield of bioreactors fed with agricultural wastes. The efficiency of Clostridium thermocellum and M. roseus to degrade lignocellulosic matter was evaluated in batch and continuously stirred tank reactors (CSTRs). Results from batch assays showed that C. thermocellum enhanced the methane yield by 34%. A similar increase was recorded in CSTR during the bioaugmentation period; however, at steady-state the effect was noticeably lower (7.5%). In contrast, the bioaugmentation with M. roseus did not promote marked anaerobic biodegradability, as the methane yield was increased up to 10% in batch and no effect was shown in CSTR. High-throughput 16S rRNA amplicon sequencing was used to assess the effect of bioaugmentation strategies on bacterial and archaeal populations. The microbial analysis revealed that both strains were not markedly resided into biogas microbiome. Additionally, the applied strategies did not alter significantly the microbial communities.

**General information**
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark, University of Padua, National University of Athens
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Number of pages: 10
Bioavailability and bioaccessibility of polycyclic aromatic hydrocarbons from (post-pyrolytically treated) biochars

Bioaccessibility data of PAHs from biochar produced under real world conditions is scarce and the influence of feedstock and various post-pyrolysis treatments common in agriculture, such as co-composting or lacto-fermentation to produce silage fodder, on their bioavailability and bioaccessibility has hardly been studied. The total (C_{total}), and freely dissolved (i.e., bioavailable) concentrations (C_{free}) of the sum of 16 US EPA PAHs of 43 biochar samples produced and treated in such ways ranged from 0.4 to almost 2000 mg/kg, and from 12 to 81 ng/L, respectively, which resulted in very high biochar-water partition coefficients (4.2 ≤ log KD ≤ 8.8 L/kg) for individual PAHs. Thirty three samples were incubated in contaminant traps that combined a diffusive carrier and a sorptive sink. Incubations yielded samples only containing desorption-resistant PAHs (C_{res}). The desorption resistant PAH fraction was dominant, since only eight out of 33 biochar samples showed statistically significant bioaccessible fractions (fbioaccessible = 1 - C_{res}/C_{total}). Bioavailability correlated positively with C_{total}/surface area. Other relationships of bioavailability and -accessibility with the investigated post-pyrolysis processes or elemental composition could not be found. PAH exposure was very limited (low C_{free}, high C_{res}) for all samples with low to moderate C_{total}, whereas higher exposure was determined in some biochars with C_{total} > 10 mg/kg.

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Organisations: Department of Environmental Engineering, Environmental Chemistry, Agroscope, Aarhus University, Norwegian Geotechnical Institute, Ithaka Institute for Carbon Strategies
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BFI (2012): BFI-level 2
Biodegradation of hydrocarbon mixtures in surface waters at environmentally relevant levels - Effect of inoculum origin on kinetics and sequence of degradation

Biodegradation is a dominant removal process for many organic pollutants, and biodegradation tests serve as tools for assessing their environmental fate within regulatory risk assessment. In simulation tests, the inoculum is not standardized, varying in microbial quantity and quality, thereby potentially impacting the observed biodegradation kinetics. In this study we investigated the effect of inoculum origin on the biodegradation kinetics of hydrocarbons for five inocula from surface waters varying in urbanization and thus expected pre-exposure to petroleum hydrocarbons. A new biodegradation method for testing mixtures of hydrophobic chemicals at trace concentrations was demonstrated: Aqueous solutions containing 9 hydrocarbons were generated by passive dosing and diluted with surface water resulting in test systems containing native microorganisms exposed to test substances at ng-μg/L levels. Automated Headspace Solid Phase Microextraction coupled to GC-MS was applied directly to these test systems to determine substrate depletion relative to abiotic controls. Lag phases were generally less than 8 days. First order rate constants were within one order of magnitude for each hydrocarbon in four of the five waters but lower in water from a rural lake. The sequence of degradation between the 9 hydrocarbons showed similar patterns in the five waters indicating the potential for using selected hydrocarbons for benchmarking between biodegradation tests. Degradation half-times were shorter than or within one order of magnitude of BioHCwin predictions for 8 of 9 hydrocarbons. These results showed that location choice is important for biodegradation kinetics and can provide a relevant input to aquatic exposure and fate models.
Biodegradation testing of chemicals with high Henry's constants – separating mass and effective concentration reveals higher rate constants

During simulation-type biodegradation tests, volatile chemicals will continuously partition between water phase and headspace. This study addressed how (1) this partitioning affects biodegradation test results and (2) it can be accounted for by combining mass balance and dynamic biodegradation models. An aqueous mixture of 9 (semi)volatile chemicals was first prepared using passive dosing and then diluted with environmental surface water to produce test systems containing concentrations in the ng/L to µg/L range. After incubation for 2 hours to 4 weeks, automated Headspace Solid Phase Microextraction (HS-SPME) was applied directly on the test systems to measure substrate depletion by biodegradation relative to abiotic controls. HS-SPME was also applied to determine air to water partitioning ratios. Water phase biodegradation rate constants, $k_{\text{water}}$, were up to 72 times higher than test system biodegradation rate constants, $k_{\text{system}}$. True water phase degradation rate constants facilitate extrapolation to other air-water systems and are more suitable input parameters for aquatic exposure and fate models. As such, they should be considered more appropriate for risk assessments than test system rate constants.
Biodegradation testing of hydrophobic chemicals in mixtures at low concentrations – covering the chemical space of petroleum hydrocarbons

Petroleum products are complex mixtures of varying composition containing thousands of hydrocarbons each with their own physicochemical properties and degradation kinetics. One approach for risk assessment of these products is therefore to group the hydrocarbons by carbon number and chemical class i.e. hydrocarbon blocks. However, the biodegradation kinetic data varies in quantity and quality for the different hydrocarbon blocks, hampering the characterization of their fate properties. In this study, biodegradation kinetics of a large number of hydrocarbons aiming to cover the chemical space of petroleum hydrocarbons, were therefore determined at ng/L to µg/L concentrations in surface water, seawater and activated sludge filtrate. Two hydrocarbon mixtures were prepared, comprising a total of 53 chemicals including paraffins, naphthenics and aromatic hydrocarbons from C8 to C20. Passive dosing from silicone rod loaded with the mixtures was used to prepare stock solutions. Test systems were then prepared using stock solution diluted with the surface water, seawater or activated sludge filtrate. Test systems were incubated at 20 °C on a roller for up to 98 days and analyzed using GC-MS and fully automated Solid Phase Micro Extraction. Results were normalized to parallel measurements of abiotic controls prior to evaluation of biodegradation kinetics. Degradation was generally faster in the activated sludge filtrate than in the seawater and lakewater. In the activated sludge filtrate lag phases were < 9 days for the 49 hydrocarbons that were degraded within test duration. Degradation rate constants and corresponding half-lives were determined for 44 of the hydrocarbons. In lakewater and seawater, less test chemicals were degraded within the test duration compared to the activated sludge filtrate.

Bioelectricity production and microbial communities in microbial fuel cell powered by macroalgal biomass

Bioelectricity production and microbial communities in microbial fuel cell powered by macroalgal biomass
Bioelectrochemical systems serve anaerobic digestion process for process monitoring and biogas upgrading

Bioelectrochemical systems (BES), which employ microbes as catalysts to convert chemical energy stored in organic matter into sustainable electricity and high-value chemicals, is an emerging and promising technology. BES have broad applications including wastewater treatment, chemical production, resource recovery and waste remediation. Recently, new concepts of been proposed. The purpose of this work was to optimize the AD process using BES in two aspects: developing a new volatile fatty acid (VFA) monitoring system which can be used as the AD process indicator, and for improving biogas quality by removing CO₂. In this thesis, a microbial desalination cell (MDC) was developed for measuring VFAs concentrations. The MDC was composed of three chambers, namely an anode, a cathode and a middle chamber. The samples were measured in the middle chamber, which was separated from the anode by an in their ionized form contained in the sample, diffused through AEM to the anode where they were microbially oxidized and produced current signals. The effect of operating parameters such as ionic strength and external resistance on the performance of the MDC-typed biosensor were assessed. High ionic strength and small external resistance were advantageous for current signal amplification. Two linear relationships between current outputs and VFA concentrations were observed. The response time was approx. 5 h and the detection range was 1 to 200 mM. The selectivity of the biosensor was demonstrated since organic matter such as protein and lipids were retained by the AEM and their interference was eliminated. The reliability was proved by real AD effluents. In order to reduce the construction cost and simplify the VFA biosensor, a new configuration was developed. The number of chambers was reduced from three to two. The new configuration was a microbial electrolysis cell (MEC). The anode and cathode chambers were separated by an AEM and a small additional voltage was supplied to the cell. The samples were measured in the cathode. The effect of different parameters such as external voltage, ionic strength and VFA composition ratio on the MEC-typed biosensor performance was evaluated. Higher current signals were observed under larger external voltage and higher ionic strengths. The current output was mainly contributed by acetate which was always dominant in AD reactors. The current density increased linearly along with VFAs concentrations ranging from 5 to 100 mM. The response of the biosensor was now only 1 h due to the faster transfer of VFAs supported by the external voltage. The interference from other non-ionic organic matter (glucose, cellulose, lipids and protein) could be eliminated since they were retained by the membrane. During the process, hydrogen (H₂) was generated from water hydrolysis. The produced H₂ could potentially contribute to the energy needs for operating the biosensor and thereby to a self-sustaining system. Moreover, the biosensor was successfully validated both with synthetic and real AD effluents. To improve biogas quality, a microbial electrolytic capture, separation and regeneration cell (MESC) was developed. The effects of external voltage and inlet gas flow rate were elucidated. The current output increased along with the gas flow rate, while cathodic pH and upgrading performance showed opposite trends. The current output, cathodic pH and upgrading performance increased with the increasing external voltage supply. In MESC, acid and alkaline generation, CO₂ capture, biogas upgrading and COD removal were simultaneously achieved. Under the optimum condition at 1.2 V external voltage and 19.6 mL/h gas flow rate, pH in the regeneration and cathode chambers could reach 1.34±0.04 and 9.19±0.11, respectively; the maximum methane content was up to 97.0±0.2% and COD removal efficiency reached 98.2±2.6%. The energy consumption for biogas upgrading was around 0.17 kWh/m³ raw biogas. Moreover, the generated H₂ from water hydrolysis could potentially compensate for 23.4% of the energy consumption. It has been proved that the development of efficient, cheap, fast and reliable VFA monitoring with a wide detection range can be realized in BES which is sustainable and environmental friendly. The development technology could easily be installed as online monitoring system for optimizing the AD process. Moreover, BES could be a sustainable economic technology to upgrade biogas to biomethane and thereby increase the value of biogas. The proof-of-concept study in lab-scale offers ideas for expanding BES application.
Bio-electrolytic sensor for rapid monitoring of volatile fatty acids in anaerobic digestion process

This study presents an innovative biosensor that was developed on the basis of a microbial electrolysis cell for fast and reliable measurement of volatile fatty acids (VFA) during anaerobic digestion (AD) process. The bio-electrolytic sensor was first tested with synthetic wastewater containing varying concentrations of VFA. A linear correlation ($R^2 = 0.99$) between current densities (0.03 ± 0.01 to 2.43 ± 0.12 A/m²) and VFA concentrations (5–100 mM) was found. The sensor performance was then investigated under different affecting parameters such as the external voltage, VFA composition ratio, and ionic strength. Linear relationship between the current density and VFA concentrations was always observed. Furthermore, the bio-electrolytic sensor proved ability to handle interruptions such as the presence of complex organic matter, anode exposure to oxygen and low pH. Finally, the sensor was applied to monitor VFA concentrations in a lab-scale AD reactor for a month. The VFA measurements from the sensor correlated well with those from GC analysis which proved the accuracy of the system. Since hydrogen was produced in the cathode as byproduct during monitoring, the system could be energy self-sufficient. Considering the high accuracy, short response time, long-term stability and additional benefit of H₂ production, this bio-electrolytic sensor could be a simple and cost-effective method for VFA monitoring during AD and other anaerobic processes.
Biological caproate production by Clostridium kluyveri from ethanol and acetate as carbon sources

Caproate is a valuable industrial product and chemical precursor. In this study, batch tests were conducted to investigate the fermentative caproate production through chain elongation from acetate and ethanol. The effect of acetate/ethanol ratio and initial ethanol concentration on caproate production was examined. When substrate concentration was controlled at 100 mM total carbon, hydrogen was used as an additional electron donor. The highest caproate concentration of 3.11 g/L was obtained at an ethanol/acetate ratio of 7:3. No additional electron donor was needed upon an ethanol/acetate ratio ≥7:3. Caproate production increased with the increase of carbon source until ethanol concentration over 700 mM, which inhibited the fermentation process. The highest caproate concentration of 8.42 g/L was achieved from high ethanol strength wastewater with an ethanol/acetate ratio of 10:1 (550 mM total carbon). Results obtained in this study can pave the way towards efficient chain elongation from ethanol-rich wastewater.
Biological systems for simultaneous methanation of CO$_2$ and H$_2$ by anaerobic microorganisms
Butanol fermentation of the brown seaweed Laminaria digitata by Clostridium beijerinckii DSM-6422

Seaweed represents an abundant, renewable, and fast-growing biomass resource for 3rd generation biofuel production. This study reports an efficient butanol fermentation process carried out by Clostridium beijerinckii DSM-6422 using enzymatic hydrolysate of the sugar-rich brown seaweed Laminaria digitata harvested from the coast of the Danish North Sea as substrate. The highest butanol yield (0.42g/g-consumed-substrates) compared to literature was achieved, with a significantly higher butanol:acetone-butanol-ethanol (ABE) molar ratio (0.85) than typical (0.6). This demonstrates the possibility of using the seaweed L. digitata as a potential biomass for butanol production. For the first time, consumption of alginate components was observed by C. beijerinckii DSM-6422. The efficient utilization of sugars and lactic acid further highlighted the potential of using this strain for future development of large-scale cost-effective butanol production based on (ensiled) seaweed.

General information
State: Published
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Butanol fermentation of the brown seaweed Laminaria digitata by Clostridium beijerinckii DSM-6422

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General information
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By-product reuse in drinking water softening: influence of operating conditions on calcium carbonate pellet characteristics

Water utilities are becoming increasingly aware of the environmental sustainability of drinking water production and distribution, while still producing water meeting regulatory guidelines in a cost-effective manner. In areas with high water hardness, central drinking water softening can provide both socio-economic and environmental benefits. However, optimal implementation of softening requires a holistic approach including e.g. possibilities for by-product reuse. A pellet reactor is one widely used softening technology that may produce up to 350 kg calcium carbonate pellets per 1000 m³ softened water. As of yet, no overview exists of how the physical and chemical properties of pellets are affected by operating conditions, such as placement in the water treatment train and which seeding material is used (quartz sand or calcium carbonate). The aim of this study was to characterize pellets formed under different operating conditions in pilot scale experiments at 8 Danish water treatment plants softening 16 water types. Results showed that iron concentrations, measured with ICP-MS, varied from 19 to 9,200 mg/kg and manganese varied from 0.5 to 980 mg/kg. The concentrations depended on both the raw water quality and the location of softening in the treatment train. Despite differences in chemical dosage, chemical composition of influent water, and seeding material, XRD analyzes showed that all pellets crystallized as calcite and have a relatively low reactivity of 7.4 to 26 % measured by the Sauerbeck & Rietz method. Our study showed that some pellet characteristics, e.g. the concentrations of iron and manganese, can be controlled in the design of the softening process. This allows for optimization of pellets with respect to environmentally sustainable reuse and ensure a pellet composition with high market value e.g. in markets such as glass or chemical industries. Our results assist the circular economy thinking in drinking water production.
Calibration of the comprehensive NDHA-N$_2$O dynamics model for nitrifier-enriched biomass using targeted respirometric assays

The NDHA model comprehensively describes nitrous oxide (N$_2$O) producing pathways by both autotrophic ammonium oxidizing and heterotrophic bacteria. The model was calibrated via a set of targeted extant respirometric assays using enriched nitrifying biomass from a lab-scale reactor. Biomass response to ammonium, hydroxylamine, nitrite and N$_2$O additions under aerobic and anaerobic conditions were tracked with continuous measurement of dissolved oxygen (DO) and N$_2$O. The sequential addition of substrate pulses allowed the isolation of oxygen-consuming processes. The parameters to be estimated were determined by the information content of the datasets using identifiability analysis. Dynamic DO profiles were used to calibrate five parameters corresponding to endogenous, nitrite oxidation and ammonium oxidation processes. The subsequent N$_2$O calibration was not significantly affected by the uncertainty propagated from the DO calibration because of the high accuracy of the estimates. Five parameters describing the individual contribution of three biological N$_2$O pathways were estimated accurately (variance/mean < 10% for all estimated parameters). The NDHA model response was evaluated with statistical metrics (F-test, autocorrelation function). The 95% confidence intervals of DO and N$_2$O predictions based on the uncertainty obtained during calibration are studied for the first time. The measured data fall within the 95% confidence interval of the predictions, indicating a good model description. Overall, accurate parameter estimation and identifiability analysis of ammonium removal significantly decreases the uncertainty propagated to N$_2$O production, which is expected to benefit N$_2$O model discrimination studies and reliable full scale applications.
Calibration of the NDHA N2O model via respirometric assays

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Department of Chemical and Biochemical Engineering, PROSYS - Process and Systems Engineering Centre, Centre for oil and gas – DTU, Technical University of Denmark
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Number of pages: 4
Publication date: 2017
Carbon Sequestration by Urban Trees

Carbon dioxide (CO2) is the most prominent component of anthropogenic greenhouse gas emissions, resulting mainly from fuel combustion in the built environment – for activities such as heating of buildings, urban mobility and cooking. The concentration of near-surface CO2 in cities is affected by a range of factors, including traffic density and atmospheric stability. Plants have the capacity to sequester CO2 through photosynthesis, and can therefore store carbon in plant biomass and in the soil. Green areas in the city may significantly affect local concentrations of atmospheric CO2, as observed in urban-to-rural comparisons showing lower CO2 concentration in the presence of vegetation. CO2 sequestration over the ‘urban forest’ displays diurnal variation during the growing period, with uptake during daytime when plants are photosynthetically active, and nocturnal emissions in response to respiration. High atmospheric CO2 concentrations represent a fertilizer for plants, promoting more efficient photosynthesis. However, urban plants often experience environmental stresses which compromise the photosynthetic apparatus, and in extreme cases may turn plants from carbon sinks into carbon sources. In this chapter, we review the most recent studies and highlight emerging research needs for a better understanding of present and future roles of urban trees in removing CO2 from the atmosphere.

Caries affected by calcium and fluoride in drinking water and family income

Water quality and socioeconomics influence caries in populations. This study broadens previous studies on how caries is associated with fluoride and calcium in drinking water and with family income by quantifying the combined effect of the three independent variables. The effects of calcium and fluoride can be described as independent effects of the two ions or, alternatively, in the form of saturation with respect to fluorite (CaF2). A general linear model describes this relationship with high significance and the model confirms the important protective effect of calcium and fluoride, independently against caries. From the model, the relative importance of fluoride and calcium to protect against caries is quantified. The relationship between caries and family income is also highly significant. It is illustrated how the linear model can be applied in planning and analyzing drinking water softening in relation to caries.
Categorization of Advanced Materials and European Environmental Regulation

General information
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Cellular networks for reliable urban rainfall monitoring

Challenges in using allylthiourea and chlorate as specific nitrification inhibitors

Challenge of material recycling at large public events

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Organisations: Department of Environmental Engineering, Urban Water Systems
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Challenge of material recycling at large public events

Large public events such as festivals, sports events or national celebrations tend to attract a considerable number of people. While some of the events are important sources of entertainment for the participants, such gatherings create a challenge to organize and maintain a functioning infrastructure. Sound waste management is one of the challenges. Some preliminary results presented here, concern waste material flows at a large public event, illustrated on the example of Roskilde Festival (Denmark). Roskilde Festival is a large annual event, which attracts more than 120,000 participants and generates more than 2000 tonnes of waste over eight days. In 2016, approximately 16% of the total waste generated was either recycled or sent to special treatment, the remaining (approximately 85%) ended up as residual waste and was sent to a waste-to-energy facility. While measures to promote material recycling at the festival have been implemented, our preliminary results suggest that there is currently large potential to recover additional materials for recycling and improve sustainability at large public events.

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
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Challenges in using allylthiourea and chlorate as specific nitrification inhibitors

Allylthiourea (ATU) and chlorate (ClO3-) are often used to selectively inhibit nitritation and nitratation. In this work we identified challenges with use of these compounds in inhibitory assays with filter material from a biological rapid sand filter
for groundwater treatment. Inhibition was investigated in continuous-flow lab-scale columns, packed with filter material from a full-scale filter and supplied with NH4+ or NO2-. ATU concentrations of 0.1-0.5 mM interfered with the indophenol blue method for NH4+ quantification leading to underestimation of the measured NH4+ concentration. Interference was stronger at higher ATU levels and resulted in no NH4+ detection at 0.5 mM ATU. ClO3- at typical concentrations for inhibition assays (1-10 mM) inhibited nitratation by less than 6%, while nitratation was instead inhibited by 91% when NH4+ was supplied. On the other hand, nitratation was inhibited by 67-71% at 10-20 mM ClO3- when NO2- was supplied, suggesting significant nitratation inhibition at higher NO2- concentrations. No chlorite (ClO2-) was detected in the effluent, and thus we could not confirm that nitratation inhibition was caused by ClO3- reduction to ClO2-. In conclusion, ATU and ClO3- should be used with caution in inhibition assays, because analytical interference and poor selectivity for the targeted process may affect the experimental outcome and compromise result interpretation.

**General information**
State: Published
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Scopus rating (2010): SJR 1.867 SNIP 1.421
Web of Science (2010): Indexed yes
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Challenges to a circular economy – the presence of impurities in wood waste for recycling

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
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Challenges to application of the three points approach (3PA) - ambiguity in definition of event magnitude, spatial scales and goals

General information
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Organisations: Department of Environmental Engineering, Urban Water Systems, Department of Management Engineering, Technology and Innovation Management
Authors: Madsen, H. M. (Intern), Rygaard, M. (Intern), Andersen, M. M. (Intern), Mikkelsen, P. S. (Intern)
Changes in Intermittent aeration regimes are effective tools to manage bio-granule size and microbial communities in partial nitritation-anammox SBRs

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Changes in phenology and the influence on the carbon sequestration in a Danish beech forest over 20 years
Observations of carbon sequestration in a Danish beech forest over the last 20 years have shown a steady increase in NEE. Earlier studies (Pilegaard et al. 2011) have shown, that about half of the increase can be attributed to an increase in the growing season length. The growing season has been determined as the carbon uptake period (CUP); i.e. the period with net uptake, determined from flux data. Additionally, we have determined the period with leaves (LP) from the attenuation of light below the canopy. In this analysis we add information from a phenology camera with data from the last 6 years using the R package Phenopix (Filippa et al. 2016). The new data is compared with CUP and LP to give more detailed information on the phenology. The information is used to examine the evolution of net ecosystem exchange (NEE) over the 20 year period.

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Characterisation of wood combustion ashes

The combustion of wood chips and wood pellets for the production of renewable energy in Denmark increased from 5.7 PJ to 10 PJ during the period 2000-2015, and further increases are expected to occur within the coming years. In 2012, about 22,300 tonnes of wood ashes were generated in Denmark. Currently, these ashes are mainly landfilled, despite Danish legislation allowing their application onto forest and agricultural soils for fertilising and/or liming purposes.

During this PhD work, 16 wood ash samples generated at ten different Danish combustion plants were collected and characterised for their composition and leaching properties. Despite the relatively large variations in the contents of nutrients and trace metals, the overall levels were comparable to typical ranges reported in the literature for other wood combustion ashes, as well as with regards to leaching. In general, the composition of the ashes complied with Danish ash quality criteria, indicating that they may be applied onto forest soil. However, according to EU landfill waste acceptance criteria, the leachates corresponded to “non-hazardous” or “hazardous” waste, thereby suggesting that recirculation of the same ashes to forestry land may constitute an environmental issue as a result of leaching, especially with regards to Cr and Se.

The release of nutrients and contaminants from two selected wood ash samples (corresponding to one mixed ash sample and one fly ash sample) was estimated based on selected pH conditions and data for both short- and long-term leaching. Acidic conditions relevant for typical forest soils in Denmark indicated considerably higher releases of Cd, Mg, Zn and P compared with releases of the natural ash pH (more than two orders of magnitude difference). The leaching of Cl, K, Na and S was rather pH-independent, high during the initial leaching and most likely governed by the availability of these elements in the ash matrix. On the other hand, the leaching of Al, Ba, Ca, Cr, Mg, Sb, V and Zn was distributed over a wider liquid-to-solid (L/S) interval and differences of at least one order of magnitude were shown between the observed cumulative releases at L/S 10 L/kg and L/S 1000 L/kg. Relatively large fractions of P (i.e. 33 % and 48 % of the fly ash and mixed ash P contents, respectively) were observed to dissolve after extraction with neutral ammonium citrate, which indicated the potential use of wood ashes as a P supplement for the soil.

The release of major elements such as Al, Ba, Ca, Fe, Mg, Si, P and S was governed mainly by mineral solubility. The most likely minerals governing the release of these elements were found to be in general agreement with mineral phases identified in the literature for other wood combustion ashes, but also minor and trace elements within the ashes. The leaching of trace elements, such as Cu, Cr, Pb and Zn, was described adequately as a combination of mineral solubility, adsorption onto Al/Fe (hydr-) oxides and complexation with dissolved organic matter.

The influence of common ash pre-treatments, such as hardening (also known as ageing or maturing) and granulation, on ash chemistry, liming potential and leaching behaviour was investigated through a series of laboratory experiments. Ash granules were relatively hard (barely breakable by finger-pinching) and demonstrated a reduced leaching compared to loose ashes, an effect that appeared to be related to the specific surface area granules. Ash granules may be used in actual field applications to minimise dust generation. Hardening affected the mineralogical structure of the ashes, but their overall acid neutralisation capacity remained practically constant. Column leaching tests showed that hardened ashes presented pH levels about two units lower than fresh ashes and a reduced leaching of alkalinity. The leaching of As, P, Sb and V increased after hardening, while the leaching of Ba, Ca, Pb and Zn was generally reduced to concentration levels below or close to limit of quantitation levels. Ash hardening was observed to be a relatively simple and fast treatment. Preferably, this process should be carried out under controlled conditions, before the ashes are applied, as this will minimise their overall reactivity as well as the leaching of most trace elements.

The effects of ash application on the mobility of nutrients and trace elements in soil pore water were evaluated through a series of column experiments. The two uppermost soil horizons of a Danish nutrient-poor forest soil were tested against three ash dosages, namely 3, 9 and 30 tonnes/ha. Ash application promoted the release of nutrients such as K and P during the entire duration of the experiment, corresponding to about eight field-scale years. A short-term release of Cl, K, Mg and S was also observed within the first 500 L/m² of infiltrating water (corresponding to fewer than two years on the field scale). While an overall increase in the leached amounts of As and Cu from the organic soil horizon were observed in the case of ash application (from 2.2 to 5.0-5.8 mg/m² for As and from 2.0 to 4.9-7.6 mg/m² for Cu), their concentration levels in the percolating soil solutions was generally within Danish groundwater quality criteria. Though the effects of both the 3 and 9 tonnes/ha dosages were limited and comparable, the use of 30 tonnes/ha indicated considerably larger amounts of K, Mg, S and Si within the first 500 L/m² (at least five times larger than the soil controls). Furthermore, because of the low mobility of many trace elements, such as Cd, Cr, Ni, Pb and Zn, potential accumulation of these elements on the forest floor should be evaluated. Consequently, such high dosages cannot be recommended based on these experiments.

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Characteristic Rain Events: A Methodology for Improving the Amenity Value of Stormwater Control Measures

Local management of rainwater using stormwater control measures (SCMs) is gaining increased attention as a sustainable alternative and supplement to traditional sewer systems. Besides offering added utility values, many SCMs also offer a great potential for added amenity values. One way of achieving amenity value is to stage the rainwater and thus bring it to the attention of the public. We present here a methodology for creating a selection of rain events that can help bridge between engineering and landscape architecture when dealing with staging of rainwater. The methodology uses quantitative and statistical methods to select Characteristic Rain Events (CREs) for a range of frequent return periods: weekly, bi-weekly, monthly, bi-monthly, and a single rarer event occurring only every 1–10 years. The methodology for selecting CREs is flexible and can be adjusted to any climatic settings; here we show its use for Danish conditions. We illustrate with a case study how CREs can be used in combination with a simple hydrological model to visualize where, how deep and for how long water is visible in a landscape designed to manage rainwater.
Characteristics of volatile compound emission and odor pollution from municipal solid waste treating/disposal facilities of a city in Eastern China

Transfer station, incineration plant, and landfill site made up the major parts of municipal solid waste disposal system of S city in Eastern China. Characteristics of volatile compounds (VCs) and odor pollution of each facility were investigated from a systematic perspective. Also major index related to odor pollution, i.e., species and concentration of VCs, olfactory odor concentration, and theoretic odor concentration, was quantified. Oxygenated compounds and hydrocarbons were the most abundant VCs in the three facilities. Different chemical species were quantified, and the following average concentrations were obtained: transfer station, 54 VCs, 2472.47 μg/m3; incineration plant, 75 VCs, 33,129.25 μg/m3; and landfill site, 71 VCs, 1694.33 μg/m3. Furthermore, the average olfactory odor concentrations were 20,388.80; 50,677.50; and 4951.17, respectively. The highest odor nuisance was detected in the waste tipping port of the incineration plant. A positive correlation between the olfactory and chemical odor concentrations was found with R2 = 0.918 (n = 15, P < 0.01). The result shows odor pollution risk transfer from landfill to incineration plant when adopting thermal technology to deal with the non-source-separated waste. Strong attention thus needs to be paid on the enclosed systems in incineration plant to avoid any accidental odor emission.

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Characterization of the planktonic microbiome in upflow anaerobic sludge blanket reactors during adaptation of mesophilic methanogenic granules to thermophilic operational conditions

Upflow anaerobic sludge blanket (UASB) technology refers to reactor technology where granules, i.e. self-immobilised microbial associations, are the biological catalysts involved in the anaerobic digestion process. During the start-up period, UASB reactors operate at relatively long HRT and therefore the liquid phase of the reactor becomes a favourable environment for microbial growth. The current study aimed to elucidate the dynamicity of the suspended microbial community in UASB reactors, during the transition from mesophilic to thermophilic conditions. High throughput 16S rRNA amplicon sequencing was used to characterize the taxonomic composition of the microbiome. The results showed that the microbial community was mainly composed by hydrolytic and fermentative bacteria. Results revealed relevant shifts in the microbial community composition, which is mainly determined by the operational conditions and the reactor performance. Finally, shared OTUs between the microbial consortia of the suspended and the granular sludge showed that planktonic microbiota is significantly influencing the granule microbial community composition.

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Characterization of waste from nanoenabled products: Occurrence, distribution, fate and nanoparticle release

In the last decades, benefits provided by nanotechnology have been utilised for example to increase the sustainability and functionality of consumer products. Engineered nanomaterials (ENMs) are widely used in consumer products across different applications, but their use in nanoproducts has not been regulated specifically - as is the case for other chemicals and substances. This has caused concern regarding the possible release and effects of ENMs during the life cycle of nanoproducts. Specifically knowledge regarding the end-of-life phase is limited. In order to assess the potential
environmental exposure or risks associated with ENMs in waste from nanoproducts, it is necessary to investigate what ENMs are being used and to which extent, how they are treated at the end-of-life of the nanoproduct and, finally, what is the likelihood of them being released during waste treatment. This PhD project addressed these knowledge gaps by mapping and analysing available nano-enabled products, developing a method for categorising waste material fractions of nanoproducts and estimating their likely waste treatment. Furthermore, new experimental data regarding ENM release from nano-enabled products was provided, applying a standardised waste characterisation test. To investigate the abundance and distribution of nanoproducts, different product inventories exist, such as BUND, PEN CPI and The Nanodatabase. However, they are all limited by the lack of available quantitative information about ENM mass or particle number in the products. Overall, the most common product applications for ENMs are the “Health & Fitness” or “Home & Garden” sector, which was still the case, despite the increasing number of nanoproducts. The product inventories PEN CPI and The Nanodatabase are based on manufacturers’ claims regarding nanotechnology, which are often unsubstantial leading to many products being registered with an unknown ENM, such as 64% of all products registered on The Nanodatabase. It was discovered that out of all ENMs registered on The Nanodatabase nano-Ag was used in the greatest number of products and in a range of product applications (e.g. in cosmetics, textiles and food containers). By utilising The Nanodatabase product inventory, a method was developed for analysing the distribution of ENMs in waste, which involved the estimation of ENM fate in selected waste treatments based on their main matrix material. This information was included on The Nanodatabase to enable the online analysis of different waste treatment scenarios. The waste treatment analysis revealed that the most significant waste material fraction was “Plastic packaging” followed by “Electronic”, “Textile” and “Multi material” waste. “Plastic packaging” waste involved mainly the large number of products sold in plastic containers, meaning that the remaining ENM mass at the time of disposal is expected to be minor. Nano-Ag was widespread across the identified waste fractions, thereby corresponding with the wide use of the material in different product categories. Furthermore, titanium-, silicon- and carbon-based ENMs were also present in several different waste material fractions (i.e. “Electronic”, “Multi material”, “Unknown”, “Plastic, other” and “Plastic, packaging”), whereas nano-phosphate and bamboo charcoal were only found in “Batteries” and “Textile” waste, respectively. In terms of waste treatment, it was estimated that on average in the EU around 50% of nano-enabled products are recycled, 19% are incinerated and 26% landfilled. However, these percentages depend on the specific waste treatments available in the investigated region. It is also expected that more ENMs will eventually enter a landfill, since they may accumulate in sewage sludge or waste incineration ashes, both of which are often landfilled. Another prerequisite for ENM characterisation in a waste scenario is the ability to quantify the potential ENM release from a nanowaste matrix. Experimental characterisation of ENM release from nano-enabled products or waste matrices is scarce, and most studies are limited by analytical constraints to detect the ENMs, or have investigated an artificial or “spiked” waste matrix. These studies cannot identify the behaviour of ENMs released from a real nano-enabled product nor how realistic environmental conditions will influence this release. The main challenges facing experimental nanowaste characterisation relate to the complexity of the matrices (both the waste matrix itself and the variety of ENM and product matrix combinations), the low concentration of ENMs present in the waste and, for some ENMs, the background quantities of natural particles being high making it near impossible to distinguish between engineered and natural entities. In this thesis, selected nanoproducts were investigated using a standardised waste characterisation test and the potential ENM release was characterised using nano-specific methods, namely single particle-ICP-MS, TEM/EDX and zeta potential. Since more than 50% of ENMs are expected to be landfilled on a global scale, a standardised batch leaching test was applied to characterise the nanoproducts. The case studies represented two different types of ENMs and product matrices: self-cleaning ceramic tiles with a nano-TiO2 coating and wood painted with nano-CuO wood protection paint. Different environmental conditions were mimicked i.e. high ionic strength (added CaCl2) and addition of organic matter. For both materials, the potential ENM release under these conditions was considered to be low, but they indicated that, there was an effect of media conditions on the particles released from a nano-enabled product. For nano-TiO2-coated tiles, total titanium release was approximately 0.01 µg/g material or below detection limit, slightly higher concentrations were found in leachates from nano-enabled tiles. Particle sizes and number concentrations were below calculated limits of detection (with the exception of one sample, “Ti CAL”) and the sp-ICP-MS analysis generally suffered interference from calcium. For wood painted with nano-CuO paint, presence of nano-Cu particles, of approximately 60-80nm in size, was confirmed using sp-ICP-MS. However, these findings are associated with uncertainty, and so additional tests are needed to assess quantitatively the nano-CuO release in terms of particle size and number concentration. While these two case studies showed limited release, it cannot be excluded that other matrix and ENM combinations may cause more significant releases. New approaches concerning nanowaste characterisation, both indirect and direct methods, were presented in this thesis, but further research is needed to develop and validate these methods. Future studies, assessing the potential release of ENMs from waste, should apply nano-enabled products and different product matrix combinations to take into account the transformations of the ENMs which may occur during the product life cycle. The development of analytical methods is promising e.g. the use of fingerprinting or other tracer techniques for ENMs, and sp-ICP-MS is becoming a routine analysis, though large challenges regarding matrix complexity and interferences still persist. Considering the large number of nanoproducts available, the potential release of ENMs from these products would have to be understood to perform a risk assessment of these products. Since ENMs are considered possible contaminants of the solid waste, it is important to include nano-specific characterisation tests in waste characterisation to ensure a safe disposal of the nanowaste.

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Chemical disinfection of combined sewer overflows

In Copenhagen, a significant number of harbour bathing areas are occasionally closed for recreational activities, due to the discharge of untreated combined sewer overflows (CSOs). A CSO event occurs when the designed capacity of the combined sewer system is exceeded during major rainfall events. A CSO, a variable mixture of wastewater and rainwater, is discharged into the nearby surface water, which renders surface water unusable for recreational activities, such as bathing. This is because the microbial water quality of receiving waters is not of a suitable quality as mentioned in the EU directive 2006/7/EC. Nordic countries have a short summer season, and the frequent closures of harbour bathing areas in prime weeks for recreational activities are due mainly to the discharge of untreated CSO. Disinfecting a CSO in the existing CSO structure, before discharging it to the surface water, would be a quick way to maintain limits on the indicator bacteria of 500 MPN Escherichia coli (E. coli) per 100 mL and 200 MPN Enterococcus spp per 100 mL in the receiving waters. Disinfecting CSO has not been practiced before in Denmark, but it would increase the usability of surface waters for recreational activities. The occurrence of a CSO event, and its quality and quantity, is unpredictable, so the disinfectants employed for such a task should be robust, in order to treat water varying in quality.

The present thesis provides a solution to designing a CSO disinfection system, without changing CSO overflow structures. An overview of the chemical disinfection of a CSO, from the batch scale to the full-scale, was studied, and disinfection efficiency was evaluated by calculating the removal of bacteria from a CSO and quantifying disinfectants during treatment. Residual toxicity was studied for a preliminary risk assessment of disinfectants entering the aquatic ecosystem in the receiving water's post-disinfection discharge.

Perfomic acid (PFA) and peracetic acid (PAA) are used to disinfect CSO water, in order to reduce the number of indicator bacteria. Moreover, PFA and PAA do not form toxic by-products when they react with the ammonia present in the CSO. Disinfectant dose and contact time in the present study were designed by disinfecting a laboratory-simulated CSO with different wastewater concentrations. Degradation kinetics of PFA and PAA in the simulated CSO as well as the disinfection efficiency were studied. PAA degradation in the simulated CSO was slower compared to the degradation of PFA, the latter of which, at a dose (1-8 mg/L) and with 10 minutes’ contact time, efficiently removed 4.2 logs of E. coli and 3 logs of Enterococcus spp from the simulated CSO. Furthermore, the ecotoxicity of the residual disinfectants PFA, PAA and chlorine dioxide (ClO2), and their degradation products hydrogen peroxide and chlorite, in relation to organisms in the aquatic ecosystem was studied. With the help of ecotoxicity data, a preliminary environmental risk assessment of PFA, PAA and ClO2 for CSO disinfection was done, to ensure the safety of the aquatic ecosystem in the receiving waters. This assessment could also be used to obtain permission from authorities for full-scale disinfection. Based on the maximum allowable concentration quality standards for the freshwater and predicted residual concentrations of PFA, PAA and ClO2,
a minimum dilution factor (590 times for PFA, 138 times for PAA and 700 times for ClO2) is needed for discharge into the surface water, to avoid the risk of toxic effect in the aquatic environment, albeit the rapid degradation of PFA and ClO2 in water will not have an acute toxic effect, and lower dilution factors may also be safe for the receiving waters. PFA and PAA were applied for the full-scale disinfection of CSO in two different Danish CSO structures. In the first CSO events, 2-8 mg/L PFA with 20 minutes’ contact time efficiently reduced E. coli and Enterococcus spp below the limit mentioned in EU directive 2006/7/EC, when treated CSO was diluted into the Øresund strait. In the second CSO event, however, low PFA (1-4 mg/L) failed to reduce the number of E. coli and Enterococcus spp bacteria below the limit mentioned in the EU directive, even after dilution, entering the Øresund. PAA was used for full-scale disinfection when CSO was pretreated with chemical coagulation and through the HydroSeparator to remove suspended solids. During the CSO event, 10 mg/L PAA reduced Enterococcus spp from 105.5 MPN per 100 mL to 103.7 MPN per 100 ml with 10 minutes’ contact time. Microbial profiles, made by measuring Enterococcus spp before and after a CSO event, revealed that the numbers of Enterococcus spp post-disinfection were almost the same as pre-existing Enterococcus spp in the first recipient. To summarise, frequent closures of recreational areas can be minimised by chemically disinfecting CSOs before discharging into surface waters.
reconstruct images using a four-way factorization scheme. By doing so, this study succeeded to remove the cloud shadow effects and image noise in UAS imagery providing normalized reflectance. The comparison between the corrected and uncorrected images shows a significant improvement for reflectance estimation in the shadow areas. Further, analysis of vegetation indices e.g. normalized difference vegetation index derived from the corrected and uncorrected images also showed improvement. This method could also have the ability to resolve artifacts, such as temporary objects (e.g. humans, tractors etc.) from the vegetation background.

Co-cultivation of Green Microalgae and Methanotrophic Bacteria for Single Cell Protein Production from Wastewater

Conventional water treatment technologies remove nutrients via resource intensive processes. However, new approaches for residual nutrient recycling are needed to provide food to the increasing world population. This work explores the use of microbial biomass – methane oxidizing bacteria and green microalgae – as a means to recover nutrients from industrial wastewater and upcycle them to feed grade single cell protein. Results demonstrated that both algae and bacteria could remove or assimilate most of the organic carbon present in the wastewater. However, their growth stopped before nutrients and substrates in the gas phase (i.e., methane and oxygen for methanotrophs and carbon dioxide for algae) were depleted. Likely, algal growth was light limited and stopped after organic carbon was consumed, whilst growth of methanotrophic bacteria could be limited by trace elements (e.g., copper). Nevertheless, the amino acid profile of both the monocultures and the algal-bacteria consortium was suitable for substitution of conventional protein sources. Further research should focus on increasing productivity of biomass grown on wastewater resources.

Co-existence of Anaerobic Ammonium Oxidation Bacteria and Denitrifying Anaerobic Methane Oxidation Bacteria in Sewage Sludge: Community Diversity and Seasonal Dynamics

Anaerobic ammonium oxidation (ANAMMOX) and denitrifying anaerobic methane oxidation (DAMO) have been recently discovered as relevant processes in the carbon and nitrogen cycles of wastewater treatment plants. In this study, the seasonal dynamics of ANAMMOX and DAMO bacterial community structures and their abundance in sewage sludge collected from wastewater treatment plants were analysed. Results indicated that ANAMMOX and DAMO bacteria co-existed in sewage sludge in different seasons and their abundance was positively correlated (P < 0.05). The high abundance of ANAMMOX and DAMO bacteria in autumn and winter indicated that these seasons were the preferred time
to favour the growth of ANAMMOX and DAMO bacteria. The community structure of ANAMMOX and DAMO bacteria could also shift with seasonal changes. The “Candidatus Brocadia” genus of ANAMMOX bacteria was mainly recovered in spring and summer, and an unknown cluster was primarily detected in autumn and winter. Similar patterns of seasonal variation in the community structure of DAMO bacteria were also observed. Group B was the dominant in spring and summer, whereas in autumn and winter, group A and group B presented almost the same proportion. The redundancy analysis revealed that pH and nitrate were the most significant factors affecting community structures of these two groups (P < 0.01). This study reported the diversity of ANAMMOX and DAMO in wastewater treatment plants that may be the basis for new nitrogen removal technologies.
Co-fermentation of onion and whey: A promising symbiotic combination

Juice from three different onion varieties was mixed with sweet whey and used as growth substrate for four lactic acid bacteria strains, isolated from agri-food by-products, to evaluate the possibility to exploit such substrates, known to be rich in bioactive molecules, as fermented drinks for human consumption. Results show good growth performance for Lactobacillus fabifermentans, L. plantarum and Streptococcus macedonicus. On the contrary S. thermophilus did not grow in the mixture while S. macedonicus did not develop in pure onion juice. After 48 h the overall sugar content decreased significantly. In particular, glucose was not utilized while inulin was completely preserved. Moreover, MS/MS analysis revealed the presence of the rare trisaccharide lactosucrose. In the light of these considerations, the formulation obtained may be considered a potential symbiotic product with pleasant taste and beneficial effects for consumers and also an eco-friendly solution to convert an agro-food by-product into value added products.

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Comammox Nitrospira are abundant ammonia oxidizers in diverse groundwater-fed rapid sand filter communities

The recent discovery of completely nitrifying Nitrospira demands a re-examination of nitrifying environments to evaluate their contribution to nitrogen cycling. To approach this challenge, tools are needed to detect and quantify comammox Nitrospira. We present primers for the simultaneous quantification and diversity assessment of both comammox Nitrospira clades. The primers cover a wide range of comammox diversity, spanning all available high quality sequences. We applied these primers to 12 groundwater-fed rapid sand filters, and found comammox Nitrospira to be abundant in all filters. Clade B comammox comprise the majority (~75%) of comammox abundance in all filters. Nitrosomonadaceae were present in all filters, although at low abundance (mean=1.8%). Ordination suggests that temperature impacts the structure of nitrifying communities, and in particular that increasing temperature favours Nitrospira. The nitrogen content of the filter material, sulfate concentration and surface ammonium loading rates shape the structure of the comammox guild in the filters. This work provides an assay for simultaneous detection and diversity assessment of clades A and B comammox Nitrospira, expands our current knowledge of comammox Nitrospira diversity and demonstrates a key role for comammox Nitrospira in nitrification in groundwater-fed biofilters.

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Comammox Nitrospira are key nitrifiers in diverse groundwater-fed drinking water filters

Nitrification is a dominant process in groundwater-fed rapid sand filters (RSFs) used for drinking water purification. Near complete removal of ammonium and nitrite is required in the EU and Denmark due to strict regulatory limits that enable high water stability in the distribution system. RSFs are a unique environment harboring diverse microbial communities including a range of ammonia oxidizers (AOs); Betaproteobacterial ammonia oxidizers (Nitrosomonas, Nitrospira), ammonia oxidizing archaea, diverse heterotrophs and a large fraction of Nitrospira spp., which in one studied filter have been shown to comprise both nitrite oxidizers as well as complete nitrifying (comammox) Nitrospira spp. (Palomo et al. 2016). We developed a new qPCR assay for the quantification of the comammox Nitrospira amoA gene which amplifies both clades A and B and applied this assay to the study of 12 drinking water treatment plants across Denmark. We further sequenced amplicons of the 16S rRNA gene of total Bacteria and amoA gene of Nitrospira to examine the microbial biodiversity present in the filters. Our results show that comammox Nitrospira are present in high abundance making up an average of 19% of the microbial communities in the examined filters. While members of both clades A (41 sequence variants) and B (47 sequence variants) were both present in high abundance, the majority of comammox diversity (70-90% in each filter) was made up by clade B. Ordination analysis with variance partitioning was performed on the total microbial communities and the comammox Nitrospira communities to identify physicochemical parameters of the influent water, filter material, or operational parameters which influenced the community structures in an effort to understand the success of comammox Nitrospira in these filters. Temperature as well as the sulfate and calcium content of the influent water made significant contributions towards explaining both the total and comammox community structures, while the iron content of the filter material made a significant contribution to explaining only the structure of the comammox Nitrospira communities. Further examination of groundwater-fed RSFs with higher variability in microbial communities and physicochemical parameters may provide further information on the ecology of comammox Nitrospira and explain their success in the groundwater-fed filters examined in this study. Together this work provides a new assay for the simultaneous detection of clade A and B comammox Nitrospira and expands our current knowledge of the diversity of
comammox Nitrospira, while attempting to explain the success of comammox Nitrospira in these groundwater-fed filters.

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**Combined forward osmosis-reverse osmosis for the treatment of brewery wastewater**

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Organisations: Department of Environmental Engineering, Water Technologies
Authors: Schneider, C. (Intern), Zarebska, A. (Intern), Hélix-Nielsen, C. (Intern)
Number of pages: 1
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Forward osmosis, Brewery wastewater, Water extraction, Cleaning
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Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

**Combined UV treatment and ozonation for the removal of by-product precursors in swimming pool water**

Both UV treatment and ozonation are used to reduce different types of disinfection by-products (DBPs) in swimming pools. UV treatment is the most common approach, as it is particularly efficient at removing combined chlorine. However, the UV treatment of pool water increases chlorine reactivity and the formation of chloro-organic DBPs such as trihalomethanes. Based on the similar selective reactivity of ozone and chlorine, we hypothesised that the created reactivity to chlorine, as a result of the UV treatment of dissolved organic matter in swimming pool water, might also be expressed as increased reactivity to ozone. Moreover, ozonation might saturate the chlorine reactivity created by UV treatment and mitigate increased formation of a range of volatile DBPs. We found that UV treatment makes pool water highly reactive to ozone. The subsequent reactivity to chlorine decreases with increasing ozone dosage prior to contact with chlorine. Furthermore, ozone had a half-life of 5 min in non-UV treated pool water whereas complete consumption of ozone was obtained in less than 2 min in UV treated pool water. The ozonation of UV-treated pool water induced the formation of some DBPs that are not commonly reported in this medium, in particular trichloronitromethane, which is noteworthy for its genotoxicity, though this issue was removed by UV treatment when repeated combined UV/ozone treatment interchanging with chlorination was conducted over a 24-h period. The discovered reaction could form the basis for a new treatment method for swimming pools.

**General information**
State: Published
Organisations: Department of Environmental Engineering, Water Technologies
Authors: Cheema, W. A. (Intern), Kaarsholm, K. M. S. (Intern), Andersen, H. R. (Intern)
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.49 SJR 2.629 SNIP 2.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.689 SNIP 2.507 CiteScore 6.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.957 SNIP 2.727 CiteScore 6.13
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.693 CiteScore 6.02
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.966 SNIP 2.456 CiteScore 5.15
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.867 SNIP 2.374 CiteScore 5.43
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.582 SNIP 2.196
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.319 SNIP 2.225
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.065 SNIP 2.19
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.994 SNIP 2.208
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.895 SNIP 2.214
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.114 SNIP 2.337
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.227 SNIP 2.106
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.696 SNIP 1.917
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.54 SNIP 1.775
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.321 SNIP 1.711
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.305 SNIP 1.688
Web of Science (2000): Indexed yes
Comparative assessment of Vibrio virulence in marine fish larvae

Vibrionaceae infections are a major obstacle for marine larviculture; however, little is known about virulence differences of Vibrio strains. The virulence of Vibrio strains, mostly isolated from vibriosis outbreaks in farmed fish, was tested in larval challenge trials with cod (Gadus morhua), turbot (Scophthalmus maximus) and halibut (Hippoglossus hippoglossus) using a multiwell dish assays with single-egg/larvae cultures. The strains differed significantly in virulence as some caused a high mortality of larva reaching 100% mortality after a few days, while others had no or only marginal effects on survival. Some Vibrio strains were pathogenic in all of the larva species, while some caused disease only in one of the species. Twenty-nine of the Vibrio anguillarum strains increased the mortality of larvae from at least one fish species; however, pathogenicity of the strains differed markedly. Other Vibrio species had no or less pronounced effects on larval mortalities. Iron uptake has been related to V. anguillarum virulence; however, the presence or absence of the plasmid pJM1 encoding anguibactin did not correlate with virulence. The genomes of V. anguillarum were compared (D. Castillo, P.W. D’Alvise, M. Middelboe & L. Gram, unpublished data) and most of the high-virulent strains had acquired virulence genes from other pathogenic Vibrio.

General information
State: Published
Organisations: Department of Systems Biology, Bacterial Ecophysiology and Biotechnology, Department of Environmental Engineering, National Food Institute, Department of Biotechnology and Biomedicine, Bacterial Ecophysiology and Biotechnology, University of Copenhagen, University of Bergen, Fishlab, Institute of Marine Research
Authors: Rønneseth, A. (Ekstern), Castillo, D. (Ekstern), D’Alvise, P. (Intern), Tønnesen, Ø. (Ekstern), Haugland, G. (Ekstern), Grotkjær, T. (Intern), Engell-Sørensen, K. (Ekstern), Nørremark, L. (Ekstern), Bergh, Ø. (Ekstern), Wergeland, H. I. (Ekstern), Gram, L. (Intern)
Pages: 1373-1385
Publication date: 2017
Main Research Area: Technical/natural sciences
Comparative LCA of repairing flooded houses versus construction of a dam

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Department of Management Engineering, Quantitative Sustainability Assessment
Comparative use of different emission measurement approaches to determine methane emissions from a biogas plant

A sustainable anaerobic biowaste treatment has to mitigate methane emissions from the entire biogas production chain, but the exact quantification of these emissions remains a challenge. This study presents a comparative measurement campaign carried out with on-site and ground-based remote sensing measurement approaches conducted by six measuring teams at a Swedish biowaste treatment plant. The measured emissions showed high variations, amongst others caused by different periods of measurement performance in connection with varying operational states of the plant. The overall methane emissions measured by ground-based remote sensing varied from 5 to 25kg/h (corresponding to a methane loss of 0.6-3.0% of upgraded methane produced), depending on operating conditions and the measurement method applied. Overall methane emissions measured by the on-site measuring approaches varied between 5 and 17kg/h (corresponding to a methane loss of 0.6 and 2.1%) from team to team, depending on the number of measured emission points, operational state during the measurements and the measurement method applied. Taking the operational conditions into account, the deviation between different approaches and teams could be explained, in that the two largest methane-emitting sources, contributing about 90% of the entire site's emissions, were found to be the open digestate storage tank and a pressure release valve on the compressor station.
Comparing two enhancing methods for improving kitchen waste anaerobic digestion: bentonite addition and autoclaved de-oiling pretreatment

The effects of different enhancement methods, including adding bentonite (1.25%, w/w, wet substrate) and autoclaved de-oiling pretreatment (121 °C, 30 minutes), on the anaerobic digestion of kitchen waste (KW) were comparably studied. Mesophilic continuous stirred tank reactors were used under different organic loading rates (OLRs) of 1.11 to 1.84 gVS (volatile solid) L−1d−1 and two different hydraulic retention times (HRTs) (20 d and 25 d). In this study, two enhancement methods and extending HRT could prevent volatile fatty acids (VFA) accumulation and obtain a high methane production at low OLR. Owing to the effect of providing nutrients and buffering capacity, the maximum methane yield was obtained with adding bentonite at OLR of 1.39 gVS L−1d−1. However, for high OLR (1.84 gVS L−1d−1), a decrease of the methane yield and system breakdown occurred due to the accumulation of VFAs. Engineering design and process evaluation of a CSTR biogas plant treating with KW based on the laboratory experiment was stated.

General information
State: Accepted/In press
Organisations: Department of Environmental Engineering, Residual Resource Engineering, China Agricultural University
Comparison of approaches for assessing sustainable remediation of contaminated sites

It has been estimated that there are approximately 2.5 million potentially contaminated sites in Europe. Of these, approximately 340,000 sites are thought to be contaminated to a degree that may require remediation (Joint Research Center, 2014). Until recently, remediation was considered to be inherently green or sustainable since it removes a
contaminant problem. However, it is now broadly recognized that while remediation is intended to address a local environmental threat, it may cause other local, regional and global impacts on the environment, society and economy. Over the last decade, the broader assessment of these criteria is occurring in a movement toward ‘sustainable remediation’. This paper aims to review the available methods for assessing the sustainability of remediation alternatives.

Sustainable remediation seeks to reduce direct contaminant point source impacts on the environment, while minimizing the indirect cost of remediation to the environment, society and economy. Here we present and compare the available tools and methods for assessing the sustainability of remedial solutions and discuss some of the key issues and future challenges. The aim of a sustainability assessment is to compare the sustainability of two or more remedial solutions for a contaminated site. A sustainability assessment does not provide an absolute measure of whether remediation of a specific site is sustainable. Instead it provides a relative measure which can be used to select the most sustainable solution from amongst a number of defined remedial scenarios.

Results of the review show that most approaches use multi-criteria assessment methods (MCA) to structure a decision support process because it allows the combined assessment of criteria which may be either quantitatively or qualitatively assessed. Different combinations of environmental, social and economic criteria are employed, and are assessed either in qualitative or quantitative forms with various tools such as life cycle assessment and cost benefit analysis. Stakeholder involvement, which is a key component of sustainable remediation, is conducted in various ways. Some approaches involve stakeholders directly in the evaluation or weighting of criteria, whereas other approaches only indirectly consider stakeholder preferences.

This study has reviewed available methods for assessing and comparing the sustainability of contaminated site remediation alternatives. It is concluded that MCA methods are very useful when comparing remediation alternatives, since they allow for a joint assessment of many types of indicators; however the available tools and methods differ substantially, for instance in their selection of indicators, criteria evaluation methods, and approaches to stakeholder involvement and uncertainty analysis. Further work is needed in order to test the assessment approaches for real case studies, since to date only few documented case applications have been published. The presentation will give specific examples of approaches ranging from more qualitative assessments to more quantitative assessments of criteria.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Office for Study Programmes and Student Affairs
Authors: Søndergaard, G. L. (Intern), Binning, P. J. (Intern), Bjerg, P. L. (Intern)
Pages: 242-242
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Title of host publication: 14th International Conference on Sustainable Use and Management of Soil: Book of abstracts
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Conference: 14th International Conference Sustainable Use and Management of Soil, Sediment and Water Resources (AquacOnSoil), Lyon, France, 26/06/2017 - 26/06/2017
Electronic versions: abstracts_2017.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Comparison of Fenton, UV-Fenton and nano-Fe3O4 catalyzed UV-Fenton in degradation of phloroglucinol under neutral and alkaline conditions: Role of complexation of Fe3+ with hydroxyl group in phloroglucinol
Phloroglucinol degradation at initial pH from 7.0 to 9.0 has been investigated in Fenton, UV-Fenton and nano-Fe3O4 catalyzed UV-Fenton (Hetero-Fenton). Within the reaction time given in this study (not more than 4 h), 150 mg·L−1 phloroglucinol was completely removed, while there was some difference in TOC removal efficiency: about 90% for UV-Fenton, nearly 60% for Fenton and Hetero-Fenton. Increasing initial pH from 7.0 to 9.0, there was an obvious decline in the degradation rate. The average values of H2O2 utilization efficiency were 0.65 ± 0.01 for Fenton, 0.66 ± 0.09 for UV-Fenton, and 1.35 ± 0.15 for Hetero-Fenton, suggesting Hetero-Fenton required less H2O2 consumption. Solution pH could decrease to strongly acidic conditions of pH <4.0 and the generation of organic acids including formic, acetic, oxalic, and maleic acids depended on the type of oxidation process. The spectrophotometric study showed phloroglucinol would complex with Fe(III) at pH 7.0 to form homogeneous aqueous solution which exhibited strong light absorption in the wavelength range of 400 nm to 600 nm. Therefore, formation of Fe(III)-phloroglucinol complex and pH decrease to strongly acidic condition played important roles in Fenton degradation under neutral and alkaline pH. The result of effect of pollutant content showed phloroglucinol at lower concentrations of 20 and 50 mg·L−1 could still be completely removed by all Fenton-based systems at pH 7.0, however, in Fenton with 20 mg·L−1 phloroglucinol, a significantly decreased degradation rate was observed due to the slowdown of pH drop and inhibited formation of Fe(III)-phloroglucinol complex.

General information
State: Published
Comparison of radar and numerical weather model rainfall forecasts in the perspective of urban flood prediction

An early flood warning system has been developed for urban catchments and is currently running in online operation in Copenhagen. The system is highly dependent on the quality of rainfall forecast inputs. An investigation of precipitation inputs from Radar Nowcast (RN), Numerical Weather Prediction (NWP) with assimilation of radar and cloud data (RA3), and Ensemble NWP with 25 members (S05) is conducted by comparing against rain gauge measurements and flood extent. Despite lower spatial and temporal resolution, the ensemble product seems promising for forecasting extreme events. A combination of the three forecast products is expected to yield the optimal input for flood warning.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Technical University of Denmark, Biofos A/S, Krüger A/S, Danish Meteorological Institute
Authors: Lovring, M. M. (Ekstern), Löwe, R. (Intern), Courdent, V. A. T. (Intern), Meneses, E. J. (Ekstern), Petersen, S. O. (Ekstern), Vedel, H. (Ekstern), Petersen, H. M. (Ekstern), Mikkelsen, P. S. (Intern)
Number of pages: 4
Publication date: 2017
Event: Abstract from 14th IWA/IAHR International Conference on Urban Drainage 2017, Prague, Czech Republic.
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
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Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Comparison of the impacts of urban development and climate change on exposing European cities to pluvial flooding

The economic and human consequences of extreme precipitation and the related flooding of urban areas have increased rapidly over the past decades. Some of the key factors that affect the risks to urban areas include climate change, the densification of assets within cities and the general expansion of urban areas. In this paper, we examine and compare quantitatively the impact of climate change and recent urban development patterns on the exposure of four European cities to pluvial flooding. In particular, we investigate the degree to which pluvial floods of varying severity and in different geographical locations are influenced to the same extent by changes in urban land cover and climate change. We have selected the European cities of Odense, Vienna, Strasbourg and Nice for analyses to represent different climatic conditions, trends in urban development and topographical characteristics. We develop and apply a combined remote-sensing and flood-modelling approach to simulate the extent of pluvial flooding for a range of extreme precipitation events for historical (1984) and present-day (2014) urban land cover and for two climate-change scenarios (i.e. representative concentration pathways, RCP 4.5 and RCP 8.5). Changes in urban land cover are estimated using Landsat satellite imagery for the period 1984-2014. We combine the remote-sensing analyses with regionally downscaled estimates of precipitation extremes of current and expected future climate to enable 2-D overland flow simulations and flood-hazard assessments. The individual and combined impacts of urban development and climate change are quantified by examining the variations in flooding between the different simulations along with the corresponding uncertainties. In addition, two different assumptions are examined with regards to the development of the capacity of the urban drainage system in response to urban development and climate change. In the "stationary" approach, the capacity resembles present-day design, while it is updated in the "evolutionary" approach to correspond to changes in imperviousness and precipitation intensities due to urban development and climate change respectively. For all four cities, we find an increase in flood exposure corresponding to an observed absolute growth in impervious surfaces of 7-12% during the past 30 years of urban development. Similarly, we find that climate change increases exposure to pluvial flooding under both the RCP 4.5 and RCP 8.5 scenarios. The relative importance of urban development and climate change on flood exposure varies considerably between the cities. For Odense, the impact of urban development is comparable to that of climate change under an RCP 8.5 scenario (2081-2100), while for Vienna and Strasbourg it is comparable to the impacts of an RCP 4.5 scenario. For Nice, climate change dominates urban development as the primary driver of changes in exposure to flooding. The variation between geographical locations is caused by differences in soil infiltration properties, historical trends in urban development and the projected regional impacts of climate change on extreme precipitation. Developing the capacity of the urban drainage system in relation to urban development is found to be an effective adaptation measure as it fully compensates for the increase in runoff caused by additional sealed surfaces. On the other hand, updating the drainage system according to changes in precipitation intensities caused by climate change only marginally reduces flooding for the most extreme events.

General information
State: Published
Organisations: Department of Management Engineering, Systems Analysis, Department of Environmental Engineering, Urban Water Systems, LNH Water, DHI Denmark
Authors: Kaspersen, P. S. (Intern), Høegh Ravn, N. (Ekstern), Arnbjerg-Nielsen, K. (Intern), Madsen, H. (Ekstern), Drews, M. (Intern)
Number of pages: 17
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Publication date: 2017
Compositional data analysis of household waste recycling centres in Denmark

**General information**

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Girona
Authors: Edjabou, M. E. (Intern), Martín-Fernández, J. A. (Ekstern), Boldrin, A. (Intern), Astrup, T. F. (Intern)
Number of pages: 7
Publication date: 2017
Event: Abstract from 7th international Workshop on Compositional Data analysis (CoDaWork 2017), Siena, Italy.
Main Research Area: Technical/natural sciences

Electronic versions:
Edjabou_Mart_n_Fern_ndez_Boldrin_and_Astrup_CoDaWork2017.pdf

Compositional data analysis of household waste recycling centres in Denmark

The Danish government has set a target of 50% recycling rates for household waste by 2022. To achieve this goal, the Danish municipalities should increase the source separation of household waste. While significant knowledge and experiences were locally gained, lessons learnt have not been extensively exploited country-wise, an important reason being that the influence of these changes has not been rigorously investigated and quantified, meaning that generalized conclusions could not be drawn so far. One of the reasons is that a consistent calculation method to assess and document the effect of these projects on the recycling rates does not exist. Thus, compositional data analysis technique was applied to analyze consistently waste data. Based on the waste composition obtained from a recycling center in Denmark, we analyzed the composition of waste treatment and disposal options. Zero and non-zero pattern was used to describe historical changes in the definition and components of waste fractions. Variation array was applied to determine the relationship between waste treatment and disposal options. As a result, compositional data analysis technique enables to analyze waste data regardless of the unit (mass or percentage).

Concentration of downstream effluents from pharmaceutical industry using Aquaporin Inside™ hollow fiber forward osmosis membranes - Influence of flow conditions on membrane performance

**General information**

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Girona
Authors: Camilleri Rumbau, M. S. (Forskerdatabase), Vargas, L. C. (Ekstern), Romagnoli, A. (Ekstern), Trzaskus, K. (Ekstern), Gad, E. (Ekstern), Hélix-Nielsen, C. (Intern)
Number of pages: 1
Publication date: 2017

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Place of publication: San Fransisco, CA, USA
Conceptualization of contamination using depth discrete monitoring of dynamic PCE concentration changes during pumping

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Capital Region of Denmark
Authors: Broholm, M. M. (Intern), Fjordbøge, A. S. (Intern), Mosthaf, K. (Intern), Binning, P. J. (Intern), Brauns, B. (Intern), Bjerg, P. L. (Intern), Kerrn-Jespersen, H. (Ekstern)
Number of pages: 1
Publication date: 2017
Main Research Area: Technical/natural sciences
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Conceptualization of residual contamination using depth discrete monitoring of dynamic PCE concentration changes during and after remedial pumping and pumping test

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Office for Study Programmes and Student Affairs, Office for Innovation & Sector Services, Region Hovedstaden
Authors: Broholm, M. M. (Intern), Fjordbøge, A. S. (Intern), Mosthaf, K. (Intern), Binning, P. J. (Intern), Brauns, B. (Intern), Tsitseli, T. (Intern), Bjerg, P. L. (Intern), Kerrn-Jespersen, H. (Ekstern)
Pages: 92-92
Publication date: 2017
Host publication information
Title of host publication: 14th International Conference on Sustainable Use and Management of Soil : Book of abstracts
Place of publication: Lyon, France
Main Research Area: Technical/natural sciences
Conference: 14th International Conference Sustainable Use and Management of Soil, Sediment and Water Resources (AquaConSoil), Lyon, France, 26/06/2017 - 26/06/2017
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Source: PublicationPreSubmission
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Conceptualization of residual contamination using depth discrete monitoring of dynamic PCE concentration changes during and after remedial pumping and pumping test

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Office for Study Programmes and Student Affairs, Office for Innovation & Sector Services, Capital Region of Denmark
Authors: Broholm, M. M. (Intern), Fjordbøge, A. S. (Intern), Mosthaf, K. (Intern), Binning, P. J. (Intern), Brauns, B. (Intern), Tsitseli, T. (Intern), Bjerg, P. L. (Intern), Kerrn-Jespersen, H. (Ekstern)
Number of pages: 1
Publication date: 2017
Contaminant mass discharge to streams: Comparing direct groundwater velocity measurements and multi-level groundwater sampling with an in-stream approach

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, University of Kansas
Authors: Rønde, V. (Intern), McKnight, U. S. (Intern), Sonne, A. T. (Intern), Balbarini, N. (Intern), Devlin, J. (Ekstern), Bjerg, P. L. (Intern)
Pages: 43-54
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Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.26 SJR 0.982 SNIP 1.065
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.951 SNIP 1.083 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.319 SNIP 1.516 CiteScore 2.4
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.501 SNIP 1.453 CiteScore 3.04
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.595 SNIP 1.686 CiteScore 2.97
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.396 SNIP 1.572 CiteScore 2.49
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.352 SNIP 1.186
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.323 SNIP 1.33
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.41 SNIP 1.55
Web of Science (2008): Indexed yes
Continuous estimation of gross primary productivity and evapotranspiration from an Unmanned Aerial System

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, National Space Institute, Geodesy, Atmospheric Environment, Technical University of Denmark, European Commission - Joint Research Center
Authors: Wang, S. (Intern), Bandini, F. (Intern), Jakobsen, J. (Intern), Zarco Tejada, P. J. (Ekstern), Liu, X. (Ekstern), Olesen, D. H. (Intern), Ibrom, A. (Intern), Bauer-Gottwein, P. (Ekstern), Garcia, M. (Intern)
Number of pages: 1
Publication date: 2017
Event: Abstract from 2017 AGU Fall Meeting, New Orleans, United States.
Main Research Area: Technical/natural sciences
Electronic versions: AGUabstract.pdf
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Controlling sewer systems – a critical review based on systems in three EU cities
The term Real Time Control (RTC) is widely used to describe all types of control systems in sewer systems. Today the term covers everything from the simplest to the most advanced types of control systems, making it difficult to communicate about sewer system control in a precise manner, as well as search and find specific types of control systems for comparison. Through a survey of implemented control systems in three EU cities today and with the perspectives of current research within the field of sewer system control, the needs for a new control system design framework is identified. With the basis of existing frameworks for control system design, a new time-scale dependent framework is proposed. We believe this comprehensive time-scale dependent framework can help water utilities to retrofit and design new control solutions and facilitate knowledge sharing about existing designs.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS, HOFOR A/S, Biofos A/S
Authors: Mollerup, A. L. (Ekstern), Mikkelsen, P. S. (Intern), Thornberg, D. (Ekstern), Sin, G. (Intern)
Number of pages: 8
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Publication date: 2017
Main Research Area: Technical/natural sciences
Converting wastewater into fertilizing irrigation

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Danish Technological Institute, Minor Change Group, Samsø spildevand
Authors: Litty, K. (Ekstern), Lindholst, S. (Ekstern), Mikkelsen, N. (Ekstern), Moestrup, N. (Ekstern), Aagaard, J. (Ekstern), Rasmussen, P. E. (Ekstern), Heinen, N. (Ekstern), Haase, J. (Ekstern), Andersen, H. R. (Intern)
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Title of host publication: Abstract proceedings - 11th annual meeting danish water forum
Place of publication: Frederiksberg
Copper dosing enhances nitrification in biofilters treating groundwater

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Water Technologies, Krüger A/S
Authors: Wagner, F. B. (Intern), Borch Nielsen, P. (Ekstern), Diwan, V. (Intern), Boe-Hansen, R. (Ekstern), Smets, B. F. (Intern), Dechesne, A. (Intern), Albrechtsen, H. (Intern)
Number of pages: 4
Publication date: 2017
Event: Abstract from Water Quality Technology Conference (WQTC) 2017, Portland, United States.
Main Research Area: Technical/natural sciences
Electronic versions:
Wagner_et_al_Copper_AWWA_WQTC_2017_ext_abstr_logo.pdf
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Correction to Development of Comparative Toxicity Potentials of TiO$_2$ Nanoparticles for Use in Life Cycle Assessment

General information
State: Published
Organisations: Quantitative Sustainability Assessment, Department of Environmental Engineering, Environmental Chemistry, Department of Management Engineering, Technical University of Denmark, Quantis, Radboud University Nijmegen
Authors: Ettrup, K. (Ekstern), Kounina, A. (Ekstern), Hansen, S. F. (Intern), Meesters, J. A. J. (Ekstern), Blikra Vea, E. (Ekstern), Laurent, A. (Intern)
Pages: 7295-7295
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmental Science and Technology
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General information
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Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Hedegaard, M. J. (Intern), Albrechtsen, H. (Intern)
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Publication information
Coulombic interactions during advection-dominated transport of ions in porous media

Solute transport of charged species in porous media is significantly affected by the electrochemical migration term resulting from the charge-induced interactions among dissolved ions and with solid surfaces. Therefore, the characterization of such Coulombic interactions and their effect on multicomponent ionic transport is of critical importance for assessing the fate of charged solutes in porous media. In this work we present a detailed investigation of the electrochemical effects during conservative multicomponent ionic transport in homogeneous and heterogeneous domains by means of laboratory bench-scale experiments and numerical simulations. The investigation aims at quantifying the key role of small-scale electrostatic interactions in flow-through systems, especially when advection is the dominant mass-transfer process. Considering dilute solutions of strong electrolytes (e.g., MgCl₂ and NaBr) we report results showing the important role of Coulombic interactions in the lateral displacement of the different ionic species for steady-state transport scenarios in which the solutions are continuously injected through different portions of the flow-through chamber [1, 2]. Successively, we focus our attention on transient transport and pulse injection of the electrolytes. In these experiments high-resolution spatial and temporal monitoring of the ions' concentrations (600 samples; 1800 concentration measurements), at closely spaced outlet ports (5 mm), allowed us resolving the effects of charge interactions on the temporal breakthrough and spatial profiles of the cations and anions [3]. The interpretation of the experimental results requires a multicomponent modeling approach with an accurate description of local hydrodynamic dispersion, as well as the explicit quantification of the dispersive fluxes' cross-coupling due to the Coulombic interactions between the charged species. A new 2-D simulator [4], coupling the solution of the multicomponent ionic transport problem with the geochemical code PHREEQC has been developed and used to quantitatively interpret the experimental results.

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Organisations: Department of Environmental Engineering, Water Resources Engineering, Technical University of Denmark
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Counter-diffusion biofilms have lower N₂O emissions than co-diffusion biofilms during simultaneous nitrification and denitrification: Insights from depth-profile analysis

The goal of this study was to investigate the effectiveness of a membrane-aerated biofilm reactor (MABR), a representative of counter-current substrate diffusion geometry, in mitigating nitrous oxide (N₂O) emission. Two laboratory-
scale reactors with the same dimensions but distinct biofilm geometries, i.e., a MABR and a conventional biofilm reactor (CBR) employing co-current substrate diffusion geometry, were operated to determine depth profiles of dissolved oxygen (DO), nitrous oxide (N2O), functional gene abundance and microbial community structure. Surfacial nitrogen removal rate was slightly higher in the MABR (11.0 ± 0.8 g-N/(m2 day)) than in the CBR (9.71 ± 0.94 g-N/(m2 day)), while total organic carbon removal efficiencies were comparable (96.9 ± 1.0% for MABR and 98.0 ± 0.8% for CBR). In stark contrast, the dissolved N2O concentration in the MABR was two orders of magnitude lower (0.011 ± 0.001 mg N2O-N/L) than that in the CBR (1.38 ± 0.25 mg N2O-N/L), resulting in distinct N2O emission factors (0.0058 ± 0.0005% in the MABR vs. 0.72 ± 0.13% in the CBR). Analysis on local net N2O production and consumption rates unveiled that zones for N2O production and consumption were adjacent in the MABR biofilm. Real-time quantitative PCR indicated higher abundance of denitrifying genes, especially nitrous oxide reductase (nosZ) genes, in the MABR versus the CBR. Analyses of the microbial community composition via 16S rRNA gene amplicon sequencing revealed the abundant presence of the genera Thauera (31.2 ± 11%), Rhizobium (10.9 ± 6.6%), Stenotrophomonas (6.8 ± 2.7%), Sphingobacteria (3.2 ± 1.1%) and Brevundimonas (2.5 ± 1.0%) as potential N2O-reducing bacteria in the MABR.

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Organisations: Department of Environmental Engineering, Water Technologies, University of Tokyo, National Institute of Advanced Industrial Science and Technology, University of Tokushima
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Scopus rating (2010): SJR 2.582 SNIP 2.196
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Covalent organic polymer functionalization of activated carbon surfaces through acyl chloride for environmental clean-up

Nanoporous networks of covalent organic polymers (COPs) are successfully grafted on the surfaces of activated carbons, through a series of surface modification techniques, including acyl chloride formation by thionyl chloride. Hybrid composites of activated carbon functionalized with COPs exhibit a core-shell formation of COP material grafted to the outer layers of activated carbon. This general method brings features of both COPs and porous carbons together for target-specific environmental remediation applications, which was corroborated with successful adsorption tests for organic dyes and metals.

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Cross validation of two partitioning-based sampling approaches in mesocosms containing PCB contaminated field sediment, biota, and activated carbon amendment

The Gold Standard for determining freely dissolved concentrations (Cfree) of hydrophobic organic compounds in sediment interstitial water would be in situ deployment combined with equilibrium sampling, which is generally difficult to achieve. In the present study, ex situ equilibrium sampling with multiple thicknesses of silicone and in situ pre-equilibrium sampling with low density polyethylene (LDPE) loaded with performance reference compounds were applied independently to measure polychlorinated biphenyls (PCBs) in mesocosms with (1) New Bedford Harbor sediment (MA, USA), (2) sediment and biota, and (3) activated carbon amended sediment and biota. The aim was to cross validate the two different sampling approaches. Around 100 PCB congeners were quantified in the two sampling polymers, and the results confirmed the good precision of both methods and were in overall good agreement with recently published silicone to LDPE partition ratios. Further, the methods yielded Cfree in good agreement for all three experiments. The average ratio between Cfree determined by the two methods was factor 1.4±0.3 (range: 0.6-2.0), and the results thus cross-validated the two sampling approaches. For future investigations, specific aims and requirements in terms of application, data treatment, and data quality requirements should dictate the selection of the most appropriate partitioning-based sampling approach.

General information

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CryoSat-2 Altimetry Applications over Rivers and Lakes

Monitoring the variation of rivers and lakes is of great importance. Satellite radar altimetry is a promising technology to do this on a regional to global scale. Satellite radar altimetry data has been used successfully to observe water levels in lakes and (large) rivers, and has also been combined with hydrologic/hydrodynamic models. Except CryoSat-2, all radar altimetry missions have been operated in conventional low resolution mode with a short repeat orbit (35 days or less). CryoSat-2, carrying a Synthetic Aperture Radar (SAR) altimeter, has a 369-day repeat and a drifting ground track pattern and provides new opportunities for hydrologic research. The narrow inter-track distance (7.5 km at the equator) makes it possible to monitor many lakes and rivers and SAR mode provides a finer along-track resolution, higher return power and speckle reduction through multi-looks. However, CryoSat-2 challenges conventional ways of dealing with satellite inland water altimetry data because virtual station time series cannot be directly derived for rivers. We review the CryoSat-2 mission characteristics, data products, and its use and perspectives for inland water applications. We discuss all the important steps in the workflow for hydrologic analysis with CryoSat-2, and conclude with a discussion of promising future research directions.
CryoSat-2 radar altimetry for monitoring freshwater resources of China

Surface water bodies (lakes, reservoirs, and rivers) are key components of the water cycle and are important water resources. Water level and storage vary greatly under the impacts of climate change and human activities. Due to sparse in-situ monitoring networks, a comprehensive national-scale monitoring dataset of surface water bodies in China is not available. Over the last two decades, satellite altimetry has been used successfully for inland water monitoring. Here, we use CryoSat-2 radar altimetry to monitor water level variations of large lakes, reservoirs and rivers across China and demonstrate its potential to complement available in-situ monitoring datasets for the country.

In this study, over 1000 lakes and reservoirs, and 6 large rivers are investigated. The results show that surface water varied greatly over the past 6 years, e.g. in the Tibetan Plateau, the Junggar Basin, the Northeast China Plain, and the central Yangtze River basin. Estimated changes in volume indicate that surface water variation contributes significantly to terrestrial storage variation, especially in the Qaidam Basin and the Tibetan Plateau. CryoSat-2 is capable of measuring regional-scale river level at high spatial resolution and competitive accuracy as demonstrated by comparison with available in-situ gauging data. The results are encouraging with RMSE values ranging from 0.24 to 0.35 m for the Heilongjiang-Amur River, 0.22 to 0.6 m for the Yellow River and 0.22 to 0.5 m for the Songhua River. Comparatively, accuracy is much lower over the Yangtze and Pearl Rivers (RMSE ~ 2.6 m and ~ 3.3 m), probably due to intensive inland waterway navigation. CryoSat-2 shows great potential for monitoring surface water at national scale in China.
CryoSat-2 satellite radar altimetry for river analysis and modelling

The global coverage of in situ observations of surface water dynamics is insufficient to effectively manage water resources. Moreover, the availability of these data is decreasing, due to the lack of gauging stations and data sharing. Satellite radar altimetry, initially developed to monitor ocean water levels, also offers measurements of water levels of rivers and lakes on a global scale. Because of the continuous upstart of new missions, and sensor and processing innovations, the importance of satellite altimetry data for the hydrologic community is increasing.

CryoSat-2, launched by the European Space Agency (ESA) in 2010, is one of the more recent additions to the set of satellite altimeters. It is unique due to two characteristics. First, its radar altimetry instrument provides, besides conventional observations in Low Resolution mode (LRM), observations in Synthetic Aperture Radar (SAR) and Synthetic Aperture Radar Interferometric (SARIn) mode. SAR and SARIn have reduced footprint size in the along-track direction owing to delay/Doppler processing, potentially increasing observation accuracy. Second, CryoSat-2 is placed on a unique long-repeat orbit with a cycle of 369 days. This is different from previous and current satellite altimetry missions, which are in short-repeat orbits with cycles of 10 to 35 days.

The orbit configuration of CryoSat-2 is a challenge for hydrologic applications. Short-repeat missions allow deriving time series at locations where the satellite ground track repeatedly intersects with the river – the so-called virtual stations. Because of the long repeat cycle of CryoSat-2, its virtual station time series have a temporal resolution of 369 days, which is inadequate for most hydrologic applications. This requires rethinking some methods to process such data, distribute
Density and distribution of nitrifying guilds in rapid sand filters for drinking water production: Dominance of Nitrospira spp.

We investigated the density and distribution of total bacteria, canonical Ammonia Oxidizing Bacteria (AOB) (Nitrosomonas plus Nitrosospira), Ammonia Oxidizing Archaea (AOA), as well as Nitrobacter and Nitrospira in rapid sand filters used for groundwater treatment. To investigate the spatial distribution of these guilds, filter material was sampled at four drinking water treatment plants (DWTPs) in parallel filters of the pre- and after-filtration stages at different locations and depths. The target guilds were quantified by qPCR targeting 16S rRNA and amoA genes. Total bacterial densities (ignoring 16S rRNA gene copy number variation) were high and ranged from 109 to 1010 per gram (1015 to 1016 per m3) of filter material. All examined guilds, except AOA, were stratified at only one of the four DWTPs. Densities varied spatially within filter (intra-filter variation) at two of the DWTPs and in parallel filters (inter-filter variation) at one of the DWTPs. Variation analysis revealed random sampling as the most efficient strategy to yield accurate mean density estimates, with collection of at least 7 samples suggested to obtain an acceptable (below half order of magnitude) density precision. Nitrospira was consistently the most dominant guild (5–10% of total community), and was generally up to 4 orders of magnitude more abundant than Nitrobacter and up to 2 orders of magnitude more abundant than canonical AOBs. These results, supplemented with further analysis of the previously reported diversity of Nitrospira in the studied DWTPs based on 16S rRNA and nxrB gene phylogeny (Gülçay et al., 2016; Palomo et al., 2016), indicate that the high Nitrospira abundance is due to their comammox (complete ammonia oxidation) physiology. AOA densities were lower than AOB densities, except in the highly stratified filters, where they were of similar abundance. In conclusion, rapid sand filters are microbially dense, with varying degrees of spatial heterogeneity, which requires replicate sampling for a sufficiently precise determination of them to the hydrologic community and combine them with river models. However, the orbit configuration of CryoSat-2 also results in a small inter-track distance, providing measurements with unprecedented spatial resolution along rivers. These points were the main motivation for this PhD study.

Two case studies were chosen; the Po River in Italy, and the Brahmaputra River in South Asia. CryoSat-2 level 2 data, i.e. point observations of surface height, were filtered over high resolution river masks derived from Landsat imagery. This yielded roughly 340 observations per year over the Po River, and roughly 1300 per year over the Brahmaputra River. The CryoSat-2 observations were validated against in situ observations along the Po River. The average root mean square error (RMSE) between CryoSat-2 and in situ observations was found to be 0.38m, which is comparable to previous missions.

The CryoSat-2 water level observations then were used to parameterize 1-dimensional (1D) hydrodynamic river models. For the Po River, where surveyed cross sections are available, CryoSat-2 was used to calibrate channel roughness. The distributed CryoSat-2 data allowed calibrating channel roughness with a higher spatial resolution than possible in a conventional approach using in situ data. Over the ungauged Brahmaputra River, CryoSat-2 data were used to calibrate shapes of synthetic cross sections. For the calibrated model, the RMSE between simulated and CryoSat-2 observed water levels is 1.24m. It is assumed to accurately reproduce water level-discharge relationships; without relying on river cross section information.

Finally, the potential of CryoSat-2 data for updating hydrodynamic models was evaluated based on the Brahmaputra River case study. A flexible Data Assimilation (DA) framework was developed, which can assimilate observations of river state with any spatio-temporal resolution to a DHI MIKE HYDRO River 1D hydrodynamic model. DA can, amongst others, improve flood forecasting. Synthetic tests showed a high potential of CryoSat-2, improving discharge predictions of the model in terms of Continuous Ranked Probability Score (CRPS) by up to 32%, while real tests could improve the CRPS by up to 10%. Also, synthetic experiments were conducted to evaluate the impact of increased observation accuracy and different sampling patterns.

The results from this study highlight the value of CryoSat-2 altimetry data, which delivers water level observations with unprecedented spatial resolution along rivers. The study presented methods to cope with the distinct spatio-temporal distribution of the CryoSat-2 data and move beyond the common concept of virtual stations. Potentially, this flexibility opens up new opportunities for the use of remote sensing data in the hydrologic community.
total microbial community and specific population densities. A consistently high Nitrospira to bacterial and archaeal AOB density ratio suggests that non-canonical pathways for nitrification may dominate the examined RSFs.
Detailed landfill leachate plume mapping using 2D and 3D Electrical Resistivity Tomography - with correlation to ionic strength measured in screens

Leaching of organic and inorganic contamination from landfills is a serious environmental problem as surface water and aquifers are affected. In order to assess these risks and investigate the migration of leachate from the landfill, 2D and large scale 3D electrical resistivity tomography were used at a heavily contaminated landfill in Grindsted, Denmark. The inverted 2D profiles describe both the variations along the groundwater flow as well as the plume extension across the flow directions. The 3D inversion model shows the variability in the low resistivity anomaly pattern corresponding to differences in the ionic strength of the landfill leachate. Chemical data from boreholes agree well with the observations indicating a leachate plume which gradually sinks and increases in size while migrating from the landfill in the groundwater flow direction. Overall results show that the resistivity method has been very successful in delineating the landfill leachate plume and that good correlation exists between the resistivity model and leachate ionic strength.

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In this study, a full-scale enclosed microalgal air-lift photobioreactor (PBR) module was operated using both defined and industrial wastewater (WW) media. In the effort to establish full-scale operation: a WW ultrafiltration system, two algal productions, and a harvesting microfiltration system were tested. Bioindustrial WW medium was treated with ultrafiltration and was demonstrated to be a viable microalgal growth medium at large scale; however, further treatment is needed for the removal of fecal coliform to meet drinking water standards. The fresh water mesophilic algae Chlorella sorokiniana was successfully grown on bioindustrial WW medium at suboptimal temperatures (< 25 °C) and natural lighting with peak specific growth rate (SGR) of 0.48 day⁻¹, consistent with lab-scale results from literature. Optical densities (OD) of the algae at 665, 680, and 735 nm were found to be viable proxies for cell number of C. sorokiniana grown outdoors with daily fluctuations, despite inherent differences in chlorophyll sensitivity at each absorbance wavelength. However, OD measurements at different reactor locations shown to diverge at the onset of growth. Greenhouse temperature and solar insolation were measured, where it was observed that the SGR did not considerably improve from higher solar irradiance during periods of lower temperatures. Finally, the viability of harvested cells after microfiltration was also examined, with a negative exponential correlation between cell death and the volume of remaining filter condensate (R² = 0.9247).
Determining lower threshold concentrations for synergistic effects

Though only occurring rarely, synergistic interactions between chemicals in mixtures have long been a point of focus. Most studies analyzing synergistic interactions used unrealistically high chemical concentrations. The aim of the present study is to determine the threshold concentration below which proven synergists cease to act as synergists towards the aquatic crustacean Daphnia magna. To do this, we compared several approaches and test-setups to evaluate which approach gives the most conservative estimate for the lower threshold for synergy for three known azole synergists. We focus on synergistic interactions between the pyrethroid insecticide, alpha-cypermethrin, and one of the three azole fungicides prochloraz, propiconazole or epoxiconazole measured on Daphnia magna immobilization. Three different experimental setups were applied: A standard 48h acute toxicity test, an adapted 48h test using passive dosing for constant chemical exposure concentrations, and a 14-day test. Synergy was defined as occurring in mixtures where either EC50 values decreased more than two-fold below what was predicted by concentration addition (horizontal assessment) or as mixtures where the fraction of immobile organisms increased more than two-fold above what was predicted by independent action (vertical assessment). All three tests confirmed the hypothesis of the existence of a lower azole threshold concentration below which no synergistic interaction was observed. The lower threshold concentration, however, decreased with increasing test duration from 0.026±0.013μM (9.794±4.897μgL(-1)), 0.425±0.089μM (145.435±30.46μgL(-1)) and 0.757±0.253μM (249.659±83.44μgL(-1)) for prochloraz, propiconazole and epoxiconazole in standard 48h toxicity tests to 0.015±0.004μM (5.651±1.507μgL(-1)), 0.145±0.025μM (49.619±8.555μgL(-1)) and 0.122±0.0417μM (40.236±13.75μgL(-1)), respectively, in the 14-days tests. Testing synergy in relation to concentration addition provided the most conservative values. The threshold values for the vertical assessments in tests where the two could be compared were in general 1.2 to 4.7 fold higher than the horizontal assessments. Using passive dosing rather than dilution series or spiking did not lower the threshold significantly. Below the threshold for synergy, slight antagony could often be observed. This is most likely due to induction of enzymes active in metabolization of alpha-cypermethrin. The results emphasize the importance of test duration when assessing synergy, but also show that azole concentrations within the typically monitored range of up to 0.5μgL(-1) are not likely to cause severe synergy concerning Daphnia magna immobilization.

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Authors: Bjergager, M. A. (Ekstern), Dalhoff, K. (Ekstern), Kretschmann, A. (Ekstern), Nørgaard, K. B. (Ekstern), Mayer, P. (Intern), Cedergreen, N. (Ekstern)
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Development and validation of a novel monitoring system for batch flocculant solids settling process

Secondary sedimentation is the main hydraulic bottleneck of effective pollution control WWTP under wetweather flow conditions. Therefore, online monitoring tools are required for control and optimization of the settling process under dynamic conditions. In this work we propose a novel monitoring system able to monitor batch settling tests by tracking the sludge blanket height and solid concentration along the column in the range of 1 to 8 g L\(^{-1}\). The system could be efficiently applied to monitor the batch settling tests of several full scale treatment plants run under different operational conditions.

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Development of Comparative Toxicity Potentials of TiO₂ Nanoparticles for Use in Life Cycle Assessment

Studies have shown that releases of nanoparticles may take place through the life cycle of products embedding nanomaterials, thus resulting in potential impacts on ecosystems and human health. While several life cycle assessment (LCA) studies have assessed such products, only a few of them have quantitatively addressed the toxic impacts caused by released nanoparticles, thus leading to potential biases in their conclusions. Here, we address this gap and aim to provide a framework for calculating characterization factors or comparative toxicity potentials (CTP) for nanoparticles and derive CTP values for TiO₂ nanoparticles (TiO₂-NP) for use in LCA. We adapted the USEtox 2.0 consensus model to integrate the SimpleBox4Nano fate model, and we populated the resulting model with TiO₂-NP specific data. We thus calculated CTP values for TiO₂ nanoparticles for air, water, and soil emission compartments for freshwater ecotoxicity and human toxicity, both cancer effects and noncancer effects. Our results appeared plausible after benchmarking with CTPs for other nanoparticles and substances present in the USEtox database, while large differences were observed with CTP values for TiO₂ nanoparticles published in earlier studies. Assumptions, which were performed in those previous studies because of lack of data and knowledge at the time they were made, primarily explain such discrepancies. For future assessment of potential toxic impacts of TiO₂ nanoparticles in LCA studies, we therefore recommend the use of our calculated CTP.
Different cultivation methods to acclimatise ammonia-tolerant methanogenic consortia

Bioaugmentation with ammonia tolerant-methanogenic consortia was proposed as a solution to overcome ammonia inhibition during anaerobic digestion process recently. However, appropriate technology to generate ammonia tolerant methanogenic consortia is still lacking. In this study, three basic reactors (i.e. batch, fed-batch and continuous stirred-tank reactors (CSTR)) operated at mesophilic (37°C) and thermophilic (55°C) conditions were assessed, based on methane production efficiency, incubation time, TAN/FAN (total ammonium nitrogen/free ammonia nitrogen) levels and maximum methanogenic activity. Overall, fed-batch cultivation was clearly the most efficient method compared to batch and CSTR. Specifically, by saving incubation time up to 150%, fed-batch reactors were acclimatised to nearly 2-fold higher FAN levels with a 37%-153% methanogenic activity improvement, compared to batch method. Meanwhile, CSTR reactors were inhibited at lower ammonia levels. Finally, specific methanogenic activity test showed that hydrogenotrophic methanogens were more active than aceticlastic methanogens in all FAN levels above 540 mg NH₃-N L⁻¹.
Diffusion and sorption of organic micropollutants in biofilms with varying thicknesses

Solid-liquid partitioning is one of the main fate processes determining the removal of micropollutants in wastewater. Little is known on the sorption of micropollutants in biofilms, where molecular diffusion may significantly influence partitioning kinetics. In this study, the diffusion and the sorption of 23 micropollutants were investigated in novel moving bed biofilm reactor (MBBR) carriers with controlled biofilm thickness (50, 200 and 500 μm) using targeted batch experiments (initial concentration = 1 μg L⁻¹, for X-ray contrast media 15 μg L⁻¹) and mathematical modelling. We assessed the influence of biofilm thickness and density on the dimensionless effective diffusivity coefficient \( f \) (equal to the biofilm-to-aqueous diffusivity ratio) and the distribution coefficient \( K_{d,eq} \) (L g⁻¹). Sorption was significant only for eight positively charged micropollutants (atenolol, metoprolol, propranolol, citalopram, venlafaxine, erythromycin, clarithromycin and roxithromycin), revealing the importance of electrostatic interactions with solids. Sorption equilibria were likely not reached within the duration of batch experiments (4 h), particularly for the thickest biofilm, requiring the calculation of the distribution coefficient \( K_{d,eq} \) based on the approximation of the asymptotic equilibrium concentration \( t > 4 \) h. \( K_{d,eq} \) values increased with increasing biofilm thickness for all sorptive micropollutants (except atenolol), possibly due to higher porosity and accessible surface area in the thickest biofilm. Positive correlations between \( K_{d,eq} \) and micropollutant properties (polarity and molecular size descriptors) were identified but not for all biofilm thicknesses, thus confirming the challenge of improving predictive sorption models for positively charged compounds. A diffusion-sorption model was developed and calibrated against experimental data, and estimated \( f \) values also increased with increasing biofilm thickness. This indicates that diffusion in thin biofilms may be strongly limited \( f \approx 0.1 \) by the high biomass density (reduced porosity).

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Organisations: Department of Environmental Engineering, Water Technologies, Environmental Chemistry, Aarhus University, Veolia Water Technologies AB
Authors: Torresi, E. (Intern), Polesel, F. (Intern), Bester, K. (Ekstern), Christensson, M. (Ekstern), Smets, B. F. (Intern), Trapp, S. (Intern), Andersen, H. R. (Intern), Plósz, B. G. (Intern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.49 SJR 2.629 SNIP 2.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.689 SNIP 2.507 CiteScore 6.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Discovery and description of complete ammonium oxidizers in groundwater-fed rapid sand filters

Microbial communities are directly linked with process performance in several engineered systems. In the last century, intense study of microorganisms has contributed to optimize important environmental biotechnologies such as the activated sludge process or anaerobic digestion. However, less attention has been paid to the role of microorganisms in drinking water treatment technologies. In contrast, much effort has been devoted to eliminate potential pathogens in the drinking water treatment and supply systems. Nevertheless, the role of microbes in some drinking water treatments systems as biological filtration has long been acknowledged and recently been investigated. Biological filtration technology is widely used around the world and is especially important in Denmark as groundwater is the main source water for...
drinking water production. Because the groundwater has a relative high-quality, aeration followed by biological filtration is the only required treatment before distribution. In the last years, the microbial communities in rapid gravity sand filters, the typical biological filter used in Denmark, have been characterized, but little knowledge had been required about their physiological activity and roles in compound removal from the source water.

This PhD project focused on a comprehensive investigation of the microbial communities in rapid sand filters beyond their purely taxonomical identification. For this purpose, samples collected from a rapid sand filter were subjected to metagenomics analysis and genome recovery to identify the genetic capacities of the dominant types in the microbial community. Fourteen near-complete population genomes representing the dominant community were recovered comprising the capacity to grow on the typical compounds found in groundwater. The identified population genomes contained capabilities to oxidize ammonium, nitrite, methane, hydrogen sulfide, iron and manganese as well as to assimilate organic compounds. A composite population genome was assigned to Nitrospira. This genus had previously been found in multiple rapid sand filters at an unexplained high abundance. Nitrospira spp. are known to perform the second step of nitrification: oxidation of nitrite to nitrate. The two-step nitrification process disclosed at the end of the 19th century was assumed to be carried out by two different functional groups, ammonia oxidizing prokaryotes and nitrite oxidizing bacteria. Strikingly, the Nitrospira composite population genome not only contained the genes to oxidize nitrite to nitrate, but also the genetic potential to execute the first step of nitrification. Exhaustive bioinformatics investigation ruled out the possibility of genomic contamination and confirmed that the Nitrospira composite population genome harbour the complete ammonium oxidation (comammox) pathway. At the same time, evidence of a single microbe's capacity to carry out complete nitrification was obtained by three other groups; in all cases the comammox type belonged to the Nitrospira genus.

To further investigate the genomic capacities of comammox Nitrospira, the Nitrospira composite genome was separated into individual population genomes using a differential coverage binning approach. As a result, five individual genomes were recovered, four of them containing the complete ammonium oxidation pathway. These genomes together with 11 high-quality publically available Nitrospira genomes (seven comammox and four strict nitrite oxidizers) were subject to a comparative genomics analysis. This examination showed specific genomic features for comammox, strict nitrite oxidizers and the two comammox clades. Thus, comammox Nitrospira harbour a higher variety of genes related to adaptation to nutrient-limited environments. The two comammox clades differ in their ammonium uptake affinity systems. Additionally, comammox Nitrospira genomes lack the genetic capacity to use nitrite as the only nitrogen source.

The evolutionary history of comammox Nitrospira was also examined based on protein dissimilarity, gene arrangement and reconciliation analysis. We detected a high probability of horizontal gene transfer events from betaproteobacterial ammonia oxidizers to comammox Nitrospira for genes belonging to the ammonium oxidation pathway as well as from comammox clade B to clade A for a subset of genes.

I investigated the abundance of comammox Nitrospira in rapid sand filters at 12 different waterworks in Denmark. As these new microorganisms are taxonomically similar to strict Nitrospira nitrite oxidizers, we developed specific primers to exclusively target comammox based on their gene encoding the ammonia monooxygenase subunit A. With these primers, we detected comammox Nitrospira as the dominant nitrifier in the biofilters with an abundance typically one order of magnitude higher than canonical ammonium oxidizing prokaryotes.

Lastly, I carried out lab-scale experiments with filter material from the top and bottom layers of a rapid sand filter containing different proportions of comammox Nitrospira, and strict nitrite and ammonia oxidizing prokaryotes under different loading conditions. Specifically, I exposed the filter material to distinct ammonium loading, under presence or absence of external carbon source as well as under oxygen limitation. In relation to the nitrifying community three main findings were made: (i) simultaneous growth of comammox Nitrospira and ammonium oxidizing prokaryotes; (ii) lower fitness of ammonium oxidizing archaea at higher temperatures; (iii) selection of comammox clade A over clade B at increasing ammonium loadings at reference temperature.

Overall, this PhD has provided insights into the genomic capabilities of the main types in the microbial community of a groundwater-fed biological filter. Moreover, the previously observed high abundances of Nitrospira spp. in rapid sand filters, has now been explained, by the discovery of complete ammonium oxidizing (comammox) Nitrospira from metagenomics analysis. In addition, this thesis presents the first extensive analysis of the genomic capabilities of comammox Nitrospira compared to canonical ammonium and nitrite oxidizers.
Discover and description of complete ammonium oxidizers in groundwater-fed rapid sand filters

Diversity, structure, and novel physiologies in microbial communities in rapid sand filters

In order to develop sustainable waste management systems with considering life cycle perspective, scientists and domain experts in environmental science require readily applicable tools for modeling and evaluating the life cycle impacts of the waste management systems. Practice has proved that modeling these systems with general-purpose tools is a cumbersome task. On one hand, the scientists have to spend considerable amount of time to understand these tools in order to develop their models. On another hand, integrated assessments are becoming gradually common in environmental management and therefore scientists are also faced with the problem of integrating models across scales and domains, which is not a straightforward process.

Domain-Specific Languages (DSLs) are languages which are specialized for a specific application domain and they promise to increase developer productivity by raising the level of abstraction. They allow domain experts, who are non-programmers, to directly encode their domain knowledge about what a system under development should do. In this thesis, we utilize domain-specific languages, on the basis of the flow-based programming (FBP) paradigm, to model and evaluate environmental technologies i.e. solid waste management systems. Flow-based programming is used to support concurrent execution of the processes, and provides a model-integration language for composing processes from homogeneous or heterogeneous domains. And a domain-specific language is used to define atomic processes and domain-specific validation rules for composite processes. We call these DSLs, which are based on FBP paradigm, domain-specific flow based languages and we provide a formal framework to develop them. To this end, we advocate aspect-oriented concepts to FBP to separate cross-cutting concerns, by providing an extension called AOFBP. Afterwards, we propose the framework based on this extension, and we use a formal language called ForSpec, which is an extension of FORMULA, to formally specify the structural and behavioral semantics of the sub-languages proposed in this framework. Finally, we propose a domain specific language for modeling of waste-management systems on the basis of our framework. We evaluate the language by providing a set of case studies. The contributions of this thesis are; addressing separation of concerns in Flow-based programming and providing the formal specification of its syntax and semantics; a formal language and framework to specify domain-specific flow based languages; design and develop domain specific languages for waste management modeling; and finally our work also can be considered as another case study for structural and behavioral semantics specifications in ForSpec and FORMULA.

Domain Specific Language for Modeling Waste Management Systems

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software Engineering, Department of Environmental Engineering, Residual Resource Engineering
Authors: Zarrin, B. (Intern), Baumeister, H. (Intern), Damgaard, A. (Intern)
Number of pages: 233
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Draft genome sequence of the yeast Starmerella bacillaris (syn., Candida zemplinina) FRI751 isolated from fermenting must of dried Raboso grapes

Starmerella bacillaris is an ascomycetous yeast commonly present in enological environments. Here, we report the first draft genome sequence of S. bacillaris FRI751, which will facilitate the study of the characteristics of this interesting enological yeast.

Dramatic loss of comammox Nitrospira associated with long-term nitrite feeding

Until recently, nitrification was thought to be a strict two-step process where ammonia was first oxidized to nitrite by ammonia-oxidizing bacteria and/or archaea, and subsequently to nitrate by nitrite oxidizing bacteria (NOB). Recent studies in NOB metabolism, however, have revealed that certain Nitrospira are capable of performing both steps, resulting in complete ammonia oxidation (comammox) by single microorganisms. These comammox Nitrospira have been detected in drinking water (Pinto et al., 2015; Palomo et al., 2016) and aquaculture systems (van Kessel et al., 2015), as well as deep oil exploration wells (Daims et al., 2015). The discovery of comammox Nitrospira has significantly changed our understanding of biogeochemical nitrogen cycle. The goal of this experiment was to determine the extent of competition between comammox Nitrospira and canonical Nitrospira in ammonium scarce environment, with nitrite as the main energy source. Community assembly was monitored on well-established biofilms formed on the grains of rapid sand filter (RSF) for drinking water production. RSF sand was placed in laboratory scale column bioreactors and subjected to continuous
feeding of tap water spiked with NO$_2$- (1 mg-N/L) for 250 days. The biofilms were then characterized by Illumina MiSeq platform, targeting the 16S rRNA gene. The relative abundance of a putative comammox clade B Nitrospira sequence variant (with 100% 16S rRNA gene similarity to comammox CG24_A assembled genome) identified in the initial RSF sand (Palomo et al., unpublished) at a relative abundance of 12.4±1.1%, was not detected in 4 out of 6 replicates after 250 days. Similar trend was observed for other putative comammox clade B Nitrospira sequence variants. In contrast, we observed significant increase (padj<0.001) in canonical Nitrospira sequences (100% similarity to uncultured Nitrospira sp. clone KC836101 (Pester et al., 2014)). These observations indicate different behavior of Nitrospira in the absence of ammonia and point to a possible competitive advantage of canonical Nitrospira in environments where nitrite is the sole nitrogen, as well as energy source. In addition, the results suggest that other comammox Nitrospira could also be unable to grow in the only presence of nitrite as it was observed for comammox Ca. Nitrospira inopinata (Daims et al., 2015).

**General information**
State: Published
Organisations: Department of Environmental Engineering, Water Technologies
Authors: Kinnunen, M. (Intern), Palomo, A. (Intern), Dechesne, A. (Intern), Smets, B. F. (Intern)
Number of pages: 1
Publication date: 2017
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**Drikkevand – er den danske holdning til vandbehandling tidssvarende?**

**General information**
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Albrechtsen, H. (Intern)
Number of pages: 9
Publication date: 2017

**Publication information**
Media of output: Powerpoint
Original language: Danish
Place of publication: Kgs. Lyngby
Publisher: DTU Miljø, Danmarks Tekniske Universitet
Main Research Area: Technical/natural sciences
Electronic versions:
17_Albrechtsen_Milj_tek_Topm_de_20170202.pdf

**Relations**
Activities:
Miljøteknisk Topmøde
Publication: Research › Sound/Visual production (digital) – Annual report year: 2017

**Dynamics of N$_2$O production pathways analyzed by $^{15}$N$^{18}$O isotope labeling**
Nitrous oxide production associated with biological nitrogen transformations can contribute substantially to the CO2 footprint of both man-made and natural systems, but the pathways and regulation of N2O production are poorly understood. We developed a 15N/18O dual isotope labelling technique to distinguish and quantify these pathways in mixed communities. The use of 18O-O2 permits differentiation of hydroxylamine oxidation and nitrifier-denitrification driven N2O production by ammonium oxidizing bacteria. We analysed N2O production pathways during biological nitrogen removal at Lynetten wastewater treatment plant. Under anoxia, N2O accumulated due to denitrification, but N2O accumulation was ~3 and 1.7 times higher at 30 and 100 µM O2, respectively. Oxic N2O production was dominated by nitrifier-denitrification, reaching 73% of the total with the remainder due to hydroxylamine oxidation. Our results demonstrate three active pathways of N2O production, each with different environmental controls. The dual 15N/18O isotope labelling approach can contribute to the development of strategies to minimise N2O emissions from man-made and natural systems.
Eco-efficiency assessment of dairy wastewater reuse

The food processing industry is a major water user in many countries and, for example, in Denmark the food sector’s water use amounts to 43% of the total industrial water use. The large water consumption is related to an equally important wastewater production. Besides being costly, both water supply and wastewater management can limit the production capacity of an industrial facility, when local water resources are under stress or wastewater treatment capacity is limited. In such situations, the industry will seek to increase its water efficiency through implementation of new technology. To evaluate the eco-efficiency of new technologies we have developed a method that aligns assessment of environmental impacts and value creation within a life-cycle boundary of a food processing industry. Using standard life-cycle assessment and the concept of value added we have demonstrated the method for a proposed decentralized wastewater reuse scheme in a dairy. The life-cycle assessment covered "gate-to-retail" under the assumption that wastewater reuse at the dairy would not affect primary production and consumers’ behavior. We included upstream processes like power generation and water production, and downstream processes like centralized wastewater handling and biogas production. Life-cycle assessment followed ILCD guidelines and value added was calculated for all processes likely to change more than 1% by the proposed scheme. The reuse scheme would potentially lead to an 86% reduction in drinking water imports compared to business-as-usual. The decentralized reuse facility was found to slightly increase global warming potential by 0.4 mPE/ton raw milk due to intensified water treatment. On the other hand, large reductions (-1.2 to -19 mPE/ton) were seen for impacts on the freshwater resource and nutrient enrichment. For the dairy facility, the reuse scheme would improve the value added by 1.5€/ton. However, reduced demand for water imports and less wastewater discharges to public utilities will lead to decreased value creation in these parts of the value chain. For the entire system we found a 1€/ton reduction in value added. Further studies will investigate the value added from increased production capacity and potential investment savings at the public utilities. For the specific case study, a wastewater reuse scheme was found to reduce environmental impacts from dairy production, but it comes at the cost of decreased value creation when considering the entire value chain. The applied eco-efficiency method showed the benefits and drawbacks of implementing a new technology for all involved stakeholders and the concept of value added resonates well with the commercial actors involved. The method was a good platform for comparing environmental and economic consequences and ensured consistent boundaries between the two assessments, but also stressed the importance of well-defined system boundaries.

Ecological effects of scrubber water discharge on coastal plankton: Potential synergistic effects of contaminants reduce survival and feeding of the copepod Acartia tonsa

To meet the oncoming requirements for lower sulphur emissions, shipping companies can install scrubbers where the exhaust is sprayed with seawater and subsequently discharged to the sea. The discharge water has a pH around 3 and contains elevated concentrations of vanadium, nickel, lead and hydrocarbons. We investigated 1) the threshold concentrations of scrubber discharge water for survival, feeding and reproduction of the copepod Acartia tonsa, 2) whether the effects depend on the exposure route and 3) whether exposure to discharge water can be detected in field-collected organisms. A direct exposure to discharge water increased adult copepod mortality and reduced feeding at metal
concentrations which were orders of magnitude lower than the lethal concentrations in previous single-metal studies. In contrast, reproduction was not influenced by dietary uptake of contaminants. Scrubber water constituents could have synergistic effects on plankton productivity and bioaccumulation of metals, although the effects will depend on their dilution in the marine environment.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Department of Environmental Engineering, Environmental Chemistry
Authors: Koski, M. (Intern), Stedmon, C. (Intern), Trapp, S. (Intern)
Pages: 374-385
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Main Research Area: Technical/natural sciences

**Publication information**

Journal: Marine Environmental Research
Volume: 129
ISSN (Print): 0141-1136
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.24 SJR 1.092 SNIP 1.083
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.103 SNIP 1.103 CiteScore 3.15
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.95 SNIP 1.109 CiteScore 2.67
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.969 SNIP 1.12 CiteScore 2.48
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.93 SNIP 1.241 CiteScore 2.4
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.896 SNIP 1.07 CiteScore 2.17
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.833 SNIP 0.851
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.831 SNIP 0.901
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.993 SNIP 1.067
Scopus rating (2007): SJR 0.888 SNIP 0.838
Scopus rating (2006): SJR 1.355 SNIP 1.236
Scopus rating (2005): SJR 0.763 SNIP 0.847
Scopus rating (2004): SJR 1.3 SNIP 1.506
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.82 SNIP 0.942
Scopus rating (2002): SJR 0.717 SNIP 1.271
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.662 SNIP 0.722
Scopus rating (2000): SJR 1.114 SNIP 1.088
Web of Science (2000): Indexed yes
**Scopus rating (1999):** SJR 0.689 SNIP 0.763

**Original language:** English

**Scrubber discharge water, Copepod, Survival, Feeding, Metals, Synergistic effects**

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**Source:** FindIt

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**Publication:** Research - peer-review › Journal article – Annual report year: 2017

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**Ecological effects of scrubber water discharge on coastal plankton: Potential synergistic effects of contaminants reduce survival and feeding of the copepod *Acartia tonsa***

**General information**

State: Published

Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Department of Environmental Engineering, Environmental Chemistry

Authors: Koski, M. (Intern), Stedmon, C. (Intern), Trapp, S. (Intern)

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Title of host publication: Book of Abstracts Sustain 2017

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Electronic versions:

SustainAbstracts2017c.compressed_12.pdf

Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

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**Ecological restoration of groundwater-dependent vegetation in the arid Ejina Delta: evidences from satellite evapotranspiration**

**General information**

State: Published

Organisations: Department of Environmental Engineering, Water Resources Engineering, Chinese Academy of Sciences, Technical University of Denmark

Authors: Kai, L. (Ekstern), Garcia, M. (Intern), Yu, J. (Ekstern), Zhang, Y. (Ekstern), Wang, P. (Ekstern), Wang, S. (Intern), Liu, X. (Ekstern)

Number of pages: 1

Publication date: 2017

Conference: EGU General Assembly 2017, Vienna, Austria, 24/04/2017 - 24/04/2017

Main Research Area: Technical/natural sciences

**Publication information**

Journal: Geophysical Research Abstracts

Volume: y

Article number: EGU2017-19121-2

ISSN (Print): 1607-7962

Ratings:

Web of Science (2014): Indexed yes

ISI indexed (2013): ISI indexed no

Web of Science (2013): Indexed yes

ISI indexed (2012): ISI indexed no

Web of Science (2012): Indexed yes

ISI indexed (2011): ISI indexed no

Web of Science (2011): Indexed yes

BFI (2009): BFI-level 1

Original language: English

Electronic versions:

EGU2017_19121_2.pdf

Publication: Research - peer-review › Conference abstract in journal – Annual report year: 2017
Ecosystem Resilience to Drought and Temperature Anomalies in the Mekong River Basin

Climate change is leading to an increasing in the frequency and intensity of extreme weather events, which significantly affect ecosystems stability. In this study, ecological stability metrics in response to wet/dry events and warm/cold events on vegetation greenness were assessed using an auto-regressive model of NDVI in the Mekong River basin (around 759,000 km²) where large ecological and climatic gradients exist. Gridded temperature, and the Global Standard Precipitation Evaporation Index (SPEI) and antecedent NDVI were used as model predictors. The forest in north Laos was more resilient to the temperate and wet/dry anomalies events than other regions in the basin. Drought reduced green biomass in north Laos, northeast Thailand and Myanmar, but in these tropical climate regions’ the vegetation biomass was also more responsive by higher temperatures. Vegetation in northeast Thailand, Cambodia and the Mekong delta were less sensitive to the temperature anomalies effect compared to other part of Mekong River basin. The map of resistance and resilience metrics can help to determine the most vulnerable regions to extreme events for policy makers.

General information
State: Published
Organisations: Department of Environmental Engineering, Air, Land & Water Resources, Chinese Academy of Sciences
Authors: Na-U-Dom, T. (Ekstern), Garcia, M. (Intern), Mo, X. (Ekstern)
Number of pages: 6
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: I O P Conference Series: Earth and Environmental Science
Volume: 68
Issue number: 1
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ISSN (Print): 1755-1307
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2016): CiteScore 0.38 SJR 0.186 SNIP 0.567
Scopus rating (2015): SJR 0.253 SNIP 0.358 CiteScore 0.22
Scopus rating (2014): SJR 0.168 SNIP 0.391 CiteScore 0.19
Scopus rating (2013): SJR 0.173 SNIP 0.13 CiteScore 0.06
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.338 SNIP 0.141 CiteScore 0.29
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.116 SNIP 0 CiteScore 0
ISI indexed (2011): ISI indexed no
Web of Science (2008): Indexed yes
Original language: English


Ecotoxicity testing and environmental risk assessment of iron nanomaterials for sub-surface remediation – Recommendations from the FP7 project NanoRem

Nanoremediation with iron (Fe) nanomaterials opens new doors for treating contaminated soil and groundwater, but is also accompanied by new potential risks as large quantities of engineered nanomaterials are introduced into the environment. In this study, we have assessed the ecotoxicity of four engineered Fe nanomaterials, specifically, Nano-Goethite, Trap-Ox Fe-zeolites, Carbo-Iron® and FerMEG12, developed within the European FP7 project NanoRem for sub-surface remediation.
remediation towards a test battery consisting of eight ecotoxicity tests on bacteria (V. fisheri, E. coli), algae (P. subcapitata, Chlamydomonas sp.), crustaceans (D. magna), worms (E. fetida, L. variegatus) and plants (R. sativus, L. multiflorum). The tested materials are commercially available and include Fe oxide and nanoscale zero valent iron (nZVI), but also hybrid products with Fe loaded into a matrix. All but one material, a ball milled nZVI (FerMEG12), showed no toxicity in the test battery when tested in concentrations up to 100 mg/L, which is the cutoff for hazard labeling in chemicals regulation in Europe. However it should be noted that Fe nanomaterials proved challenging to test adequately due to their turbidity, aggregation and sedimentation behavior in aqueous media. This paper provides a number of recommendations concerning future testing of Fe nanomaterials and discusses environmental risk assessment considerations related to these.
Ecotoxicity testing of nanoparticles - The quest for disclosing the nano-effect

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Baun, A. (Intern), Skjolding, L. M. (Intern), Sørensen, S. N. (Intern), Hjorth, R. (Intern), Hansen, S. F. (Intern), Hartmann, N. B. (Intern)
Pages: 48-48
Publication date: 2017

Host publication information
Title of host publication: Abstracts - 8th international symposium on nanotechnology, occupational and environmental health
Place of publication: Elsinore, Denmark
Publisher: National research centre for the working environment
Main Research Area: Technical/natural sciences
Conference: 8th international symposium on nanotechnology, occupational and environmental health, Elsinore, Denmark, 29/05/2017 - 29/05/2017
Electronic versions:
Nanotech_symp_Ecotoxicity.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Effect of Anisotropy Structure on Plume Entropy and Reactive Mixing in Helical Flows
Plume dilution and reactive mixing can be considerably enhanced by helical flows occurring in three-dimensional anisotropic porous media. In this study, we perform conservative and reactive transport simulations considering different anisotropy structures of a single inclusion with the objective of exploring the effect of the inclusion’s geometry and orientation on the patterns of twisted streamlines and on the overall dilution and reaction of solute plumes. We analyzed 100 different scenarios by varying key parameters such as the angle of the anisotropic structures with respect to the average flow velocity, the spacing between alternated heterogeneous zones of coarse and fine materials, the permeability contrast between such matrices, and the magnitude of the seepage velocity. Entropy conservation equations and entropy-based metrics for both conservative and reactive species were adopted to quantify dilution, reactive mixing and their interactions with the helical flow patterns in the considered three-dimensional anisotropic setups. The results allowed identifying optimal anisotropic configurations maximizing mixing and reactions, and yielding enhancement factors up to 15 times the outcomes of analogous simulations in homogeneous media. Furthermore, the effects of compound-specific diffusive/dispersive properties of the transported species were found to be relevant for both plume dilution and reactive
mixing in helical flows.

**General information**
State: Accepted/In press
Organisations: Department of Environmental Engineering, Water Resources Engineering, Hohai University, Technical University of Munich
Authors: Ye, Y. (Ekstern), Chiogna, G. (Ekstern), Lu, C. (Ekstern), Rolle, M. (Intern)
Number of pages: 18
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Transport in Porous Media
ISSN (Print): 0169-3913
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed Yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.16 SJR 0.767 SNIP 1.316
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.728 SNIP 1.317 CiteScore 1.94
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.932 SNIP 1.433 CiteScore 1.91
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.04 SNIP 1.433 CiteScore 2.03
- ISI indexed (2013): ISI indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.942 SNIP 1.522 CiteScore 1.88
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.921 SNIP 1.337 CiteScore 1.81
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.615 SNIP 1.203
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.612 SNIP 1.088
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 0.7 SNIP 0.924
- Scopus rating (2007): SJR 0.717 SNIP 1.215
- Web of Science (2007): Indexed yes
- Scopus rating (2006): SJR 0.929 SNIP 1.284
- Scopus rating (2005): SJR 0.918 SNIP 1.293
- Scopus rating (2004): SJR 1.071 SNIP 1.227
- Scopus rating (2003): SJR 0.879 SNIP 1.195
- Scopus rating (2002): SJR 0.982 SNIP 0.938
- Scopus rating (2001): SJR 1.006 SNIP 0.975
- Scopus rating (2000): SJR 0.896 SNIP 0.732
Effect of electrostatic interactions on pH fronts propagation in saturated in saturated porous media

General information
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Organisations: Department of Environmental Engineering, Water Resources Engineering, University of Tubingen
Authors: Muniruzzaman, M. (Ekstern), Rolle, M. (Intern)
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Publication date: 2017
Main Research Area: Technical/natural sciences
Electronic versions:
Muniruzzaman_Rolle_Interpore_2017_531_MS1.16.pdf
Source: PublicationPreSubmission
Source-ID: 139657035
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Effect of medium-pressure UV-lamp treatment on disinfection by-products in chlorinated seawater swimming pool waters

Several brominated disinfection by-products (DBPs) are formed in chlorinated seawater pools, due to the high concentration of bromide in seawater. UV irradiation is increasingly employed in freshwater pools, because UV treatment photodegrades harmful chloramines. However, in freshwater pools it has been reported that post-UV chlorination promotes the formation of other DBPs. To date, UV-based processes have not been investigated for DBPs in seawater pools. In this study, the effects of UV, followed by chlorination, on the concentration of three groups of DBPs were investigated in laboratory batch experiments using a medium-pressure UV lamp. Chlorine consumption increased following post-UV chlorination, most likely because UV irradiation degraded organic matter in the pool samples to more chlorine-reactive organic matter. Haloacetic acid (HAA) concentrations decreased significantly, due to photo-degradation, but the concentrations of trihalomethanes (THMs) and haloacetonitriles (HANs) increased with post-UV chlorination. Bromine incorporation in HAAs was significantly higher in the control samples chlorinated without UV irradiation but decreased significantly with UV treatment. Bromine incorporation was promoted in THM and HAN after UV and chlorine treatment. Overall, the accumulated bromine incorporation level in DBPs remained essentially unchanged in comparison with the control samples. Toxicity estimates increased with single-dose UV and chlorination, mainly due to increased HAN concentrations. However, brominated HANs are known in the literature to degrade following further UV treatment.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Aix-Marseille University, Aix Marseille Universite
Authors: Cheema, W. A. (Intern), Manasfi, T. (Ekstern), Kaarsholm, K. M. S. (Intern), Andersen, H. R. (Intern), Boudenne, J. (Ekstern)
Pages: 910-917
Publication date: 2017
Main Research Area: Technical/natural sciences

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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.09 SJR 1.621 SNIP 1.849
Web of Science (2016): Indexed yes
Effect of micro-aeration and inoculum type on the biodegradation of lignocellulosic substrate

The effect of various micro-aeration strategies on the anaerobic digestion (AD) of wheat straw was thoroughly examined using a mixture of inocula, containing compost and well digested sludge from biogas plant. The aim was to determine the most efficient oxygen load, pulse repetition and treatment duration, resulting in the highest methane production. The oxygen load had the largest impact on the biodegradability of straw, among the examined variables. More specifically, a
micro-aeration intensity of 10mLO2/gVS was identified as the critical threshold above which the AD performance was more susceptible to instability. The highest enhancement in biogas production was achieved by injecting 5mLO2/gVS for a consecutive 3-day treatment period, presenting a 7.2% increase compared to the untreated wheat straw. Nevertheless, the results from optimisation case study indicated a higher increase of 9% by injecting 7.3mLO2/gVS, distributed in 2 pulses during a slightly shorter treatment period (i.e. 47h).
Effect of nitrogen source and acclimatization on specific growth rates of microalgae determined by a high throughput in vivo microplate autofluorescence method

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, National Food Institute, Research Group for Bioactives – Analysis and Application
Number of pages: 1
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Event: Abstract from 7th International Conference, Kos, Greece.
Main Research Area: Technical/natural sciences
Electronic versions:
Sider_fra_UV_for_seawater_pools.pdf
Source: PublicationPreSubmission
Source-ID: 132847742
Publication: Research - peer-review › Poster – Annual report year: 2017

Effect of UV treatment on DBPs formation in chlorinated seawater swimming pools - a laboratory study

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Aix-Marseille University, Aix Marseille Universite
Authors: Cheema, W. A. (Intern), Manasfi, T. (Ekstern), Kaarsholm, K. M. S. (Intern), Andersen, H. R. (Intern), Boudenne, J. L. (Ekstern)
Publication date: 2017
Event: Abstract from 7th International Conference, Kos, Greece.
Main Research Area: Technical/natural sciences
Electronic versions:
Sider_fra_UV_for_seawater_pools.pdf

Relations
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Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017
Effect of UV treatment on formation of disinfection by-products in chlorinated seawater swimming pools

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Aix-Marseille University, Aix Marseille Universite
Authors: Cheema, W. A. (Intern), Manasfi, T. (Ekstern), Kaarsholm, K. M. S. (Intern), Andersen, H. R. (Intern), Boudenne, J. (Ekstern)
Pages: 103-104
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Place of publication: Kos Island, Greece
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Main Research Area: Technical/natural sciences
Conference: 7th International Conference, Kos, Greece, 02/05/2017 - 02/05/2017
Electronic versions:
UV_treatment_for_DBPs_in_seawater_pools.pdf
Source: PublicationPreSubmission
Source-ID: 132032212
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Effect of UV treatment on formation of disinfection by-products in chlorinated seawater swimming pools

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Aix-Marseille University, Aix Marseille Universite
Authors: Cheema, W. A. (Intern), Manasfi, T. (Ekstern), Kaarsholm, K. M. S. (Intern), Andersen, H. R. (Intern), Boudenne, J. (Ekstern)
Number of pages: 1
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Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Effects of climate model interdependency on the uncertainty quantification of extreme rainfall projections
The inherent uncertainty in climate models is one of the most important uncertainties in climate change impact studies. In recent years, several uncertainty quantification methods based on multi-model ensembles have been suggested. Most of these methods assume that the climate models are independent. This study investigates the validity of this assumption and its effects on the estimated probabilistic projections of the changes in the 95% quantile of wet days. The methodology is divided in two main parts. First, the interdependency of the ENSEMBLES RCMs is estimated using the methodology developed by Pennell and Reichler (2011). The results show that the projections from the ENSEMBLES RCMs cannot be assumed independent. This result is then used to estimate the uncertainty in climate model projections. A Bayesian approach has been developed using the procedure suggested by Tebaldi et al. (2005) in order to quantify the uncertainty.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Urban Water Systems, DHI Denmark
Authors: Sunyer, M. A. (Intern), Rosbjerg, D. (Intern), Arnbjerg-Nielsen, K. (Intern), Madsen, H. (Ekstern)
Pages: 284-289
Publication date: 2017

Host publication information
Title of host publication: 9th International Workshop on Precipitation in Urban Areas: Urban Challenges in Rainfall Analysis, Urbanrain 2012
Publisher: ETH Zurich
ISBN (Electronic): 9783906031217
Main Research Area: Technical/natural sciences
Effects of copper oxide nanoparticles and copper ions to zebrafish (Danio rerio) cells, embryos and fry

The use of engineered metal nanoparticles (NPs) is continuously increasing and so is the need for information regarding their toxicity. This study compares the toxicity of CuO NPs with ionic Cu in three zebrafish model systems: zebrafish hepatoma cell line (ZFL), fish embryo toxicity test (FET) and fry locomotion. In the ZFL tests, no significant cytotoxicity (cell death, decreased metabolic or cell membrane integrity) was detected for either treatment, though both significantly affected reactive oxygen species (ROS) production. Embryo mortality was affected by both Cu ions and CuO NPs with similar concentration-response relationships, whereas only Cu ions affected fry mortality (24h LC50≈30μM, ≈2mgCuL-1 for Cu ions and no significant mortality observed at up to 200μM, 12.7mgCuL-1 for CuO NP). Both Cu forms increased fry swimming activity during light cycles and decreased activity during dark cycles: Cu ions had significant impact at lower concentrations than CuO NPs. The implications are that Cu ions generally are more toxic than CuO NPs to embryos and fry but there is a marked difference in toxicity among the different zebrafish model systems. Metal NPs release into the environment may have adverse effects on fish and other aquatic organisms.

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Roskilde University, University of Gothenburg
Authors: Thit, A. (Ekstern), Skjolding, L. M. (Intern), Selck, H. (Ekstern), Sturve, J. (Ekstern)
Pages: 89-100
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Publication information
Journal: Toxicology in Vitro
Volume: 45
Issue number: 1
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.15 SJR 0.997 SNIP 0.929
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.098 SNIP 1.145 CiteScore 3.38
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.949 SNIP 1.136 CiteScore 3.03
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.935 SNIP 1.267 CiteScore 3.32
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.924 SNIP 1.162 CiteScore 3.05
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.838 SNIP 1.047 CiteScore 2.8
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Effects of diffuse radiation on carbon and water fluxes of a high latitude temperate deciduous forest

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Atmospheric Environment
Authors: Wang, S. (Intern), Ibrom, A. (Intern), Pilegaard, K. (Intern), Bauer-Gottwein, P. (Intern), Garcia, M. (Intern)
Number of pages: 1
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Publication information
Journal: Geophysical Research Abstracts
Volume: 19
Article number: EGU2017-12865-2
ISSN (Print): 1607-7962
Ratings:
Web of Science (2014): Indexed yes
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2009): BFI-level 1
Original language: English
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EGU2017_12865.pdf
Publication: Research - peer-review » Conference abstract in journal – Annual report year: 2017

Effects of thermal drying on phosphorus availability from iron-precipitated sewage sludge
Thermal drying of sewage sludge implies sanitation and improves practical handling options of the sludge prior to land application. However, it may also affect its value as a fertilizer. The objective of this study was to assess whether thermal drying of sewage sludge, as well as drying temperature, affects plant P availability after application to soil. The experiment included dewatered sewage sludge (20% DM) and thermally dried sewage sludge (95% DM) collected at a Danish wastewater treatment plant, as well as laboratory oven-dried (70, 130, 190, and 250°C; DM > 95%) subsamples of the dewatered sludge, and a triple superphosphate as a reference. Plant P availability was studied in a 197 d soil incubation
experiment, with sampling for Diffusive Gradients in Thin films (DGT) and water extractable P (WEP) analyses over time, and in a pot experiment with spring barley (Hordeum vulgare L.). In both experiments, thermal drying reduced P availability, as shown by 37 and 23% lower DGT and WEP values, respectively, and a 16% lower P uptake by barley in the pot experiment. The specific drying temperature did not appear to have much effect. Overall, our results suggest that thermal drying of iron-precipitated sewage sludge is not an optimal treatment option if the aim is to optimize plant P availability.
Efficient pharmaceutical removal from (hospital) wastewater by staged-moving bed biofilm reactors (MBBRs) followed by ozonation

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Danish Technological Institute, Aarhus University
Authors: Kragelund, C. (Ekstern), Ooi, G. T. H. (Intern), Tang, K. (Intern), Christensen, A. T. (Ekstern), Bester, K. (Ekstern), Andersen, H. R. (Intern)
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Place of publication: Frederiksberg
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Editors: Flindt Jørgensen, L., Mosolff Larsen, T., Jensen, B. K.
Main Research Area: Technical/natural sciences
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Electronic versions:
Abstract proceedings book

Efficient treatment of aniline containing wastewater in bipolar membrane microbial electrolysis cell-Fenton system
Aniline-containing wastewater can cause significant environmental problems and threaten the human’s life. However, rapid degradation of aniline with cost-efficient methods remains a challenge. In this work, a novel microbial electrolysis cell with bipolar membrane was integrated with Fenton reaction (MEC-Fenton) for efficient treatment of real wastewater containing a high concentration (4460 ± 52 mg L−1) of aniline. In this system, H2O2 was in situ electro-synthesized from O2 reduction on the graphite cathode and was simultaneously used as source of radical dotOH for the oxidation of aniline wastewater under an acidic condition maintained by the bipolar membrane. The aniline was effectively degraded following first-order kinetics at a rate constant of 0.0166 h−1 under an applied voltage of 0.5 V. Meanwhile, a total organic carbon (TOC) removal efficiency of 93.1 ± 1.2% was obtained, revealing efficient mineralization of aniline. The applicability of bipolar membrane MEC-Fenton system was successfully demonstrated with actual aniline wastewater. Moreover, energy balance showed that the system could be a promising technology for removal of biorefractory organic pollutants from wastewaters.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Li, X. (Intern), Jin, X. (Intern), Zhao, N. (Intern), Angelidaki, I. (Intern), Zhang, Y. (Intern)
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Journal: Water Research
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BFI (2018): BFI-level 2
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BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.49 SJR 2.629 SNIP 2.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.689 SNIP 2.507 CiteScore 6.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.957 SNIP 2.727 CiteScore 6.13
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.693 CiteScore 6.02
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.966 SNIP 2.456 CiteScore 5.15
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.867 SNIP 2.374 CiteScore 5.43
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.582 SNIP 2.196
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.319 SNIP 2.225
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.065 SNIP 2.19
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.994 SNIP 2.208
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.895 SNIP 2.214
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.114 SNIP 2.337
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.227 SNIP 2.106
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.696 SNIP 1.917
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.54 SNIP 1.775
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.321 SNIP 1.711
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.305 SNIP 1.688
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.456 SNIP 1.576

Original language: English
Microbial electrolysis cell, Fenton reaction, Aniline, Industrial wastewater, Bipolar membrane, H2O2
DOIs:
10.1016/j.watres.2017.04.047
Efficient water table evolution discretization using domain transformation

Domain transformation methods are useful techniques for solving problems on non-stationary domains. In this work, we consider the evolution of the water table in an unconfined aquifer. This nonlinear, time-dependent problem is greatly simplified by using a mapping from the physical domain to a reference domain and is then further reduced to a single, (nonlinear) partial differential equation. We show well-posedness of the approach and propose a stable and convergent discretization scheme. Numerical results are presented supporting the theory.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, University of Bergen
Authors: Boon, W. M. (Ekstern), Balbarini, N. (Intern), Binning, P. J. (Intern), Nordbotten, J. M. (Ekstern)
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Main Research Area: Technical/natural sciences

Publication information
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Volume: 21
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.6 SJR 0.933 SNIP 1.413
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.277 SNIP 1.517 CiteScore 2.91
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.232 SNIP 1.619 CiteScore 2.62
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.012 SNIP 1.393 CiteScore 2.09
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.856 SNIP 1.366 CiteScore 1.8
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.691 SNIP 1.01 CiteScore 1.92
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.741 SNIP 1.266
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.122 SNIP 1.787
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.664 SNIP 1.548
Scopus rating (2007): SJR 0.716 SNIP 1.489
Web of Science (2007): Indexed yes
Electricity generation and microbial community in response to short-term changes in stack connection of self-stacked
submersible microbial fuel cell powered by glycerol

Stack connection (i.e., in series or parallel) of microbial fuel cell (MFC) is an efficient way to boost the power output for
practical application. However, there is little information available on short-term changes in stack connection and its effect
on the electricity generation and microbial community. In this study, a self-stacked submersible microbial fuel cell
(SSMFC) powered by glycerol was tested to elucidate this important issue. In series connection, the maximum voltage
output reached to 1.15 V, while maximum current density was 5.73 mA in parallel. In both connections, the maximum
power density increased with the initial glycerol concentration. However, the glycerol degradation was even faster in
parallel connection. When the SSMFC was shifted from series to parallel connection, the reactor reached to a stable
power output without any lag phase. Meanwhile, the anodic microbial community compositions were nearly stable.
Comparatively, after changing parallel to series connection, there was a lag period for the system to get stable again and
the microbial community compositions became greatly different. This study is the first attempt to elucidate the influence of
short-term changes in connection on the performance of MFC stack, and could provide insight to the practical utilization of
MFC.

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Authors: Zhao, N. (Intern), Angelidaki, I. (Intern), Zhang, Y. (Intern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.49 SJR 2.629 SNIP 2.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.689 SNIP 2.507 CiteScore 6.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.957 SNIP 2.727 CiteScore 6.13
Web of Science (2014): Indexed yes
Electrochemical monitoring of ammonia during anaerobic digestion

Ammonia is known as key inhibitor to methanogens in anaerobic digestion (AD) process. It’s of importance to develop efficient tool for ammonia monitoring. In this study, an electrolysis cell (EC) coupled with a complete nitrification reactor was developed as sensor for real time and online monitoring of ammonia in AD. The AD effluent was pumped into nitrification reactor first, in which ammonia was converted to nitrate. Afterwards, the nitrate-rich effluent was introduced into cathode chamber of EC. The correlation between currents and ammonia levels was first evaluated with synthetic ammonia-rich digesters. It was observed that the initial transient currents (0 min) were linearly corresponding to the ammonia levels (from 0 to 95.75 mg/L NH₄⁺-N, R² = 0.9673). Finally, this new sensor was tested with real AD effluent and the results showed no significant difference with that measured by conventional methods. The sensor developed here has great potential for online, cost-saving, fast and accurate ammonia monitoring in AD process.
Elemental composition of natural nanoparticles and fine colloids in European forest stream waters and their role as phosphorus carriers

Biogeochemical cycling of elements largely occurs in dissolved state, but many elements may also be bound to natural nanoparticles (NNP, 1–100 nm) and fine colloids (100-450 nm). We examined the hypothesis that the size and composition of stream water NNP and colloids vary systematically across Europe. To test this hypothesis, 96 stream water samples were simultaneously collected in 26 forested headwater catchments along two transects across Europe. Three size fractions (~1–20 nm, >20–60 nm, >60 nm) of NNP and fine colloids were identified with Field Flow Fractionation coupled to inductively coupled plasma mass-spectrometry and an organic carbon detector. The results showed that NNP and fine colloids constituted between 2±5% (Si) and 53±21% (Fe; mean ± SD) of total element concentrations, indicating a substantial contribution of particles to element transport in these European streams, especially for P and Fe. The particulate contents of Fe, Al and organic C were correlated to their total element concentrations, but those of particulate Si, Mn, P and Ca were not. The fine colloidal fractions >60 nm were dominated by clay minerals across all sites. The resulting element patterns of NNP <60 nm changed from North to South Europe from Fe- to Ca-dominated particles, along with associated changes in acidity, forest type and dominant lithology.
To assess the exposure to polycyclic aromatic hydrocarbons (PAHs) it is important to understand the binding mechanisms between specific soil constituents and the organic pollutant. In this study, sorptive bioaccessibility extraction (SBE) was applied to quantify the accessible PAH fraction in industrially contaminated soil with and without passive dosing of a competitive sorbate. SBE experiments revealed an accessible PAH fraction of 41 ± 1% (∑16 US EPA PAHs + 5 further PAHs). The passive dosing of toluene below its saturation level revealed competitive binding and resulted in an average increase of the accessible fraction to 49 ± 2%, whereby primarily the accessibility of higher molecular weight PAHs (log Kow > 6) was affected. Competitive binding was verified using the same soil with only desorption-resistant PAHs present. In this experiment, passive dosing of toluene resulted in desorption of 13 ± 0.4% PAH. We explain increased PAH desorption after addition of toluene by competitive adsorption to high-affinity sorption sites while acknowledging that toluene could additionally have increased PAH mobility within the soil matrix. Findings suggest that the presence of copollutants at contaminated sites deserves specific considerations as these may increase accessibility and thereby exposure and mobility of PAHs.
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Volume: 51
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.26 SJR 2.538 SNIP 1.889
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.584 SNIP 1.828 CiteScore 5.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.103 CiteScore 5.52
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.146 SNIP 2.056 CiteScore 5.17
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.178 SNIP 1.953 CiteScore 5.16
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.964 SNIP 1.729
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.835 SNIP 1.803
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.943 SNIP 1.942
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.8 SNIP 1.927
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.541 SNIP 1.901
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.604 SNIP 2.014
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.863 SNIP 2.046
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.545 SNIP 2.071
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.353 SNIP 1.953
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.419 SNIP 1.977
Web of Science (2001): Indexed yes
Enhancing biogas production from recalcitrant lignocellulosic residue

Lignocellulosic substrates are abundant in agricultural areas around the world and lately, are utilized for biogas production in full-scale anaerobic digesters. However, the anaerobic digestion (AD) of these substrates is associated with specific difficulties due to their recalcitrant nature which protects them from enzymatic attack. Hence, the main purpose of this work was to define diverse ways to improve the performance of AD systems using these unconventional biomasses. Thus, mechanical and thermal alkaline pretreatments, microaeration and bioaugmentation with hydrolytic microbes were examined. The studied substrates were fresh and ensiled meadow grass, regularly cultivated ensiled grass, digested manure fibers and wheat straw. AD of lignocellulosic substrates is time demanding and an extended incubation period is often needed. Initially, diverse analytical methods were used (i.e. electrical conductivity, soluble chemical oxygen demand and enzymatic hydrolysis) as a rapid way to predict the methane production. However, the precision of methane yield prediction was not high (R² < 0.68) and thus, the biochemical methane potential (BMP) test is concluded to be the most precise method to estimate the biomethanation process. Various mechanical pretreatments were examined on ensiled meadow grass biodegradability by applying shearing forces. Preliminary results showed that the methane production of ensiled meadow grass can be efficiently increased up to 25% compared to untreated samples. Hence, the most efficient method was further applied on the same substrate, focusing on different age of vegetation under mono- and co-digestion with livestock manures (i.e. poultry, mink and cattle manure). The differences on biomass' chemical composition were also determined in order to demonstrate the effect of vegetation stage. Clear alterations were revealed due to late harvest time and specifically, the lignin content was markedly augmented (~30% of dry matter) with advancing age, implying the need of pretreatment. Mechanically pretreated biomass of increased maturity was co-digested with diverse livestock manures in order to define the optimum silage/manure ratio in the feedstock. Results showed that the ideal lignocellulose/manure contribution differs among the examined substrates and that the chemical characteristics of the feedstock mixture significantly influenced the biomethanation process. The application of shearing forces was also examined on the hardly degradable fraction of digested manure fibers. However, limited efficacy was observed on biomethanation and the remaining volatile solids (VS) were not highly utilized. Conversely, the well-studied thermal alkaline pretreatments using sodium hydroxide as a catalyst promoted the yield from approximately 42 mLCH₄/gVS to 170 mLCH₄/gVS. Furthermore, the positive results were validated in the co-digestion of biofibers with cattle manure under continuous mode operation. Mechanical and thermal alkaline pretreatment (6% NaOH at 55 °C for 24 h) had an effect of 7% and 26% respectively, without provoking process inhibition. Focusing on full-scale practices, the application of simple and efficient treatment methods is generally suggested. Accordingly, the reduction of supply chain steps prior to AD could eventually improve the energy budget and subsequently, process profitability. Hence, the integration of mechanical pretreatment at harvesting step was examined as a solution to scale-up the used mechanical method in real-life applications. On this topic, an innovative Disc-mower (named as Excoriator) was studied in order to simultaneously harvest and pretreat fresh meadow grass through the application of shearing forces. Kinetic studies showed that the lag phase was decreased, the methane production rate was increased and finally, the methane yield was significantly enhanced by up to 27% under optimal conditions. Further investigations on full-scale experiments mowing regularly cultivated grass confirmed the positive effect due to the selection of the most appropriate harvester. The modern harvester poses the ability improve the energy balance and subsequently, the sustainability of lignocellulose-based AD. The co-digestion of pig manure and lignocellulosic silage was assessed in continuous stirred tank reactors (CSTR). Addition of mechanically pretreated silage in the feedstock positively affected the methane yield (+16%) and in parallel, reduced the risk of ammonia inhibition compared to mono-digestion of pig manure. Furthermore, metagenomic analysis was performed to determine differences among the microbial communities in CSTRs operating under mono- and co-digestion. Species similar to Clostridium thermocellum, with increased cellulolytic activity, were detected to be adherent to the solid fraction of digested feedstock and concluded to be key players for lignocellulose's disintegration. Moreover, various microaeration strategies were applied in order to elucidate the effect of oxygen load (O₂), pulse repeatability and treatment period on the AD of wheat straw. The results obtained from this study demonstrated a 7.2% increase in methane yield after a 3 days microaeration period, using 5 mL O₂/gVS served by once. In addition, an optimisation study was conducted and the analysis indicated that the methane yield could have been increased by 9%, if 7.3 mL O₂/gVS were injected. It was indicated that microaeration can be an alternative solution for augmented biomass solubilization without causing inhibition to the mandatory anaerobic methanogenic community. Based on the initial microbial analysis, the bioaugmentation with the typically abundant in AD systems C. thermocellum was examined in biogas reactors fed with wheat straw. Bioaugmentation with the hydrolytic strain had a remarkable result on methane production. Nevertheless, the long term monitoring showed that routine bioaugmentation is needed to retain a positive effect of approximately 7%. Moreover, it was indicated that the bioaugmentation with C. thermocellum can be periodically applied in biogas reactors in order to extract the residual methane from the amassing materials and avoid potential accumulation. Additionally, the facultative anaerobic Melioribacter roseus was inoculated in a replicate CSTR following different bioaugmentation strategies, either strictly anaerobic or micro-aerobic conditions. Nevertheless, the novel strain did not enhance the biomethanation process and the
metagenomic analysis revealed that the inoculated strain did not adapt in the biogas reactor. The results obtained confirm that lignocellulose-based AD can lead to high biogas yield. At lab-scale experiments, the bioenergy production can be further improved using micro-aeration, bioaugmentation with C. thermocellum, thermal-alkaline or mechanical pretreatments. Further insights into AD microbiome can improve and optimize the used processes. Among the examined pretreatments, only mechanical methods were evaluated in full-scale operation due to their easiness in application. On this topic, modern harvesting technology simulating the process applied in lab-scale could generate similar enhancement under full-scale trials. Machineries orientated to pretreat biomass using simplified techniques can positively affect the industrial applications.

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Enquiring into the roots of bioenergy - epistemic uncertainties in life cycle assessments
The research for this Thesis was originally framed around the “sustainability assessment of full chain bioenergy”. However, it is known for some years that the critical impacts of dedicated bioenergy relate to induced land use changes (LUC). Their critically derives from their potential to dominate environmental impacts from a life-cycle perspective and from the uncertainty that accompanies them. On the other hand, continued land use may be a concern for soil’s long-term sustainability (understood as fertility), which has recently received attention in environmental life-cycle assessments (LCA) under the respective life-cycle initiative of the UNEP-SETAC. The Thesis thus focused on these two aspects of sustainability of bioenergy. The overall aim was to disentangle the epistemic uncertainties related to land use impact assessments in order to provide science based decision-support for environmentally sustainable land use management and policy-making, especially relevant for land-demanding or dedicated bioenergy deployment.

Paper I took a Danish willow plantation for cogeneration of heat and power (CHP) through gasification and framed the research around the key land-use reference assumptions. For this, the LCA was structured around three basic land scenarios: marginal abandoned land, marginal extensive grassland and arable land. For each scenario, different LUC models were developed which represent the different impacts induced from the occupation of land for energy cropping. Despite being the most productive, occupying arable land proved to have the largest impacts due to indirect LUC. Gasification willow from marginal abandoned land had also significant impacts from preventing natural regeneration, but it showed a significantly better environmental performance (even under the considered uncertainties) than CHP from natural gas. The implementation of such bioenergy systems on abandoned lands would be thus justified as long as they substitute fossil-fuel based CHP.

In Paper II, the key assumptions related to time horizons in LCA of bioenergy systems were analysed and crucial definitions for them were proposed, as well as generic recommendations regarding them. Similarly, the effect of different modelling approaches in LUC emission accounting was studied by the application of several methods to four biofuel case studies. As a result, dynamic land-use baseline methods were rejected for LUC accounting while top-down LUC models showed to be a more solid alternative to economic LUC models for regulation and footprinting purposes. After considering the studied epistemic uncertainties and based on the key conservative assumptions taken, it was concluded that land-demanding biofuels have larger global warming impacts than the respective fossil fuels they replace unless planted on abandoned lands.

With Papers I-II, the selection of the land-use references and time horizons involved in LCA of biofuels was demonstrated to be crucial for the characterization of the resulting environmental impacts. On top of that, different LCA modelling approaches exist with different virtues and applications, which logically articulate different sets of other key assumptions. Therefore, three land-use reference frameworks were proposed in Paper III to enable value-consistent land use impact assessments. Based on previous findings and recommendations, new methodological modifications to the existing UNEP-SETAC framework were suggested. The proposed modifications were articulated by discriminating among different long-term impacts from land use and by classifying different ecosystem services provided by land as environmental stocks or flows. These modifications reorient the land use impact assessments to impacts during occupation and suggest dealing with permanent impacts separately. In the proposed new methodology, dynamic land-use references are suggested for assessing occupation impacts on abandoned lands (relevant for consequential LCA) while static references are suggested
for generic occupation impacts (in any LCA). Static references, understood as the precedent vegetation cover in equilibrium, are also suggested for every transformation impact assessed with any LCA modelling approach. Last but not least, a hybrid LCA (HLCA) framework was also proposed as an alternative to existing attributional LCA which facilitates both absolute and relative sustainability assessments. Unknown or indirect LUC can be included with top-down LUC models (LUCglobal factor for world-average greenhouse gas (GHG) emissions or LUCGHGprotocol factors for country-average, crop-specific GHG emissions). In order to enable absolute land use impact assessments, the use of substitution is not allowed in the HLCA framework and an area based functional unit (FU) should be chosen. For this, land use impacts can be linked to planetary and regional ecosystem boundaries through normalization references (taken as carrying capacity thresholds). Environmental footprinting of products from land-use systems with co-products can be carried out by choosing product-based FU, but absolute land use impact assessments would involve then value-laden allocation choices. Value-free absolute impact assessments can still be carried out with area-based FU and by adding function-equivalent synthetic products to the other system(s), which allow system (rather than product) comparability.

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Enriched ammonia-tolerant methanogenic cultures as bioaugmentation inocula in continuous biomethanation processes
Many ammonia-rich biomass sources, such as manures and protein-rich substrates, are potential inhibitors of the anaerobic digestion (AD) process. It was previously demonstrated that bioaugmentation of Methanoculleus bourgensis MS2T in an ammonia inhibited process in a continuous stirred tank reactor (CSTR), resulted in up to 90% recovery of the methane production compared to the uninhibited production. However, cultivation of pure strains has practical difficulties due to the need of special growth media and sterile conditions. In contrast, acclimatized enriched cultures have minor sterility requirements. In the current study, an enriched ammonia-tolerant methanogenic culture was bioaugmented in a CSTR reactor operating under ammonia-induced, inhibited-steady-state. The results demonstrated that bioaugmentation, completely counteracted the ammonia toxicity effect. This indicates that a commercial application of bioaugmentation could improve up to 36% the methane production, the greenhouse gas reduction efficiency and the gross revenue of ammonia inhibited full scale biogas reactors. 16S rRNA gene sequencing showed that bioaugmentation changed the microbial composition of the reactors resulting in higher bacterial and lower archaeal community diversity. The bioaugmented reactor showed a fourfold increase of the abundance of the bioaugmented methanogens compared to the control reactor. This indicates that ammonia-tolerant methanogens established well in the ammonia-inhibited reactor and dominated over the domestic methanogenic population. Finally, this study showed that the enriched culture alleviated ammonia toxicity 25% more efficiently than the previously used pure culture.

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Entropy-based critical reaction time for mixing-controlled reactive transport

Entropy-based metrics, such as the dilution index, have been proposed to quantify dilution and reactive mixing in solute transport problems. In this work, we derive the transient advection dispersion equation for the entropy density of a reactive
plume. We restrict our analysis to the case where the concentration distribution of the transported species is Gaussian and we observe that, even in case of an instantaneous complete bimolecular reaction, dilution caused by dispersive processes dominates the entropy balance at early times and results in the net increase of the entropy density of a reactive species. Successively, the entropy of the reactant decreases until it vanishes. We show the existence of a unique critical value of dilution, which corresponds to the complete consumption of one of the reactants. This critical dilution index is independent of advective and dispersive processes, and depends only on the dimensionality of the problem, on the stoichiometry of the reaction and on the initial concentrations of the reactants. Furthermore, we provide simple analytical expressions to compute the critical reaction time, i.e., the time at which the critical dilution index is reached, for selected flow configurations. Our results show that, differently from the critical dilution index, the critical reaction time depends on solute transport processes such as advection and hydrodynamic dispersion.

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Environmental assessment of presence of impurity materials and chemical pollutants in wood waste meant for recycling

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Environmental Assessment of Sewage Sludge Management – Focusing on Sludge Treatment Reed Bed Systems
Sewage sludge is generated from the treatment of domestic wastewaters at wastewater treatment plants. Since the implementation of stricter requirements for wastewater treatment in the European Union in 2005, the amount of sludge produced has increased, creating the demand for more effective treatment and recycling.

In Denmark, the application of sludge on agricultural land is an often-used recycling strategy, as it returns nutrients and microelements to the soil, which can substitute for commercial fertilisers. Conventionally, sludge produced in Denmark is dewatered with mechanical devices; however, in the late 1980s, sludge treatment reed bed (STRB) systems were introduced in Denmark and in 2016, more than 100 STRB systems were operating in the country. Sludge treatment in STRB systems is often considered more environmentally friendly compared to mechanical sludge treatment technologies, albeit only a few life cycle assessments (LCAs) comparing the environmental performances of sludge treatment technologies include STRB systems. Furthermore, as data on the STRB system technology suitable for LCA are scarce, the results of these LCAs are unreliable.

The project aimed at generating data on the STRB system technology that would be useable for LCA. Based on identified knowledge gaps, research focused on three areas; quantification of gas emissions directly related to treatment, establishment of substance flows through the technology and the fate of carbon and nitrogen-based compounds in treated sludge when applied to the land. The overall goal of the project was to perform an LCA comparing the environmental performance of the STRB system technology with a conventional technology based on mechanical dewatering of sludge on a decanter centrifuge and subsequent storage. Geographically, the project focused on Denmark, and was carried out as a collaborative effort between the Technical University of Denmark (DTU) and the Danish environmental consultancy Orbicon A/S. The outcome of the project was a dataset on the STRB system technology usable for LCA, and an LCA comparing the environmental profiles of the STRB system technology and a mechanical treatment technology, constituting a basis for decision-making in relation to choice of technology.

A major part of the project involved performance of fieldwork and laboratory work. Data were collected at three Danish,
well-operated STRB systems; furthermore, data required to represent the mechanical treatment technology were collected alongside data on STRB systems. Most of the data collection was undertaken at a wastewater treatment plant housing both technologies, thereby making it possible to make the two datasets as comparable as possible.

Fourteen environmental impact categories were included in the LCA, and the environmental loadings and saving provided by the sludge treatment technologies normalised to represent the treatment of 1000 kg wet weight of sludge. The life cycle inventory and the choices underlying the life cycle impact assessment were based on international acknowledged standards and recommendations. An attributional LCA approach was chosen, and the loadings and savings for all impact categories were normalised to people equivalents (PE) (the annual loadings and savings provided by one average person). Three sludge treatment scenarios were defined: 1) mechanical treatment on centrifuge, followed by storage and finally land application, 2) treatment in an STRB system and finally land application (S-STRB), and 3) treatment in an STRB system, followed by post-treatment on a stockpile area (SPA) and finally application (S-SPA).

The project succeeded in generating data on STRB systems, which could form the basis for a LCA, and comparable data related to mechanical sludge treatment. The results of the LCA revealed that STRB systems performed comparable to or better than mechanical treatment. The two scenarios based on the STRB system technology (S-STRB and S-SPA) performed comparable which only minor differences.

According to toxic impact categories, which for both technologies were mainly impacted by metals contained by treated sludge applied on land, the three scenarios performed comparable. Indeed, the substance flow analyses revealed that the metals held by sludge subjected to treatment for all scenarios were accumulated in the final sludge product. For all scenarios, the net-loadings for the impact categories Human Toxicity – Non-Carcinogenic and Ecotoxicity corresponded to 2.010-2 PE, and for Human Toxicity – Carcinogenic to 5.0 10-4 PE.

Emission rates of CO2, CH4 and N2O related to biological processes in sludge subjected to treatment in STRB systems were measured during all four seasons of the year. The results revealed that seasonal variations were considerable, and should be taken into account when calculating annual, average emission rates. The emission rate of CO2 measured from external storage of mechanically treated sludge was much lower compared to those measured for STRB systems, reflecting a lower microbial activity in the mechanical dewatered sludge. As the emission rates of the potent greenhouse gasses CH4 and N2O were larger for mechanical dewatered sludge, the net environmental loadings provided to the impact category Climate Change by this technology (S-CEN) and the STRB system technology (S-STRB and S-SPA) ended up being equally sized (9.010-4 PE), despite of higher biological activity in the STRB systems.

As a consequence of the lower microbial activity in mechanically treated sludge, the concentration of carbon and nitrogen-based compounds in the final sludge product produced by this treatment technology was higher compared to the final sludge product produced by treatment in STRB systems. Hence, the loadings affecting impact categories related to eutrophication and acidification were higher for the mechanical treatment technology, especially in relation to the category Marine Eutrophication, the net-loadings to this category being 8.0 10-4 PE for mechanical treatment (S-CEN) and 3.0 10-4 PE for STRB systems (S-STRB and S-SPA).

The STRB system technology consumed fewer abiotic resources, due mainly to the fact that the mechanical treatment process requires an input of polymer coagulant, while a STRB system does not require this contribution. Furthermore, as mechanically treated sludge often have a stronger odour compared to sludge treated in STRB systems, the latter is often claimed by the local land application sites, while mechanically treated sludge often must be transported longer distances to land application sites willing to apply it. Hence, the STRB system technology required a lower input of fuel for transportation.

In the future, it would be relevant to use the obtained data on STRB systems to compare the technology with other sludge treatment technologies commonly used. Furthermore, it would be relevant to generate a comparable dataset on representing the performance of the technology in other climate zones, and to expand the data set with more data related to economics, making it possible to make more detailed economical assessments.
Environmental impacts and resource losses of incinerating misplaced household special wastes (WEEE, batteries, ink cartridges and cables)

The contribution of misplaced special waste (sWEEE, lamps, CRT, batteries, ink cartridges and cables) to environmental impacts from incineration of residual household waste was quantified through life cycle assessment (LCA)-modelling. Misplaced special waste was quantified to constitute less than 1% of the net impact for most environmental impact categories, except for the toxic impact categories (4–28% of toxic impacts) and the impact on abiotic resource depletion. It was found that the main contributor (96%) to the toxic impact categories was related to the presence of mercury (Hg) from lamps and batteries. However as shown by sensitivity analysis, lack of good data on the transfer of rare and hazardous metals to the flue gas in the incineration process should receive further investigation before the environmental impacts from misplaced incinerated special waste can fully be concluded upon. Although the misplaced special waste is only 0.5% of residual household waste, it constitutes in the residual household waste the most significant fraction with respect to metal content when iron and aluminum are excluded. By extending the boundary of the LCA beyond the traditional “zero burden boundary”, we were able to quantify the impact of abiotic resources not recovered from incineration residues. This appeared to be a significant impact category, and the special waste contributed about 96% of this category although it by weight makes up only 0.5% of the waste. Furthermore, enhancing the recovery of iron (Fe) and aluminum (Al) from the ashes would not affect the loss of abiotic resources significantly. Only by recovering elements as platinum (Pt), copper (Cu), gold (Au), and silver (Ag) would it be possible to reduce the loss of abiotic resources from the system. These elements are primarily found in misplaced special waste (sWEEE, lamps, CRT, batteries, ink cartridges, and cables).

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Environmental impacts of stormwater management and pollutant discharges

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Environmental impacts of stormwater management and pollutant discharges

Stormwater management systems are necessary to protect people and assets from flooding and pollution, especially in densely built, sealed urban areas. The possible solutions range from underground pipes and basins, where rain water is often handled together with wastewater, to local and multi-functional solutions, e.g. rain beds or retention lakes. Ideally, these solutions are not only economically, but also environmentally sustainable. Risk assessments are sometimes carried out, e.g. to determine the effect of discharges during extreme events, but they lack a holistic perspective: While pollutants in runoff are one possible source of (local) environmental impacts, the stormwater management system itself is a source of emissions. Raw material extraction, construction, operation, renewal, and disposal all cause environmental impacts at a more regional or even global scale. These impacts can be quantified using life cycle assessment, which on the other hand usually neglects the impacts from local emissions, even though these may potentially be significant. By integrating local emissions into the assessment, we are able to quantify the total environmental impacts of stormwater management solutions.

We have tested the approach using a sub-catchment of Copenhagen. The existing stormwater management system has to be adapted to climatic changes to maintain existing flood safety levels. The environmental impacts from both local and global emissions over a period of 100 years have been quantified using life cycle assessment. The inventory for the assessment is based on an extensive literature research, planning documents and expert interviews.
Here, we focus on the ecotoxicity impacts: The impact over the whole life cycle of the system, excluding local emissions, is 14 mio comparative toxic units (CTUe). This ecotoxicity impact is mainly caused by the emission of metals. Metals are, however, also important pollutants in stormwater runoff. In Copenhagen, the emission of stormwater pollutants from runoff are found to cause additional impacts of 19 mio CTUe when discharged directly to freshwater. If the water first infiltrates through soil, the impacts are significantly lower (10 mio CTUe). The stormwater system itself is passive, and mainly causes impacts during construction, while runoff goes through the system constantly over 100 years, which explains the large difference in impacts. The results are characterized by a high uncertainty, which is caused by large ranges in measured concentrations in literature (up to 5 orders of magnitude). Limiting these uncertainties is the subject of ongoing research.

Our results highlight the importance of including local emission of toxic compounds in stormwater management systems. Often, an increase in global emission, e.g. through the construction of treatment facilities, will lead to reduced local impacts, and vice versa. By taking into account both local and global impacts, stormwater management systems can be optimized holistically to minimize environmental impacts and create more sustainable stormwater management systems.

Environmental Multiobjective Optimization of the Use of Biomass Resources for Energy

Bioenergy is often considered an important component, alongside other renewables, to mitigate global warming and to reduce fossil fuel dependency. Determining sustainable strategies for utilizing biomass resources, however, requires a holistic perspective to reflect a wider range of potential environmental consequences. To circumvent the limitations of scenario-based life cycle assessment (LCA), we develop a multiobjective optimization model to systematically identify the environmentally optimal use of biomass for energy under given system constraints. Besides satisfying annual final energy demand, the model constraints comprise availability of biomass and arable land, technology- and system-specific capacities, and relevant policy targets. Efficiencies and environmental performances of bioenergy conversions are derived using biochemical process models combined with LCA data. The application of the optimization model is exemplified by a case aimed at determining the environmentally optimal use of biomass in the Danish energy system in 2025. A multiobjective formulation based on fuzzy intervals for six environmental impact categories resulted in impact reductions of 13-43% compared to the baseline. The robustness of the optimal solution was analyzed with respect to parameter uncertainty and choice of environmental objectives.
Environmental performance of gasified willow from different lands including land-use changes

A life-cycle assessment (LCA) of a low-input, short rotation coppice (SRC) willow grown on different Danish lands was performed. Woodchips are gasified, producer gas is used for co-generation of heat and power (CHP) and the ash-char output is applied as soil amendment in the field. A hybrid model was developed for the estimation of greenhouse gas (GHG) emissions from indirect land-use changes (iLUC) induced by willow cropping on arable land. For this, area expansion results from a general equilibrium economic model were combined with global LUC trends to differentiate between land transformation (as additional agricultural expansion, in areas with historical deforestation) and occupation
(as delayed relaxation, DR, in areas with historical land abandonment) impacts. A biophysical approach was followed to
determine the iLUCfeed emissions factor from marginal grassland. Land transformation impacts were derived from latest
world deforestation statistics, while a commercial feed mix of equivalent nutritive value was assumed to substitute the
placed grass as fodder. Intensification effects were included in both iLUC factors as additional N-fertilizer consumption.
Finally, DR impacts were considered for abandoned farmland, as a relative C stock loss compared to natural regeneration.
ILUC results show that area related GHG emissions are dominant (93% of iLUCfood and 80% of iLUCfeed),
transformation being more important (82% of iLUCfood) than occupation (11%) impacts. LCA results show that CHP from
willow emits 4,047 kg CO2-eq haocc−1 (or 0.8 gCO2-eq MJ−1) when grown on arable land, while sequestering 43,745
kg CO2-eq haocc−1 (or -10.4 gCO2-eq MJ−1) when planted on marginal pastureland, and 134,296 kg CO2-eq
haocc−1 (or -31.8 gCO2-eq MJ−1) when marginal abandoned land is cultivated. Increasing the bioenergy potential
without undesirable iLUC effects, especially relevant regarding biodiversity impacts, requires that part of the marginally
used extensive grasslands are released from their current use or energy cropping on abandoned farmland incentivized.
recycling of materials and recovering and utilization of energy. Environmental benefits come from paper recycling and, to a lesser extent, the recycling of metals and glass. Waste-to-energy plants can lead to an environmental load (as in France) or a saving (Germany and Denmark), depending mainly on the composition of the energy being substituted. Sensitivity analysis and a data quality assessment identified a range of critical parameters, suggesting from where better data should be obtained. The study concluded that household waste management is environmentally the best in European countries with a minimum reliance on landfilling, also induced by the implementation of the Waste Hierarchy, though environmental performance does not correlate clearly with the rate of material recycling. From an environmental point of view, this calls for a change in the waste management paradigm, with less focus on where the waste is routed and more of a focus on the quality and utilization of recovered materials and energy.

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Environmental risk assessment of poorly soluble substances: Improved tools for assessing biodegradation, (de)sorption, and modeling (project RABIT)

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Erratum to: A global approach for sparse representation of uncertainty in Life Cycle Assessments of waste management systems
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Establishment and calibration of consensus process model for nitrous oxide dynamics in water quality engineering

Research on biological nitrogen removal (BNR) in wastewater treatment plants (WWTP) has historically focused on achieving good effluent quality, with more recent attention to energy savings and carbon dioxide (CO2) footprints. Novel processes and operating conditions are being implemented that enhance cost and energy efficiency in BNR, while maintaining effluent quality. Now, increasing attention is placed on direct emissions of nitrous oxide (N2O) as a by-product of BNR; N2O is a greenhouse gas (GHG) with a high warming potential and also an ozone-depleting chemical compound. Several N2O production pathways have been identified from pure culture studies, while mechanisms are still being unravelled. Heterotrophic bacteria (HB) and ammonium oxidizing bacteria (AOB) are well known to produce N2O. However, the effect of environmental factors on N2O production is not yet well understood. Current process modelling efforts aim to reproduce experimental data with mathematical equations, structuring our understanding of the system.

Various mechanistic models with different structures describing N2O production have been proposed, but no consensus exists between researchers. Hence, the existing plant-wide GHG models still lack a complete biological process model that can be integrated in a methodology that assesses N2O emissions and their impact on overall plant performance. A mathematical model structure that describes N2O production during biological nitrogen removal is proposed. Two autotrophic and one heterotrophic biological pathways are coupled with abiotic processes. The model stoichiometry and process rates synthesize a comprehensive literature review on the metabolism of microbes involved in nitrogen removal. The proposed model can describe all relevant NO and N2O production pathways with fewer parameters than present in other proposed models. A novel experimental design based on the developed model and on extant respirometric techniques is introduced. Monitoring dissolved oxygen and N2O allowed the isolation of individual processes and the
Ecosystem respiration (Reco) is the second largest flux of CO2 between the biosphere and the atmosphere. It consists of several components, such as plant respiration and soil respiration (Rsoil), each of which may respond differently to abiotic factors, and thus to global climate change. Rsoil, which is the largest component of Reco, is often quantified by the closed-chamber method, where automated chambers can provide information on Rsoil on a high temporal scale. Although it is a widely used method, some methodological biases are still not fully understood. One emergent issue is the overestimation of closed-chamber fluxes at low atmospheric turbulence. Thus, this potential bias needs to be quantified, and methods need to be developed, to yield correct estimates of Rsoil. Apart from correct quantification of the flux of CO2 from Rsoil, the isotopic composition of C in CO2 (or δ13C) can reveal important information on the partitioning of Rsoil into several components, such as plant respiration and soil respiration (Rsoil), each of which may respond differently to abiotic factors, and thus to global climate change. Rsoil, which is the largest component of Reco, is often quantified by the closed-chamber method, where automated chambers can provide information on Rsoil on a high temporal scale. Although it is a widely used method, some methodological biases are still not fully understood. One emergent issue is the overestimation of closed-chamber fluxes at low atmospheric turbulence. Thus, this potential bias needs to be quantified, and methods need to be developed, to yield correct estimates of Rsoil. Apart from correct quantification of the flux of CO2 from Rsoil, the isotopic composition of C in CO2 (or δ13C) can reveal important information on the partitioning of Rsoil into autotrophic and heterotrophic respiration. Traditionally, measurements of δ13C have been performed by isotope-ratio mass spectrometry, limiting the applicability to low frequency manual measurements. However, recent advances in laser spectroscopy have allowed for real-time measurements of δ13C, thereby providing new ways to investigate the CO2 fluxes of natural ecosystems at a high temporal scale.

This PhD thesis had three main aims that were all addressed experimentally in a Danish beech forest: The first main aim was to quantify the effect of overestimation of automated closed-chamber soil CO2 fluxes due to low atmospheric turbulence, and to develop methods to account for this effect. The second main aim was to quantify the individual components of Reco at an annual, seasonal and diel time scale, and the third main aim was to combine an isotope quantum cascade laser with an automated closed-chamber system to yield high temporal δ13C of chamber-based ecosystem CO2 fluxes.

To address the first main aim, we measured Rsoil hourly for one year by automated closed-chambers. The data showed a clear diel pattern of Rsoil across all seasons with highest rates during nighttime. However, further analysis showed a clear negative relationship between measured flux rates and atmospheric turbulence measured as friction velocity (u*) above the canopy, suggesting that the measured Rsoil was overestimated at low atmospheric turbulence. Filtering our data at low u* values removed, or even inverted, the observed diel pattern, such that the highest fluxes were now observed during daytime, and also led to a substantial decrease of 21 %, depending on u* threshold value, in the estimated annual Rsoil. By installing fans to produce continuous turbulent mixing of air around the soil chambers, we tested the hypothesis that overestimation of soil CO2 fluxes during low u* can be eliminated if proper mixing of air is ensured, and indeed the use of fans removed the overestimation of Rsoil during low u*.

To address the second main aim, total Reco was measured by the eddy covariance method and the components of tree stem respiration (Rstem), heterotrophic Rsoil from trenched soil, heterotrophic and autotrophic Rsoil from intact soil, and
coarse root respiration (Rroot) were measured every two hours by automated closed-chambers for one year. We found that the contribution of Rstem to total Reco varied across the year, by only accounting for 6 % of Reco during winter and 16 % during summer. In contrast, Rsoil showed a fairly similar contribution to Reco during winter, spring and summer of 52, 45 and 49 %, respectively, while the contribution increased to 79 % during autumn. By using the trenching method, we found that autotrophic Rsoil accounted for 34 % of Rsoil during summer. Diel Rstem and Rroot showed a clear pattern during summer with the highest respiration seen around 13:00-15:00 CET for Rstem, and the highest respiration seen from 9:00-15:00 for Rroot. In contrast, Rsoil showed the lowest respiration during daytime with no clear difference in the diel pattern between the intact and trenched soil plots. Finally, we calculated the annual Rsoil for different transects at the site, and found that annual Rsoil estimated from a previously used transect at the site was underestimated by 20 %, due to Rsoil of the transect not being representative for the spatial heterogeneity of Rsoil at the site.

To address the third main aim, an Aerodyne quantum cascade laser for CO2 isotopes was combined with a LI-8100A/8150 automatic closed-chamber system to yield the δ13C of CO2 during automated chamber measurements. The δ13C of the respired CO2 for each chamber measurement was determined by the Keeling plot methodology. We found that the δ13C measured by the laser was influenced by the water vapour and CO2 concentration of the sample air. However, we quantified these dependencies, and implemented a correction method to yield precise measurements of δ13C. The corrections increased the average δ13C determined from the Keeling plots by 2.1 and 3.4 ‰ for the water vapour and the CO2 concentration dependence corrections, respectively. The system was used during a two month campaign where we measured δ13C every two hours from intact soil, trenched soil, tree stems and coarse roots. The results revealed an average δ13C of -29.8, -29.7, -30.2 and -32.6 ‰ for the intact soil plots, the trenched soil plots, the stem plots and the coarse root plots, respectively.

Taken together, the work presented in this PhD thesis shows that periods with low atmospheric turbulence can provide a significant source of error in Rsoil rates estimated by the closed-chamber techniques and that erroneous data must be filtered out to obtain unbiased diel patterns, accurate relationships to biotic and abiotic factors, and before estimating Rsoil fluxes over longer time scales. The work also shows that artificial turbulent air mixing may provide a method to overcome the issue with overestimated fluxes, allowing for measurements even at low atmospheric turbulence. Furthermore, the results show that a quantum cascade laser can successfully be combined with an automated closed-chamber system to yield δ13C of ecosystem CO2 fluxes at a high temporal scale, but also that the measured δ13C is highly influenced by water vapour and CO2 concentration, why a calibration procedure, as developed in this study, is crucial to yield precise measurements of δ13C.
Evaluation of Externality Costs in Life-Cycle Optimization of Municipal Solid Waste Management Systems

The development of sustainable solid waste management (SWM) systems requires consideration of both economic and environmental impacts. Societal life-cycle costing (S-LCC) provides a quantitative framework to estimate both economic and environmental impacts, by including "budget costs" and "externality costs". Budget costs include market goods and services (economic impact), whereas externality costs include effects outside the economic system (e.g., environmental impact). This study demonstrates the applicability of S-LCC to SWM life-cycle optimization through a case study based on an average suburban U.S. county of 500000 people generating 320000 Mg of waste annually. Estimated externality costs are based on emissions of CO2, CH4, N2O, PM2.5, PM10, NOx, SO2, VOC, CO, NH3, Hg, Pb, Cd, Cr (VI), Ni, As, and dioxins. The results indicate that incorporating S-LCC into optimized SWM strategy development encourages the use of a mixed waste material recovery facility with residues going to incineration, and separated organics to anaerobic digestion. Results are sensitive to waste composition, energy mix and recycling rates. Most of the externality costs stem from SO2, NOx, PM2.5, CH4, fossil CO2, and NH3 emissions. S-LCC proved to be a valuable tool for policy analysis, but additional data on key externality costs such as organic compounds emissions to water would improve future analyses.
Evaluation of high resolution spatio-temporal precipitation extremes from a stochastic weather generator

Spatio-temporal rainfall is modelled for the North-Eastern part of Zealand (Denmark) using the Spatio-Temporal Neyman-Scott Rectangular Pulses model as implemented in the RainSim software. Hourly precipitation series for fitting the model are obtained from a dense network of tipping bucket rain gauges in the model area. The spatiotemporal performance of the model with respect to precipitation extremes is evaluated in the points of a 2x2 km regular grid covering the full model area. The model satisfactorily reproduces the extreme behaviour of the observed precipitation with respect to event intensity levels and unconditional spatial correlation when evaluated using an event based ranking approach at point scale and an advanced spatiotemporal coupling of extreme events. Prospectively the model can be used as a tool to evaluate the impact of climate change without relying on precipitation output from climate model modelled precipitation directly, but merely on the climate change signal derived from climate models.
Evaluation of microalgae production coupled with wastewater treatment
In the present study the feasibility of microalgae production coupled with wastewater treatment was assessed. Continuous cultivation of Chlorella sorokiniana with wastewater was tested in lab-scale flat panel photobioreactors. Biomass productivity was determined for four dilution rates (4.32 d⁻¹, 3.6 d⁻¹, 1.8 d⁻¹ and 0.72 d⁻¹). The productivity peak was 1.524 g l⁻¹d⁻¹ at the dilution rate of 2.41 d⁻¹. Nitrogen and phosphorus removals were found to be inversely proportional to dilution rates, while COD removal was found to be 50% at all the tested conditions. The biomass obtained at the highest dilution rate was characterized for its content of lipids, proteins and pigments. The average yields of fatty acid methyl esters (FAME), protein, lutein, chlorophylls and β-carotene were 62.4 mg, 388.2 mg, 1.03 mg, 11.82 mg and 0.44 mg per gram dry biomass, respectively. Economic analysis revealed that potentially more than 70% of revenue was from the production of pigments, i.e. chlorophyllin (59.6%), lutein (8.9%) and β-carotene (5.0%) while reduction in discharging costs of the treated wastewaters could account for 19.6% of the revenue. Due to the low yield of FAME and the low market price of biodiesel, the revenue from the above was found to be the least profitable (1.4%). Even when taking into account all these different revenues combined, this cultivation strategy was found with the current prices to be uneconomical. Power consumption for artificial light was responsible for the 94.5% of the production costs.

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Experimental determination of isotope enrichment factors – bias from mass removal by repetitive sampling

Application of compound-specific stable isotope approaches often involves comparisons of isotope enrichment factors (ε). Experimental determination of ε-values is based on the Rayleigh equation, which relates the change in measured isotope ratios to the decreasing substrate fractions and is valid for closed systems. Even in well-controlled batch experiments, however, this requirement is not necessarily fulfilled, since repetitive sampling can remove a significant fraction of the analyte. For volatile compounds the need for appropriate corrections is most evident and various methods have been proposed to account for mass removal and for volatilization into the headspace. In this study we use both synthetic and experimental data to demonstrate that the determination of ε-values according to current correction methods is prone to considerable systematic errors even in well-designed experimental setups. Application of inappropriate methods may lead to incorrect and inconsistent ε-values entailing misinterpretations regarding the processes underlying isotope fractionation. In fact, our results suggest that artifacts arising from inappropriate data evaluation might contribute to the variability of published ε-values. In response, we present novel, adequate methods to eliminate systematic errors in data evaluation. A model-based sensitivity analysis serves to reveal the most crucial experimental parameters and can be used for future
experimental design to obtain correct ε-values allowing mechanistic interpretations.
Experimental investigation of concentration and stable isotopes signals during organic contaminants back diffusion

Back diffusion of organic contaminants is often the cause of groundwater plumes’ persistence and can significantly hinder cleanup interventions [1, 2]. In this study we perform a high-resolution investigation of back diffusion in a well-controlled flow-through laboratory setup. We considered cis-dichloroethene (cis-DCE) as model contaminant and we investigated its back diffusion from an impermeable source into a permeable saturated layer, in which advection-dominated flow conditions were established. We used concentration and stable chlorine isotope measurements to investigate the plumes originated by cis-DCE back diffusion in a series of flow-through experiments, performed in porous media with different hydraulic conductivity and at different seepage velocities (i.e., 0.4, 0.8 and 1.2 m/day). A two-centimeter thick agarose gel layer was placed at the bottom of the setup to simulate the source of cis-DCE back diffusion from an impervious layer. Intensive sampling (>1000 measurements) was carried out, including the withdrawal of aqueous samples at closely spaced (1 cm) outlet ports, as well as the high-resolution sampling of the source zone (agarose gel) at the end of each experiment. The transient behavior of the plumes originated by back diffusion was investigated by sampling the outlet ports at regular intervals in the experiments, each run for a total time corresponding to 15 pore volumes. The high-resolution sampling allowed us to resolve the spatial and temporal evolution of concentration and stable isotope gradients in the flow-through setup. In particular, steep concentration and stable isotope gradients were observed at the outlet. Lateral isotope gradients corresponding to chloride isotope fractionation up to 20‰ were induced by cis-DCE back diffusion and subsequent advection-dominated transport in all flow-through experiments. A numerical modeling approach, tracking individually all chlorine isotopologues, based on the accurate parameterization of local dispersion, as well as on the values of aqueous diffusion coefficients and diffusion-induced isotope fractionation from a previous study [3], provided a good agreement with the experimental data.
Experimental investigation of the impact of compound-specific dispersion and electrostatic interactions on transient transport and solute breakthrough

This study investigates the effects of compound-specific diffusion/dispersion and electrochemical migration on transient solute transport in saturated porous media. We conducted laboratory bench-scale experiments, under advection-dominated regimes (seepage velocity: 0.5, 5, 25 m/d), in a quasi two-dimensional flow-through setup using pulse injection of multiple tracers (both uncharged and ionic species). Extensive sampling and measurement of solutes' concentrations (~1500 samples; >3000 measurements) were performed at the outlet of the flow-through setup, at high spatial and temporal resolution. The experimental results show that compound-specific effects and charge-induced Coulombic interactions are important not only at low velocities and/or for steady state plumes but also for transient transport under high flow velocities. Such effects can lead to a remarkably different behavior of measured breakthrough curves also at very high Péclet numbers. To quantitatively interpret the experimental results, we used four modeling approaches: classical advection-dispersion equation (ADE), continuous time random walk (CTRW), dual-domain mass transfer model (DDMT), and a multicomponent ionic dispersion model. The latter is based on the multicomponent formulation of coupled diffusive/dispersive fluxes and was used to describe and explain the electrostatic effects of charged species. Furthermore, we determined experimentally the temporal profiles of the flux-related dilution index. This metric of mixing, used in connection with the traditional solute breakthrough curves, proved to be useful to correctly distinguish between plume spreading and mixing, particularly for the cases in which the sole analysis of integrated concentration breakthrough curves may lead to erroneous interpretation of plume dilution.

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Web of Science (2015): Indexed yes
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Explorative analysis of long time series of very high resolution spatial rainfall

We examine rainfall characteristics of convective and front extreme events in high spatio-temporal resolution (5 minutes, 1x1 km) over an area of 1824 km² covering the catchment of the Wupperverband, North Rhine-Westphalia. The main focus of the analysis is a description of the complexity of hourly and daily extreme rainfall with the purpose of identifying suitable characteristics that can be used in a spatial weather generator of similar resolution. The spatial and temporal properties of the extreme events are explored by means of principal component analysis, cluster analysis, and linear models. For each method a set of 17 variables are used to describe the properties of each event, e.g. duration, maximum
volumes, spatial coverage and heterogeneity, and movement of cells. A total of 5-9 dimensions can be found in the data, which can be interpreted as a rough indication of how many independent variables a weather generator should employ. Both principal component analysis and cluster analysis show patterns that are in accordance with our understanding of physical properties of rainfall. In particular it seems that the differences between hourly and daily extremes can be described by relatively simple scaling across the set of variables, i.e. the level of each variable varies significantly, but not the overall structure of the spatial precipitation. The analysis show that there is a good potential for making a spatial weather generator for high spatio-temporal precipitation for precipitation extremes. Before the method can be employed further work is necessary to describe non-linear correlation between the variables and also the tracking algorithm employed needs to be improved.

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Ex-situ biogas upgrading and enhancement in different reactor systems
Biogas upgrading is envisioned as a key process for clean energy production. The current study evaluates the efficiency of different reactor configurations for ex-situ biogas upgrading and enhancement, in which externally provided hydrogen and carbon dioxide were biologically converted to methane by the action of hydrogenotrophic methanogens. The methane content in the output gas of the most efficient configuration was >98%, allowing its exploitation as substitute to natural gas. Additionally, use of digestate from biogas plants as a cost efficient method to provide all the necessary nutrients for microbial growth was successful. High-throughput 16S rRNA sequencing revealed that the microbial community was resided by novel phylotypes belonging to the uncultured order MBA08 and to Bacteroidales. Moreover, only hydrogenotrophic methanogens were identified belonging to Methanothermobacter and Methanoculleus genera. Methanothermobacter thermautotrophicus was the predominant methanogen in the biofilm formed on top of the diffuser surface in the bubble column reactor.

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Factors affecting the hydraulic performance of infiltration based SUDS in clay

The influence of small scale soil heterogeneity on the hydraulic performance of infiltration based SUDS was studied using field data from a clayey glacial till and groundwater simulations with the integrated surface water and groundwater model HydroGeoSphere. Simulations of homogeneous soil blocks with hydraulic properties ranging from sand to clay showed that infiltration capacities vary greatly for the different soil types observed in glacial till. The inclusion of heterogeneities dramatically increased infiltration volume by a factor of 22 for a soil with structural changes above and below the CaC03
boundary. Infiltration increased further by 8% if tectonic fractures were included and by another 61% if earthworm burrows were added. Comparison of HydroGeoSphere infiltration hydrographs with a simple soakaway model (Roldin et al. 2012) showed similar results for homogenous soils but indicated that exclusion of small scale soil physical features may greatly underestimate hydraulic performance of infiltration based SUDS.

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Authors: Bockhorn, B. (Ekstern), Klint, K. (Ekstern), Locatelli, L. (Intern), Park, Y. (Ekstern), Binning, P. J. (Intern), Sudicky, E. (Ekstern), Jensen, M. B. (Ekstern)
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Feasibility of phytoremediation for common soil and groundwater pollutants

During the past two to three decades numerous studies reporting highly efficient remediation of contaminated soil and groundwater by plants have been published. The promises of phytoremediation has been great but till now the technology has not been widely applied and recognized, commercially and in a regulatory context, on par with other conventional soil and groundwater remediation technologies. This thesis elucidates the field of phytoremediation and addresses the lack of recognition of the technology. It aims to assesses the overall feasibility of phytoremediation and identify obstacles within the field. Further, it considers phytoremediation from a more technical perspective, setting up a mass balance for a generic plant-soil system. On basis of the data review and the mass balance application, an initial assessment of the feasibility of phytoremediation for common soil and groundwater pollutants is conducted. Several knowledge gaps and limitations were identified. Phytoremediation is restricted by phytotoxicity, root depth and long remediation time. Further, there is an evident lack of information about fate of contaminants in plants and the plant processes affecting uptake, excretion and metabolism of contaminants. These data are needed for mass balance modelling purposes. The mass balance revealed that if contaminants are degraded (k_{deg} \sim 0.01/day or higher) the governing loss of contaminant mass in the soil matrix is by aerobic microbial degradation in the rhizosphere and not by plant uptake. If the total removal of contaminant mass by degradation, direct volatilization and other unknown processes (not including plant uptake and leaching) is negligible, the governing removal process is plant uptake. However, removal by plant uptake is slow compared to rhizo-degradation and it is controlled by the soil matrix volume and the soil/water distribution coefficient (Kd). For compounds with high Kd (e.g. lead) phytoremediation may take immensely long time (>80,000 years). Extraction efficiency of plants is proportional to the soil volume which explains why pot experiments tend to under estimate the remediation time. The feasibility of phytoremediation for organic compounds with limited aerobic degradation (e.g. many chlorinated solvents) and low Kd (<10 L/kg) is more difficult to assess due to lack of knowledge of...
their fate. The second part of the thesis proposes two flow charts for assessment of the applicability of phytoremediation and applicability of phytoremediation techniques, respectively. They can be seen as a check list of things to consider before implementation of phytoremediation and are meant to ease the decision-support process. Further, they emphasize the need for phytotoxicity data, fate, metabolism- and mass balance studies. It is shown that existing phytotoxicity tests with higher terrestrial plants, not including seed germination, lack standardization and reporting requirements for easy comparison and transparency. The willow tree acute toxicity test by Trapp et al. (2000) is suggested as a candidate for a standardized test as it allows combined uptake, metabolism and toxicity studies. An overview of phytotoxicity data generated by the willow tree acute toxicity test is provided and compared to results generated by the standardized phytotoxicity tests on freshwater green algae and duckweed. No species could be classified as the most sensitive. It is proposed to establish a phytotoxicity database for standardized tests on terrestrial plants, not including seed germination. The fate and metabolism of trichloroethylene (TCE) in plants were evaluated by the willow tree acute toxicity test with chloride as indicator of dehalogenation. Willows and willows inoculated with TCE co-metabolizing strains of the plant endophyte Burkholderia cepacia were continuously exposed to TCE during a tree week period. Approximately 96% of the added TCE evaporated from solution and only 4% was taken up by the plants. Less than 3% of the added TCE was mineralized. To assess the feasibility of phytoremediation at a sodium fluoride contaminated site, the uptake of fluoride in plants were determined by the willow tree acute toxicity test. The mass balance revealed that the willows were capable of enzymatic removal of fluoride from the roots at low external concentrations. At high external concentrations the enzyme system collapsed and fluoride was taken up leading to further toxic effects. Phytoremediation was not assessed to be feasible at the site. The work encompassed in this thesis underlines that phytoremediation may occasionally be feasible. However, there are several limitations which strongly inhibit the applicability. Phytoremediation is assessed to be feasible for nutrients and organic pollutants which can be degraded aerobically. Most trace elements are too strongly bound to the soil matrix to be available for plant extraction and are thus not feasible for phytoremediation. For phytoremediation to become an accepted and recognized technology it must be proven by providing examples of field-scale applications where the soil quality criteria are reached within acceptable timeframes.
Flood damage assessment – Literature review and recommended procedure

The assessment of flood risk is an essential tool in evaluating the potential consequences of a flood. The analysis of the risk can be applied as part of the floodplain management, but can also be used in a cost-benefit analysis, when comparing different adaptation strategies. This analysis is therefore important when assessing flood disaster mitigation options and economical optimizations of possible measures. A common definition is that the flood risk is found with the use of a flood hazard assessment and a flood vulnerability assessment (Apel, Merz and Thieken, 2008).

The flood hazard is the quantification of amount, extent, and location of flooding expected to occur with a given return period. This means that the spatial distribution of the calculated inundation depth as a function of the return period can be used to describe the flood hazard. The vulnerability is the susceptibility of the area subjected to the flooding. A way to express the vulnerability is through a damage cost assessment.

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Food waste prevention in Denmark: Identification of hotspots and potentials with Life Cycle Assessment

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Tonini, D. (Intern), Brogaard, L. K. (Intern), Astrup, T. F. (Intern)
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Forced-gradient tracer tests in a fractured limestone aquifer designed and interpreted by modeling

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Organisations: Department of Environmental Engineering, Water Resources Engineering, GEO, Region Hovedstaden
Authors: Mosthaf, K. (Intern), Brauns, B. (Intern), Broholm, M. M. (Intern), Fjordbøge, A. S. (Intern), Bjerg, P. L. (Intern), Binning, P. J. (Intern), Rohde, M. M. (Ekstern), Kern-Jespersen, H. (Ekstern)
Formulating and testing a method for perturbing precipitation time series to reflect anticipated climatic changes

Urban water infrastructure has very long planning horizons, and planning is thus very dependent on reliable estimates of the impacts of climate change. Many urban water systems are designed using time series with a high temporal resolution. To assess the impact of climate change on these systems, similarly high-resolution precipitation time series for future climate are necessary. Climate models cannot at their current resolutions provide these time series at the relevant scales. Known methods for stochastic downscaling of climate change to urban hydrological scales have known shortcomings in constructing realistic climate-changed precipitation time series at the sub-hourly scale. In the present study we present a deterministic methodology to perturb historical precipitation time series at the minute scale to reflect non-linear expectations to climate change. The methodology shows good skill in meeting the expectations to climate change in extremes at the event scale when evaluated at different timescales from the minute to the daily scale. The methodology also shows good skill with respect to representing expected changes of seasonal precipitation. The methodology is very robust against the actual magnitude of the expected changes as well as the direction of the changes (increase or decrease), even for situations where the extremes are increasing for seasons that in general should have a decreasing trend in precipitation. The methodology can provide planners with valuable time series representing future climate that can be used as input to urban hydrological models and give better estimates of climate change impacts on these systems.
In recent years, membrane technology has been widely used in wastewater treatment and water purification. Membrane technology is simple to operate and produces very high quality water for human consumption and industrial purposes. One of the promising technologies for water and wastewater treatment is the application of forward osmosis. Essentially, forward osmosis is a process in which water is driven through a semipermeable membrane from a feed solution to a draw solution due to the osmotic pressure gradient across the membrane. The immediate advantage over existing pressure driven membrane technologies is that the forward osmosis process per se eliminates the need for operation with high hydraulic pressure and forward osmosis has low fouling tendency. Hence, it provides an opportunity for saving energy and membrane replacement cost. However, there are many limitations that still need to be addressed. Here we briefly review some of the applications within water purification and new developments in forward osmosis membrane fabrication.

**Forward Osmosis in Wastewater Treatment Processes**

In recent years, membrane technology has been widely used in wastewater treatment and water purification. Membrane technology is simple to operate and produces very high quality water for human consumption and industrial purposes. One of the promising technologies for water and wastewater treatment is the application of forward osmosis. Essentially, forward osmosis is a process in which water is driven through a semipermeable membrane from a feed solution to a draw solution due to the osmotic pressure gradient across the membrane. The immediate advantage over existing pressure driven membrane technologies is that the forward osmosis process per se eliminates the need for operation with high hydraulic pressure and forward osmosis has low fouling tendency. Hence, it provides an opportunity for saving energy and membrane replacement cost. However, there are many limitations that still need to be addressed. Here we briefly review some of the applications within water purification and new developments in forward osmosis membrane fabrication.

**General information**

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Organisations: Department of Environmental Engineering, Water Technologies, University of Maribor, The Energy and Resources Institute (TERI)
Authors: Korenak, J. (Ekstern), Basu, S. (Ekstern), Balakrishnan, M. (Ekstern), Hélix-Nielsen, C. (Intern), Petrinic, I. (Ekstern)
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**Fremtidens vandteknologi er blå - ikke grønne**

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From biofilm ecology to reactors: a focused review

Biofilms are complex biostructures that appear on all surfaces that are regularly in contact with water. They are structurally complex, dynamic systems with attributes of primordial multicellular organisms and multifaceted ecosystems. The presence of biofilms may have a negative impact on the performance of various systems, but they can also be used beneficially for the treatment of water (defined herein as potable water, municipal and industrial wastewater, fresh/brackish/salt water bodies, groundwater) as well as in water stream-based biological resource recovery systems.

This review addresses the following three topics: (1) biofilm ecology, (2) biofilm reactor technology and design, and (3) biofilm modeling. In so doing, it addresses the processes occurring in the biofilm, and how these affect and are affected by the broader biofilm system. The symphonic application of a suite of biological methods has led to significant advances in the understanding of biofilm ecology. New metabolic pathways, such as anaerobic ammonium oxidation (anammox) or complete ammonium oxidation (comammox) were first observed in biofilm reactors. The functions, properties, and constituents of the biofilm extracellular polymeric substance matrix are somewhat known, but their exact composition and role in the microbial conversion kinetics and biochemical transformations are still to be resolved. Biofilm grown microorganisms may contribute to increased metabolism of micro-pollutants. Several types of biofilm reactors have been used for water treatment, with current focus on moving bed biofilm reactors, integrated fixed-film activated sludge, membrane-supported biofilm reactors, and granular sludge processes. The control and/or beneficial use of biofilms in membrane processes is advancing. Biofilm models have become essential tools for fundamental biofilm research and biofilm reactor engineering and design. At the same time, the divergence between biofilm modeling and biofilm reactor modeling approaches is recognized.
From macro- to microplastics - Analysis of EU regulation along the life cycle of plastic bags

Plastic pollution and its environmental effects has received global attention the recent years. However, limited attention has so far been directed towards how plastics are regulated in a life cycle perspective and how regulatory gaps can be addressed in order to limit and prevent environmental exposure and hazards of macro- and microplastics. In this paper,
we map European regulation taking outset in the life cycle perspective of plastic carrier bags: from plastic bag production to when it enters the environment. Relevant regulatory frameworks, directives and authorities along the life cycle are identified and their role in regulation of plastics is discussed. Most important regulations were identified as: the EU chemical Regulation, the Packaging and Packaging Waste Directive including the amending Directive regarding regulation of the consumption of lightweight plastic carrier bags, the Waste Framework Directive and the Directive on the Landfill of Waste. The main gaps identified relate to lack of clear definitions of categories of polymers, unambitious recycling rates and lack of consideration of macro- and microplastics in key pieces of legislation. We recommend that polymers are categorized according to whether they are polymers with the same monomer constituents (homopolymers) or with different monomer constituents (copolymers) and that polymers are no longer exempt from registration and evaluation under REACH. Plastics should furthermore have the same high level of monitoring and reporting requirements as hazardous waste involving stricter requirements to labelling, recordkeeping, monitoring and control over the whole lifecycle. Finally, we recommend that more ambitious recycle and recovery targets are set across the EU. Regulation of the consumption of lightweight plastic carrier bags should also apply to heavyweight plastic carrier bags. Last, the Marine and Water Framework Directives should specifically address plastic waste affecting water quality.
From vision to operation - Smart real-time control of water systems in Aarhus, Denmark

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Functional nanostructured materials for stormwater runoff treatment
Numerous heavy metal removal practices for stormwater runoff have been studied and applied; however, there is still room for improvement. Among these practices, adsorption has proven to be the most efficient way of removing heavy metals. Commonly used adsorbents have an innate sorption capacity in relation to high concentrations of heavy metal ions, but if they are to be used for stormwater runoff, high affinity with rapid sorption kinetics for low concentrations of heavy metals is necessary. Therefore, in this study, new types of functional nanostructured polymer sorbents for effective heavy metal removal from stormwater are suggested.
First, comparison studies of several existing polymer sorbents were conducted, to find decisive functional groups for removing heavy metals from the solution. To enhance the sorption kinetics and affinity of polymer sorbents in the presence of competing ions, sulphur functional groups and polar functional groups in the polymer networks were found to be imperative. Based on this result, new types of covalently connected polymer sorbents were devised and characterised. One of the novel polymer sorbents, disulphide-linked polymer (COP-63), was selected for pursuing heavy metal sorption behaviour. Although COP-63 has a moderate surface area, it demonstrated cadmium removal efficiency equivalent to highly porous activated carbon (AC), while it also exhibited 16 times faster sorption kinetics compared to AC, owing to high affinity towards disulphide and thiol functionality. The chemisorption mechanism of sorbents was confirmed by sorption kinetics, the effects of pH and metal complexation. The metal ions copper, cadmium and zinc showed high binding affinity towards the polymer sorbent, even in the presence of competing cations in the form of calcium.

To retrofit polymer sorbents for a real stormwater filter, controlling the size of sorbents by formulating composites was applied. The first composites were obtained by grafting polymer onto granular-AC through acyl chlorination (DiS-AC), and the formulation of composites was confirmed by various characterisation techniques. DiS-AC demonstrated 89 L/g sorption affinity for cadmium, which is notably higher than conventional sorbents’ sorption affinity. Furthermore, within an hour, half of the trace amounts of cadmium ions were removed by the DiS-AC, even in a batch test. Other composites were obtained by embedding the polymer particles on the surface of an alginate bead (DiS-algi). Moreover, the sorption capacity of DiS-algi was 22.3 mg/g, and within 6 minutes, half of the cadmium had been removed with 31 L/mg of Langmuir sorption affinity, outperforming an AC filter.

Moreover, DiS-algi was used to build the reactive filtration column for simulating a real stormwater treatment filter. A breakthrough test of the reactive column showed the complete uptake of cadmium from a contaminated flow, lasting two hours until reaching the breakthrough point. The maximum sorption capacity of the reactive column was 877 µg/g. Furthermore, regeneration tests of the column verified its reusability. Based on the results of this PhD, novel polymer and composites sorbents are proposed for distinct uses. The devised functional nanostructured polymers confirmed their potential for efficient heavy metal removal, and the simulation of a real-life stormwater filter was successful. Therefore, the novel polymer sorbents herein proved to be viable materials for stormwater runoff filtration systems.

**General information**

**State:** Published
**Organisations:** Department of Environmental Engineering, Water Technologies, Department of Micro- and Nanotechnology, Surface Engineering, Korea Advanced Institute of Science and Technology, Seoul National University
**Authors:** Ko, D. (Intern), Andersen, H. R. (Intern), Yavuz, C. T. (Ekstern), Jakobsen, M. H. (Intern), Hwang, Y. (Ekstern)
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**Functional nanostructured materials for stormwater runoff treatment**

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**Future scenario development within life cycle assessment of waste management systems**

Life Cycle Assessment (LCA) is an acknowledged tool for quantifying the sustainability of waste management solutions. However, the use of LCA for decision-making is hindered by the strong dependency of the LCA results on the assumptions regarding the future conditions in which the waste management solutions will operate. Future scenario methods from the management engineering field may provide valid approaches for formulating consistent assumptions on future conditions for the waste management system modelled with LCA. However, the standardized LCA procedure currently does not offer much guidance on how to model future scenarios in LCA.

This thesis highlights critical findings aiming at strengthening the role of LCA in decision support and strategic planning for waste management. In particular, the thesis thoroughly investigated the future scenario methods, the existing guidance on modelling of future scenarios in LCA, and peer-reviewed articles in the literature combining future scenarios and LCA, across sectors, and the specific modelling mechanisms occurring in LCA when assessing future scenarios. For each of these aspects, the thesis investigated the specific needs of the waste management field. The quantitative modelling implications were tested within real-scale LCA models focusing on the management of residual waste in Denmark. In a wide range of scenarios, this thesis addressed the influence on the LCA model results of realistic technology and waste composition uncertainties, as well as the effects of implementing future energy scenarios and design-stage technologies. The thesis underlines that future scenarios can be used to formulate consistent assumptions for waste management systems. However, in order to obtain well-founded quantitative results with LCA, the implementation of future scenarios should comply with the following conditions:

Future scenarios should include important aspects identified within the case-specific LCA model. Important aspects can be identified from a preliminary LCA, but should always be evaluated again after implementing the future scenarios in LCA.
Identification of important aspects (such as parameters of the modelled technologies, waste composition, and framework conditions) ultimately governing the LCA results of the future scenarios should be regarded as a fundamental part of the future scenario process and be communicated to the final receivers of the LCA. The main outcome of this thesis is a systematic framework that can be used to assess future scenarios in LCAs of waste management systems. The framework combines approaches developed during the PhD study in order to systematically address the modelling implications of combining future scenarios and LCAs of waste management systems.

The study developed a systematic definition of importance of LCA model parameters based on their input uncertainty and their sensitivity on results with a Global Sensitivity Analysis (GSA) approach. Within LCAs of waste management systems, the GSA approach allowed quantifying the importance of the waste composition versus the more commonly tested technology parameters. Less than 10 waste composition parameters as well as 5-6 technology parameters, out of a total of 750 waste and technology parameters in the LCA model, were found important for the results across all tested impact categories. These findings were used to improve existing step-wise approaches for quantification of uncertainty in LCA. Moreover, this PhD study provided a novel method to quantitatively determine the most robust waste management solution across several future scenarios combining results of uncertainty analysis and scenario analysis into a simple and conveyable score.

The systematic framework for future scenarios in LCA should start from a preliminary LCA carried out on the case-specific system and identifying the important aspects with the GSA approach. The future scenarios can be formulated with whichever future scenario technique in preference, including the important aspects identified in the preliminary LCA. Then, the future scenarios can be implemented in further LCAs. A subsequent determination of important parameters with GSA is fundamental for identifying the aspects of the model ultimately governing the future scenario results and any necessary revisions in the future scenarios or model data. Finally, sustainability on the long-term can be strengthened by the combined use of uncertainty and scenario analysis. This means that the LCA results can be communicated as probabilities of each individual waste solution being environmentally better compared to the others, together with a clear indication of which aspects and parameters critically affect the performance of the solution.

The proposed systematic framework can be adapted to LCAs carried out in all fields and can also be used to quantitatively carry out systematic scenario analyses on the assumptions of present-day LCAs.

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**Gas chromatography vs. quantum cascade laser-based N₂O flux measurements using a novel chamber design**
Recent advances in laser spectrometry offer new opportunities to investigate the soil-atmosphere exchange of nitrous oxide. During two field campaigns conducted at a grassland site and a willow field, we tested the performance of a quantum cascade laser (QCL) connected to a newly developed automated chamber system against a conventional gas chromatography (GC) approach using the same chambers plus an automated gas sampling unit with septum capped vials and subsequent laboratory GC analysis. Through its high precision and time resolution, data of the QCL system were used for quantifying the commonly observed nonlinearity in concentration changes during chamber deployment, making the calculation of exchange fluxes more accurate by the application of exponential models. As expected, the curvature values in the concentration increase was higher during long (60 min) chamber closure times and under high-flux conditions (F-N₂O > 150 mu g Nm(-2)h(-1)) than those values that were found when chambers were closed for only 10 min and/or when fluxes were in a typical range of 2 to 50 mu g Nm(-2)h(-1). Extremely low standard errors of fluxes, i.e., from similar to 0.2 to 1.7% of the flux value, were observed regardless of linear or exponential flux calculation when using QCL data. Thus, we recommend reducing chamber closure times to a maximum of 10 min when a fast-response analyzer is available and this type of chamber system is used to keep soil disturbance low and conditions around the chamber plot as natural as possible. Further, applying linear regression to a 3 min data window with rejecting the first 2 min after closure and a sampling time of every 5 s proved to be sufficient for robust flux determination while ensuring that standard errors of N₂O fluxes were still on a relatively low level. Despite low signal-to-noise ratios, GC was still found to be a useful method to determine the mean soil-atmosphere exchange of N₂O on longer timescales during specific campaigns. Intriguingly,
the consistency between GC and QCL-based campaign averages was better under low than under high N2O efflux
conditions, although single flux values were highly scattered during the low efflux campaign. Furthermore, the QCL
technology provides a useful tool to accurately investigate the highly debated topic of diurnal courses of N2O fluxes and its
controlling factors. Our new chamber design protects the measurement spot from unintended shading and minimizes
disturbance of throughfall, thereby complying with high quality requirements of long-term observation studies and research
infrastructures.

**General information**

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<td>Organisations:</td>
<td>Department of Environmental Engineering, Atmospheric Environment, Thünen Institute of Climate-Smart Agriculture, University of Copenhagen</td>
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<tr>
<td>Authors:</td>
<td>Bruemmer, C. (Ekstern), Lyshede, B. (Ekstern), Lempio, D. (Ekstern), Delorme, J. (Ekstern), Rueffer, J. J. (Ekstern), Fuss, R. (Ekstern), Moffat, A. M. (Ekstern), Hurkuck, M. (Ekstern), Ibrom, A. (Intern), Ambus, P. (Ekstern), Flessa, H. (Ekstern), Kutsch, W. L. (Ekstern)</td>
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**Publication information**

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<td>SJR 1.848 SNIP 1.234</td>
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Gas collection efficiency at two Danish landfills

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Fathi Aghdam, E. (Intern), Fredenslund, A. M. (Intern), Kjeldsen, P. (Intern), Scheutz, C. (Intern)
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Source: PublicationPreSubmission
Source-ID: 140589428
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Gas composition of sludge residue profiles in a sludge treatment reed bed between loadings

Treatment of sludge in sludge treatment reed bed systems includes dewatering and mineralization. The mineralization process, which is driven by microorganisms, produces different gas species as by-products. The pore space composition of the gas species provides useful information on the biological processes occurring in the sludge residue. In this study, we measured the change in composition of gas species in the pore space at different depth levels in vertical sludge residue profiles during a resting period of 32 days. The gas composition of the pore space in the sludge residue changed during the resting period. As the resting period proceeded, atmospheric air re-entered the pore space at all depth levels. The methane (CH4) concentration was at its highest during the first part of the resting period, and then declined as the sludge residue became more dewatered and thereby aerated. In the pore space, the concentration of CH4 often exceeded the concentration of carbon dioxide (CO2). However, the total emission of CO2 from the surface of the sludge residue exceeded the total emission of CH4, suggesting that CO2 was mainly produced in the layer of newly applied sludge and/or that CO2 was emitted from the sludge residue more readily compared to CH4.

General information
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Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 0.587 SNIP 0.685 CiteScore 1.14
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Scopus rating (2008): SJR 0.579 SNIP 0.697
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Scopus rating (2007): SJR 0.749 SNIP 0.781
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.693 SNIP 0.796
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Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.76 SNIP 0.885
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.889 SNIP 0.936
Genome comparison and physiological characterization of eight Streptococcus thermophilus strains isolated from Italian dairy products

Eight Streptococcus thermophilus strains of dairy origin isolated in Italy were chosen to investigate autochthonous bacterial diversity in this important technological species. In the present study a comparative analysis of all the 17 S. thermophilus genomes publicly available was performed to identify the core and the variable genes, which vary among strains from 196 to 265. Additionally, correlation between the isolation site and the genetic distance was investigated at genomic level. Results highlight that the phylogenetic reconstruction differs from the geographical strain distribution. Moreover, strain M17PTZA496 has a genome of 2.15 Mbp, notably larger than that of the others, determined by lateral gene transfer (including phage-mediated incorporation) and duplication events. Important technological characters, such as growth kinetics, bacteriocin production, acidification kinetics and surface adhesion capability were studied in all the Italian strains. Results indicate a wide range of variability in adhesion properties that significantly clustered strains into four groups. Genomic differences among strains in relation to these characters were identified but a clear correlation between genotype and phenotype was not always found since most of the genomic modifications arise from single nucleotide polymorphisms. This research represents a step forward in the identification of strains-specific functions in Streptococcus thermophilus and it has also the potential to provide valuable information to predict strain specific behaviors in industrial processes.
GISMOWA: Geospatial Risk-Based Analysis Identifying Water Quality Monitoring Sites in Distribution Systems

Monitoring water quality in drinking water distribution systems is the basis for proactive approaches to prevent or manage emerging water quality issues, and such a monitoring requires a strategic selection of relevant and representative monitoring sites. GISMOWA is a new GIS and risk-based analysis tool to identify and prioritize pipe segments for water quality monitoring and to comply with existing monitoring and sampling guidelines. The tool was designed to integrate multiple parameters categorized as (1) hydraulic and structural weaknesses in the system, e.g., residence time; (2) external threats, e.g., contaminated sites; and (3) sensitive consumers, e.g., hospitals, in a GIS environment. The tool used a multicriteria decision analysis to evaluate multiple monitoring site parameters and map zones particularly suitable for water quality monitoring. GISMOWA was applied to Danish water distribution systems as a transparent and simple-to-use tool facilitating a complete overview of the distribution system, including sensitive consumers and consumers in general, thus fulfilling a precondition for a HACCP-based monitoring strategy of drinking water. (C) 2017 American Society of Civil Engineers.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Larsen, S. L. (Intern), Christensen, S. C. B. (Intern), Albrechtsen, H. (Intern), Rygaard, M. (Intern)
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Goodness of dustiness index for predicting human exposure to airborne nanomaterials

General information
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Greenhouse gas emission quantification from wastewater treatment plants, using a tracer gas dispersion method

Plant-integrated methane (CH4) and nitrous oxide (N2O) emission quantifications were performed at five Scandinavian wastewater treatment plants, using a ground-based remote sensing approach that combines a controlled release of tracer gas from the plant with downwind concentration measurements. CH4 emission factors were between 1 and 21% of CH4 production, and between 0.2 and 3.2% of COD influent. The main CH4 emitting sources at the five plants were sludge treatment and energy production units. The lowest CH4 emission factors were obtained at plants with enclosed sludge treatment and storage units. N2O emission factors ranged from < 0.1 to 5.2% of TN influent, and from < 0.1 to 5.9% of TN removed. In general, measurement-based, site-specific CH4 and N2O emission factors for the five studied plants were in the upper range of the literature values and default emission factors applied in international guidelines. This study showed that measured CH4 and N2O emission rates from wastewater treatment plants were plant-specific and that emission rates estimated using models in current guidelines, mainly meant for reporting emissions on the country scale, were unsuitable for Scandinavian plant-specific emission reporting.
Greenhouse gas emissions from integrated urban drainage systems: where do we stand?

General information
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Greenhouse gas emissions from the mineralisation process in a Sludge Treatment Reed Bed system: Seasonal variation and environmental impact

Greenhouse gas emission data from the mineralisation process in Sludge Treatment Reed Bed systems (STRB) are scarce. The aim of this study was to quantify the emission rates of carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) and to investigate seasonal variations in order to estimate the annual greenhouse gas emission rate of the mineralisation process. The full-scale STRB at Helsinge wastewater treatment plant (WWTP) in Denmark was chosen as the study site. Gas emission rates were measured using static surface flux chambers. The measurements were carried out in October/November 2014, March/April 2015, June/July 2015 and January/February 2016. We found that the emission rates of all included gas species were significantly affected by season. For CO2 and CH4, the highest emission rates were recorded in summer, being 138 and 5.2 g m⁻² d⁻¹, respectively, while the lowest rates were recorded in winter, being 442 and 0.7 g m⁻² d⁻¹, respectively. For N2O, the highest and lowest rates were recorded in autumn and spring, being 0.47 and 0.31 g m⁻² d⁻¹, respectively. Emissions of CO2 and CH4 appeared to be affected by changes in temperature, while N2O appeared to be affected not only by temperature, but also by the amount of precipitation. An annual greenhouse gas emission rate (given in CO2 equivalents) of the mineralisation process was calculated for two scenarios based on the assumptions; 1) gas emission rates are not affected by the amount of sludge accumulated in the STRB and 2) gas emission rates are affected by the amount of sludge accumulated in the STRB. The results revealed that the annual global warming potential is to be found in a range between 7 and 13.4 kg CO2-eq PE⁻¹ y⁻¹.

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Scopus rating (2016): SJR 1.053 SNIP 1.522 CiteScore 3.45
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Scopus rating (2015): SJR 1.085 SNIP 1.485 CiteScore 3.09
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Scopus rating (2014): SJR 1.181 SNIP 1.655 CiteScore 3.03
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Scopus rating (2013): SJR 1.225 SNIP 2.108 CiteScore 3.55
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BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.791 SNIP 2.111 CiteScore 3.48
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.697 SNIP 1.851 CiteScore 3.6
ISI indexed (2011): ISI indexed yes
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GrundRisk - Coupling of vertical and horizontal transport models
This report presents the development of the GrundRisk model for contaminated site risk assessment.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering
Authors: Locatelli, L. (Intern), Rosenberg, L. (Intern), Bjerg, P. L. (Intern), Binning, P. J. (Intern)
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Heat and water transport in soils and across the soil-atmosphere interface: 1. Theory and different model concepts
Evaporation is an important component of the soil water balance. It is composed of water flow and transport processes in a porous medium that are coupled with heat fluxes and free air flow. This work provides a comprehensive review of model concepts used in different research fields to describe evaporation. Concepts range from nonisothermal two-phase flow, two-component transport in the porous medium that is coupled with one-phase flow, two-component transport in the free air flow to isothermal liquid water flow in the porous medium with upper boundary conditions defined by a potential
evaporation flux when available energy and transfer to the free airflow are limiting or by a critical threshold water pressure when soil water availability is limiting. The latter approach corresponds with the classical Richards equation with mixed boundary conditions. We compare the different approaches on a theoretical level by identifying the underlying simplifications that are made for the different compartments of the system: porous medium, free flow and their interface, and by discussing how processes not explicitly considered are parameterized. Simplifications can be grouped into three sets depending on whether lateral variations in vertical fluxes are considered, whether flow and transport in the air phase in the porous medium are considered, and depending on how the interaction at the interface between the free flow and the porous medium is represented. The consequences of the simplifications are illustrated by numerical simulations in an accompanying paper.

**General information**

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Authors: Vanderborght, J. (Ekstern), Fetzer, T. (Ekstern), Mosthaf, K. (Intern), Smits, K. M. (Ekstern), Helmig, R. (Ekstern)
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- Scopus rating (2015): SJR 2.58 SNIP 1.617 CiteScore 4.06
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- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 2.44 SNIP 1.643 CiteScore 3.75
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- Scopus rating (2011): SJR 1.946 SNIP 1.481 CiteScore 2.92
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 2.051 SNIP 1.433
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 2.132 SNIP 1.524
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 1.753 SNIP 1.522
Heat and water transport in soils and across the soil-atmosphere interface: 2. Numerical analysis

In an accompanying paper, we presented an overview of a wide variety of modeling concepts, varying in complexity, used to describe evaporation from soil. Using theoretical analyses, we explained the simplifications and parameterizations in the different approaches. In this paper, we numerically evaluate the consequences of these simplifications and parameterizations. Two sets of simulations were performed. The first set investigates lateral variations in vertical fluxes, which emerge from both homogeneous and heterogeneous porous media, and their importance to capturing evaporation behavior. When evaporation decreases from parts of the heterogeneous soil surface, lateral flow and transport processes in the free flow and in the porous medium generate feedbacks that enhance evaporation from wet surface areas. In the second set of simulations, we assume that the vertical fluxes do not vary considerably in the simulation domain and represent the system using one-dimensional models which also consider dynamic forcing of the evaporation process, for example, due to diurnal variations in net radiation. Simulated evaporation fluxes subjected to dynamic forcing differed considerably between model concepts depending on how vapor transport in the air phase and the interaction at the interface between the free flow and porous medium were represented or parameterized. However, simulated cumulative evaporation losses from initially wet soil profiles were very similar between model concepts and mainly controlled by the desorptivity, \( \text{Sevap} \), of the porous medium, which depends mainly on the liquid flow properties of the porous medium.
Original language: English

Electronic versions:
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Heterotrophs are key contributors to nitrous oxide production in mixed liquor under low C-to-N ratios during nitrification - batch experiments and modelling

Nitrous oxide (N₂O), a by-product of biological nitrogen removal during wastewater treatment, is produced by ammonia-oxidizing bacteria (AOB) and heterotrophic denitrifying bacteria (HB). Mathematical models are used to predict N₂O emissions, often including AOB as the main N₂O producer. Several model structures have been proposed without consensus calibration procedures. Here, we present a new experimental design that was used to calibrate AOB-driven N₂O dynamics of a mixed culture. Even though AOB activity was favoured with respect to HB, oxygen uptake rates indicated HB activity. Hence, rigorous experimental design for calibration of autotrophic N₂O production from mixed cultures is essential. The proposed N₂O production pathways were examined using five alternative process models confronted with experimental data inferred. Individually, the autotrophic and heterotrophic denitrification pathway could describe the observed data. In the best-fit model, which combined two denitrification pathways, the heterotrophic was stronger than the autotrophic contribution to N₂O production. Importantly, the individual contribution of autotrophic and heterotrophic to the total N₂O pool could not be unambiguously elucidated solely based on bulk N₂O measurements. Data on NO would increase the practical identifiability of N₂O production pathways.

General information
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Organisations: Department of Environmental Engineering, Water Technologies, Technical University of Denmark
Authors: Domingo Felez, C. (Intern), Pellicer i Nàcher, C. (Intern), Petersen, M. S. (Ekstern), Jensen, M. M. (Intern), Plósz, B. G. (Intern), Smets, B. F. (Intern)
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BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.589 SNIP 1.401 CiteScore 4.16
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BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.621 SNIP 1.425 CiteScore 4.44
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BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.639 SNIP 1.366 CiteScore 4.04
ISI indexed (2012): ISI indexed yes
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Scopus rating (2011): SJR 1.668 SNIP 1.483 CiteScore 4.08
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High efficient ethanol and VFA production from gas fermentation: effect of acetate, gas and inoculum microbial composition

In bioindustry, syngas fermentation is a promising technology for biofuel production without the use of plant biomass as sugar-based feedstock. The aim of this study was to identify optimal conditions for high efficient ethanol and volatile fatty acids (VFA) production from synthetic gas fermentation. Therefore, the effect of different gases (pure CO, H2, and a synthetic syngas mixture), media (acetate medium and acetate-free medium), and biocatalyst (pure and mixed culture) were studied. Acetate was the most dominant product independent on inoculum type. The maximum concentration of volatile fatty acids and ethanol was achieved by the pure culture (Clostridium ragsdalei). Depending on the headspace gas composition, VFA concentrations were up to 300% higher after fermentation with Clostridium ragsdalei compared to fermentation with mixed culture. The preferred gas composition with respect to highest VFA concentration was pure CO (100%) regardless of microbial composition of the inoculum and media composition. The addition of acetate had a negative impact on the VFA formation which was depending on the initial gas composition in head space.

General information
State: Published
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Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 1.888 SNIP 1.985 CiteScore 4.36
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.678 SNIP 1.823 CiteScore 4.42
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.545 SNIP 1.743 CiteScore 3.66
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BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.793 SNIP 2.283 CiteScore 4.74
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.931 SNIP 2.254
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BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.743 SNIP 2.187
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.609 SNIP 2.073
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.454 SNIP 1.77
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.292 SNIP 1.954
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.226 SNIP 1.398
Scopus rating (2004): SJR 1.037 SNIP 1.637
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.693 SNIP 1.312
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.442 SNIP 0.764
Scopus rating (2001): SJR 0.468 SNIP 0.994
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How much can we trust data from the real world? Assessing the performance of online sensors for CSO monitoring when operated in non-ideal conditions

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State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Water Technologies, Technical University of Denmark
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Human health no-effect levels of TiO₂ nanoparticles as a function of their primary size

As engineered nanomaterials are increasingly introduced on the market into a broad range of commodities or nanoproducts, there is a need for operational, reliable tool, enabling to consistently assess the risks and impacts associated with the releases of nanoparticles. The lack of a developed metric that accurately represents their toxic effects while capturing the influence of the most relevant physicochemical properties is one of the major impediments. Here, we investigate the relationships between the toxic responses of nano-sized and micro-sized particles in in vivo toxicological studies and their physicochemical properties. Our results for TiO₂ particles indicate statistically significant associations between the primary particle size and their toxicity responses for combined inhalation and ingestion exposure routes, although the numerical values should be considered with care due to the inability to encompass influences from other relevant physicochemical properties like surface coatings. These findings allow for expressing mass-based adverse effect levels as a continuous function of the primary size of particles. This meaningful, exploratory metric can thus be used for screening purposes and pave the way for reaching adaptive, robust risk assessments of nanomaterials, e.g. for setting up consistent threshold levels, as well as consistent life cycle assessments of nanoproducts. We provide examples of such applications.

General information
State: Published
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Main Research Area: Technical/natural sciences
A laboratory scale Hybrid Moving Bed Biofilm Reactor (HMBBR) was used to study the removal of five benzotriazoles and one benzothiazole from municipal wastewater. The HMBBR system consisted of two serially connected fully aerated bioreactors that contained activated sludge (AS) and K3-biocarriers and a settling tank. The average removal of target compounds ranged between 41% (4-methyl-1H-benzotriazole; 4TTR) and 88% (2-hydroxybenzothiazole; OHBTH). Except for 4TTR, degradation mainly occurred in the first bioreactor. Calculation of biodegradation constants in batch experiments and application of a model for describing micropollutants removal in the examined system showed that AS is mainly involved in biodegradation of OHBTH, 1H-benzotriazole (BTR) and xylytriazole (XTR), carriers contribute significantly on 4TTR biodegradation, while both types of biomass participate on elimination of 5-chlorobenzotriazole (CBTR) and 5-methyl-1H-benzotriazole (5TTR). Comparison of the HMBBR system with MBBR or AS systems from literature showed that the HMBBR system was more efficient for the biodegradation of the investigated chemicals. Biotransformation...
products of target compounds were identified using ultra high-performance liquid chromatography, coupled with a quadrupole-time-of-flight high-resolution mass spectrometer (UHPLC-QToF-MS). Twenty two biotransformation products were tentatively identified, while retention time denoted the formation of more polar transformation products than the parent compounds.

**General information**

State: Published
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Scopus rating (2010): SJR 1.671 SNIP 1.704
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Scopus rating (2009): SJR 1.649 SNIP 2.023
Web of Science (2009): Indexed yes
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Scopus rating (2008): SJR 1.247 SNIP 1.534
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Hydraulics and drones: observations of water level, bathymetry and water surface velocity from Unmanned Aerial Vehicles

The planet faces several water-related threats, including water scarcity, floods, and pollution. Satellite and airborne sensing technology is rapidly evolving to improve the observation and prediction of surface water and thus prevent natural disasters. While technological developments require extensive research and funding, they are far less expensive and therefore more important than disaster restoration and remediation. Thus, our research question was “Can we retrieve hydraulic observations of inland surface water bodies, whenever and wherever it is required, with (i) high accuracy, (ii) high spatial resolution and (iii) at a reasonable cost?”. Unmanned Aerial Vehicles (UAVs) and their miniaturized components can solve this challenge. Indeed, they can monitor dangerous or difficult-to-reach areas delivering real time data. Furthermore, they ensure high accuracy and spatial resolution in monitoring surface water bodies, at a limited cost and with high flexibility. This PhD project investigates and demonstrates how UAVs can enrich the set of available hydraulic observations in inland water bodies, including: 1. Orthometric water level. 2. Water depth (bathymetry). 3. Surface water speed. The novelty of this research is to retrieve water level and bathymetry measurements from UAVs. The objective is to retrieve these observations with an accuracy of few cm, without any need for GCPs (Ground Control Points), and without any dependency on river morphology, water turbidity, and maximum water depth. Although UAV-borne measurements of surface water speed have already been documented in the literature, a novel approach was developed to avoid GCPs. This research is the first demonstration that orthometric water level can be measured from UAVs with a radar system and a GNSS (Global Navigation Satellite System) receiver. As in satellite altimetry, the GNSS receiver measures the altitude above mean sea level, while the radar measures the range to the water surface. The orthometric water level is then computed by subtracting the range measured by the radar from the GNSS-derived altitude. However, compared to satellites, UAVs have several advantages: high spatial resolution, repeatability of the flight missions and good tracking of the water bodies. Nevertheless, UAVs face several constraints: vibrations, limited size, weight, and electric power available for the sensors. In this thesis, we present the first studies on UAV altimetry. Studies were conducted to measure orthometric water level (height of water surface above sea mean level) in rivers, lakes, and in the worldwide unique cenotes and lagoons of the Yucatan peninsula. An accuracy of ca. 5-7 cm is achievable with our technology. This accuracy is higher than any other spaceborne radar or spaceborne LIDAR altimeter.

Water depths were measured by UAV with a tethered sonar controlled by the UAV. Bathymetry can be estimated by subtracting water depth from water level. Our technology aims to combine the large spatial and temporal coverage capabilities of remote sensing techniques, with the accuracy of in-situ measurements. An accuracy of ca. 2.1% of the actual depth was achieved with our system, with a maximum depth capability potentially up to 80 m. Since remote sensing techniques (e.g LIDARs, through-water photogrammetry, spectral-depth signature of multispectral imagery) can survey water depths up to few meters only, our technology has a maximum depth capability and an applicability range superior to any other remote sensing technique. Compared to manned or unmanned vessels equipped with echo sounders, our UAV-borne technology can also survey non-navigable rivers and overpass obstacles (e.g. river structures).

Computer vision, autopilot system and beyond visual line-of-sight (BVLOS) flights will ensure the possibility to retrieve hyper-spatial observations of water depth, without requiring the operator to access the area. Surface water speed can be measured with UAVs using image cross correlation techniques. UAV-borne water speed observations can overcome the practical difficulties of traditional methods. Indeed flow measurements are often intrusive (e.g. flow meters) or require deployment of vessels equipped with expensive acoustic Doppler current profilers (ADCPs). For these reasons, water speed observations have been traditionally challenging, especially in difficult-to-access environments. Conversely, UAV-borne observations open up the possibility of measuring water speed over extended regions at a low cost. The 2D water surface velocity field is computed by analysing the UAV-borne video frames using a technique called large scale PIV (Particle Image Velocimetry). PIV is well known in micro scale applications, but large scale PIV faces several challenges. For
instance, it is not possible to use laser systems to better illuminate the water surface. Our preliminary studies show that UAVs can measure surface water speed of rivers. However, seeding of the water surface is required due to the lack of natural tracers (e.g. bubbles, debris, and foam) occurring in the Danish free-flowing rivers. Furthermore, video stabilization techniques are essential to remove the effects of drone vibrations. An innovative procedure was adopted to convert from image units (pixels) into metric units, by using the on-board radar observations. A study was conducted to evaluate the potential of UAV-borne water observations for calibrating a hydrological model. The hydrological model simulates Mølleåen river (Denmark) and its catchment. The model-derived estimates of groundwater-surface water (GW-SW) interaction were significantly improved after calibration against synthetic UAV-borne observations. After calibration against UAV-borne water level observations, the sharpness (width of the confidence interval) of GW-SW time series is improved by ca. 50%, RMSE (Root Mean Square Error) decreases by ca. 75%, and the direction of the GW-SW flux is better simulated.

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State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering
Authors: Bandini, F. (Intern), Bauer-Gottwein, P. (Intern), Garcia, M. (Intern)
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Hydroeconomic analysis
Hydroeconomic analysis and modeling provides a consistent and quantitative framework to assess the links between water resources systems and economic activities related to water use, simultaneously modeling water supply and water demand. It supports water managers and decision makers in assessing trade-offs between different water uses, different geographic regions, and various economic sectors and between the present and the future. Hydroeconomic analysis provides consistent economic performance criteria for infrastructure development and institutional reform in water policies and management organizations. This chapter presents an introduction to hydroeconomic analysis and modeling, and reviews the state of the art in the field. We review available economic water-valuation techniques and summarize the main types of decision problems encountered in hydroeconomic analysis. Popular solution strategies for hydroeconomic problems are introduced. Typical problems and issues in real-world applications of hydroeconomic analysis and modeling are discussed. The chapter ends with a discussion of challenges, limitations, and future research directions in this field.

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Hydrogen assisted biological biogas upgrading

Wind and biomass are promoted worldwide as sustainable forms of energy. Anaerobic digestion of biomass produces biogas with ~50–70% CH4 and 30–50% CO2. However, biogas with >90% CH4 content has higher heating value, can be injected into the natural gas grid or used as alternative to natural gas as vehicle fuel. Methods currently available for biogas upgrading mainly consists of physicochemical CO2 removal, requiring the use of chemical substances and energy input and, thus, increasing process costs. This PhD project proposes an alternative to existing biogas upgrading technologies, where H2, produced by water electrolysis, using excess of electricity from wind mills, is coupled with the CO2 contained in the biogas to convert them to CH4. This process is defined as biological biogas upgrading and is carried out by hydrogenotrophic methanogenic archaea that couples CO2 with H2 to produce biomethane, via hydrogenotrophic methanogenesis. This reaction results in an increment of the total volume of CH4 produced avoiding any loss of CH4. Moreover, the CO2 is converted rather than being released to the atmosphere providing enhanced environmental benefits of biogas technologies. Moreover, hydrogenotrophic methanogenesis can operate in moderate operating conditions, without using chemical substances, and exploiting mixed culture, rather than pure culture, markedly reducing operation costs. The combination of these characteristics makes biomethane an energy carrier with exceptional potential, which could become a key element in the future renewable-based energy system. Nevertheless, the direct injection of H2 in the reactor (in-situ biogas upgrading) can cause scientific challenges, such as pH increase due to the CO2 removal and process inhibition due to higher H2 partial pressure. Therefore, ex-situ biogas upgrading emerged as a solution aiming at the optimization of the upgrading process in dedicated external reactors. In this concept, biogas and H2 are introduced into an anaerobic reactor containing a mixed hydrogenotrophic culture where the biogas is upgraded to higher CH4 content. To overcome the issues related to in-situ biogas upgrading, a two-stage Continuous Stirred Tank Reactor (CSTR) was designed. In this configuration, the biogas and the digestate produced in the first reactor were transferred to the second one, where H2 was injected, decoupling biogas production (mainly occurring in the first reactor) and biogas upgrading (occurring in the second reactor) and providing higher process efficiency. Moreover, biogas production and upgrading performances at mesophilic and thermophilic conditions were compared. The results demonstrate the feasibility of the biogas upgrading process, at both temperature conditions with higher biomethanation and CO2 conversion efficiency at thermophilic. Moreover, upon H2 addition, the produced biogas was upgraded to average CH4 content of 89% in the mesophilic reactor and 85% in the thermophilic. Nevertheless, H2 is known to be poorly soluble in aqueous media and its transfer to the reactors’ liquid phase represents a strong limiting factor for H2 availability for methanogens. Therefore, the optimization of H2 dispersion is crucial to ensure efficient biogas upgrading process. Gas transfer to the liquid phase is specific for given reactor configuration and operating conditions and can be modulated by adjusting on parameters such as mixing speed, gas recirculation and H2 diffusion device. This aspect has been investigated in a thermophilic granular up-flow anaerobic sludge blanket (UASB) reactor connected to a separate H2-injection chamber, for in-situ biogas upgrading. The effect of liquid and gas recirculation on gas-liquid transfer was evaluated. Moreover, the application of different packing materials in the separate chamber, as a mean to minimize gas bubble size and thus increase the gas dissolution in the liquid was discussed. Finally, the effect of gas retention time was evaluated in different chamber configurations to elucidate its role for CO2 and H2 conversion to CH4. It was observed that by distributing H2 through a stainless steel diffuser followed by a ceramic sponge in a separate chamber (having a volume of 25% of the reactor) and by applying a moderate gas recirculation, CO2 content in the biogas dropped from 42 to 10% and the final biogas was upgraded from 58 to 82% CH4 content. Based on these finding, further enhancement of the H2 gas-liquid mass transfer rate was investigated in four up-flow reactors for ex-situ biogas upgrading. The effect of different H2 distribution devices and different pore sizes on H2 uptake by methanogens was elucidated. Moreover the role of input gas flow rate and gas recirculation on H2 and CO2 conversion to CH4 was investigated. The results showed that the configurations involving diffusion devices with larger pore size presented the best kinetics and output-gas quality and at the highest recirculation rate tested, they managed to convert all the input H2 and CO2 into CH4, up to a H2 loading rate of 3.6 L/REACTOR.d. Accordingly, the CH4 content in the reactor increased from 23 to 96% and the CH4 yield reached 0.25 LCH4/LH2. Finally, to provide higher process control and efficiency, a better understanding of the biogas community composition is crucial. Previous studies have showed that in each microbial community there is a fraction of microorganisms that is always present and constitutes the core of the community and a fraction depending on operating conditions. Therefore, we hypothesized that the H2 addition would selectively stimulate the hydrogenotrophic pathway enhancing the CO2 consumption and thus the biogas upgrading. Based on this knowledge, different bioinformatics approaches, comprising the commonly utilized, 16S rRNA amplicon sequencing, but also Assembled Full-Length 16S rRNA gene sequencing and total random sequencing followed by de novo assembly and by a binning strategy, were applied to the study of biogas production and upgrading communities. Specifically, biogas core community was composed of several recurrent microbial groups, including resilient methanogenic archaea such as Methanoculleus and Methanotermobacter and bacteria belonging to phylum Proteobacteria and genus Syntrophomonas. Moreover, upon H2 addition, the concomitant proliferation of hydrogenotrophic methanogens and syntrophic bacteria, such as Desulfovibrio, and some Thermoanaerobacteraceae and Syntrophomonadaceae, and the reduction of acetoclastic methanogens and fermentative bacteria state the role of the H2 moving biomethanation process toward the final steps stimulating CO2 consumption and therefore biogas upgrading.

General information
State: Published
Organizations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Bassani, I. (Intern), Angelidaki, I. (Intern), Kougiou, P. (Intern)
Number of pages: 57
This paper presents a novel modeling analysis of a 40-year-long dataset to examine the impact of urbanization, with widespread stormwater infiltration, on groundwater levels and the water balance of a watershed. A dataset on the hydrologic impact of urbanization with extensive stormwater infiltration is not widely available, and is important because many municipalities are considering infiltration as an alternative to traditional stormwater systems. This study analyzes groundwater level observations from an urban catchment located in Perth, Western Australia. The groundwater observation data cover approximately a 40-year-long period where land use changes (particularly due to urbanization) occurred; moreover, the monitored area contains both undeveloped and urbanized areas where stormwater infiltration is common practice via soakwells (shallow vertical infiltration wells). The data is analyzed using a distributed and dynamic hydrological model to simulate the groundwater response. The model explicitly couples a soakwell model with a groundwater model so that the performance of the soakwells is reduced by the increase of groundwater levels. The groundwater observation data is used to setup, calibrate and validate a coupled MIKE SHE-MIKE URBAN groundwater model and the model is used to quantify the extent of groundwater rise as a result of the urbanization process. The modeled urbanization processes included the irrigation of new established private and public gardens, the reduction of evapotranspiration due to a decrease in green areas, and the development of artificial stormwater infiltration. The study demonstrates that urbanization with stormwater infiltration affects the whole catchment water balance, increasing recharge and decreasing evapotranspiration. These changes lead to a rise in the groundwater table and an increase in the probability of groundwater seepage above terrain.
Identifying criteria for environmental risk assessment models at different stagegates of nano-material/product innovation considering requirements of various stakeholders

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Impact of compound-specific mixing and electrostatic interactions on transient transport and solute breakthrough

General information
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Organisations: Department of Environmental Engineering, Water Resources Engineering, University of Tubingen
Authors: Rolle, M. (Intern), Muniruzzaman, M. (Ekstern)
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Impact of external carbon dose on the removal of micropollutants using methanol and ethanol in post-denitrifying Moving Bed Biofilm Reactors

Addition of external carbon sources to post-denitrification systems is frequently used in wastewater treatment plants to enhance nitrate removal. However, little is known about the fate of micropollutants in post-denitrification systems and the influence of external carbon dosing on their removal. In this study, we assessed the effects of two different types and availability of commonly used carbon sources - methanol and ethanol - on the removal of micropollutants in biofilm systems.

Two laboratory-scale moving bed biofilm reactors (MBBRs), containing AnoxKaldnes K1 carriers with acclimated biofilms from full-scale systems, were operated in continuous-flow using wastewater dosed with methanol and ethanol, respectively. Batch experiments with 22 spiked pharmaceuticals were performed to assess removal kinetics. Acetyl-sulfadiazine, atenolol, citalopram, propranolol and trimethoprim were easily biotransformed in both MBBRs (biotransformations rate constants kbio between 1.2 and 12.9 L gbiomass(-1) d(-1)), 13 compounds were moderately biotransformed (rate constants between 0.2 and 2 L gbiomass(-1) d(-1)) and 4 compounds were recalcitrant. The methanol-dosed MBBR showed higher kbio (e.g., 1.5-2.5-fold) than in the ethanol-dosed MBBR for 9 out of the 22 studied compounds, equal kbio for 10 compounds, while 3 compounds (i.e., targeted sulfonamides) were biotransformed faster in the ethanol-dosed MBBR. While biotransformation of most of the targeted compounds followed first-order kinetics, removal of venlafaxine, carbamazepine, sulfamethoxazole and sulfamethizole could be described with a cometabolic model. Analyses of the microbial composition in the biofilms using 16S rRNA amplicon sequencing revealed that the methanol-dosed MBBR contained higher microbial richness than the one dosed with ethanol, suggesting that improved biotransformation of targeted compounds could be associated with higher microbial richness. During continuous-flow operation, at conditions representative of full-scale denitrification systems (hydraulic residence time = 2 h), the removal efficiencies of micropollutants were below 35% in both MBBRs, with the exception of atenolol and trimethoprim (>80%). Overall, this study demonstrated that MBBRs used for post-denitrification could be optimized to enhance the biotransformation of a number of micropollutants by accounting for optimal carbon sources and extended residence time.

General information
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Organisations: Department of Environmental Engineering, Water Technologies, Environmental Chemistry, Aarhus University
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Importance of copper for nitrification in biological rapid sand filters for drinking water production

When anoxic groundwater is treated to produce drinking water, ammonium is commonly removed through nitrification in rapid sand filters. Nitrification is a biological process, and is mediated by chemoautotrophic microorganisms. Ammonia oxidizing bacteria (AOB) and archaea (AOA) oxidize ammonium to nitrite, which is further oxidized by nitrite oxidizing bacteria (NOB) to nitrate. Besides these canonical, strict ammonia and nitrite oxidizers, bacteria capable of complete oxidation of ammonia all the way to nitrate have recently been described (comammox). Although nitrification is commonly applied, the reaction rate is sometimes not high enough. This results in incomplete nitrification, with residual ammonium and nitrite concentrations in the finished water, which are problematic for the biological stability of the drinking water. In Denmark, 11 % of the larger water works (>350,000 m³/year) fail to remove ammonium to below the national drinking water quality standard of 0.05 mg NH4+/L. A better process understanding of nitrifying biofilters is needed to optimize treatment performance, remediate existing filters, and to prevent future nitrification problems. The frequent incidents of insufficient nitrification during drinking water production provided the motivation to investigate if a lack of copper could be responsible for the problems in nitrifying biofilters. Copper is believed to be an essential cofactor in the enzyme ammonia monoxygenase (AMO), which catalyzes the first essential step in the oxidation of ammonia to hydroxylamine. Thus, slow and incomplete nitrification could be caused by a lack of sufficient amounts of copper. The overall aim of this PhD project was therefore to determine whether copper supplementation could enhance nitrification in rapid sand filters with incomplete nitrification. Investigations were carried out in situ at full scale drinking water treatment plants (DWTPs) in Denmark, thereby underlining the problem-solving approach, which focuses on process optimization of real systems. Initial investigations were carried out at Nærum DWTP. The plant has had a long history of incomplete nitrification, with ammonium effluent concentrations of approx. 0.23 mg NH4+/L. Copper concentrations in the raw and filter inlet water were <0.01 µg Cu/L. Subsequently, initiated controlled dosing at approx. 0.4 µg Cu/L doubled a filter's ammonium removal rate (ARR) within only 20 days, so that ammonium effluent concentrations dropped to <0.01 mg NH4+/N/L soon after. Water sampling over filter depth with a specially constructed sampling probe revealed that nitrification activity had moved upwards in the filter, with an almost 14-fold increase in ARR in the top 10 cm. The stratified removal meant that less contact time was necessary for complete oxidation of ammonium. In another filter, the stimulation of nitrification lasted for at least 238 days after the dosing was stopped. This, taken together with the stimulatory effect of the dosing, is of great practical importance and shows that continuous dosing is not necessary. During initial experiments at Nærum DWTP, a novel method for trace metal dosing, employing active release of copper through electrolysis from solid metal electrodes, was developed (patents pending). The method has the benefits that low amounts of copper can be supplied in a controlled fashion, and that little maintenance and no chemicals are required. Copper dosing through the novel electrolysis method, as well as through passive dosing from solid copper and active dosing of copper solution, was studied at nine more DWTPs, which all shared a long history of incomplete nitrification. The plants represented a wide range of various parameters, with differences in water chemistry, ammonium concentrations and loading rates, filter design and operation, and treatment steps. Ammonium removal was stimulated at all plants and was complete after an average dosing time of only 19 days. This confirmed a generic, broad applicability of copper dosing to remediate nitrification problems in copper deficient biofilters. After ammonium removal was complete, ammonium loading rates (ALRs) twice as high as the normal ALR were imposed on a filter at one plant. Nevertheless, the filter successfully removed increased loads, with a 2.6-fold increase in ammonium removal capacity. The acquired extra capacity makes the filters more robust towards ALR upshifts during dynamic filter operation. To evaluate bioavailability of copper in rapid sand filters, filter sand extractions and chemical speciation modelling were carried out for Nærum DWTP. Results showed that substantial amounts of copper were bound to iron oxide-hydroxides in the filter and that bicarbonate heavily complexed copper in the water phase. Only <3 % were bioavailable free Cu²+, whereas 91 % of total copper was present as CuCO₃. Furthermore, copper availability can be affected by desorption of copper from iron oxides or deposits, biofilm diffusion limitations, (re)cycling of copper within the biofilm, and competition for copper with other microorganisms. Since factors such as iron and bicarbonate concentrations can vary between plants, a site-specific evaluation of copper bioavailability is recommended to adjust dosing accordingly. State-of-the-art microbial methods (qPCR and Illumina sequencing) revealed that not only nitrification activity was affected by the dosing, but also nitrifier densities. At two investigated sites, genus Nitrosomonas (betaproteobacterial AOB) increased from 0.5 to 2.7 % and from 1.1 to 8.5 %, respectively, relative to the total community. With dosing, the ratio within ammonia oxidizing prokaryotes (AOP) was shifted towards Nitrosomonas and away from the comammox Nitrospira, which were also abundant in the filters. Prior to dosing, cell specific ammonium removal rates of betaproteobacterial AOB were low, at 0.03 to 0.08 x 10³ fg N/cell/day, possibly due to the copper deficiency. With dosing, rates increased to 0.15 to 0.79 x 10³ fg N/cell/day, making it plausible that canonical AOB were the main active ammonium oxidizers during the dosing. This PhD project revealed that copper is of vital importance for efficient nitrification in biological rapid sand filters for drinking water production. The results of this study have important practical implications for biofilters currently in operation and for future filter designs. The developed dosing apparatus is at present successfully applied at a number of Danish DWTPs. Today, all investigated treatment plants have efficient and complete nitrification, and are able to deliver water of better quality to the consumers.
Importance of waste composition for Life Cycle Assessment of waste management solutions

The composition of waste materials has fundamental influence on environmental emissions associated with waste treatment, recycling and disposal, and may play an important role also for the Life Cycle Assessment (LCA) of waste management solutions. However, very few assessments include effects of the waste composition and waste LCAs often rely on poorly justified data from secondary sources. This study systematically quantifies the influence and uncertainty on LCA results associated with selection of waste composition data. Three archetypal waste management scenarios were modelled with the waste LCA model EASETECH based on detailed waste composition data from the literature. The influence from waste composition data on the LCA results was quantified with a step-wise Global Sensitivity Analysis (GSA) approach involving contribution, sensitivity, uncertainty and discernibility analyses. The waste composition data contributed significantly to the LCA results and the uncertainty associated with these results. The importance of 405 individual waste properties was evaluated in comparison with 345 technology parameters. Overall, less than 10 physico-chemical properties dominated the output uncertainty of the LCA results, although these properties had low sensitivity in the model. Moreover, the uncertainties associated with the physico-chemical properties were responsible for output uncertainties that spanned from impacts to benefits. The GSA approach applied in this study constitutes a valuable tool for systematically assessing the importance of waste composition and for consciously collecting and using waste composition data within LCAs of waste management systems.
Improving the energy balance of grass-based anaerobic digestion through combined harvesting and pretreatment

An important challenge that has to be addressed to achieve sustainable anaerobic digestion of lignocellulosic substrates is the development of energy and cost efficient pretreatment methods. Technologies orientated to simultaneously harvest and mechanically pretreat the biomass at the field could meet these criteria as they can potentially reduce the energy losses. The objective of this study was to elucidate the effect of two full-scale harvesting machines to enhance the biogas production and subsequently, improve energy balance. The performances of Disc-mower and Excoriator were assessed on meadow and cultivated grass silages. The results showed that relatively high methane production can be achieved from meadow and cultivated grass harvested in different seasons. The findings indicated that the bioenergy production can be improved based on the selection of the appropriate harvesting technology. More specifically, Excoriator, which cuts and subsequently applies shearing forces on harvested biomass, enhanced the methane production up to 10% and the overall energy budget was improved proportionally to the driving speed increase.

General information
Anaerobic digestion, Energy balance, Grass, Harvesting, Methane
Increasing nitrification in biological rapid sand filters: Diagnosing and supplementing micronutrients needed for proper filter performance

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Krüger A/S
Authors: Lee, C. O. (Intern), Wagner, F. B. (Intern), Boe-Hansen, R. (Ekstern), Albrechtsen, H. (Intern)
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Main Research Area: Technical/natural sciences
Conference: 11th Annual Meeting of Danish Water Forum, Copenhagen, Denmark, 30/01/2017
Electronic versions:
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Activities:
11th annual Danish Water Forum (DWF) 2017
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Influence of humic acid addition on the degradation of pharmaceuticals by biofilms in effluent wastewater
The degradation of organic micropollutants in wastewater treatment is suspected to depend on co-degradation i.e. be dependent on concentrations of substrate. This complicates predicting and modelling their fate. The effect of humic acid, as a model for complex organic substrate, was investigated in relation to the biodegradation of pharmaceuticals by suspended biofilm carriers adapted to polishing effluent water from a tertiary sewage treatment plant. Twelve out of 22 investigated pharmaceuticals were significantly biodegradable. The biodegradation rate constants of ten of those compounds were increasing with increased humic acid concentrations. At the highest humic acid concentration (30. mgC/L), the biodegradation rate constants were four times higher than the biodegradation rate constants without added humic acid. This shows that the presence of complex substrate stimulates degradation via a co-metabolism-like mechanism and competitive inhibition does not occur. Increases of rate constant per mgC/L are tentatively calculated.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Aarhus University
Authors: Tang, K. (Intern), Escola Casas, M. (Ekstern), Ooi, G. T. H. (Intern), Kaarsholm, K. M. S. (Intern), Bester, K. (Ekstern), Andersen, H. R. (Intern)
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Scopus rating (2016): CiteScore 4.22 SJR 1.338 SNIP 1.435
Informing a hydrological model of the Ogooué with multi-mission remote sensing data

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, National Space Institute, Geodesy, DHI GRAS
Authors: Kittel, C. M. M. (Intern), Bauer-Gottwein, P. (Intern), Nielsen, K. (Intern), Tøttrup, C. (Ekstern)
Number of pages: 1
Publication date: 2017
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Ingestion of micro- and nanoplastics in Daphnia magna – Quantification of body burdens and assessment of feeding rates and reproduction

Evidence is increasing that micro- and nanoplastic particles can have adverse effects on aquatic organisms. Exposure studies have so far mainly been qualitative since quantitative measurements of particle ingestion are analytically challenging. The aim of this study was therefore to use a quantitative approach for determining ingestion and egestion of micro- and nanoparticles in Daphnia magna and to analyze the influence of particle size, exposure duration and the presence of food. One week old animals were exposed to 2 µm and 100 nm fluorescent polystyrene beads (1 mg/l) for 24 h, followed by a 24 h egestion period in clean medium. During both phases body burdens of particles were determined by measuring the fluorescence intensity in dissolved tissues. Ingestion and egestion were investigated in the absence and presence of food (6.7·10⁵ cells of Raphidocelis subcapitata per ml). Furthermore, feeding rates of daphnids in response to particle exposure were measured as well as effects on reproduction during a 21 days exposure (at 1 mg/l, 0.5 mg/l and 0.1 mg/l) to investigate potential impairments of physiology. Both particle sizes were readily ingested, but the ingested mass of particles was five times higher for the 2 µm particles than for the 100 nm particles. Complete egestion did not occur within 24 h but generally higher amounts of the 2 µm particles were egested. Animal body burdens of particles were strongly reduced in the presence of food. Daphnid feeding rates decreased by 21% in the presence of 100 nm particles, but no effect on reproduction was found despite high body burdens of particles at the end of 21 days exposure. The lower egestion and decreased feeding rates, caused by the 100 nm particles, could indicate that particles in the nanometer size range are potentially more hazardous to D. magna compared to larger particle sizes.

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Rist, S. (Intern), Baun, A. (Intern), Hartmann, N. B. (Intern)
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.27 SJR 1.786 SNIP 1.729
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.002 SNIP 1.73 CiteScore 4.72
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.986 SNIP 2.03 CiteScore 4.57
Infiltration is a key process controlling runoff, but varies depending on antecedent conditions. This study provides estimates on initial conditions for urban permeable surfaces via continuous simulation of the infiltration capacity using historical rain data. An analysis of historical rainfall records show that accumulated rainfall prior to large rain events does not depend on the return period of the event. Using an infiltration-runoff model we found that for a typical large rain storm, antecedent conditions in general lead to reduced infiltration capacity both for sandy and clayey soils and that there is substantial runoff for return periods above 1–10 years.

Initial conditions of urban permeable surfaces in rainfall-runoff models using Horton's infiltration

Infiltration is a key process controlling runoff, but varies depending on antecedent conditions. This study provides estimates on initial conditions for urban permeable surfaces via continuous simulation of the infiltration capacity using historical rain data. An analysis of historical rainfall records show that accumulated rainfall prior to large rain events does not depend on the return period of the event. Using an infiltration-runoff model we found that for a typical large rain storm, antecedent conditions in general lead to reduced infiltration capacity both for sandy and clayey soils and that there is substantial runoff for return periods above 1–10 years.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, LNH Water
Authors: Davidsen, S. (Intern), Löwe, R. (Intern), Heegh Ravn, N. (Ekstern), Jensen, L. N. (Ekstern), Ambjerg-Nielsen, K. (Intern)
Number of pages: 8
Insights on the activity of the anaerobic digestion microbiome by means of metatranscriptomic functional investigation

**General information**
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Padua, Technical University of Denmark
Authors: Treu, L. (Intern), Campanaro, S. (Ekstern), Fontana, A. (Ekstern), Zhu, X. (Intern), Kougias, P. G. (Ekstern), Angelidaki, I. (Intern)
Number of pages: 1
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Publisher: Technical University of Denmark (DTU)
Article number: R-18
Main Research Area: Technical/natural sciences
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Electronic versions:
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Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

In-situ biogas upgrading process: modeling and simulations aspects
Biogas upgrading processes by in-situ hydrogen (H2) injection are still challenging and could benefit from a mathematical model to predict system performance. Therefore, a previous model on anaerobic digestion was updated and expanded to include the effect of H2 injection into the liquid phase of a fermenter with the aim of modeling and simulating these processes. This was done by including hydrogenotrophic methanogen kinetics for H2 consumption and inhibition effect on the acetogenic steps. Special attention was paid to gas to liquid transfer of H2. The final model was successfully validated considering a set of Case Studies. Biogas composition and H2 utilization were correctly predicted, with overall deviation below 10% compared to experimental measurements. Parameter sensitivity analysis revealed that the model is highly sensitive to the H2 injection rate and mass transfer coefficient. The model developed is an effective tool for predicting process performance in scenarios with biogas upgrading.

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State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Instituto Maua de Tecnologia (IMT), Technical University of Denmark
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Journal: Bioresource Technology
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Integrated assessment of chemical stressors and ecological impact in mixed land use stream systems
The increasing human population and development pressure during the last century has motivated land use changes of importance on a global scale. Urban expansion and increasing agricultural production have thus created a wide range of pressures, which in particular affect the freshwater bodies such as streams, as they are highly connected to their catchment through their draining system. The pressures include hydromorphological alterations, as well as diffuse chemical sources (e.g. geogenic, agricultural activities) and point sources (e.g. wastewater outlets, contaminated sites). The degradation of these mixed land use stream systems causes critical changes and thus jeopardizes the health of the stream ecosystems. The various chemical sources result in a highly diverse group of chemical stressors leading to a decrease in the chemical quality of the different stream compartments (i.e. stream water, hyporheic zone and bed sediment). These compartment(s) will be impacted differently by the various chemicals present in the system, depending on e.g. the stressor’s pathway to the stream, their physico-chemical properties, and controlling hydrological and biogeochemical processes. The resulting impairment of the different stream compartments thus comprises both temporal and spatial variation. Despite the growing understanding of the complexity, approaches for a holistic risk assessment of the potential impacts in the three stream compartments of a mixed land use stream system are still missing. To investigate and improve the understanding of the presence of multiple chemical stressors and any related ecological impacts in such a system, Grindsted stream was chosen as the study site for this PhD project. The groundwater-fed stream is situated in a mixed land use catchment hosting both urban and agricultural activities, including contaminated sites. To determine potential impacts, the chemical quality of both organic (i.e. pharmaceuticals, gasoline constituents, chlorinated solvents, and pesticides) and inorganic (i.e. metals, general water chemistry and macronions) compounds was assessed in all three stream compartments. To evaluate the magnitude of the sources, a combination of three established approaches was employed: contaminant mass discharge, toxic potential and threshold values. To subsequently account for potential ecological impacts, benthic invertebrate communities (both macro- and meiofauna) were characterized to enable a full coverage of the quality of all three stream compartments. Possible links between the chemical quality of the individual compartments and the ecological stream quality were then explored by using multivariate statistical analyses. The evaluation of the chemical quality in the three stream compartments revealed a substantial influence on both stream water and hyporheic zone from the diffuse metal sources (aluminum, barium, copper, lead, nickel, zinc) of both geogenic and anthropogenic origin in the catchment. The release of metals (particularly copper, nickel, zinc) was additionally enhanced by acidification of the noncalcareous aquifer. Moreover, the approach combining an evaluation of the contaminant mass discharge of the known anthropogenic point sources in the catchment together with the in-stream contaminant mass discharge showed to be an effective tool to both display their mutual importance and to reveal “new” sources. It further demonstrated the importance of contaminated sites as a potential noteworthy source to continuously impact the chemical stream quality (> ½ tonne per year of organic xenobiotics). An assessment of the chemical patterns (similarities) along the investigated stream corridor made it possible to link the chemical quality to a detected ecoresponse in the invertebrate communities. This study thus demonstrated significant ecological impact resulting from the additional chemical stress of the inflow of a contaminated groundwater plume. The mechanism for this impact indicated that this was not caused solely by the presence of organic xenobiotics, but also by the strongly reduced redox conditions (e.g. high concentrations of dissolved iron and manganese) and secondary effects (e.g. high concentrations of dissolved arsenic), as a result of the organic degradation (e.g. benzene, toluene, ethylbenzene, and xylene) in the plume. The ecological impact was detected predominantly in the organisms living in the upper bed sediment. The sensitivity was especially pronounced in the meioinvertebrate community, which could be a promising tool to standardize the characterization of the ecological quality of streams considering their ubiquitous distribution throughout all ecoregions. The methodology developed here, applying a holistic evaluation of both the chemical and ecological stream quality, thus demonstrates the importance for future risk assessments to include multiple compounds (i.e. organic and inorganic chemical stressors) and stream compartments to...
locate key sources and risk drivers. The approaches and findings in this thesis could truly be helpful for management and future remediation of mixed land use stream systems.

**General information**

State: Published  
Organisations: Department of Environmental Engineering, Water Resources Engineering, Aarhus University  
Authors: Sonne, A. T. (Intern), Bjerg, P. L. (Intern), McKnight, U. S. (Intern), Rasmussen, J. (Ekstern)  
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Publication: Research › Ph.D. thesis – Annual report year: 2017

**Integrated characterization of NA of PCE plume after thermal source zone remediation - microbial techniques and dual isotope analysis**

**General information**

State: Published  
Organisations: Department of Environmental Engineering, Water Resources Engineering, Universite de Neuchatel, Aarhus University, University of Neuchâtel, SiREM, Region Syddanmark  
Authors: Broholm, M. M. (Intern), Badin, A. (Ekstern), Palau, J. (Ekstern), Hunkeler, D. (Ekstern), Jacobsen, C. S. (Ekstern), Dennis, P. (Ekstern), Just, N. (Ekstern)  
Number of pages: 1  
Publication date: 2017  
Main Research Area: Technical/natural sciences  
Electronic versions:  
BatelleBio_2017_Broholm_Abs_Microbial_2_.pdf  
Source: PublicationPreSubmission  
Source-ID: 133814904  
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**Integrated characterization of perchloroethene plume natural attenuation after thermal source zone remediation - molecular biology tools and dual isotope analysis**

**General information**

State: Published  
Authors: Murray, A. M. (Intern), Drude, B. (Ekstern), Brabæk, L. (Ekstern), Kristensen, I. L. (Ekstern), Broholm, M. M. (Intern), Maillard, J. (Ekstern), Johansen, A. (Ekstern), Hunkeler, D. (Ekstern)  
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Publication date: 2017  
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Electronic versions:  
ISSSM_2017_Murray_OralAbstract.pdf

**Relations**

Activities:  
Integrated characterization of perchloroethene plume natural attenuation after thermal source zone remediation - molecular biology tools and dual isotope analysis
Integrated electrochemical-biological process as an alternative mean for ammonia monitoring during anaerobic digestion of organic wastes

Ammonia monitoring is important to control anaerobic digestion (AD) process due to inhibition effect. Here, an electrolysis cell (EC) was integrated with a complete nitrification reactor as an alternative approach for online monitoring of ammonia during AD processes. The AD effluent was pumped into nitrification reactor to convert ammonia to nitrate, followed by the introduction of nitrate-rich effluent to EC cathode. It was first evaluated with synthetic ammonia-rich digesters and was observed that the current at 5min were linearly corresponding to the ammonia levels (from 0 to 7.5mM NH4+-N, R²=0.9673). The linear relationship was always observed regardless of different wastewater pH and external voltage. Pre-removal of other electron acceptors from digestate at cathode could eliminate their disturbances to sensor performance. Finally, the accuracy of biosensor was verified with real digestate test. The simple and reliable biosensor showed great promising for online ammonia monitoring of AD processes.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Zhao, N. (Intern), Li, X. (Intern), Jin, X. (Intern), Angelidaki, I. (Intern), Zhang, Y. (Intern)
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BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.39 SJR 1.417 SNIP 1.606
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.51 SNIP 1.57 CiteScore 4.04
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.593 SNIP 1.651 CiteScore 3.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.724 SNIP 1.767 CiteScore 3.92
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.818 SNIP 1.623 CiteScore 3.5
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.961 SNIP 1.515 CiteScore 3.61
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.867 SNIP 1.421
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.836 SNIP 1.573
Basic details
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 1.651 SNIP 1.591
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 1.511 SNIP 1.616
- Web of Science (2007): Indexed yes
- Scopus rating (2006): SJR 1.416 SNIP 1.676
- Web of Science (2006): Indexed yes
- Scopus rating (2005): SJR 1.478 SNIP 1.563
- Web of Science (2005): Indexed yes
- Scopus rating (2004): SJR 1.633 SNIP 1.494
- Web of Science (2004): Indexed yes
- Scopus rating (2003): SJR 1.324 SNIP 1.324
- Web of Science (2003): Indexed yes
- Scopus rating (2002): SJR 0.912 SNIP 1.066
- Web of Science (2002): Indexed yes
- Scopus rating (2001): SJR 0.928 SNIP 0.975
- Web of Science (2001): Indexed yes
- Scopus rating (2000): SJR 0.876 SNIP 0.876
- Web of Science (2000): Indexed yes
- Scopus rating (1999): SJR 1.048 SNIP 0.846
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- DOIs: 10.1016/j.chemosphere.2017.12.139
- Source: FindIt
- Source-ID: 2394585080
- Publication: Research - peer-review › Journal article – Annual report year: 2017

Abstract
Integrated hydrological model-based assessment of stormwater management scenarios in Copenhagen's first climate resilient neighbourhood using the three point approach

The city of Copenhagen currently pursues a very ambitious plan to make the city 'cloudburst proof' within the next 30 years. The cloudburst management plan has the potential to support the city's aim to become more green, liveable, and sustainable. In this study, we assessed stormwater system designs using the Three Point Approach (3PA) as a framework, where an indicator value for each domain was calculated using state-of-the-art modelling techniques. We demonstrated the methodology on scenarios representing sequential enhancements of the cloudburst management plan for a district that has been appointed to become the first climate resilient neighbourhood in Copenhagen. The results show that if the cloudburst system is exploited to discharge runoff from selected areas that are disconnected from the combined sewer system, then the plan leads to multiple benefits. These include improved flood protection under a 100-years storm (i.e., compliance with the new demands in domain C of the 3PA), reduced surcharge to terrain under a 10-years storm (i.e., compliance with the service goal in domain B of the 3PA) and an improved yearly water balance (i.e., better performance in domain A of the 3PA).

General information
- State: Published
- Organisations: Department of Environmental Engineering, Urban Water Systems, Technical University of Denmark
- Authors: Lerer, S. M. (Intern), Righetti, F. (Intern), Rozario, T. (Ekstern), Mikkelsen, P. S. (Intern)
- Number of pages: 12
- Publication date: 2017
- Main Research Area: Technical/natural sciences

Publication information
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- Volume: 9
- Issue number: 11
- Article number: 883
- ISSN (Print): 2073-4441
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Integration of geological, geophysical and contaminant monitoring technologies for contaminated site investigation

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Aarhus University, Geological Survey of Denmark and Greenland
Authors: Balbarini, N. (Intern), Rønde, V. K. (Intern), Maurya, P. K. (Ekstern), Klint, K. E. (Ekstern), Christiansen, A. V. (Ekstern), Binning, P. J. (Intern)
Number of pages: 2
Publication date: 2017
Main Research Area: Technical/natural sciences
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Source: FindIt
Source-ID: 2393188415
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Source-ID: 140729954
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Integrity of clay till aquitards to DNAPL migration: Assessment using current and emerging characterization tools
Field investigations were carried out to determine the occurrence of tetrachloroethene (PCE) dense non-aqueous phase liquid (DNAPL), the source zone architecture and the aquitard integrity at a 30-50 year old DNAPL release site. The DNAPL source zone is located in the clay till unit overlying a limestone aquifer. The DNAPL source zone architecture was investigated through a multiple-lines-of-evidence approach using various characterization tools; the most favorable combination of tools for the DNAPL characterization was geophysical investigations, Membrane Interface Probe (MIP),
core subsampling with quantification of chlorinated solvents, hydrophobic dye test with Sudan IV and Flexible Liner Underground Technologies (FLUTe) NAPL liners with activated carbon felt (FACT). While the occurrence of DNAPL was best determined by quantification of chlorinated solvents in soil samples supported by the hydrophobic dye tests (Sudan IV and NAPL FLUTe), the conceptual understanding of source zone architecture was greatly assisted by the indirect continuous characterization tools. Although mobile or high residual DNAPL (St >1%) only occurred in 11% of the source zone samples (intact cores), they comprised 86% of the total PCE mass. The data set, and associated data analysis, supported vertical migration of DNAPL through fractures in the upper part of the clay till, horizontal migration along high permeability features around the redox boundary in the clay till, and to some extent vertical migration through the fractures in the reduced part of the clay till aquitard to the underlying limestone aquifer. The aquitard integrity to DNAPL migration was found to be compromised at a thickness of reduced clay till of less than 2 m.
Intermittent Aeration Suppresses Nitrite-Oxidizing Bacteria in Membrane-Aerated Biofilms: A Model-Based Explanation

Autotrophic ammonium oxidation in membrane-aerated biofilm reactors (MABRs) can make treatment of ammonium-rich wastewaters more energy-efficient, especially within the context of short-cut ammonium removal. The challenge is to exclusively enrich ammonium-oxidizing bacteria (AOB). To achieve nitritation, strategies to suppress nitrite-oxidizing bacteria (NOB) are needed, which are ideally grounded on an understanding of underlying mechanisms. In this study, a nitrifying MABR was operated under intermittent aeration. During eight months of operation, AOB dominated, while NOB were suppressed. On the basis of dissolved oxygen (DO), ammonium, nitrite, and nitrate profiles within the biofilm and in the bulk, a 1-dimensional nitrifying biofilm model was developed and calibrated. The model was utilized to explore the potential mechanisms of NOB suppression associated with intermittent aeration, considering DO limitation, direct pH effects on enzymatic activities, and indirect pH effects on activity via substrate speciation. The model predicted strong periodic shifts in the spatial gradients of DO, pH, free ammonia, and free nitrous acid, associated with aerated and nonaerated phases. NOB suppression during intermittent aeration was mostly explained by periodic inhibition caused by free ammonia due to periodic transient pH upshifts. Dissolved oxygen limitation did not govern NOB suppression. Different intermittent aeration strategies were then evaluated for nitritation success in intermittently aerated MABRs: both aeration intermittency and duration were effective control parameters.
Intermittent provision of H₂ and CO₂ in up-flow reactors for ex-situ biogas upgrading

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Invasion in microbial communities: Role of community composition and assembly processes

Microbes contribute to all biogeochemical cycles on earth and are responsible for key biological processes that support the survival of plants and animals. There is increased interest in controlling and managing microbial communities in different ecosystems in order to make targeted microbiological processes more effective. In order to manage microbial communities, it is essential to understand the factors that shape and influence microbial community composition. In addition to abiotic factors, such as environmental conditions and resource availability, biotic factors also shape the dynamics of microbial community assembly. Biotic factors include interactions between different microbial groups as well as the community response to alien species – invaders.

Microbial invasions can have significant effects on the composition and functioning of resident communities. There is, however, lack of agreement on the core determinants of invasion in microbial communities. Current models and concepts for invasion in microbial ecology are largely based on the macro-ecology literature. Although attempts have been made to examine the applicability of these concepts to microbial communities, a general conceptual framework for microbial invasion applicable across ecosystems is missing. The overall aim of this PhD project was therefore to propose a conceptual framework to study microbial community invasion and to test this framework against experimental observations.

Based on a synthesis of earlier frameworks on invasion and community ecology, I defined invasion in a microbial community as the establishment of an alien microbial type in a resident community and have proposed simple criteria to define aliens, residents, and alien establishment, applicable across a wide variety of communities. I suggested the adoption of the community ecology framework advanced by Vellend (2010) to identify determinants of invasion. This framework lists the four fundamental processes that govern community assembly as: dispersal, selection, drift and diversification. We have suggested that it is important to determine which processes dominate the assembly of a resident community in order to understand what governs invasion in that community.

To test invasion in microbial communities while controlling the processes driving community assembly, I developed a high-throughput flow-through experimental microcosm system that enabled me to manipulate the relative importance of selection versus drift during initial community assembly. I used this new system to establish resident microbial biofilm communities dominated by nitrite-oxidizing bacteria, where the direction of selection as well as contribution of drift was manipulated through differential nitrite loading rates.

Subsequently, I experimentally characterized the community assembly processes in the biofilm communities, using replicate communities assembled under same conditions. Both total community and guild-level analyses provided evidence for contribution of neutral processes (drift) combined with selection. More precisely, I observed the deterministic enrichment of certain types of nitrite-oxidizing bacteria in the biofilms: elevated nitrite loading selected for a single Nitrotoga representative, while lower nitrite conditions selected for a number of Nitrospira.

I then repeated the assembly experiment and subjected the assembled biofilms to invasion by a Nitrospira HW29 culture. I found no significant (negative) correlation between community diversity and invasion success, in contrast with the often cited diversity/invasibility relationship. Instead, I observed that at high phylogenetic similarity between invader and resident types, the effect of selection is surpassed by the effect of drift on invasion success. My results suggest that controlling invasion in communities that contain members that are phylogenetically similar to the invader is nearly impossible because stochastic processes determine the invasion outcome when selection towards invader and resident community is similar.

In conclusion, during this PhD project I proposed a simple conceptual framework to study and characterize microbial invasions. This conceptual framework allows comparison of experimental observations across ecosystems using a coherent ecological terminology and consideration of community assembly processes rather than indices to describe community composition. Furthermore, I experimentally identified the dominant processes in newly assembled biofilms enriched in nitrite-oxidizing guilds before subjecting the resident guilds to invasion by an alien nitrite-oxidizer. The results of my experiments indicate that neutral processes have significantly higher contribution to community assembly – including invasion – than previously suggested.
Managing invasion of microbial communities by new members can be a powerful tool in microbial resource management. Abundant studies have examined how resource availability and resident community diversity affect invasion success. Yet, a more rigorous approach towards studying invasion would consider a broader community ecology framework. For example, the effect of propagule pressure, often studied in macro-ecology, has rarely been examined for microbial communities. Also, the interactions between processes governing community assembly and propagule pressure on invasion success have never been reported.

The objective of this study was to determine the effect of propagule pressure on invasion success in microbial communities, shaped by varying degrees of stochasticity and determinism. The experimental system consisted of nitrite oxidizing bacterial enrichments, developed in replicate flow-through biofilm reactors using drinking water as inoculum and continuous feeding with nitrite as a sole energy source. Different nitrite loading rates were applied, as these were previously shown to influence nitrifying guild composition and stochasticity [1]. After 6 weeks, the reactors were invaded for 24 hours by nitrite oxidizer strain (Candidatus Nitrotoga sp. HW29) at 3 different propagule pressures. The reactors were then operated another 2 weeks before analyzing community composition by targeted qPCRs and 16S rRNA gene amplicon analysis. We successfully assembled resident communities with different ratios of Nitrotoga to Nitrospira as a result of deterministic processes created by different nitrite concentrations: High nitrite loading selected for a diverse and abundant Nitrotoga population while low nitrite loading selected for an abundant Nitrospira population. We noted invasion success only at the highest propagule pressure, and the frequency of establishment was higher under low versus high nitrite loading conditions. Contrary to previous invasion studies, we found no significant correlation between resident community diversity and invasion success. Instead, our results suggest that deterministic processes combined with resident-invader phylogenetic relatedness influence invasion success.
m−2s−1. For a senescing forest (DK-Sor), located in an agricultural region, deposition rates of 250ng NH3-N m−2s−1 were measured prior to leaf fall, and emission rates up to 670ng NH3-N m−2s−1 were measured following leaf fall. For MMSF, simulated stomatal NH3 emissions explain the daytime flux observations well, and it is hypothesized that cuticular desorption is responsible for the observed NH3 emissions at night. During leaf fall in DK-Sor, ground fluxes dominate the NH3 flux with a mean emission rate of 150ng NH3-N m−2s−1. This study shows that forests potentially comprise a natural source of NH3 to the atmosphere, and that it is crucial to take into account the bi-directional exchange processes related to both the stomatal, cuticular and ground layer pathways in order to realistically simulate forest–atmosphere fluxes of NH3.
Investigating the state of a 6 years old full-scale biocover at a Danish landfill

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Investigation of mixing enhancement in porous media under helical flow conditions: 3-D bench-scale experiments

Investigation of mixing enhancement in porous media under helical flow conditions: 3-D bench-scale experiments

Investigation of mixing enhancement in porous media under helical flow conditions: 3-D bench-scale experiments

Lateral mass exchange at the fringe of solute plumes is a fundamental process leading to plume dilution and reactive mixing. Mass transfer between the plume and ambient water can be considerably enhanced by helical flow occurring in three-dimensional heterogeneous anisotropic porous media [1-3]. We performed steady-state conservative tracer experiments in a fully three-dimensional flow-through chamber to investigate the effects of helical flow on plume spiraling and deformation, as well as on its dilution [4]. Helical flow was created by packing the porous medium in angled stripes of materials with different grain sizes to create blocks with macroscopically anisotropic hydraulic conductivity. The hydraulic conductivity of the blocks was varied in different experiments. Solute concentrations and flow rates were measured at high spatial resolution for samples collected at 49 outlet ports. This allowed us to quantify spreading and dilution of the solute plumes at the outlet cross section. Moreover, we collected direct evidence of plume spiraling and visual proof of helical flow by freezing and slicing the porous medium at different cross sections and observing the dye-tracer distribution. Model-based interpretation of the results allowed substantiating the effect of the helical flow field on plume dilution and on mixing-controlled reactive transport. The simulation results were evaluated using metrics of reactive mixing such as the critical dilution index and the length of continuously injected steady-state plumes.

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In vitro fermentation of key dietary compounds with rumen fluid: A genome-centric perspective

The anaerobic decomposition of organic substrates leads to the generation of gases, such as methane, which can either be a valuable energy carrier in industrial applications or can be considered as a main greenhouse gas when it is naturally emitted. In this study we investigated in vitro the effect of dietary compounds, such as starch and proteins, on the microbial community present in the rumen fluid. High throughput shotgun sequencing, followed by metagenomic assembly and binning allowed the extraction of 18 genome bins. A composite bioinformatic analysis led to the prediction of metabolic pathways involved in the degradation of dietary compounds and in the biosynthesis of crucial products like propionate, methane and ammonia. The identification of genomes belonging to poorly characterized phyla such as Thermoplasmata and Elusimicrobia shed light on their putative role. The high abundance of methylotrophic archaea in the inoculum suggests a relevant role in methane production.
iTRAQ quantitative proteomic analysis reveals the pathways for methanation of propionate facilitated by magnetite

Methanation of propionate requires syntrophic interaction of propionate-oxidizing bacteria and hydrogenotrophic methanogens, which is referred to as interspecies electron transfer. The present study showed that 10 mg/L conductive magnetite enhanced the methane production rate from propionate by around 44% in batch experiments, and both direct interspecies electron transfer and interspecies H2 transfer were thermodynamically feasible with the addition of magnetite. The methanation of propionate facilitated by magnetite was also demonstrated in a long-term operated continuous reactor. The methane production rate from acetate by the enriched mixed culture with magnetite was higher than that without
magnetite, while similar methane production rates were found from H2/CO2 by the enriched mixed culture with and without magnetite. The ability to utilize molecular H2 indicated interspecies H2 transfer played a role in the enriched culture with magnetite, and propionate-oxidizing bacteria relating with interspecies H2 transfer were also detected by metagenomic sequencing. Metagenomic sequencing analysis also showed that Thauera, possibly relating with direct interspecies electron transfer, were enriched with the addition of magnetite. iTRAQ quantitative proteomic analysis, which was used in mixed culture for the first time, showed that magnetite induced the changes of protein expression levels involved in various pathways during the methanation of propionate. The up-regulation of proteins involved in propionate metabolism were found, and they were mainly originated from propionate-oxidizing bacteria which were not reported to be capable of direct interspecies electron transfer until now. Cytochrome c oxidase was also revealed as the possible protein relating with direct interspecies electron transfer considering its up-regulation with the addition of magnetite and origination from Thauera. Most of the up-regulated proteins in methane metabolism were originated from Methanosaeta, while most of the enzymes with down-regulated proteins were originated from Methanosarcina. However, the up-regulated proteins relating with hydrogenotrophic methanogenesis were originated from neither Methanosaeta nor Methanosarcina, indicating they were not involved in direct interspecies electron transfer. The hydrogenotrophic methanogens, e.g. Methanospirillum, Methanospirulina et al., might be involved in direct interspecies electron transfer. Overall, the present study showed that both direct interspecies electron transfer and interspecies H2 transfer were present during methanation of propionate facilitated by magnetite.

**General information**

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Kinetic considerations of two Sulfurospirillum spp. competing for tetrachloroethene

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Kronik: Havet skyller ind over Danmark - hvad gør vi?

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Laminaria digitata as potential carbon source in heterotrophic microalgae cultivation for the production of fish feed supplement

A novel concept using the macroalgae Laminaria digitata as substrate to grow heterotrophically microalgae species to be used as fish feed supplement is investigated in the present study. Enzymatic hydrolysis of the macroalgae was performed to release the sugars present in the biomass. The hydrolysate was then used as culture medium and nutrient source to grow heterotrophically three different microalgae species, namely Chlorella protothecoides, Chlorella vulgaris and Chlorella sorokiniana, identified as valuable sources of proteins. Due to its faster growth rates, C. protothecoides was selected for further cultivation in batch reactors and its protein content and amino acid composition were measured. At the end of the process the biomass production reached $10.68 \pm 1.33 \text{ g L}^{-1}$ with a total protein accumulation of $41.77 \pm 1.82\%$ (dry weight basis) and a protein yield of $0.17 \pm 0.06$. Moreover, the essential amino acids score at the end of the experiment was 6 times greater than for the original content of the macroalgae hydrolysate which was used as substrate for the microalgae cultivation. Therefore, this study reveals the potential of macroalgae hydrolysate as culture medium for microalgae cultivation and it opens possibilities for the development of future strategies to optimize the microalgae production processes.
Langtidsmålinger viser overraskende resultat: Bøgeskov øger kulstofoptagelsen med tiden

LCA of Drinking Water Supply

Water supplies around the globe are growing complex and include more intense treatment methods than just decades ago. Now, desalination of seawater and wastewater reuse for both non-potable and potable water supply have become common practice in many places. LCA has been used to assess the potentials and reveal hotspots among the possible technologies and scenarios for water supplies of the future. LCA studies have been used to support decisions in the planning of urban water systems and some important findings include documentation of reduced environmental impact from desalination of brackish water over sea water, the significant impacts from changed drinking water quality and reduced environmental burden from wastewater reuse instead of desalination. Some of the main challenges in conducting LCAs of water supply systems are their complexity and diversity, requiring very large data collection efforts, with multiple sources of information, many of them not public and requiring cooperation. Important for product and system LCAs with substantial water use, it is emphasized that standard life cycle inventory databases do not reflect the significant variance in environmental impacts of water supply across locations and technologies.
LCA of Soil and Groundwater Remediation

Today, there is increasing interest in applying LCA to support decision-makers in contaminated site management. In this chapter, we introduce remediation technologies and associated environmental impacts, present an overview of literature findings on LCA applied to remediation technologies and present methodological issues to consider when conducting LCAs within the area. Within the field of contaminated site remediation, a terminology distinguishing three types of environmental impacts: primary, secondary and tertiary, is often applied. Primary impacts are the site-related impacts due to the contamination in the ground, secondary impacts are the impacts related to clean-up of the site, and tertiary impacts are the impacts associated with the future use of the site. The major methodological issues to consider when conducting LCA are: (i) defining a functional unit that considers time frame and efficiency of remediation, which are important for assessment or primary impacts; (ii) robust assessment of primary impacts using site-specific fate and exposure models; (iii) weighting of primary and secondary (or tertiary) impacts to evaluate trade-offs between life cycle impacts from remediation and reduced pressure locally; and (iv) comparison with a no action scenario to determine whether there is a net environmental benefit from remediation. Overall, LCA is an important tool for the assessment of the secondary environmental impacts of remediation, and occasionally it has also been used to assess primary and tertiary impacts. In order to obtain robust decisions for the management of contaminated sites, the combination of LCA with other tools is necessary, including multi-criteria decision analysis tools, site-specific fate and exposure models and consideration of stakeholders’ views.

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LCA of Solid Waste Management Systems

The chapter explores the application of LCA to solid waste management systems through the review of published studies on the subject. The environmental implications of choices involved in the modelling setup of waste management systems are increasingly in the spotlight, due to public health concerns and new legislation addressing the impacts from managing our waste. The application of LCA to solid waste management systems, sometimes called “waste LCA”, is distinctive in that system boundaries are rigorously defined to exclude all life cycle stages except from the end-of-life. Moreover, specific methodological challenges arise when investigating waste systems, such as the allocation of impacts and the consideration of long-term emissions. The complexity of waste LCAs is mainly derived from the variability of the object under study (waste) which is made of different materials that may require different treatments. This chapter attempts to address these challenges by identifying common misconceptions and by providing methodological guidance for alleviating the associated uncertainty. Readers are also provided with the list of studies reviewed and key sources for reference to implement LCA on solid waste systems.

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Let's Be Clear(er) about Substitution: A Reporting Framework to Account for Product Displacement in Life Cycle Assessment: A Framework to Account for Substitution in LCA

The multifunctional character of resource recovery in waste management systems is commonly addressed through system expansion/substitution in life cycle assessment (LCA). Avoided burdens credited based on expected displacement of other product systems can dominate the overall results, making the underlying assumptions particularly important for the interpretation and recommendations. Substitution modeling, however, is often poorly motivated or inadequately described, which limits the utility and comparability of such LCA studies. The aim of this study is therefore to provide a structure for the systematic reporting of information and assumptions expected to contribute to the substitution potential in order to make substitution modeling and the results thereof more transparent and interpretable. We propose a reporting framework that can also support the systematic estimation of substitution potentials related to resource recovery. Key components of the framework include waste-specific (physical) resource potential, recovery efficiency, and displacement rate. End-use-specific displacement rates can be derived as the product of the relative functionality (substitutability) of the recovered resources compared to potentially displaced products and the expected change in consumption of competing products. Substitutability can be determined based on technical functionality and can include additional constraints. The case of anaerobic digestion of organic household waste illustrates its application. The proposed framework enables well-motivated substitution potentials to be accounted for, regardless of the chosen approach, and improves the reproducibility of comparative LCA studies of resource recovery.
Purpose: Diminishing fossil resources and environmental concerns associated with their vast utilization have been in focus by energy policy makers and researchers. Among the different scenarios put forth to commercialize biofuels, various biorefinery concepts have aroused global interests because of their ability in converting biomass into a spectrum of marketable products and bioenergies. This study was aimed at developing different novel castor-based biorefinery scenarios for generating biodiesel and other co-products, i.e., ethanol and biogas. In these scenarios, glycerin, heat, and electricity were also considered as byproducts. Developed scenarios were also compared with a fossil reference system delivering the same amount of energy through the combustion of neat diesel. Materials and methods: Life cycle assessment (LCA) was used to investigate the environmental consequences of castor biodiesel production and consumption with a biorefinery approach. All the input and output flows from the cultivation stage to the combustion in diesel engines as well as changes in soil organic carbon (SOC) were taken into account. Impact 2002+ method was used to quantify the environmental consequences. Results and discussion: The LCA results demonstrated that in comparison with the fossil reference system, only one scenario (i.e., Sc-3 with co-production of significant amounts of biodiesel and biomethane) had 16% lower GHG emissions without even considering the improving effect of SOC. Moreover, resource damage category of this scenario was 50% lower than that of neat diesel combustion. The results proved that from a life cycle perspective, energy should be given priority in biorefineries because it is essential for a biorefinery to have a positive energy balance in order to be considered as a sustainable source of energy. Despite a positive effect on energy and GHG balances, these biorefineries had negative environmental impacts on the other damage categories like Human Health and Ecosystem Quality. Conclusions: Although biorefineries offer unique features as promising solutions for mitigating climate change and reducing dependence on fossil fuels, the selection of biomass processing options and management decisions can affect the final results in terms of environmental evaluations and energy balance. Moreover, if biorefineries are focused on transportation fuel production, a great deal of effort should still be made to have better environmental performance in Human Health and Ecosystem Quality damage categories. This study highly recommends that future studies focus towards biomass processing options and process optimization to guarantee the future of the most sustainable biofuels.
Life cycle assessment of orange peel waste management

The management of orange peel waste constitutes an economic and environmental problem in regions in which there are important citrus processing industries, as is the case of southern Italy. Traditional handling techniques are either not economically attractive (e.g. composting and animal feeding) or discouraged by European policy (landfilling). As an alternative to these technologies, others aimed at recovering energy and resources are currently receiving increasing attention. The consequential life cycle assessment adopted in this work compares the environmental performance of ten orange peel waste management scenarios. These include mono-treatment scenarios (pyrolysis, incineration, and anaerobic mono-digestion) and co-treatment (four anaerobic co-digestion strategies with animal manure and seaweed) ones aimed at energy/resource recovery, which were compared with three "traditional non-energy focused handling techniques (landfilling, composting and animal feeding). Overall, the co-digestion scenarios appear to be the best, in terms of global warming and resource depletion mitigation. However, they also suffer from a drawback, that is, a potential eutrophication impact, due to nitrate leaching following on-land digestate use. Orange peel waste use for animal feeding, while appearing interesting from an environmental perspective (for example to reduce meal imports), presents practical challenges as far as the nutritional aspects and costs are concerned, and these eventually hinder its market potential. A preliminary cost flow analysis has concluded that anaerobic digestion strategies are economically preferable to the other alternatives.
Life cycle inventory modeling of phosphorus substitution, losses and crop uptake after land application of organic waste products

Purpose: Life cycle assessments (LCAs) that attempt to provide advice on treatment options for phosphorus (P) containing organic waste products encounter problems related to the quantification of mineral P fertilizer substitution, P loss and crop P uptake after land application. The purpose of this study was to develop a relatively easy to use life cycle inventory model, known as PLCI, that could be used to estimate these values. Methods: A life cycle inventory model for P was developed, which estimates the effect of an application of organic waste followed by ordinary fertilizer management in the modeling period. This was compared with a simulation without the initial waste application. The difference in mineral P fertilizer application (substitution), P loss and crop P uptake was then calculated and expressed as a proportion of the amount of waste applied. As an example, the effect of an initial application of mineral fertilizer, sewage sludge and ash on two farm types was simulated. These results were applied in an LCA case study of different sewage sludge treatment options. Results and discussion: Farm type influenced the P fertilizer substitution, loss and crop uptake factors. The application on an arable farm showed a substitution of 28 to 31%, relatively low P loss and a large spread in crop P uptake for the different P sources, compared with the pig farm. Application on a pig farm showed no mineral P substitution. For substitution, mineral fertilizer outperformed waste product fertilizer with a short modeling period, due to higher immediate P availability, which was not the case with a long period. The LCA case study showed that the P substitution factor had an influence on the environmental impact categories climate change and depletion of reserve-based abiotic resources while the P loss factor influenced freshwater eutrophication. Application of the P loss and substitution factors generated from the PLCI model resulted in higher environmental burdens and lower savings than using conventional factors. Conclusions: The soil P status mainly affected P substitution and loss, with the fertilizer type only having a small influence when soils had a low P status. The PLCI model can facilitate more coherent and rigorous estimates of P substitution and loss to be used in LCA studies involving application of waste products on agricultural land. This is important since P substitution and loss can have an important influence on impact categories, such as freshwater eutrophication and resource depletion.
To generate meaningful results, life cycle assessments (LCAs) require accurate technology data that are consistent with the goal and scope of the analysis. While literature data are available for many products and processes, finding representative data for highly site-specific technologies, such as waste treatment processes, remains a challenge. This study investigated representative life cycle inventory (LCI) modeling of waste treatment technologies in consideration of variations in technological level and climate. The objectives were to demonstrate the importance of representative LCI modeling as a function of the specificity of the study, and to illustrate the necessity of iteratively refining the goal and scope of the study as data are developed. A landfill case study was performed where 52 discrete landfill data sets were built and grouped to represent different technology options and geographical sites, potential impacts were calculated, and minimum/maximum (min-max) intervals were generated for each group. The results showed decreasing min-max intervals with increasing specificity of the scope of study, which indicates that compatibility between the scope of study and LCI model is critical. Hereby, this study quantitatively demonstrates the influence of representative modeling on LCA results. The results indicate that technology variations and site-specific conditions (e.g., the influence of precipitation and cover permeability on landfill gas generation and collection) should be carefully addressed by a systematic analysis of the key process parameters. Therefore, a thorough understanding of the targeted waste treatment technologies is necessary to ensure that appropriate data choices are made within the boundaries of the defined scope of the study.

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BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.628 SNIP 1.706 CiteScore 3.07
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.171 SNIP 1.405 CiteScore 2.47
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Liquid chromatography-tandem mass spectrometry determination of synthetic cathinones and phenethylamines in influent wastewater of eight European cities

The popularity of new psychoactive substances (NPS) has grown in recent years, with certain NPS commonly and preferentially consumed even following the introduction of preventative legislation. With the objective to improve the knowledge on the use of NPS, a rapid and very sensitive method was developed for the determination of ten priority NPS (N-ethylcathinone, methylenedioxypyrovalerone (MDPV), methylene, butylone, methedrone, mephedrone, naphyrone, 25-C-NBOMe, 25-I-NBOMe and 25-B-NBOMe) in influent wastewater. Sample clean-up and pre-concentration was made by off-line solid phase extraction (SPE) with Oasis MCX cartridges. Isotopically labelled internal standards were used to correct for matrix effects and potential SPE losses. Following chromatographic separation on a C18 column within 6 min, the compounds were measured by tandem mass spectrometry in positive ionization mode. The method was optimised and validated for all compounds. Limits of quantification were evaluated by spiking influent wastewater samples at 1 or 5 ng/L. An investigation into the stability of these compounds in influent wastewater was also performed, showing that, following acidification at pH 2, all compounds were relatively stable for up to 7 days. The method was then applied to influent wastewater samples from eight European countries, in which mephedrone, methylene and MDPV were detected. This work reveals that although NPS use is not as extensive as for classic illicit drugs, the application of a highly sensitive analytical procedure makes their detection in wastewater possible. The developed analytical methodology forms the basis of a subsequent model-based back-calculation of abuse rate in urban areas (i.e. wastewater-based epidemiology).
Longitudinal dispersion coefficients for numerical modeling of groundwater solute transport in heterogeneous formations

Most recent research on hydrodynamic dispersion in porous media has focused on whole-domain dispersion while other research is largely on laboratory-scale dispersion. This work focuses on the contribution of a single block in a numerical model to dispersion. Variability of fluid velocity and concentration within a block is not resolved and the combined spreading effect is approximated using resolved quantities and macroscopic parameters. This applies whether the formation is modeled as homogeneous or discretized into homogeneous blocks but the emphasis here being on the latter. The process of dispersion is typically described through the Fickian model, i.e., the dispersive flux is proportional to the gradient of the resolved concentration, commonly with the Scheidegger parameterization, which is a particular way to compute the dispersion coefficients utilizing dispersivity coefficients. Although such parameterization is by far the most commonly used in solute transport applications, its validity has been questioned. Here, our goal is to investigate the effects of heterogeneity and mass transfer limitations on block-scale longitudinal dispersion and to evaluate under which conditions the Scheidegger parameterization is valid. We compute the relaxation time or memory of the system; changes in time with periods larger than the relaxation time are gradually leading to a condition of local equilibrium under which dispersion is Fickian. The method we use requires the solution of a steady-state advection-dispersion equation, and thus is computationally efficient, and applicable to any heterogeneous hydraulic conductivity K field without requiring statistical or structural assumptions. The method was validated by comparing with other approaches such as the moment analysis and the first order perturbation method. We investigate the impact of heterogeneity, both in degree and structure, on the longitudinal dispersion coefficient and then discuss the role of local dispersion and mass transfer limitations, i.e., the exchange of mass between the permeable matrix and the low permeability inclusions. We illustrate the physical meaning of the method and we show how the block longitudinal dispersivity approaches, under certain conditions, the Scheidegger limit at large Péclet numbers. Lastly, we discuss the potential and limitations of the method to accurately describe dispersion in solute transport applications in heterogeneous aquifers.
Long-term and realistic global change manipulations had low impact on diversity of soil biota in temperate heathland

In a dry heathland ecosystem we manipulated temperature (warming), precipitation (drought) and atmospheric concentration of CO2 in a full-factorial experiment in order to investigate changes in below-ground biodiversity as a result of future climate change. We investigated the responses in community diversity of nematodes, enchytraeids, collembolans and oribatid mites at two and eight years of manipulations. We used a structural equation modelling (SEM) approach analyzing the three manipulations, soil moisture and temperature, and seven soil biological and chemical variables. The
analysis revealed a persistent and positive effect of elevated CO2 on litter C:N ratio. After two years of treatment, the fungi to bacteria ratio was increased by warming, and the diversities within oribatid mites, collemabolans and nematode groups were all affected by elevated CO2 mediated through increased litter C:N ratio. After eight years of treatment, however, the CO2-increased litter C:N ratio did not influence the diversity in any of the four fauna groups. The number of significant correlations between treatments, food source quality, and soil biota diversities was reduced from six to three after two and eight years, respectively. These results suggest a remarkable resilience within the soil biota against global climate change treatments in the long term.

**Long-term leaching of nutrients and contaminants from wood combustion ashes**

With increasing amounts of woody biomass being combusted for energy purposes worldwide, more wood ash is being generated and needs management. As an alternative to landfilling, residues may be utilised for liming and fertilising purposes on forest soils. Comprehensive evaluations of long-term leaching from these residues are needed in order to assess potential environmental impacts associated with their utilisation. Two Danish wood ash samples, one fly ash and
one mixed ash (a combination of fly ash and bottom ash), were evaluated in long-term percolation column tests (up to L/S ∼2000 L/kg), in order to quantify the release of major, minor and trace metal(loid)s. While columns of three different lengths were used, the leaching of individual elements could be described as a function of the L/S ratio – irrespective of the column length. At L/S 1000 L/kg, the cumulative releases of K, S, Na, Ca and Rb were at 40–100% of their respective solid contents, followed by Ba, Cr, Sb, Sr and V at 15–40% and Al, Mg, Zn, Cd, Co, Fe, Pb, Ti, Mn and P at<5%.

Speciation calculations indicated that (i) the observed concentrations of Ca, Mg, Al, Ba, Si and sulphate from both ash types could be described through the dissolution/precipitation of a limited set of minerals and that (ii) leaching of silicates should be included in long-term assessment of alkalinity release from wood ashes. Non-equilibrium conditions were indicated by flow interruptions. However, the presence of non-equilibrium did not have significant effect on the calculated cumulative releases at high L/S ratios. Based on the assessment of cumulative releases at L/S 10 L/kg and L/S 1000 L/kg it is concluded that low L/S-based data may not provide sufficient background for prediction of long-term release from wood ash, in particular for Ba, Cr, Sb and V, and less critically also for As, Cd, Cu, Mo and Ni.

**General information**

State: Accepted/In press


Authors: Maresca, A. (Intern), Hyks, J. (Ekstern), Astrup, T. F. (Intern)

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**Publication information**

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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.354 SNIP 2.044
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.739 SNIP 2.256 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.777 SNIP 2.482 CiteScore 3.43
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.822 SNIP 2.435 CiteScore 3.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.611 SNIP 2.184 CiteScore 2.91
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.698 SNIP 2.085 CiteScore 2.99
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.555 SNIP 1.78
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.502 SNIP 1.899
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.378 SNIP 2.13
Low nitrous oxide production in intermittent-feed high performance nitritating reactors

Nitrous oxide (N\textsubscript{2}O) production from autotrophic nitrogen removal processes, especially nitritating systems, is of growing concern. N\textsubscript{2}O dynamics were characterized and N\textsubscript{2}O production factors were quantified in two lab-scale intermittent-feed nitritating SBRs. 93 ± 14% of the oxidized ammonium was converted to nitrite, with the average total net N\textsubscript{2}O production of 2.1 ± 0.7% of the ammonium oxidized. Operation with intermittent feeding appears an effective optimization approach to mitigate N\textsubscript{2}O emissions from nitritating systems. Net N\textsubscript{2}O production rates transiently increased with a rise in pH after each feeding, indicating a potential role of pH in N\textsubscript{2}O production.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Technical University of Denmark
Authors: Su, Q. (Intern), Jensen, M. M. (Ekstern), Smets, B. F. (Intern)
Number of pages: 1
Publication date: 2017
Event: Abstract from Frontiers International Conference on Wastewater Treatment (FICWTM2017), Palermo, Italy.
Main Research Area: Technical/natural sciences
Electronic versions: FICWTM2017_File_II_60.pdf
Source: PublicationPreSubmission
Source-ID: 134948993
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Low nitrous oxide production through nitrifier-denitrification in intermittent-feed high-rate nitritation reactors

Nitrous oxide (N\textsubscript{2}O) production from autotrophic nitrogen conversion processes, especially nitritation systems, can be significant, requires understanding and calls for mitigation. In this study, the rates and pathways of N\textsubscript{2}O production were quantified in two lab-scale sequencing batch reactors operated with intermittent feeding and demonstrating long-term and high-rate nitritation. The resulting reactor biomass was highly enriched in ammonia-oxidizing bacteria, and converted ~93 ± 14% of the oxidized ammonium to nitrite. The low DO set-point combined with intermittent feeding was sufficient to maintain high nitritation efficiency and high nitritation rates at 20-26 °C over a period of ~300 days. Even at the high nitritation efficiencies, net N\textsubscript{2}O production was low (~2% of the oxidized ammonium). Net N\textsubscript{2}O production rates transiently increased with a rise in pH after each feeding, suggesting a potential effect of pH on N\textsubscript{2}O production. In situ application of 15N labeled substrates revealed nitrifier denitrification as the dominant pathway of N\textsubscript{2}O production. Our study highlights operational conditions that minimize N\textsubscript{2}O emission from two-stage autotrophic nitrogen removal systems.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Technical University of Denmark, University of Southern Denmark
Authors: Su, Q. (Intern), Ma, C. (Ekstern), Domingo-Felez, C. (Intern), Kiil, A. S. (Ekstern), Thamdrup, B. (Ekstern), Jensen, M. M. (Intern), Smets, B. F. (Intern)
Macroalgae Laminaria digitata and Saccharina latissima as Potential Biomasses for Biogas and Total Phenolics Production: Focusing on Seasonal and Spatial Variations of the Algae

Laminaria digitata (L. digitata) and Saccharina latissima (S. latissima) are the most common species of macroalgae in the north Atlantic and north Pacific. Because of their interesting composition, they have recently attracted attention as useful biomass for various purposes such as for biochemicals and bioenergy production. Nevertheless, their composition varies according to the season and to the local environmental conditions. Therefore, in this study, different samples harvested throughout a year and in different locations in Denmark were analyzed. The aim of the study was identifying the best period of the year and location to cultivate macroalgae for biofuels and biochemical production. Therefore, the biogas potential and the total phenolics profile for L. digitata and S. latissima were determined. The total phenolics were determined as they may represent an interesting bioactive compound, due to their significant health benefits. The highest methane yield (358.9 ± 5.1 and 285.0 ± 19.1 N mL of CH4 g⁻¹ of volatile solids for L. digitata and S. latissima, respectively) and total phenolic content (TPC) content (47.4 ± 0.0 mg of TPC g⁻¹ of dry matter for L. digitata) were recorded in summer when the sugar level and the light intensity reached their maximum.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark
Authors: D’Este, M. (Intern), Alvarado-Morales, M. (Intern), Ciofalo, A. (Ekstern), Angelidaki, I. (Intern)
Number of pages: 10
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BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.49
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.34
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.3
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.52
ISI indexed (2013): ISI indexed yes
Gas Fuels, Biomass, Bioactive compounds, Bioenergy productions, Biofuels and biochemicals, Environmental conditions, Laminaria digitata, Saccharina latissima, Spatial variations, Total phenolic content, Biogas

DOIs:
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Source: FindIt
Source-ID: 235818786
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Måling af den totale metanemission fra Lemvig Biogasanlæg A.m.b.A - januar, 2017

General information
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Authors: Fredenslund, A. M. (Intern), Scheutz, C. (Intern)
Number of pages: 8
Publication date: 2017

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Original language: Danish
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
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Publication: Commissioned › Report – Annual report year: 2017

Måling af den totale metanemission fra Ribe Biogas A/S – 17. november 2017

General information
State: Published
Organisations: Department of Environmental Engineering, Air, Land & Water Resources
Authors: Fredenslund, A. M. (Intern), Scheutz, C. (Intern)
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Publication date: 2017
Måling af den totale metanemission fra Sønderjysk Biogas – 12. december 2017

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State: Published
Organisations: Department of Environmental Engineering, Air, Land & Water Resources
Authors: Fredenslund, A. M. (Intern), Scheutz, C. (Intern)
Number of pages: 8
Publication date: 2017

Måling af den totale metanemission fra Thorsø Miljø & Biogas – 16. og 17. november, 2017

General information
State: Published
Organisations: Department of Environmental Engineering, Air, Land & Water Resources
Authors: Fredenslund, A. M. (Intern), Scheutz, C. (Intern)
Number of pages: 8
Publication date: 2017

Måling af vandkvalitet i overløbsbygværker

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Olesen, L. (Intern), Mikkelsen, P. S. (Intern), Vezzaro, L. (Intern)
Pages: 9-12
Publication date: 2017
Main Research Area: Technical/natural sciences
Mapping of water consumption and associated energy use to estimate water savings potentials

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Skrydstrup, J. (Intern), Rygaard, M. (Intern)
Number of pages: 26
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Department of Environmental Engineering, Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 140784079
Publication: Commissioned › Report – Annual report year: 2017

Measuring biomarkers in wastewater as a new source of epidemiological information: Current state and future perspectives

The information obtained from the chemical analysis of specific human excretion products (biomarkers) in urban wastewater can be used to estimate the exposure or consumption of the population under investigation to a defined substance. A proper biomarker can provide relevant information about lifestyle habits, health and wellbeing, but its selection is not an easy task as it should fulfill several specific requirements in order to be successfully employed. This paper aims to summarize the current knowledge related to the most relevant biomarkers used so far. In addition, some potential wastewater biomarkers that could be used for future applications were evaluated. For this purpose, representative chemical classes have been chosen and grouped in four main categories: (i) those that provide estimates of lifestyle factors and substance use, (ii) those used to estimate the exposure to toxicants present in the environment and food, (iii) those that have the potential to provide information about public health and illness and (iv) those used to estimate the population size. To facilitate the evaluation of the eligibility of a compound as a biomarker, information, when available, on stability in urine and wastewater and pharmacokinetic data (i.e. metabolism and urinary excretion profile) has been reviewed. Finally, several needs and recommendations for future research are proposed.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies
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Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Environment International
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ISSN (Print): 0160-4120
Ratings:
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Original language: English

Biomarker, Consumption, Epidemiology, Exposure, Population, Wastewater

**DOIs:**


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Publication: Research - peer-review › Review – Annual report year: 2017
Measuring water heights in rivers and lakes from lightweight unmanned aerial vehicles (UAVs)

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Technical University of Denmark, DIH Denmark
Authors: Bandini, F. (Intern), Butts, M. (Ekstern), Olesen, D. (Ekstern), Jakobsen, J. (Ekstern), Bauer-Gottwein, P. (Intern)
Pages: 16-16
Publication date: 2017

Host publication information
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Place of publication: Frederiksberg
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Editors: Flindt Jørgensen, L., Mosolff Larsen, T., Jensen, B. K.
Main Research Area: Technical/natural sciences
Conference: 11th Annual Meeting of Danish Water Forum, Copenhagen, Denmark, 30/01/2017
Electronic versions:
Abstract proceedings book
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Measuring water level in rivers and lakes from lightweight Unmanned Aerial Vehicles

The assessment of hydrologic dynamics in rivers, lakes, reservoirs and wetlands requires measurements of water level, its temporal and spatial derivatives, and the extent and dynamics of open water surfaces. Motivated by the declining number of ground-based measurement stations, research efforts have been devoted to the retrieval of these hydraulic properties from spaceborne platforms in the past few decades. However, due to coarse spatial and temporal resolutions, spaceborne missions have several limitations when assessing the water level of terrestrial surface water bodies and determining complex water dynamics. Unmanned Aerial Vehicles (UAVs) can fill the gap between spaceborne and ground-based observations, and provide high spatial resolution and dense temporal coverage data, in quick turn-around time, using flexible payload design. This study focused on categorizing and testing sensors, which comply with the weight constraint of small UAVs (around 1.5 kg), capable of measuring the range to water surface. Subtracting the measured range from the vertical position retrieved by the onboard Global Navigation Satellite System (GNSS) receiver, we can determine the water level (orthometric height). Three different ranging payloads, which consisted of a radar, a sonar and an in-house developed camera-based laser distance sensor (CLDS), have been evaluated in terms of accuracy, precision, maximum ranging distance and beam divergence. After numerous flights, the relative accuracy of the overall system was estimated. A ranging accuracy better than 0.5 % of the range and a maximum ranging distance of 60 m were achieved with the radar. The CLDS showed the lowest beam divergence, which is required to avoid contamination of the signal from interfering surroundings for narrow fields of view. With the GNSS system delivering a relative vertical accuracy better than 3-5 cm, water level can be retrieved with an overall accuracy better than 5-7 cm.

General information
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Organisations: Department of Environmental Engineering, Water Resources Engineering, National Space Institute, Geodesy, Technical University of Denmark
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Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.89 SJR 1.745 SNIP 1.759
Web of Science (2016): Indexed yes
Mechanical pretreatment at harvesting increases the bioenergy output from marginal land grasses

Meadow grass has recently gained increased attention as a substrate for full-scale biogas reactors. However, to increase its biodegradability, pretreatment is needed. In the present work, different harvesting machines were compared in order to assess their effect on biogas production. Specifically, a Disc-mower, an Excoriator and a Chopper were used to define the most appropriate machinery in order to improve the energy output per hectare for full-scale biogas plants. Among the harvesters, Excoriator, a novel simultaneous harvest and mechanical treatment, was found to significantly increase the
methane yield of meadow grass by 20% compared to a classical Disc-mower. The positive effect was also validated by three kinetic model equations. The modified Gompertz model was the most capable of determining the kinetics of anaerobic digestion process, pointing out also the superiority of Excoriator. The usage of the novel harvester was associated with increased energy output, either for electrical/thermal energy generation or for transport fuel production, compared to the alternative machineries. Moreover, it was shown that the co-digestion of harvested biomass with different types of manure can enhance the bioenergy output of a full-scale biogas plant in a range of 12%-23%. (C) 2017 Elsevier Ltd. All rights reserved.
Meeting the needs for released nanomaterials required for further testing - the sun approach

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Environmental Chemistry, Swiss Federal Laboratories for Materials Testing and Research, RWTH Aachen University, University of Vienna
Authors: Nowack, B. (Ekstern), Boldrin, A. (Intern), Caballero, A. (Ekstern), Hansen, S. F. (Intern), Gottschalk, F. (Ekstern), Heggelund, L. R. (Intern), Hennig, M. (Ekstern), Mackevica, A. (Intern), Maes, H. (Ekstern), Navratilova, J. (Ekstern), Neubauer, N. (Ekstern), Peters, R. J. (Ekstern), Rose, J. (Ekstern), Schäffer, A. (Ekstern), Scifo, L. (Ekstern), Leeuwen, S. V. (Ekstern), Kammer, F. V. D. (Ekstern), Wohlleben, W. (Ekstern), Wyrwoll, A. (Ekstern), Hristozov, D. (Ekstern)
Number of pages: 1
Publication date: 2017

Membrane-aerated Nitrifying Biofilms: Continuous versus Intermittent Aeration
This study evaluated the process performance of a lab-scale membrane-aerated nitrifying biofilm under continuous versus intermittent aeration regimes. Effects of intermittent aeration on the competition between individual microbial communities and the emission of nitrous oxide (N2O) were specifically studied. The principle observation under continuous aeration was more efficient ammonium removal (4.3 gNH4+_N/m2/day) but also higher N2O emission (2.9% of the N loading) and minor anaerobic ammonium oxidizer (AMX) activity compared to intermittent aeration (3.1 gNH4+_N/m2/day, 0.3% of the N loading). AMX activity increased at the expense of decreasing nitrite oxidizer (NOB) activity with intermittent aeration. Dissolved oxygen and pH microprofiles under each aeration regimes revealed that the dynamic variation of pH relevant effects could be the potential causes to these different performances. A high intermittency in aeration favors the suppression of NOB with positive effects on N2O emission reduction

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Technical University of Denmark
Authors: Ma, Y. (Intern), Piscedda, A. (Ekstern), Smets, B. F. (Intern)
Metal stressors consistently modulate bacterial conjugal plasmid uptake potential in a phylogenetically conserved manner

The environmental stimulants and inhibitors of conjugal plasmid transfer in microbial communities are poorly understood. Specifically, it is not known whether exposure to stressors may cause a community to alter its plasmid uptake ability. We assessed whether metals (Cu, Cd, Ni, Zn) and one metalloid (As), at concentrations causing partial growth inhibition, modulate community permissiveness (that is, uptake ability) against a broad-host-range IncP-type plasmid (pKJK5). Cells were extracted from an agricultural soil as recipient community and a cultivation-minimal filter mating assay was conducted with an exogenous E. coli donor strain. The donor hosted a gfp-tagged pKJK5 derivative from which conjugation events could be microscopically quantified and transconjugants isolated and phylogenetically described at high resolution via FACS and 16S rRNA amplicon sequencing. Metal stress consistently decreased plasmid transfer frequencies to the community, while the transconjugal pool richness remained unaffected with OTUs belonging to 12 bacterial phyla. The taxonomic composition of the transconjugal pools was distinct from their respective recipient communities and clustered dependent on the stress type and dose. However, for certain OTUs, stress increased or decreased permissiveness by more than 1000-fold and this response was typically correlated across different metals and doses. The response to some stresses was, in addition, phylogenetically conserved. This is the first demonstration that community permissiveness is sensitive to metal(loid) stress in a manner that is both partially consistent across stressors and phylogenetically conserved. The ISME Journal advance online publication, 2 August 2016; doi:10.1038/ismej.2016.98.

General information
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Organisations: Department of Environmental Engineering, Water Technologies, University of Copenhagen
Authors: Klümper, U. (Intern), Dechesne, A. (Intern), Riber, L. (Ekstern), Brandt, K. K. (Ekstern), Gülay, A. (Intern), Sørensen, S. J. (Ekstern), Smets, B. F. (Intern)
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Web of Science (2015): Indexed yes
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"Metharmo" is setting the standards - joint european research project develops standards for determining methane emissions from anaerobic digestion plants

General information
State: Published
Organisations: Department of Environmental Engineering, Air, Land & Water Resources, DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH, University of Natural Resources and Life Sciences
Authors: Reinelt, T. (Ekstern), Clauss, T. (Ekstern), Hrad, M. (Ekstern), Scheutz, C. (Intern)
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Microalgae biorefinery symbiosis: screening, production, and process analytical technology
Microalgae treatment of municipal wastewater (WW) has been the focal point of microalgal biotechnology research for several decades. However, this technology did not have a competitive advantage over other WW treatment technologies, which could be implemented in smaller areal footprints. In the past few decades, microalgal WW treatment has made a resurgence with the idea of using biomass from microalgal WW treatment, as a source of lipids for conversion into biodiesel. However, the savings from the treatment of nutrients and organic matter, as well as biodiesel production, are still not competitive with the price of crude oil. In recent years, microalgal research continued with the prospect of a microalgae biorefinery, where microalgal byproducts and coproducts are extracted to valorize the entire microalgal production, in which the sum of the parts of the microalgae is greater than the whole microalgae. However, in large part, the microalgae biorefinery does not comply with the treatment of nutrient-rich municipal WWs, due to regulatory concerns.
Only recently, it was realized that bioindustrial WWs are viable and conceivably regulatory compliant nutrient rich waste streams, capable of sustaining microalgal growth, as much as municipal WWs. The concept of an “industrial symbiosis” has also emerged in the past several decades, in which networks of industries cooperate to use waste sources from neighboring industries, in industrial parks, to create added value. The intersection of the microalgae biorefinery and industrial symbiosis, in a microalgae biorefinery symbiosis (MBS), may be the next generation scheme to valorize the microalgal production and promote industrial and global sustainability. Moreover, technological advances in screening, outdoor photobioreactor (PBR) design, macromolecular monitoring and process automation must all be addressed to execute the complex bioprocesses needed to valorize an MBS successfully.

In order to properly identify viable MBS partnerships with industry, microalgal species capable of producing an array of valuable products must first be screened on these potential bioindustrial WW streams for their growth potential. During screening, microalgae may have a preference or aversion for a given bioindustrial WW media, based on the types and ratios of nitrogen (ammonium, nitrate, or urea) in the WW. Furthermore, identifying algae capable of withstanding fluctuations between these nitrogen forms in dynamic WWs, is an important criterion for productivity. However, when screening microalgae on WWs containing different nitrogen sources and concentrations, assimilation of different nitrogen sources can result in starkly different physiochemical changes, specifically pH changes. In many microalgae, ammonium is the preferred nitrogen source, because it can passively transport into the cell and is directly assimilated into amino acids, without relying on light-mediated enzymatic processes to be reduced. However, when microalgae assimilate ammonium, the pH of the system can drop sharply, inhibiting growth after that; however, these pH changes do not directly reflect the microalga’s affinity to grow on ammonium. By growing batch cultivations of microalgae in 24-well microplates, a microplate reader can be used to measure relative fluorescence of chlorophyll in vivo, during balanced growth, before these pH changes occur. This technique can be used to preempt the effects of pH changes on growth and reflects the true preference or aversion of microalgae to a particular nitrogen source or a WW media. Additionally, along with being spatially high-throughput in a 24-well microplate—where 24 batch reactions can be conducted simultaneously in a small footprint—the early and low detection of growth rates is also more temporally high-throughput than any other screening method. This method can also be used to quickly screen for robust and adaptable microalgae, capable of acclimatizing to different nitrogen sources and fluctuating media as well as to screen for the upper and lower tolerances of the microalgae to various concentrations of the WW. The latter must also be addressed when screening dynamic WW capable of large fluctuations.

Over the years, there have been very few demonstrations of outdoor microalgal growth in enclosed PBRs; demonstrations, which are essential for understanding the feasibility of an MBS as a whole. From microplate scales to large-scales—six orders of magnitude larger—the industrially important screened microalgae Chlorella sorokniana was grown on bioindustrial WW, inside a novel, solar tracking, 4000 L, airlift PBR. Despite cold temperatures and low irradiance, the microalgae reached a growth rate of 0.48 day⁻¹ in the four-day period immediately following inoculation of bioindustrial WW containing ammonium, as a primary nitrogen source. After that, after ammonium was depleted and the media was augmented with nitrate, a long lag phase persisted, before undergoing the predominant production phase with a specific growth rate (SGR) of 0.15 day⁻¹ over an 18-day period. It was evident that the transition from ammonium to nitrate metabolism can severely stunt microalgal growth in the outdoor PBR under low temperature and irradiance. More importantly, the delay in growth did not appear to be due to deleterious effects of the contents of bioindustrial WW media, since rapid growth was observed early in the experiment on the unaugmented WW. Moreover, it was demonstrated that microalgae could continue to grow in adverse environmental conditions at large-scales.

The success of the in vivo fluorescence microplate assay and the complexity of these outdoor reactions demonstrate the value of pursuing real-time data of microalgae “in vivo at large-scales. The complex and dynamic nature of large-scale outdoor microalgal reactions, when grown on dynamic WW media, encourages the need for on-line, real-time monitoring to improve automation models of PBRs. In outdoor conditions with fluctuating light and temperature, there are several factors that can change the growth of microalgae, at time-scales less than a minute and as low as microseconds, which may not be accounted for in microalgal productivity models. Similarly, fluctuations of WW media are not accounted for in these models, especially in outdoor conditions. However, recent advances in hardware and software can significantly improve microalgal bioprocess models and automation, by manipulating large, time-resolute data sets, so-called “big data,” which can be acquired through high-selectivity vibrational spectroscopy, such as mid-infrared (MIR), near-infrared (NIR), or Raman vibrational spectroscopies. These large, real-time data sets can now be used to create adaptive models from artificial intelligence/machine learning tools or “black-box” models, to automate large-scale, outdoor PBRs treating WW.

With microalgae, now entering into a new paradigm of food, feed, pharmaceuticals and functional products, on top of biofuels in a biorefinery, there will be a growing need to maintain product quality, regulate, and mitigate contamination, especially in a symbiosis with WW. Vibrational spectroscopies can be used to monitor several microalgal components simultaneously, which can be used to aid fractionation of microalgal compounds in a biorefinery, while improving model building for automation and control of product quality and contamination, where quality can be built into the system.

The results and research summarized in this thesis demonstrate that the modernization of microalgal research is becoming increasingly necessary and beneficial to microalgae production in an MBS. The focus of this thesis is to bring together lab-scale demonstrations, scaled up knowledge, and a critical outlook of modern technologies capable of making the MBS a reality.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, National Food Institute, Research Group for Bioactives – Analysis and Application
Microalgae are well known for their ability to accumulate lipids intracellularly, which can be used for biofuels and mitigate CO2 emissions. However, due to economic challenges, microalgae bioprocesses have maneuvered towards the simultaneous production of food, feed, fuel, and various high-value chemicals in a biorefinery concept. On-line and in-line monitoring of macromolecules such as lipids, proteins, carbohydrates, and high-value pigments will be more critical to maintain product quality and consistency for downstream processing in a biorefinery to maintain and valorize these markets. The main contribution of this review is to present current and prospective advances of on-line and in-line process analytical technology (PAT), with high-selectivity – the capability of monitoring several analytes simultaneously – in the interest of improving product quality, productivity, and process automation of a microalgal biorefinery. The high-selectivity PAT under consideration are mid-infrared (MIR), near-infrared (NIR), and Raman vibrational spectroscopies. The current review contains a critical assessment of these technologies in the context of recent advances in software and hardware in order to move microalgae production towards process automation through multivariate process control (MVPC) and software sensors trained on "big data". The paper will also include a comprehensive overview of off-line implementations of vibrational spectroscopy in microalgal research as it pertains to spectral interpretation and process automation to aid and motivate development.
Microbial biotechnologies for potable water production

Sustainable Development Goal 6 requires the provision of safe drinking water to the world. We propose that increased exploitation of biological processes is fundamental to achieving this goal due to their low economic and energetic costs. Biological processes exist for the removal of most common contaminants, and biofiltration processes can establish a biologically stable product that retains high quality in distribution networks, minimizing opportunities for pathogen invasion.

General information

State: Published
Organisations: Department of Environmental Engineering, Water Technologies
Authors: Fowler, S. J. (Intern), Smets, B. F. (Intern)
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Fowler_et_al_1094_Microbial_Biotechnology.pdf
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Microbial community changes in methanogenic granules during the transition from mesophilic to thermophilic conditions

Upflow anaerobic sludge blanket (UASB) reactor is one of the most applied technologies for various high-strength wastewater treatments. The present study analysed the microbial community changes in UASB granules during the transition from mesophilic to thermophilic conditions. Dynamicity of microbial community in granules was analysed using high-throughput sequencing of 16S ribosomal RNA gene amplicons, and the results showed that the temperature strictly determines the diversity of the microbial consortium. It was demonstrated that most of the microbes which were present in the initial mesophilic community were not found in the granules after the transition to thermophilic conditions. More specifically, only members from family Anaerolinaceae managed to tolerate the temperature change and contributed in maintaining the physical integrity of granular structure. On the contrary, new hydrolytic and fermentative bacteria were quickly replacing the old members in the community. A direct result from this abrupt change in the microbial diversity was the accumulation of volatile fatty acids and the concomitant pH drop in the reactor inhibiting the overall anaerobic digestion process. Nevertheless, by maintaining deliberately the pH levels at values higher than 6.5, a methanogen belonging to Methanoculleus genus emerged in the community enhancing the methane production.
Microbial community dynamics during a successful acclimation process to extremely high ammonia levels in continuous anaerobic digester

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Tian, H. (Intern), Fotidis, I. (Intern), Mancini, E. (Intern), Angelidaki, I. (Intern)
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Microbial electrochemical sensor for online ammonia monitoring of waste streams

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Authors: Zhao, N. (Intern), Angelidaki, I. (Intern), Zhang, Y. (Intern)
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Microbial electrolytic capture, separation and regeneration of CO2 for biogas upgrading
Biogas upgrading to natural gas quality is essential for the efficient use of biogas in various applications. Carbon dioxide (CO2) which constitutes a major part of the biogas is generally removed by physicochemical methods. However, most of the methods are expensive and often present environmental challenges. In this study, an innovative microbial electrolytic system was developed to capture, separate and regenerate CO2 for biogas upgrading without external supply of chemicals, and potentially to treat wastewater. The new system was operated at varied biogas flow rates and external applied voltages. CO2 was effectively separated from the raw biogas and the CH4 content in the outlet reached as high as 97.0±0.2% at the external voltage of 1.2 V and gas flow rate of 19.6 mL/h. Regeneration of CO2 was also achieved in the regeneration chamber with low pH (1.34±0.04). The relatively low electric energy consumption (≤0.15 kWh/m3) along with the H2 production which can contribute to the energy input makes the overall energy need of the system low, and thereby makes the technology promising. This work provides the first attempt for development of a sustainable biogas upgrading technology and potentially expands the application of microbial electrochemical technologies.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Jin, X. (Intern), Zhang, Y. (Intern), Li, X. (Intern), Zhao, N. (Intern), Angelidaki, I. (Intern)
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Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
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Microbial growth yield as a new parameter in environmental chemistry and risk assessment

General information
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Organisations: Department of Environmental Engineering, Environmental Chemistry, Helmholtz Centre for Environmental Research
Authors: Brock, A. L. (Intern), Kästner, M. (Ekstern), Trapp, S. (Intern)
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Source: PublicationPreSubmission
Source-ID: 138068776
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Microbial growth yield estimates from thermodynamics and its importance for degradation of pesticides and formation of biogenic non-extractable residues

In biodegradation studies with isotope-labelled pesticides, fractions of non-extractable residues (NER) remain, but their nature and composition is rarely known, leading to uncertainty about their risk. Microbial growth leads to incorporation of carbon into the microbial mass, resulting in biogenic NER. Formation of microbial mass can be estimated from the microbial growth yield, but experimental data is rare. Instead, we suggest using prediction methods for the theoretical yield based on thermodynamics. Recently, we presented the Microbial Turnover to Biomass (MTB) method that needs a minimum of input data. We have estimated the growth yield of 40 organic chemicals (31 pesticides) using the MTB and two existing methods. The results were compared to experimental values, and the sensitivity of the methods was assessed. The MTB method performed best for pesticides. Having the theoretical yield and using the released CO2 as a measure for microbial activity, we predicted a range for the formation of biogenic NER. For the majority of the pesticides, a considerable fraction of the NER was estimated to be biogenic. This novel approach provides a theoretical foundation applicable to the evaluation and prediction of biogenic NER formation during pesticide degradation experiments, and may also be employed for the interpretation of NER data from regulatory studies.
Microbial population dynamics in urban organic waste anaerobic co-digestion with mixed sludge during a change in feedstock composition and different hydraulic retention times

Microbial communities play an essential role in the biochemical pathways of anaerobic digestion processes. The correlations between microorganisms’ relative abundance and anaerobic digestion process parameters were investigated, by considering the effect of different feedstock compositions and hydraulic retention times (HRTs). Shifts in microbial diversity and changes in microbial community richness were observed by changing feedstock composition from mono-digestion of mixed sludge to co-digestion of food waste, grass clippings and garden waste with mixed sludge at HRT of 30, 20, 15 and 10 days. Syntrophic acetate oxidation along with hydrogenotrophic methanogenesis, mediated by Methanothermobacter, was found to be the most prevalent methane formation pathway, with the only exception of 10 days’ HRT, in which Methanosarcina was the most dominant archaea. Significantly, the degradation of complex organic polymers was found to be the most active process, performed by members of S1 (Thermotogales), Thermonema and Lactobacillus in a reactor fed with a high share of food waste. Conversely, Thermacetogenium, Anaerobaculum, Ruminococaceae, Porphyromonadaceae and the lignocellulosic-degrading Clostridium were the significantly more abundant bacteria in the reactor fed with an increased share of lignocellulosic biomass in the form of grass clippings and garden waste. Finally, microbes belonging to Coprothermobacter, Syntrophomonas and Clostridium were correlated significantly with the specific methane yield obtained in both reactors.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Fitamo, T. M. (Intern), Treu, L. (Intern), Boldrin, A. (Intern), Sartori, C. (Ekstern), Angelidaki, I. (Intern), Scheutz, C. (Intern)
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Microplastics as Vectors for Environmental Contaminants: Exploring Sorption, Desorption, and Transfer to Biota

The occurrence and effects of microplastics (MPs) in the aquatic environment are receiving increasing attention. In addition to their possible direct adverse effects on biota, the potential role of MPs as vectors for hydrophobic organic chemicals (HOCs), compared to natural pathways, is a topic of much debate. It is evident, however, that temporal and spatial variations of MP occurrence do (and will) occur. To further improve the estimations of the role of MPs as vectors for HOC transfer into biota under varying MP concentrations and environmental conditions, it is important to identify and understand the governing processes. Here, we explore HOC sorption to and desorption from MPs and the underlying principles for their interactions. We discuss intrinsic and extrinsic parameters influencing these processes and focus on the importance of the exposure route for diffusive mass transfer. Also, we outline research needed to fill knowledge gaps and improve model-based calculations of MP-facilitated HOC transfer in the environment. Integr Environ Assess Manag 2017;13:488–493. © 2017 SETAC

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Authors: Hartmann, N. B. (Intern), Rist, S. (Intern), Bodin, J. (Ekstern), Jensen, L. H. S. (Ekstern), Nørgaard Schmidt, S. (Intern), Mayer, P. (Intern), Meibom, A. (Ekstern), Baun, A. (Intern)
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Web of Science (2015): Indexed yes
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Scopus rating (2013): SJR 1.858 SNIP 1.384 CiteScore 2
ISI indexed (2013): ISI indexed no
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BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.794 SNIP 0.752
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.388 SNIP 0.557
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.752 SNIP 0.991
Scopus rating (2007): SJR 0.654 SNIP 0.584
Miljøprofessor: Vi skal gøre op med dysfunktionelle vandafgifter

Der er for lidt vægt på almindelig økonomisk rationalitet i forhold til vand, og det har medført dysfunktionelle vandafgifter, som bør ændres ved at reformere spildevandsafgiften og indføre en klima- og miljøafgift, skriver Erik Arvin, professor emeritus, DTU Miljø.

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Publication: Communication › Internet publication – Annual report year: 2017

Mitigation of methane emissions in a pilot-scale biocover system at the AV Miljø Landfill, Denmark: 1. System design and gas distribution

Greenhouse gas mitigation at landfills by methane oxidation in engineered biocover systems is believed to be a cost effective technology, but so far a full quantitative evaluation of the efficiency of the technology in full scale has only been carried out in a few cases. A third generation semi-passive biocover system was constructed at the AV Miljø Landfill, Denmark. The biocover system was fed by landfill gas pumped out of three leachate collection wells. An innovative gas distribution system was used to overcome the commonly observed surface emission hot spot areas resulting from an uneven gas distribution to the active methane oxidation layer, leading to areas with methane overloading. Performed screening of methane and carbon dioxide surface concentrations, as well as flux measurement using a flux chamber at the surface of the biocover, showed homogenous distributions indicating an even gas distribution. This was supported by results from a tracer gas test where the compound HFC-134a was added to the gas inlet over an adequately long time period to obtain tracer gas stationarity in the whole biocover system. Studies of the tracer gas movement within the biocover system showed a very even gas distribution in gas probes installed in the gas distribution layer. Also the flux of tracer gas out of the biocover surface, as measured by flux chamber technique, showed a spatially even distribution.

Installed probes logging the temperature and moisture content of the methane oxidation layer at different depths showed elevated temperatures in the layer with temperature differences to the ambient temperature in the range of 25–50 °C at the deepest measuring point due to the microbial processes occurring in the layer. The moisture measurements showed that infiltrating precipitation was efficiently drained away from the methane oxidation layer, even gas distribution to the active methane oxidation layer, leading to areas with methane overloading. Performed screening of methane and carbon dioxide surface concentrations, as well as flux measurement using a flux chamber at the surface of the biocover, showed homogenous distributions indicating an even gas distribution. This was supported by results from a tracer gas test where the compound HFC-134a was added to the gas inlet over an adequately long time period to obtain tracer gas stationarity in the whole biocover system. Studies of the tracer gas movement within the biocover system showed a very even gas distribution in gas probes installed in the gas distribution layer. Also the flux of tracer gas out of the biocover surface, as measured by flux chamber technique, showed a spatially even distribution.
drained away from the methane oxidation layer.
Mitigation of methane emissions in a pilot-scale biocover system at the AV Miljø Landfill, Denmark: 2. Methane oxidation

Greenhouse gas mitigation at landfills by methane (CH₄) oxidation in engineered biocover systems is believed to be a cost effective technology but so far a full quantitative evaluation of the efficiency of the technology in full scale has only been carried out in a few cases. A third generation semi-passive biocover system was constructed at the AV Miljø Landfill, Denmark. The biocover was fed by landfill gas pumped out of three leachate collection wells. An innovative gas distribution system was used to overcome the often observed uneven gas distribution to the active CH₄ oxidation layer resulting in overloaded areas causing CH₄ emission hot spot areas in the biocover surface. The whole biocover CH₄ oxidation efficiency was determined by measuring the CH₄ inlet load and CH₄ surface fluxes. In addition, CH₄ oxidation was determined for single points in the biocover using two different methods; the carbon mass balance method (based on CH₄ and carbon dioxide (CO₂) concentrations in the deeper part of the cover and CH₄ and CO₂ surface flux measurements) and a new-developed tracer gas mass balance method (based on CH₄ and tracer inlet fluxes and CH₄ and tracer surface flux measurements). Overall, the CH₄ oxidation efficiency of the whole biocover varied between 81 and 100% and showed that the pilot plant biocover system installed at AV Miljø landfill was very efficient in oxidizing the landfill CH₄. The average CH₄ oxidation rate measured at nine campaigns was approximately 13gm-2d-1. Extrapolating laboratory measured CH₄ oxidation rates to the field showed that the biocover system had a much larger CH₄ oxidation potential in comparison to the tested CH₄ load. The carbon mass balance approach compared reasonably well with the tracer gas mass balance approach when applied for quantification of CH₄ oxidation in single points at the biofilter giving CH₄ oxidation efficiencies in the range of 84 to a 100%. CH₄ oxidation rates where however much higher using the tracer gas balance method giving CH₄ oxidation rates between 7 and 124gm2d-1 compared to the carbon mass balance, which gave CH₄ oxidation rates -0.06 and 40gm2d-1. The study also revealed that the compost respiration contributed significantly to the measured CO₂ surface emission, and that the contribution of the compost respiration decreased significantly with time probably due to further maturation of the compost material.
Model-based identification of chemicals transformation pathways combined with reaction kinetics models— the case of heroin biomarkers in wastewater

General information
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Modeling multicomponent ionic dispersion, electrochemical migration, and chemical reactions in porous media with IPhreeqc coupling

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Organisations: Department of Environmental Engineering, Water Resources Engineering, University of Tubingen
Authors: Muniruzzaman, M. (Ekstern), Rolle, M. (Intern)
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Modeling of flow and transport processes in a fractured limestone aquifer

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, GEO Copenhagen, Capital Region of Denmark
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Modelling biotransformation of drug biomarkers by sewer biofilms

General information
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Organisations: Water Technologies, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS, Department of Environmental Engineering, Environmental Chemistry, University of Bath
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Modelling of green microalgal growth and algal storage processes using wastewater resources

Recent research focuses on the recovery of nutrients, water and energy from wastewater. Microalgal cultivation on wastewater resources is considered as a more sustainable means to produce fertilizers or biofuels. Innovative systems that incorporate microalgal cultivation into conventional wastewater processes have been developed. The effective design, optimisation and control of these systems require modelling tools that can readily extend existing benchmark models with new sub-models. Several process models have been developed to simulate algal growth. Some models include only one variable, e.g., light, whereas others include multiple variables, such as pH, nitrogen, phosphorus and organic carbon. This chapter aims to collect and describe green microalgal process models that can be used in wastewater resource recovery systems together with their limitations. Some of the listed models have been developed according to the activated sludge modelling (ASM) framework to facilitate the integration with existing modelling frameworks in water treatment. This chapter presents in detail the recently developed ASM-A biokinetic green microalgal process model. The model includes photoautotrophic and heterotrophic algal growth and uptake and storage of nutrients, including both nitrogen and phosphorus.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies
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Publication date: 2017

Modelling tools for integrating geological, geophysical and contamination data for characterization of groundwater plumes

Contaminated sites are a major issue threatening the environment and the human health. The large number of contaminated sites require cost effective investigations to perform risk assessment and prioritize the sites that need remediation. Contaminated soil and groundwater investigations rely on borehole investigations to collect the geological, hydrological, and contaminant data. These data are integrated in conceptual and mathematical models describing the lithology, the groundwater flow, and the distribution of contaminant concentrations. Models are needed to analyze the potential risks to all receptors, including streams. Key risk assessment parameters, such as contaminant mass discharge estimates, and tools are then used to evaluate the risk. The cost of drilling often makes investigations of large and/or deep contaminant plumes unfeasible. For this reason, it is important to develop cost effective tools that reduce the number of drillings required for proper characterization of contaminant plumes. Among these tools, non-invasive surface direct current resistivity and induced polarization (DCIP) geophysical methods for contaminant plume investigations are promising. DCIP surveys provide data on the electrical properties of soil and groundwater. Thus, interpretation of DCIP surveys can supply indirect information on the geological and hydrological properties of soils. In addition, DCIP methods can be used to describe the distribution of concentration of ions in groundwater. However, the effects on the electrical signal of soil properties and of ionic compounds in groundwater can be similar. This means that the interpretation of DCIP surveys is challenging when contaminant plumes are present. Furthermore, these new types of data need to be integrated with the geological, hydrological, and contaminant data in modelling tools used for investigations of contaminated sites. This thesis presents the development of modelling tools to integrate DCIP methods with geological, hydrological and contaminant concentration data. The developed tools describe groundwater flow to meandering streams, map the distribution of contaminant plumes in contaminant plumes, and estimate the contaminant mass discharge. The tools are tested at the Grindsted landfill site and at the Grindsted stream site where a contaminant plume from a former factory site is discharging to the stream.

Groundwater flow to streams is affected by many factors, including stream channel geometry. In this study, numerical models simulating groundwater flow to synthetic sinuous streams and to a real meandering stream were developed. Comparison of the models showed that groundwater discharge to streams is greatly affected by the geometry of meanders. Groundwater flow paths near streams are also affected by the combination of meander bends and aquifer properties, such as the groundwater flow direction in the aquifer. The three-dimensional (3D) characteristics of the flow paths require 3D modelling tools to properly describe these sites. This is confirmed by the migration of the contaminant plume originating from the old factory site and discharging to Grindsted stream. Groundwater flow simulations, developed using on a 3D hydrogeological model of the site, were combined with chemical fingerprinting. This indicated that a low permeability layer separates the contaminant plume in a
shallow and a deep plume. These plumes have different chemical characteristics and different migration paths to the
stream. This has implications for the risk assessment of the stream and groundwater in the area.
The difficulty of determining groundwater flow paths means that it is also difficult to predict the distribution of contaminants
in the subsurface. Anomalies in DCIP surveys near contaminated sites have been used to indicate the presence of plumes
with high concentrations of ionic compounds, such as landfill leachate plumes. In some field studies, DCIP anomalies
have also been used to detect the presence of microbial degradation of dissolved organic contaminants. This study
presents a conceptual model describing the possible links between inorganic and organic contaminants often found at
contaminated sites and plumes. The model was used to establish correlations between DCIP derived bulk electrical
conductivity and the distribution of concentration of selected inorganic compounds (e.g. chloride and dissolved iron) in the
contaminant plumes originated from the landfill site and the factory site. DCIP derived data could also describe the
distribution of selected xenobiotic organic compounds, including pharmaceutical compounds and chlorinated ethenes. The
correlation between DCIP and organic compounds is indirect and depends on the chemical composition of the
contaminant plume and the transport processes. Thus, the correlations are site specific and may change between different
parts of a contaminated site.
DCIP data are also useful in risk assessments based on contaminant mass discharge, which is a measure of the
contaminant load on an aquifer. Contaminant mass discharge estimations often rely on multilevel wells to collect
information on contaminant concentrations and groundwater flux. Thus, the error of the contaminant mass discharge
depends on the density of the samples, on the site heterogeneity, and on the accuracy of the interpolation between data
points. A novel contaminant mass discharge method was developed which integrates contaminant concentration data and
DCIP data. The method enabled the determination of mass discharge with a lower error compared to only using
contaminant concentrations. However, the method can only be applied when a correlation between DCIP and contaminant
concentrations can be established. The geophysics based method performed better at low sample densities; thus, the
geophysics based contaminant mass discharge method is in particular valuable at large sites and deep plumes, where the
drilling costs often do not allow the installation of a sufficient number of sampling points.
In conclusion, this PhD project has developed new ways to improve contaminated site investigations by employing
integrated surface DCIP geophysical data with modelling tools for contaminant plume characterization. These combined
technologies may improve our ability to map groundwater flow and contaminant plumes more efficiently in the future.
Monitoring recent lake level variations on the Tibetan Plateau using CryoSat-2 SARIn mode data

Lakes on the Tibetan Plateau (TP) are of great interest due to their value as water resources but also as an important indicator of climate change. However, in situ data in this region are extremely scarce and only a few lakes have gauge measurements. Satellite altimetry has been used successfully to monitor lake levels. In this study, CryoSat-2 SARIn mode data over the period 2010–2015 are used to investigate recent lake level variations. The estimated water levels of the 70 largest lakes (> 100 km²) on the TP show that 48 lakes reveal a rising trend (avg. 0.28 ± 0.06 m/yr) while the other 22 show a slightly decreasing trend (avg. −0.10 ± 0.04 m/yr). To compare with the change rates during 2003–2009, ICESat data which cover 42 of the 70 lakes are also used. When combining the data, the results show that during the period of 2003–2015, 28 lakes maintained a rising trend and the change rates are comparable. Lakes in the northern part of the TP experienced pronounced rising (avg. 0.37 ± 0.10 m/yr), while lakes in southern part were steady or decreasing even in glaciated basins with high precipitation. Factor analysis indicates that driving factors for lake change are variable due to high spatial heterogeneity. However, autumn/winter temperature plays an important role in lake level change. These results demonstrate that lakes on the TP are still rapidly changing under climate change, especially in northern part of the TP, but the driving factors are variable and more research is needed to understand the mechanisms behind observed changes.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, National Space Institute, Geodesy
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Web of Science (2016): Indexed yes
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Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 1.679 SNIP 2.005 CiteScore 3.45
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Web of Science (2013): Indexed yes
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Moving bed biofilm reactors (MBBRs) for removal of pharmaceuticals in biological wastewater treatment

General information
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Organisations: Department of Environmental Engineering, Water Technologies, Environmental Chemistry, AnoxKaldnes AB
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Multi-Objective Optimization for Analysis of Changing Trade-Offs in the Nepalese Water-Energy-Food Nexus with Hydropower Development

While the water-energy-food nexus approach is becoming increasingly important for more efficient resource utilization and economic development, limited quantitative tools are available to incorporate the approach in decision-making. We
propose a spatially explicit framework that couples two well-established water and power system models to develop a
decision support tool combining multiple nexus objectives in a linear objective function. To demonstrate our framework, we
compare eight Nepalese power development scenarios based on five nexus objectives: minimization of power deficit,
maintenance of water availability for irrigation to support food self-sufficiency, reduction in flood risk, maintenance of
environmental flows, and maximization of power export. The deterministic multi-objective optimization model is spatially
resolved to enable realistic representation of the nexus linkages and accounts for power transmission constraints using an
optimal power flow approach. Basin inflows, hydropower plant specifications, reservoir characteristics, reservoir rules,
irrigation water demand, environmental flow requirements, power demand, and transmission line properties are provided
as model inputs. The trade-offs and synergies among these objectives were visualized for each scenario under multiple
environmental flow and power demand requirements. Spatially disaggregated model outputs allowed for the comparison of
scenarios not only based on fulfillment of nexus objectives but also scenario compatibility with existing infrastructure,
supporting the identification of projects that enhance overall system efficiency. Though the model is applied to the
Nepalese nexus from a power development perspective here, it can be extended and adapted for other problems.

General information
State: Published
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Scopus rating (2016): CiteScore 2.05 SJR 0.548 SNIP 1.079
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N2O and NO dynamics in AOB-enriched and mixed-culture biomass: experimental observations and model calibration

General information
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Organisations: Department of Environmental Engineering, Water Technologies, Department of Chemical and Biochemical Engineering
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Number of pages: 1
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N2O and NO dynamics in AOB-enriched and mixed-culture biomass: Experimental Observations and Model Calibration

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Authors: Domingo-Felez, C. (Intern), Plósz, B. G. (Intern), Sin, G. (Intern), Smets, B. F. (Intern)
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N2O emission from plant surfaces – light stimulated and a global phenomenon
Nitrous oxide (N2O) is an important long-lived greenhouse gas and precursor of stratospheric ozone depleting mono-nitrogen oxides. The atmospheric concentration of N2O is persistently increasing; however, large uncertainties are associated with the distinct source strengths. Here we investigate for the first time N2O emission from terrestrial vegetation in response to natural solar ultra violet radiation. We conducted field site measurements to investigate N2O atmosphere exchange from grass vegetation exposed to solar irradiance with and without UV-screening. Further laboratory tests were conducted with a range of species to study the controls and possible loci of UV-induced N2O emission from plants. Plants released N2O in response to natural sunlight at rates of c.20-50 nmol m-2 h-1, mostly due to the UV component. The emission rate is temperature dependent with a rather high activation energy indicative for an abiotic process. The prevailing zone for the N2O formation appears to be at the very surface of leaves. However, only c. 26% of the UV-induced N2O appears to originate from plant-N. Further, the process is dependent on atmospheric oxygen concentration. Our work demonstrates that ecosystem emission of the important greenhouse gas, N2O, may be up to c. 30% higher than hitherto assumed.

General information
State: Published
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Journal: Geophysical Research Abstracts
NanoCRED: A transparent framework to assess the regulatory adequacy of ecotoxicity data for nanomaterials – relevance and reliability revisited

Environmental hazard and risk assessment serve as the basis for regulatory decisions to protect the environment from unintentional adverse effects of chemical substances including nanomaterials. This process requires reliable and relevant environmental hazard data upon which classification and labelling can be based and Predicted No-Effect Concentration (PNEC) values can be estimated. In a regulatory context ecotoxicological data is often recommended to be generated according to accepted and validated test guidelines, preferably also following Good Laboratory Practice. However, engineered nanomaterials are known to behave very differently in ecotoxicity tests compared to the conventional soluble chemicals, for which most guidelines were developed. Therefore non-guideline tests, or tests following modified test guidelines, can provide valuable information and should not per se be considered less adequate for regulatory use. Here we propose a framework for reliability and relevance evaluation of ecotoxicity data for nanomaterials that take into account the challenges and characterisation requirements associated with testing of these substances. The nanoCRED evaluation criteria, and accompanying guidance, were developed to be used in combination with those developed through the 'Criteria for Reporting and Evaluating Ecotoxicity Data (CRED)' project. This approach can accommodate all types of nanomaterials, all types of aquatic ecotoxicity studies, and qualitative as well as quantitative data evaluation requirements. Furthermore, it is practically feasible to implement and directly applicable in European as well as international regulatory frameworks.

General information
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Organisations: Department of Environmental Engineering, Environmental Chemistry, Stockholm University
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Nanocotoxicology, Chemical risk assessment, Data evaluation, REACH, Predicted no-effect concentration
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Nanoscale Coloristic Pigments: Upper Limits on Releases from Pigmented Plastic during Environmental Aging, In Food Contact, and by Leaching

The life cycle of nanoscale pigments in plastics may cause environmental or human exposure by various release scenarios. We investigated spontaneous and induced release with mechanical stress during/after simulated sunlight and rain degradation of polyethylene (PE) with organic and inorganic pigments. Additionally, primary leaching in food contact and secondary leaching from nanocomposite fragments with an increased surface into environmental media was examined. Standardized protocols/methods for release sampling, detection, and characterization of release rate and form were applied: Transformation of the bulk material was analyzed by Scanning Electron Microscopy (SEM), X-ray-
tomography and Fourier-Transform Infrared spectroscopy (FTIR); releases were quantified by Inductively Coupled Plasma Mass Spectrometry (ICP-MS), single-particle-ICP-MS (sp-ICP-MS), Transmission Electron Microscopy (TEM), Analytical Ultracentrifugation (AUC), and UV/Vis spectroscopy. In all scenarios, the detectable particulate releases were attributed primarily to contaminations from handling and machining of the plastics, and were not identified with the pigments, although the contamination of 4 mg/kg (Fe) was dwarfed by the intentional content of 5800 mg/kg (Fe as Fe2O3 pigment). We observed modulations (which were at least partially preventable by UV stabilizers) when comparing as-produced and aged nanocomposites, but no significant increase of releases. Release of pigments was negligible within the experimental error for all investigated scenarios, with upper limits of 10 mg/m2 or 1600 particles/mL. This is the first holistic confirmation that pigment nanomaterials remain strongly contained in a plastic that has low diffusion and high persistence such as the polyolefin High Density Polyethylene (HDPE).

General information
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Organisations: National Food Institute, Department of Environmental Engineering, Environmental Chemistry, BASF, Aix-Marseille University, University of Vienna
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Web of Science (2016): Indexed yes
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Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.103 CiteScore 5.52
ISI indexed (2013): ISI indexed yes
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BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.146 SNIP 2.056 CiteScore 5.17
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Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
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ISI indexed (2011): ISI indexed yes
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Scopus rating (2010): SJR 2.964 SNIP 1.729
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Scopus rating (2009): SJR 2.835 SNIP 1.803
Niche differentiation and evolution of comammox Nitrospira through a comparative genomics analysis

Nitrification, the biological oxidation of ammonium to nitrate, is a fundamental process in the nitrogen cycle and plays an important role in natural and engineered systems. Throughout the last century, nitrification was assumed to be a two-step process executed by two different functional groups, ammonia oxidizing prokaryotes (AOP) and nitrite oxidizing bacteria (NOB). Recently, several articles have shown the capability of a single microorganism, belonging to the genus Nitrospira, to carry out the complete oxidation of ammonia to nitrate (comammox). Nitrospira spp. are widespread in both natural and engineered ecosystems associated with nitrogen cycling and different species are frequently observed to coexist in the same environment. Besides recent discoveries pointing towards versatile metabolism in some Nitrospira species, little is known about the functional potential of the two comammox Nitrospira clades, and the factors involved in niche-partitioning between comammox and canonical Nitrospira.

A comparative genomics analysis was conducted with five genomes recovered from a groundwater-fed rapid sand filter (including both comammox clades and a nitrite-oxidizing Nitrospira population genome) and high quality published Nitrospira genomes, to reveal distinct genomic features within Nitrospira. In addition, we investigated the evolution of the ammonia oxidation pathway in comammox Nitrospira. This analysis revealed distinct genetic capabilities of the different comammox clades and canonical Nitrospira which can help to explain the coexistence and niche partitioning of Nitrospira spp. These divergences range from the nitrogen source utilization capacity to the ability for electron donor versatility, and other characteristics such as stress response. With respect to the evolutionary history of comammox Nitrospira, our analysis indicates transfer events with betaproteobacterial ammonia oxidizers. In addition, transfer events between comammox clade A and clade B were also detected for genes belonging to the ammonium oxidation pathway. Together, these results expand the actual knowledge of the ecology and evolution of the recently discovered comammox Nitrospira.
Niche partitioning within genus Nitrospira is affected by environmental copper concentration

Nitrification is a dominant process in groundwater-fed rapid sand filters (RSFs) used for drinking water purification. Near complete removal of ammonium and nitrite is required in the EU and Denmark due to strict regulatory limits that enable high water stability in the distribution system. Previous work has revealed that in poorly functioning filters, the addition of trace copper can increase the rate of nitrification, leading to increased removal of ammonium and nitrite to below regulatory limits. RSFs are a unique environment harboring diverse microbial communities including a range of nitrifying bacteria; Betaproteobacterial ammonia oxidizers (Nitrosomonas, Nitrosospira; AOB), ammonia oxidizing archaea (AOA), diverse heterotrophs potentially capable of ammonia and/or nitrite oxidation and a large fraction of Nitrospira spp., recently shown to comprise both nitrite oxidizers and comammox Nitrospira spp.. This diversity points towards extensive niche partitioning within the nitrifying guild, and particularly within Nitrospira which generally comprises between 10 and 65% of the total filter community. Copper is a co-factor in the ammonia monoxygenase enzyme and is thus an essential and at times limiting nutrient in nitrifying environments. We sought to examine the effects of copper on niche partitioning within the genus Nitrospira in full-scale filters. Sand samples from the top of an after-filter that displayed incomplete ammonium oxidation at Nærum waterworks were taken prior to Cu dosing treatment and 4 months following the commencement of low-level Cu dosing (~ μg Cu L-1). Copper treatment had an immediate effect on nitrification, resulting in removal of ammonium and nitrite to below regulatory levels. DNA was extracted from sand samples and was subject to qPCR and amplicon based Illumina sequencing of Nitrospira nxrB (nitrite reductase B-subunit) and amoA genes using newly designed primers targeting clades A and B comammox. Quantitative PCR revealed that Cu addition resulted in a 4-fold increase of total Nitrospira, but a 5-fold decrease in the abundance of comammox Nitrospira. However, further examination of the qPCR melt curves and amoA sequence data revealed that the reduction in comammox Nitrospira resulted from the near complete loss of Clade B comammox, while Clade A comammox were present at similar absolute abundances as in the community prior to copper dosing. The reasons for the loss of Clade B comammox are currently unclear. Higher sensitivity to copper toxicity in Clade B relative to Clade A and nitrite-oxidizing Nitrospira seems unlikely due to the extremely low copper concentrations applied. An overall stimulation of the growth of nitrifying bacteria occurred once copper limitation was removed, likely resulting in the out-competition of Clade B Nitrospira ammonium oxidizers. These results suggest that copper availability plays a role in determining the diversity and distribution of Nitrospira spp. in nitrifying environments.
Nitrogen recovery from wastewater to produce microbial protein using methane oxidizing bacteria

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Residual Resource Engineering, Technical University of Denmark
Authors: Xing, W. (Ekstern), Valverde Pérez, B. (Intern), Pape, M. L. (Ekstern), De Francisci, D. (Intern), Smets, B. F. (Intern)
Number of pages: 2
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Event: Abstract from Conference on Sustainable Wastewater Treatment and Resource Recovery: Research, Planning, Design and Operation, Chongqing, China.
Main Research Area: Technical/natural sciences
Nutrient recovery, Single cell protein (SCP), Methane oxidizing bacteria (MOB)
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Nitrotoga is selected over Nitrospira in newly assembled biofilm communities from a tap water source community at increased nitrite loading

Community assembly is a central topic in microbial ecology: how do assembly processes interact and what is the relative contribution of stochasticity and determinism? Here, we exposed replicate flow-through biofilm systems, fed with nitrite-supplemented tap water, to continuous immigration from a source community, present in the tap water, to determine the extent of selection and neutral processes in newly assembled biofilm communities at both the community and the functional guild (of nitrite-oxidizing bacteria, NOB) levels. The community composition of biofilms assembled under low and high nitrite loading was described after 40 days of complete nitrite removal. The total community assembly, as well as the NOB guild assembly were largely governed by a combination of deterministic and stochastic processes. Furthermore, we observed deterministic enrichment of certain types of NOB in the biofilms. Specifically, elevated nitrite loading selected for a single Nitrotoga representative, while lower nitrite conditions selected for a number of Nitrospira. Therefore, even when focusing on ecologically coherent ensembles, assembly is the result of complex stochastic and deterministic processes that can only be interrogated by observing multiple assemblies under controlled conditions. This article is protected by copyright. All rights reserved.

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Organisations: Department of Environmental Engineering, Water Technologies, Urban Water Systems
Authors: Kinnunen, M. (Intern), Gülay, A. (Intern), Albrechtsen, H. (Intern), Dechesne, A. (Intern), Smets, B. F. (Intern)
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Main Research Area: Technical/natural sciences

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Nitrous oxide Production in Membrane-aerated Nitrifying Biofilms: Experimentation and Modelling

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Organisations: Department of Environmental Engineering, Water Technologies
Authors: Ma, Y. (Intern), Domingo-Felez, C. (Intern), Smets, B. F. (Intern)
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Normal and Inverse Diffusive Isotope Fractionation of Deuterated Toluene and Benzene in Aqueous Systems

Diffusive isotope fractionation of organic contaminants in aqueous solution is difficult to quantify, and only a few experimental data sets are available for compounds of environmental interest. In this study, we investigate diffusive fractionation of perdeuterated and nondeuterated benzene and toluene. Multitracer experiments were carried out in 1-D gel dissection tubes and in a quasi-2-D flow-through porous medium. The experiments allowed us to simultaneously and directly compare the diffusive and dispersive behavior of benzene and toluene. We observed an unexpected, opposite behavior of the two monoaromatic hydrocarbons. Toluene showed a normal diffusive isotope effect (DC7D8/DC7H8 = 0.96) with enrichment of the nondeuterated isotopologue in the direction of the diffusive and transverse dispersive fluxes. Conversely, the measured trends for benzene indicate inverse diffusive fractionation (DC6D6/DC6H6 = 1.02), with a remarkably faster diffusion rate of the perdeuterated isotopologue that was enriched in the downgradient portion of the diffusion tubes and at the fringes of the contaminant plumes in the flow-through setup. These outcomes can neither be interpreted as mass-dependent fractionation nor be described as purely hydrodynamic (i.e., mass independent) effects. The results of this study are relevant for the use of labeled/nonlabeled mixtures of organic compounds as conservative and (bio)reactive tracers in environmental applications.

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Authors: Rolle, M. (Intern), Jin, B. (Intern)
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Not all that glitters is gold - Electron microscopy study on uptake of gold nanoparticles in Daphnia magna and related artefacts

Increasing use of engineered nanoparticles has led to extensive research into their potential hazards to the environment and human health. Cellular uptake from the gut is sparsely investigated and microscopy techniques applied for uptake studies can result in misinterpretations. Various microscopy techniques are used to investigate internalization of 10nm
gold nanoparticles in Daphnia magna gut lumen and gut epithelial cells upon 24h exposure and outline potential artefacts, i.e. high contrast precipitates from sample preparation related to these techniques. Light sheet microscopy confirmed accumulation of gold nanoparticles in the gut lumen. Scanning transmission electron microscopy and elemental analysis revealed gold nanoparticles attached to the microvilli of gut cells. Interestingly, the peritrophic membrane appeared to act as a semipermeable barrier between the lumen and the gut epithelium, permitting only single particles through. Structures resembling nanoparticles were also observed inside gut cells. As elemental analysis could not verify these to be gold they were likely artifacts from the preparation, such as osmium and iron. Importantly, gold nanoparticles were in fact found inside holocrine cells with disrupted membranes. Thus, false positive observations of nanoparticle internalization may result from either preparation artefacts or by mistaking disrupted cells for intact. These findings emphasize the importance of cell integrity and combining elemental analysis with the localization of internalized nanoparticles using transmission electron microscopy.

General information
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Organisations: Center for Electron Nanoscopy, Department of Environmental Engineering, Environmental Chemistry, Department of Micro- and Nanotechnology, Molecular Windows, Roskilde University
Authors: Jensen, L. H. S. (Intern), Skjolding, L. M. (Intern), Thit, A. (Ekstern), Sørensen, S. N. (Intern), Købler, C. (Intern), Mølhave, K. (Intern), Baun, A. (Intern)
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Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.506 SNIP 1.129 CiteScore 2.89
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 1.653 SNIP 1.092 CiteScore 2.88
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
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Web of Science (2012): Indexed yes
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Scopus rating (2011): SJR 1.937 SNIP 1.168 CiteScore 3.05
ISI indexed (2011): ISI indexed yes
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Scopus rating (2009): SJR 1.613 SNIP 1.047
Web of Science (2009): Indexed yes
Novel bio-electro-Fenton technology for azo dye wastewater treatment using microbial reverse-electrodialysis electrolysis cell

Development of sustainable technologies for treatment of azo dyes containing wastewaters has long been of great interest. In this study, we proposed an innovative concept of using microbial reverse-electrodialysis electrolysis cell (MREC) based Fenton process to treat azo dye wastewater. In such MREC-Fenton integrated process, the production of $\text{H}_2\text{O}_2$, which is the key reactant of fenton-reaction was driven by the electrons harvested from the exoelectrogens and salinity-gradient between sea water and fresh water in MREC. Complete decolorization and mineralization of 400 mg L$^{-1}$ Orange G was achieved with apparent first order rate constants of 1.15 ± 0.06 and 0.26 ± 0.03 h$^{-1}$, respectively.

Furthermore, the initial concentration of orange G, initial solution pH, catholyte concentration, high and low concentration salt water flow rate and air flow rate were all found to significantly affect the dye degradation. This study provides an efficient and cost-effective system for the degradation of non-biodegradable pollutants.
Microbial Reverse-electrodialysis Electrolysis cell (MREC), Fenton reaction, Salinity gradient, Azo dye, Wastewater, Biological process

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Aquaporin proteins are of great interest to the membrane science community because of their unique characteristics of high water permeability and perfect molecular selectivity. Although these characteristics make aquaporins particularly valuable for desalination applications, none of these aquaporin-based membrane designs has been produced at a large scale. In this work, we report on the recently designed and commercially available Aquaporin Inside flat-sheet membrane designed for forward osmosis (FO) by Aquaporin A/S, Lyngby, Denmark. The Aquaporin Inside flat-sheet membrane is the first commercially available thin-film composite (TFC) FO membrane to incorporate aquaporin proteins into its polyamide-based selective layer. The membrane tested, which is a first-generation membrane, achieved water fluxes of 14.0 and 8.8 L m⁻² h⁻¹ with low reverse salt fluxes of 4.6 and 4.0 g m⁻² h⁻¹ in pressure-retarded osmosis (PRO) and FO modes, respectively, using 1.0 M sodium chloride as the draw solution and deionized water as the feed solution. The membrane structural parameter was calculated to be 630 μm, which is similar to those of existing commercial membrane options for FO. The Aquaporin Inside membrane was found to exhibit water and reverse solute flux performances similar to those of other commercially available varieties, although this membrane represents one of the few TFC membranes that is available to the academic community for FO testing at the time of this writing.
Novel pre-treatments to control bromate formation during ozonation

Worldwide water shortage increase and water quality depletion from microbial and chemical compounds, pose significant challenges for today’s water treatment industry. Both the development of new advanced oxidation technologies, but also the enhancement of existing conventional technologies is of high interest. This study tested improvements to conventional ozonation that reduce the formation of the oxidation-by-product bromate, while maintaining the effectiveness for removal of emerging contaminants (atrazine). MnO4−, ClO2−, ClO2, ClO−, CH3COOO−, HSO5− or S2O8−2 with NH4+ were tested as pre-treatments to ozonation of ground water. Each oxidant and NH4+ were added in a single stage or separately prior to ozonation. To the best of our knowledge, this is the first study that has tested all the above-mentioned oxidants for the same water matrix. Based on our results, the most promising pre-treatments were MnO4−-NH4+, ClO2−-NH4+ and ClO2-NH4+. MnO4−-NH4+ was the only pre-treatment that didn’t inhibit atrazine removal. When compared with the previously proposed Cl2/NH4+ pre-treatment, MnO4− + NH4+ was found as effective for preventing BrO3− formation, while atrazine removal was higher. In addition, MnO4− + NH4+ can be added in a single stage (compared to the 2 stage addition of Cl2/NH4+) without causing the formation of potentially harmful chlorination-by-products.

General information

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Organisations: Department of Environmental Engineering, Water Technologies, Siemens
Authors: Antoniou, M. (Intern), Sichel, C. (Ekstern), Andre, K. (Ekstern), Andersen, H. R. (Intern)
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Novel protocol for lutein extraction from microalga Chlorella vulgaris

Lutein is a pigment generally extracted from marigold flowers. However, lutein is also found in considerable amounts in microalgae. In this study a novel method was developed to improve the extraction efficiency of lutein from microalga C. vulgaris. Differently from conventional methods, ethanol was used instead of water in the saponification step, which was conducted simultaneously to the solvent extraction, performed using dichloromethane. The amount of lutein extracted from C. vulgaris dried biomass increased more than threefold, from 0.20 ± 0.00 mg\textsubscript{Lutein}/g\textsubscript{DM} to 0.69 ± 0.08 mg\textsubscript{Lutein}/g\textsubscript{DM}. Lutein purity was increased from 73.6% to 93.7% by decreasing the ethanol-water ratio from 85% to 50% in the resolubilation step. The novel method was also tested with tetrahydrofuran. The extraction proved to be again more effective than the conventional one; however dichloromethane outperformed tetrahydrofuran in terms of quantity and purity of the recovered lutein.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: D'Este, M. (Intern), De Francisci, D. (Intern), Angelidaki, I. (Intern)
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Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
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Web of Science (2007): Indexed yes
Numerical Weather Prediction and Relative Economic Value framework to improve Integrated Urban Drainage-Wastewater management

Integrated urban drainage-wastewater systems (IUDWSs) are challenged by the need for higher environmental and health standards and the increased frequency of heavy rain storms caused by climatic change. Real-time control (RTC) offers an alternative to the construction of costly facilities in cities where space is scarce and large-scale construction work a nuisance. This thesis focuses on flow domain predictions of IUDWS from numerical weather prediction (NWP) to select relevant control objectives for the IUDWS and develops a framework based on the relative economic value (REV) approach to evaluate when acting on the forecast is beneficial or not.

Rainfall forecasts are extremely valuable for estimating near future storm-water-related impacts on the IUDWS. Therefore, weather radar extrapolations “nowcasts” provide valuable predictions for RTC. However, radar nowcasts are limited by their prediction horizon of 1 to 2 hours and RTC of IUDWS could benefit from longer forecast horizons. The development of NWP models in parallel to the increase in computational power has led to limited area models (LAM) with increasingly finer spatial-temporal resolution, opening the possibility to use such weather forecast products in urban water management. NWPs are complementary to radar forecasts, providing predictions on a longer time scale (days). However, atmospheric motions are chaotic and highly nonlinear. Applying NWP to urban catchments, which often have a similar size to a single NWP grid cell, is limited by scientific gaps on how to deal with this poor spatial and temporal resolution for urban hydrology application. Its predictive skills and uncertainty, etc. Forecast uncertainty is commonly described by meteorologist using ensemble prediction systems (EPS). This thesis used the outcome of the DMI-HIRLAM-S05 model which generates an EPS of 25 members. Each forecast ensemble provides hourly time step predictions over a forecast horizon of 54 hours with a horizontal resolution of 0.05° (approx. 5.6 km).

In order to evaluate the predictions based on the end-user perspective, namely the flow in the IUWDS, a case study was established for the urban catchment of Damhuså in Copenhagen, Denmark, and a rainfall-runoff model associated to it was developed. Hence, the predictions were therefore not assessed against observed rainfall but against observed flow at the end of the coupled hydro-meteorological model chain. The predictions were assessed based on flow domain prediction, distinguishing between high and low flow events. The combination of the different possibilities between observations and forecasts can be summarised in the 2x2 contingency table containing the four possible pairs of forecast-observation: hits (correct positives), false alarms (false positives), misses (false negatives) and correct negatives. The outcome of the contingency table were used to calculate skill scores like the probability of detection (PoD) and the probability of false detection (PoFD) and to plot the relative operating characteristic (ROC) diagram illustrating the discrimination skill of the NWP EPS prediction.

Using verification methods from meteorology on flow predictions showed that NWPs have poor precision at such fine resolution. Therefore, NWP post-processing methods are necessary to cope with this limitation, getting the most out of the NWP to enhance its EPS, especially towards reducing the occurrence of missed events. This thesis investigates two NWP post-processing approaches: The neighbourhood method which includes predicted rainfall from nearby grid cells, and the time lagged ensemble (TLE) which utilises the overlap between consecutive NWP generations to expand the EPS. Both approaches have shown to be beneficial to enhance the NWP EPS, reducing the occurrence of missed events. However these approaches can lead to a large increase of the EPS size. The maximal threat neighbourhood method developed in this thesis improved the EPS discrimination skill with a limited increase of the EPS size. Despite these improvements, the high uncertainty embedded in NWP prevents the use of quantitative rainfall values directly for an urban catchment. NWP should be used, instead, in connection with a domain-based decision frame-work,
predicting for which domain the IUDWS should be optimized. The following domain-based framework was suggested, distinguishing between 4 operational domains: (i) dry weather conditions with storage basins empty, (ii) dry weather conditions with stored water, (iii) wet weather conditions within the system capacity and (iv) wet weather conditions that exceed the system capacity.

Handling uncertainty is challenging for decision makers. Tools are necessary to provide insight on when acting based on uncertain forecast data is beneficial or not. The REV framework developed in this thesis provides a tool to evaluate the added benefit of using control strategies based on uncertain forecast information, to select the most relevant control parameters and to compare different control strategies.

This REV framework was applied on two case studies. The first one used NWP EPS to predict low flow domains during which the IUDWS can be coupled with the electrical smart grid to optimise its energy consumption. The REV framework was used to determine which decision threshold of the EPS (i.e. number of ensemble members predicting an event) provides the highest benefit for a given situation. In the second case study, the REV framework was used to evaluate the current control strategy switching the WWTP to wet weather operation and to assess other control parameters and strategies. The analysis of the current control showed a significant number of false alarms, and the REV framework was used to calibrate the threshold on radar flow prognosis and to test new control strategies to solve this problem.

Uncertainty communication to end-users is a critical and challenging part of forecast usage. It can be achieved through the REV framework, which includes the possibility of considering management mistakes due to erroneous forecast. The REV framework assesses the overall benefit including these potential mismanagements, hence, maintaining the operator trust in the control.
Operational strategies for mitigation of nitrous oxide emissions from a phase isolated fullscale WWTP

Optical remote sensing for soil mapping and monitoring

Optimal adaptation to extreme rainfalls in current and future climate
Optimization of hydrogen dispersion in thermophilic up-flow reactors for ex situ biogas upgrading

This study evaluates the efficiency of four novel up-flow reactors for ex situ biogas upgrading converting externally provided CO2 and H2 to CH4, via hydrogenotrophic methanogenesis. The gases were injected through stainless steel diffusers combined with alumina ceramic sponge or through alumina ceramic membranes. Pore size, input gas loading and gas recirculation flow rate were modulated to optimize gas-liquid mass transfer, and thus methanation efficiency. Results showed that larger pore size diffusion devices achieved the best kinetics and output gas quality converting all the injected H2 and CO2, up to 3.6L/LREACTOR·d H2 loading rate. Specifically, reactors’ CH4 content increased from 23 to 96% and the CH4 yield reached 0.25LCH4/LH2. High throughput 16S rRNA gene sequencing revealed predominance of bacteria belonging to Anaerobaculum genus and to uncultured order MBA08. Additionally, the massive increase of hydrogenotrophic methanogens, such as Methanothermobacter thermautotrophicus, and syntrophic bacteria demonstrates the selection-effect of H2 on community composition.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark, University of Padua
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Optimizing sensitivity of Unmanned Aerial System optical sensors for low zenith angles and cloudy conditions

Satellite-based imagery in optical domains cannot provide information on the land surface during periods of cloud cover. This issue is especially relevant for high latitudes where overcast days and low solar zenith angles are common. Current remote sensing-based models of evapotranspiration or carbon assimilation are biased towards clear sky conditions, lacking important information on biophysical processes under cloudy conditions. Unmanned Aerial Vehicle (UAV) imagery has great potential to monitor and understand surface fluxes under cloudy conditions. For instance, in Denmark 73.54% of all days are non-clear (fraction of direct radiation less than 50%). UAV multispectral imagery acquired in these conditions tends to present low brightness and dynamic ranges, and high noise levels. Another problem is the influence of land cover types on the signal. For instance, over vegetated areas, even with low irradiance, saturation is reached in the near Infrared, while visible channels have low brightness. An individual camera setting for each channel and light conditions can improve sensor sensitivity while preventing saturation. This study aims to optimize the settings and radiometric corrections of a multispectral camera to produce high quality UAV imagery under low but homogeneous irradiance conditions. Laboratory experiments were conducted to link irradiance levels to different camera settings and calibration procedures. Results were tested outdoors over homogeneous and vegetated surfaces.

The multispectral camera (Tetra Mini-MCA6) has 6 channels in the visible and near Infrared. For the laboratory calibration experiment, different camera settings and typical irradiance levels from cloudy to clear sky were designed. The light-
source is based on super-continuum generation to produce a continuous solar spectrum. It allows more flexible settings in illumination levels than tungsten halogen lamps. A Li-Cor 1800 integrating sphere and an ASD spectroradiometer (FieldSpec HandHeld 2) were also used. Images were acquired under varying integration time and illumination levels from 0.005 to 0.2 W·m⁻²·nm⁻¹·sr⁻¹. Two radiometric calibration methods were applied to find gains to convert digital numbers (DN) into radiance and also to correct vignetting effects, apparent as the fall-off pixel intensity from the image center towards edges. The first is to apply a pixel-wise calibration from DN to radiance. The second performs a vignetting correction based on distance from each pixel to the highest DN pixel and then a global image calibration of averaged DN to radiance. To test calibration performance, images were acquired outdoors over (i) homogeneous targets (Teflon panels, grass and soil plots) and (ii) with UAV flight campaigns over a willow eddy covariance flux site under different cloudiness levels and solar zenith angles using varying camera settings. Radiance, reflectance, and vegetation indices were validated with ASD measurements and signal to noise metrics and dynamic ranges were assessed. Our results indicate that the spectral gains and camera settings can be tuned to allow higher signal to noise ratio and optimize the sensor sensitivity. This maximizes the image radiometric resolution and prevents sensor saturation for each channel. This paper is a step forward for UAV campaigns using optical cameras for low zenith angles and/or cloudy conditions.

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Projects:
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Optimum ozonation of freshwater pilot recirculating aquaculture system - Water quality

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Overestimation of closed-chamber soil CO2 effluxes at low atmospheric turbulence

Soil respiration (R-s) is an important component of ecosystem carbon balance, and accurate quantification of the diurnal and seasonal variation of R-s is crucial for a correct interpretation of the response of R-s to biotic and abiotic factors, as well as for estimating annual soil CO2 efflux rates. In this study, we measured R-s hourly for 1 year by automated closed chambers in a temperate Danish beech forest. The data showed a clear diurnal pattern of R-s across all seasons with higher rates during night-time than during daytime. However, further analysis showed a clear negative relationship between flux rates and friction velocity (u(*)) above the canopy, suggesting that R-s was overestimated at low atmospheric turbulence throughout the year due to non-steady-state conditions during measurements. Filtering out data at low u(*) values removed or even inverted the observed diurnal pattern, such that the highest effluxes were now observed during daytime, and also led to a substantial decrease in the estimated annual soil CO2 efflux. By installing fans to produce continuous turbulent mixing of air around the soil chambers, we tested the hypothesis that overestimation of soil CO2 effluxes during low u(*) can be eliminated if proper mixing of air is ensured, and indeed the use of fans removed the overestimation of R-s rates during low u(*). Artificial turbulent air mixing may thus provide a method to overcome the problems of using closed-chamber gas-exchange measurement techniques during naturally occurring low atmospheric turbulence conditions. Other possible effects from using fans during soil CO2 efflux measurements are discussed. In conclusion, periods with low atmospheric turbulence may provide a significant source of error in R-s rates estimated by the use of closed-chamber techniques and erroneous data must be filtered out to obtain unbiased diurnal patterns, accurate relationships to biotic and abiotic factors, and before estimating R-s fluxes over longer timescales.

Overestimation of closed-chamber soil CO2 effluxes at low atmospheric turbulence

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Overestimation of closed-chamber soil CO2 effluxes at low atmospheric turbulence

Soil respiration (R-s) is an important component of ecosystem carbon balance, and accurate quantification of the diurnal and seasonal variation of R-s is crucial for a correct interpretation of the response of R-s to biotic and abiotic factors, as well as for estimating annual soil CO2 efflux rates. In this study, we measured R-s hourly for 1 year by automated closed chambers in a temperate Danish beech forest. The data showed a clear diurnal pattern of R-s across all seasons with higher rates during night-time than during daytime. However, further analysis showed a clear negative relationship between flux rates and friction velocity (u(*)) above the canopy, suggesting that R-s was overestimated at low atmospheric turbulence throughout the year due to non-steady-state conditions during measurements. Filtering out data at low u(*) values removed or even inverted the observed diurnal pattern, such that the highest effluxes were now observed during daytime, and also led to a substantial decrease in the estimated annual soil CO2 efflux. By installing fans to produce continuous turbulent mixing of air around the soil chambers, we tested the hypothesis that overestimation of soil CO2 effluxes during low u(*) can be eliminated if proper mixing of air is ensured, and indeed the use of fans removed the overestimation of R-s rates during low u(*). Artificial turbulent air mixing may thus provide a method to overcome the problems of using closed-chamber gas-exchange measurement techniques during naturally occurring low atmospheric turbulence conditions. Other possible effects from using fans during soil CO2 efflux measurements are discussed. In conclusion, periods with low atmospheric turbulence may provide a significant source of error in R-s rates estimated by the use of closed-chamber techniques and erroneous data must be filtered out to obtain unbiased diurnal patterns, accurate relationships to biotic and abiotic factors, and before estimating R-s fluxes over longer timescales.
Particle-enhanced transportation of metal and PAH pollution reduces stormwater treatment efficiency based on settling and filtration

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Authors: Nielsen, K. (Intern), Sebastian, C. (Ekstern), Eriksson, E. (Ekstern), Mikkelsen, P. S. (Intern)
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Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017
Partitioning of hydrophobic organic contaminants between polymer and lipids for two silicones and low density polyethylene

Polymers are increasingly used for passive sampling of neutral hydrophobic organic substances (HOC) in environmental media including water, air, soil, sediment and even biological tissue. The equilibrium concentration of HOC in the polymer can be measured and then converted into equilibrium concentrations in other (defined) media, which however requires appropriate polymer to media partition coefficients. We determined thus polymer-lipid partition coefficients (KPL) of various PCB, PAH and organochlorine pesticides by equilibration of two silicones and low density polyethylene (LDPE) with fish oil and Triolein at 4 °C and 20 °C. We observed (i) that KPL was largely independent of lipid type and temperature, (ii) that lipid diffusion rates in the polymers were higher compared to predictions based on their molecular volume, (iii) that silicones showed higher lipid diffusion and lower lipid sorption compared to LDPE and (iv) that absorbed lipid behaved like a co-solute and did not affect the partitioning of HOC at least for the smaller molecular size HOC. The obtained KPL can convert measured equilibrium concentrations in passive sampling polymers into equilibrium concentrations in lipid, which then can be used (1) for environmental quality monitoring and assessment, (2) for thermodynamic exposure assessment and (3) for assessing the linkage between passive sampling and the traditionally measured lipid-normalized concentrations in biota. LDPE-lipid partition coefficients may also be of use for a thermodynamically sound risk assessment of HOC contained in microplastics.

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Masaryk University, TNO, Netherlands
Authors: Smedes, F. (Ekstern), Rusina, T. P. (Ekstern), Beeltje, H. (Ekstern), Mayer, P. (Intern)
Number of pages: 10
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BFI (2018): BFI-level 2
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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 4.39 SJR 1.417 SNIP 1.606
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.51 SNIP 1.57 CiteScore 4.04
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.593 SNIP 1.651 CiteScore 3.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.724 SNIP 1.767 CiteScore 3.92
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.818 SNIP 1.623 CiteScore 3.5
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.961 SNIP 1.515 CiteScore 3.61
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.867 SNIP 1.421
Ecotoxicity testing is a crucial component of chemical risk assessment. Still, due to methodological difficulties related to controlling exposure concentrations over time, data on long-term effects of organic chemicals at low concentrations are limited. The aim of the present study was therefore to test the applicability of passive dosing to maintain stable concentrations of the organochlorine bacteriocide triclosan in the water phase during a 6-week multi-generation population development test with the harpacticoid copepod Nitocra spinipes. Triclosan was loaded into silicone (1000 mg), which was used as passive dosing phase in the exposure vials. The distribution ratio for triclosan between silicone and water (D_{\text{silicone-water}}) was 10466 ± 1927. A population development test was conducted at three concentration levels of triclosan that were measured to be 3-5 µg L\(^{-1}\), 7-11 µg L\(^{-1}\) and 16-26 µg L\(^{-1}\). Our results demonstrate that passive dosing is applicable for long-term ecotoxicity testing of organic chemicals, including during significant growth of the test organism population. Shifts in the demographic structure of the population during exposure suggest the most severe effects were exerted on juvenile development. Progressively lower development index values in the populations exposed to increasing triclosan concentrations suggest developmental retardation. Our results further stress the need for chronic exposure during ecotoxicity testing in chemical risk assessment as even the most sensitive endpoint was not significant until after 7 days of exposure. This article is protected by copyright. All rights reserved.
Pathways and Controls of N₂O Production in Nitritation-Anammox Biomass

Nitrous oxide (N₂O) is an unwanted byproduct during biological nitrogen removal processes in wastewater. To establish strategies for N₂O mitigation, a better understanding of production mechanisms and their controls is required. A novel stable isotope labeling approach using ¹⁵N and ¹⁸O was applied to investigate pathways and controls of N₂O production by biomass taken from a full-scale nitritation-anammox reactor. The experiments showed that heterotrophic denitrification was a negligible source of N₂O under oxic conditions (≥0.2 mg O₂ L⁻¹). Both hydroxylamine oxidation and nitrifier denitrification contributed substantially to N₂O accumulation across a wide range of conditions with varying concentrations of O₂, NH₄⁺, and NO₂⁻. The O₂ concentration exerted the strongest control on net N₂O production with both production pathways stimulated by low O₂, independent of NO₂⁻ concentrations. The stimulation of N₂O production from hydroxylamine oxidation at low O₂ was unexpected and suggests that more than one enzymatic pathway may be involved in this process. N₂O production by hydroxylamine oxidation was further stimulated by NH₄⁺, whereas nitrifier denitrification at low O₂ levels was stimulated by NO₂⁻ at levels as low as 0.2 mM. Our study shows that ¹⁵N and ¹⁸O isotope labeling is a useful approach for direct quantification of N₂O production pathways applicable to diverse environments.
Pellets fra central blødgøring - fra affald til ressource

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, HOFOR A/S
Authors: Tang, C. (Intern), Albrechtsen, H. (Intern), Lopato, L. (Ekstern), Nyberg Kornholt, S. (Ekstern)
Pages: 54-55
Publication date: 2017
Main Research Area: Technical/natural sciences

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Pesticide degradation potential of pesticides in biological rapid sand filters at 10 different waterworks

**General information**

State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Danish Technological Institute, Kemic A/S
Authors: Lee, C. O. (Intern), Musovic, S. (Ekstern), Hedegaard, M. J. (Intern), Tatari, K. (Intern), Laugesen, H. (Ekstern), Albrechtsen, H. (Intern)
Number of pages: 7
Publication date: 2017
Event: Abstract from Water Quality Technology Conference (WQTC) 2017, Portland, United States.
Main Research Area: Technical/natural sciences
Electronic versions:
Lee_et_al._Pesticide_Degradation_RSF_AWWA_WQTC_2017_ext_abstr_logo.pdf
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Plasmid host range (permisseveness) in communities of activated sludge in wastewater treatment plant

**General information**

State: Published
Organisations: Department of Environmental Engineering, Water Technologies
Authors: Li, L. (Intern), Dechesne, A. (Intern), Smets, B. F. (Intern)
Number of pages: 93-94
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ABSTRACT BOOK
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Plasmid host range (permisseveness) in microbial communities of activated sludge in wastewater treatment plant.

**General information**

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Organisations: Department of Environmental Engineering, Water Technologies
Authors: Li, L. (Intern), Dechesne, A. (Intern), Smets, B. F. (Intern)
Number of pages: 1
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Event: Abstract from Danish Microbiological Society, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
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Possibilities for reuse of calcium carbonate pellets from drinking water softening

**General information**
Prediction of required ozone dosage for pilot recirculating aquaculture systems based on laboratory studies

In recirculating aquaculture systems (RAS), the water quality changes continuously. Organic and inorganic compounds accumulates creating toxic conditions for the farmed organisms. Ozone improves water quality diminishing significantly both bacteria load and dissolved organic matter. However, in a non-meticulously designed system, residual ozone might reach the culture tanks causing significant harm to cultured species or excess costs. The aim of the study was to predict the suitable ozone dosage in pilot RAS, for water treatment purposes, based on laboratory studies. The ozone effect on water quality of freshwater RAS and system’s ozone demand was investigated. Bench-scale ozonation experiments revealed the ozone demand of the system to be 180 mg O3/h. Three different ozone dosages were applied to four replicated systems with fixed feed loading (1.56 kg feed/m3 make up water). Results suggested that the optimal ozone dosage was 15g O3/ kg feed. Selected water quality parameters were measured, assessing biofilters performance as well as nitrogen and carbon–based compound concentration change during ozonation. Overall, this study contributed to a better understanding of the challenges of an ozonated RAS leading to the optimal design of such systems.

Prediction of the formation of biogenic non-extractable residues during degradation of environmental chemicals from biomass yields

Degradation tests with radio or stable isotope labeled compounds enable the detection of the formation of non-extractable residues (NER). In PBT and vPvB assessment, remobilisable NER are considered as a potential risk while biogenic NER from incorporation of labeled carbon into microbial biomass are treated as degradation products. Relationships between yield, released CO2 (as indicator of microbial activity and mineralization) and microbial growth can be used to estimate the formation of biogenic NER. We provide a new approach for calculation of potential substrate transformation to microbial biomass (theoretical yield) based on Gibbs free energy and microbially available electrons. We compare estimated theoretical yields of biotechnological substrates and of chemicals of environmental concern with experimentally
determined yields for validation of the presented approach. A five-compartment dynamic model is applied to simulate experiments of 13C-labeled 2,4-D and ibuprofen turnover. The results show that bioNER increase with time, and that most bioNER originate from microbial proteins. Simulations with pre-calculated input data demonstrate that pre-calculation of yields reduces the number of fit parameters considerably, increases confidence in fitted kinetic data and reduces the uncertainty of the simulation results.

**General information**

State: Accepted/In press
Organisations: Department of Environmental Engineering, Environmental Chemistry, Helmholtz Centre for Environmental Research
Authors: Trapp, S. (Intern), Brock, A. L. (Intern), Nowak, K. M. (Ekstern), Kästner, M. (Ekstern)
Publication date: 2017
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.584 SNIP 1.828 CiteScore 5.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
Web of Science (2014): Indexed yes
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ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.146 SNIP 2.056 CiteScore 5.17
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.178 SNIP 1.953 CiteScore 5.16
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.964 SNIP 1.729
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.835 SNIP 1.803
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.943 SNIP 1.942
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.8 SNIP 1.927
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.541 SNIP 1.901
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.604 SNIP 2.014
Pressure retarded osmosis from hypersaline sources - A review
Salinity gradient power has been identified as a promising new renewable energy technology, but previous attempts to commercialize the technology have failed due to low energy densities and power densities when using seawater as the saline water. One way to overcome these challenges is to use concentrated saline waters, in this context termed hypersaline waters. Hypersaline waters have higher energy densities and very high power densities are possible. Use of desalination brines has already shown promising results in pilot scale, and solutions of higher salinity may offer a potential route for commercialization. The scope of this paper is to review the existing knowledge on the use of hypersaline waters in the salinity gradient process, pressure retarded osmosis. Although only few papers have had the specific aim of investigating hypersaline waters, concentrated solutions have been used in many papers. In this review, the experiences gained from these experiments are collected and used to evaluate both the potential and challenges of using hypersaline waters. In the second part of the review, an overview is made of where hypersaline resources can be found. Finally, we provide an outlook for hypersaline based salinity gradient energy and point to the areas that require further research.
The optimal use of biomass from a global warming mitigation perspective depends upon numerous factors, including competition for land and other constraints. The goal of this study is identifying optimal uses of domestic biomass resources for the case of Denmark, with the objectives of minimizing global warming contribution and fossil energy resource consumption. For this purpose, consequential life cycle assessment of the different options for biomass was performed. Optimal solutions were identified, given specific national environmental targets, using linear programming. Results highlighted that utilizing the energy potential of manure and straw represents the primary opportunity for further global warming mitigation. For this purpose, co-digestion (for manure) and combustion with heat-and-power production (for straw) appear as the most promising technologies. The utilization of biomass (or biogas) for electricity/heat is generally preferred, as long as coal/oil is still used within the energy system. Yet, to fulfill environmental targets for renewable energy in the transport sector, the diversion of a significant share of biogas (and/or other biofuels) from these more beneficial uses is necessary. To completely phase out coal/oil, additional biomass (to current domestic resources) must be included, either through domestic energy crops cultivation or biomass/biofuel import; alternatively, natural gas could be used.

**Priority of domestic biomass resources for energy: Importance of national environmental targets in a climate perspective**

The optimal use of biomass from a global warming mitigation perspective depends upon numerous factors, including competition for land and other constraints. The goal of this study is identifying optimal uses of domestic biomass resources for the case of Denmark, with the objectives of minimizing global warming contribution and fossil energy resource consumption. For this purpose, consequential life cycle assessment of the different options for biomass was performed. Optimal solutions were identified, given specific national environmental targets, using linear programming. Results highlighted that utilizing the energy potential of manure and straw represents the primary opportunity for further global warming mitigation. For this purpose, co-digestion (for manure) and combustion with heat-and-power production (for straw) appear as the most promising technologies. The utilization of biomass (or biogas) for electricity/heat is generally preferred, as long as coal/oil is still used within the energy system. Yet, to fulfill environmental targets for renewable energy in the transport sector, the diversion of a significant share of biogas (and/or other biofuels) from these more beneficial uses is necessary. To completely phase out coal/oil, additional biomass (to current domestic resources) must be included, either through domestic energy crops cultivation or biomass/biofuel import; alternatively, natural gas could be used.

**General information**

*State:* Published

*Organisations:* Department of Environmental Engineering, Residual Resource Engineering, ETH Zurich

*Authors:* Tonini, D. (Intern), Vadenbo, C. (Ekstern), Astrup, T. F. (Intern)
Probabilistic predictions using a groundwater model informed with airborne EM data

Some hydrological model predictions are particularly sensitive to the hydrostratigraphy of numerical groundwater models, which are used extensively in the management of groundwater resources. In this paper we present a method to estimate hydrological prediction uncertainty originating from uncertainty in subsurface structure. Densely sampled airborne electromagnetic (AEM) data, which captures the main geological features, along with borehole lithological information are used as input to the hydrostratigraphic models. Geophysical resistivity models obtained from spatially constrained 1-D inversion of the AEM data are translated into clay-fraction values with a spatially variable translator function. Hydrostratigraphic units are identified by k-means clustering on the 2-D space defined by estimated resistivity values and clay-fraction values. Areas with no data are represented stochastically using sequential indicator simulation (SIS) where the spatial model of each hydrostratigraphic unit is characterized by an indicator variogram. This results in an ensemble of equally likely hydrostratigraphic representations of the subsurface. A hydraulic conductivity value of each hydrostratigraphic unit of each realization is estimated in a groundwater model calibration constrained by observations of hydraulic head and stream base flow. Pumping well catchment areas are calculated for each realization. The result is a probabilistic well catchment area, which is checked for bias with a manually constructed geological model. There is a probability of 85% of the catchment extending beyond the manually constructed geology. The method is applied to the 45 km² large groundwater model of the Kasted site in Denmark. The method presented in the paper has the advantage of being data-driven, making the modeling process entirely reproducible.
Mechanical pretreatment is considered to be a fast and easily applicable method to prepare the biomass for anaerobic digestion. In the present study, the effect of mechanical pretreatment on lignocellulosic silages biodegradability was elucidated in batch reactors. Moreover, co-digestion of the silages with pig manure in continuously fed biogas reactors was examined. Metagenomic analysis for determining the microbial communities in the pig manure digestion system was performed by analysing unassembled shotgun genomic sequences. A comparative analysis allowed to identify the microbial species firmly attached to the digested grass particles and to distinguish them from the planktonic microbes floating in the liquid medium. It was shown that the methane yield of ensiled grass was significantly increased by 12.3% due to mechanical pretreatment in batch experiments. Similarly, the increment of the methane yield in the co-digestion system reached 6.4%. Regarding the metagenomic study, species similar to Coprothermobacter proteolyticus and to Clostridium thermocellum, known for high proteolytic and cellulolytic activity respectively, were found firmly attached to the solid fraction of digested feedstock. Results from liquid samples revealed clear differences in microbial community composition, mainly dominated by Proteobacteria. The archaeal community was found in higher relative abundance in the liquid fraction of co-digestion experiment compared to the solid fraction. Finally, an unclassified Alkaliphilus sp. was found in high relative abundance in all samples.
Main Research Area: Technical/natural sciences

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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.78 SJR 3.058 SNIP 2.573
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.912 SNIP 2.61 CiteScore 6.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.254 SNIP 3.28 CiteScore 6.93
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.164 SNIP 3.377 CiteScore 6.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.854 SNIP 3.108 CiteScore 5.69
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.473 SNIP 2.84 CiteScore 5.5
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.516 SNIP 2.25
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.003 SNIP 1.781
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.974 SNIP 1.215
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.179 SNIP 1.709
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.979 SNIP 1.293
Scopus rating (2005): SJR 1.043 SNIP 0.996
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.643 SNIP 0.839
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.778 SNIP 0.797
Scopus rating (2002): SJR 0.577 SNIP 0.775
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.376 SNIP 0.578
Scopus rating (2000): SJR 0.352 SNIP 0.515
Scopus rating (1999): SJR 0.182 SNIP 0.45
Purification and functional characterization of nine human Aquaporins produced in Saccharomyces cerevisiae for the purpose of biophysical characterization

The sparse number of high-resolution human membrane protein structures severely restricts our comprehension of molecular physiology and ability to exploit rational drug design. In the search for a standardized, cheap and easily handled human membrane protein production platform, we thoroughly investigated the capacity of S. cerevisiae to deliver high yields of prime quality human AQPs, focusing on poorly characterized members including some previously shown to be difficult to isolate. Exploiting GFP labeled forms we comprehensively optimized production and purification procedures resulting in satisfactory yields of all nine AQP targets. We applied the obtained knowledge to successfully upscale purification of histidine tagged human AQP10 produced in large bioreactors. Glycosylation analysis revealed that AQP7 and 12 were O-glycosylated, AQP10 was N-glycosylated while the other AQPs were not glycosylated. We furthermore performed functional characterization and found that AQP 2, 6 and 8 allowed flux of water whereas AQP3, 7, 9, 10, 11 and 12 also facilitated a glycerol flux. In conclusion, our S. cerevisiae platform emerges as a powerful tool for isolation of functional, difficult-to-express human membrane proteins suitable for biophysical characterization
Whole-site emissions of methane and nitrous oxide, from a combined dry anaerobic digestion and composting facility, were quantified using a tracer dispersion technique that combines a controlled tracer gas release from the treatment facility with time-resolved concentration measurements downwind of the facility. Emission measurements were conducted over a period of three days, and in total, 80 plume traverses were obtained. On-site screening showed that important processes resulting in methane emissions were aerobic composting reactors, anaerobic digester reactors, composting windrows and the site's biofilter. Average whole-site methane emissions measured during the three days were 27.5±7.4, 28.5±6.1 and 30.1±11.4kg CH4 h⁻¹, respectively. Turning the windrows resulted in an increase in methane emission from about 26.3-35.9kg CH4 h⁻¹. Lower emissions (21.5kg CH4 h⁻¹) were measured after work hours ended, in comparison to emissions measured during the facility's opening hours (30.2kg CH4 h⁻¹). Nitrous oxide emission was too small for a downwind quantification. Direct on-site measurements, however, suggested that the main part of the emitted nitrous oxide came from the biofilter (about 1.4kg N2O h⁻¹). Whole-site emissions were compared to emissions previously measured at different point sources on-site. Whole-site fugitive emissions were three to eight times higher than the sum of emissions measured at on-site sources. The magnitude of the emissions had a significant influence on the overall environmental impact of the treatment facility, assessed by consequential life cycle assessment. Including the higher whole-site fugitive emissions led to an increase in global warming potential, from a saving of 97kgCO2-eq. tonne⁻¹ of treated waste (wet weight) to a loading of 71kg CO2-eq. tonne⁻¹, ultimately flipping the environmental profile of the treatment facility.
Scopus rating (2015): SJR 1.739 SNIP 2.256 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.777 SNIP 2.482 CiteScore 3.43
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.822 SNIP 2.435 CiteScore 3.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.611 SNIP 2.184 CiteScore 2.91
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.698 SNIP 2.085 CiteScore 2.99
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.555 SNIP 1.78
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.502 SNIP 1.899
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.378 SNIP 2.13
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.035 SNIP 1.767
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.046 SNIP 1.749
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.059 SNIP 1.65
Scopus rating (2004): SJR 1.289 SNIP 1.939
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.847 SNIP 1.269
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.561 SNIP 0.874
Scopus rating (2001): SJR 0.456 SNIP 0.696
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.271 SNIP 0.451
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Source: FindIt
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Quantification of the methane emissions from masons landfill, UK

General information
State: Published
Organisations: Department of Environmental Engineering, Air, Land & Water Resources, University of Southampton
Authors: Mønster, J. (Intern), Rees-White, T. (Ekstern), Beaven, R. (Ekstern), Scheutz, C. (Intern)
Quantitative assessment of micro- and nanoplastic ingestion and interactions with feeding in Daphnia magna

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Authors: Rist, S. (Intern)
Pages: 70-70
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Conference: Sardinia 2017, 16th International Waste Management and Landfill Symposium, S. Margherita di Pula, Italy, 02/10/2017 - 02/10/2017
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Rapid biochemical methane potential prediction of urban organic waste with near-infrared reflectance spectroscopy

The anaerobic digestibility of various biomass feedstocks in biogas plants is determined with biochemical methane potential (BMP) assays. However, experimental BMP analysis is time-consuming, costly and challenging to optimise stock management and feeding to achieve improved biogas production. The aim of the present study is to develop a fast and reliable model based on near-infrared reflectance spectroscopy (NIRS) for the BMP prediction of urban organic waste (UOW). The model comprised 87 UOW samples. Additionally, 88 plant biomass samples were included, to develop a combined model predicting BMP. The coefficient of determination (R2) and root mean square error in prediction (RMSEP) of the UOW model were 0.88 and 44 mL CH4/g VS, while the combined model was 0.89 and 50 mL CH4/g VS. Improved model performance was obtained for the two individual models compared to the combined version. The BMP prediction with NIRS was satisfactory and moderately successful.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Southern Denmark
Authors: Fitamo, T. M. (Intern), Triolo, J. M. (Ekstern), Boldrin, A. (Intern), Scheutz, C. (Intern)
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React now regarding nanomaterial regulation
The time has come to implement a regulatory framework tailored to manufactured materials. I propose a new legislative framework that combines registration, evaluation, authorization and categorization of nanomaterials.
Readiness of control banding tools for safe innovation and regulatory occupational exposure assessment of nanomaterials

General information
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Organisations: Department of Environmental Engineering, Environmental Chemistry, Steinbeis Advanced Risk Technologies GmbH, GAIKER Technology Center, ECSIN-ECAMRICERT, National Research Center for Working Environment
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Recirculation of biomass ashes onto forest soils: Ash composition, mineralogy and leaching properties
In Denmark, increasing amounts of wood ashes are generated from biomass combustion for energy production. The utilisation of ashes on top of forest soil for timing purposes has been proposed as an alternative to landfilling. Danish wood ash samples were collected and characterised with respect to chemical composition, mineralogy and leaching properties (batch leaching at L/S 2 and 10L/kg, and pH-dependent leaching at 10L/kg). Large variations in the ash liming properties were observed (ANC7.5: 1.8-6.4meqH+/g), indicating that similar soil application dosages may result in different liming effects. High contents of Ca, Si, P, K and Mg were observed in all samples, while the highest contents of S and N were found in fly ashes and mixed ashes (combination of fly and bottom ashes). Similarly, the highest contents of some trace metals, e.g. Cd, Mo and Se, were observed for fly ash. Releases of major, minor and trace elements were affected significantly by pH: high releases of PO4 3-, Mg, Zn, Cu and Cd were found for acidic conditions relevant to forest soils, while the highest releases of Mo and Cr were observed in alkaline conditions. Mineral phases were selected based on XRD analyses and the existing literature, and they were applied as inputs for the geochemical modelling of pH-dependent leaching. Mineral dissolution was found adequate for a wide range of major elements and nutrients, while the description of trace elements could be done only for parts of the pH-range. Content and leaching of PAHs were observed below detection limits. The source-term release of Ca, K, Mg, Mn, and P in acidic conditions relevant to forest soils was higher than ten years of atmospheric deposition, in contrast to the relatively low release of Al, Fe and Na. The potential release of Cd was found to be the most critical element compared with soil quality criteria, whereas the maximum theoretical loads of Ba, Cd, Cr, Sr, Mo, Ni, Pb, Sb, Se, Sn and V were relatively low.

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Recycling of plastic waste: Screening for brominated flame retardants (BFRs)

Flame retardants are chemicals vital for reducing risks of fire and preventing human casualties and property losses. Due to the abundance, low cost and high performance of bromine, brominated flame retardants (BFRs) have had a significant share of the market for years. Physical stability on the other hand, has resulted in dispersion and accumulation of selected BFRs in the environment and receiving biota. A wide range of plastic products may contain BFRs. This affects the quality of waste plastics as secondary resource: material recycling may potentially reintroduce the BFRs into new plastic product cycles and lead to increased exposure levels, e.g. through use of plastic packaging materials. To provide quantitative and qualitative data on presence of BFRs in plastics, we analysed bromophenols (tetrabromobisphenol A (TBBPA), dibromophenols (2,4- and 2,6-DBP) and 2,4,6-tribromophenol (2,4,6-TBP)), hexabromocyclododecane stereoisomers (α-, β-, and γ-HBCD), as well as selected polybrominated diphenyl ethers (PBDEs) in samples of household waste plastics, virgin and recycled plastics. A considerable number of samples contained BFRs, with highest concentrations associated with acrylonitrile butadiene styrene (ABS, up to 26,000,000 ng TBBPA/g) and polystyrene (PS, up to 330,000 ng ΣHBCD/g). Abundance in low concentrations of some BFRs in plastic samples suggested either unintended addition in plastic products or degradation of higher molecular weight BFRs. The presence of currently restricted flame retardants (PBDEs and HBCD) identified in the plastic samples illustrates that circular material flows may be contaminated for extended periods. The screening clearly showed a need for improved documentation and monitoring of the presence of BFRs in plastic waste routed to recycling.

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Regional frequency analysis of short duration rainfall extremes using gridded daily rainfall data as co-variate
A regional partial duration series (PDS) model is applied for estimation of intensity duration frequency relationships of extreme rainfalls in Denmark. The model uses generalised least squares regression to relate the PDS parameters to gridded rainfall statistics from a dense network of rain gauges with daily measurements. The Poisson rate is positively correlated to the mean annual precipitation for all durations considered (1 min to 48 hours). The mean intensity can be assumed constant over Denmark for durations up to 1 hour. For durations larger than 1 hour the mean intensity is significantly correlated to the mean extreme daily precipitation. A Generalised Pareto distribution with a regional constant shape parameter is adopted. Compared to previous regional studies in Denmark a general increase in extreme rainfall intensity for durations up to 1 hour is found, whereas for larger durations both increases and decreases are seen. A subsample analysis is conducted to evaluate the impacts of non-stationarities in the rainfall data. The regional model includes the nonstationarities as an additional source of uncertainty together with sampling uncertainty and uncertainty caused by spatial variability.
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Regulatory adequacy of aquatic ecotoxicity testing of nanomaterials

Nanocotoxicology as a discipline has matured significantly over the last years, from the first paper in 2004 to close to a thousand studies published today. We are therefore no longer facing a scarcity of data as severe as only a few years ago. From a regulatory standpoint, it is timely to question whether ecotoxicity testing is now able to facilitate regulatory decision-making on manufactured nanomaterials (MNs). In this paper, we review the state of aquatic ecotoxicity testing of MNs as well as the overarching issues that challenge the reliability and relevance of such testing. We conclude that within the field there is an increased focus on characterization of the exposure rather than controlling exposure as it is traditionally done in guideline testing of chemicals. However, the lack of characterization options under actual testing conditions makes it difficult to make meaningful comparisons between studies, which question the regulatory reliability of the data currently available. Accordingly, lack of data suited for regulatory decision-making is still a pressing issue in nanocotoxicology even though the data availability has increased. Nevertheless, we emphasize that by deliberately directing test method developments towards increased regulatory reliability and acknowledging the implicit limitations in the dual purpose of guideline testing for chemical risk assessment (i.e. for hazard identification and for hazard assessment) it is possible to generate data sufficient for regulatory needs.

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Regulatory adequacy of ecotoxicity data for risk assessment of nanomaterials - the NanoCRED framework

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Regulatory relevant and reliable methods and data for determining the environmental fate of manufactured nanomaterials

The widespread use of manufactured nanomaterials (MN) increases the need for describing and predicting their environmental fate and behaviour. A number of recent reviews have addressed the scientific challenges in disclosing the governing processes for the environmental fate and behaviour of MNs, however there has been less focus on the regulatory adequacy of the data available for MN. The aim of this paper is therefore to review data, testing protocols and guidance papers which describe the environmental fate and behaviour of MN with a focus on their regulatory reliability and relevance. Given the often identified need for modification of OECD testing guidelines, the use of these cannot per se be assigned high regulatory adequacy. Though the specific test considerations will differ between conventional chemicals and MN, the ultimate endpoints of interest are similar. The water compartment must be considered as one of the main points of entry, facilitating dispersion of MN in the environment and establishing a link to the other environmental compartments such as soil, sediment, air, and biota. Once released to water various processes like dissolution, agglomeration, heteroagglomeration, sedimentation, interaction with natural organic matter, transformation and uptake by biota are processes of high relevance for the fate of MN in water. In the review it is found that the OECD draft test guidelines for dissolution and agglomeration will greatly assist in the generation of regulatory relevant and reliable data. Gaps do however exist in test methods for environmental fate, such as methods to estimate heteroagglomeration and the tendency for MNs to transform in the environment.

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Removal efficiency and economic cost comparison of hydrated electron-mediated reductive pathways for treatment of bromate

Bromate, a potential carcinogen, is a well known highly persistent and environmentally recalcitrant contaminant. UV-254/sulfite-based advanced reductive pathways (ARPs) were proposed to eliminate bromate successfully from water. Experiments with N2, N2O, 2-chlorophenol, inorganic ions, and different pH (highly acidic to highly basic) proved that UV-254/sulfite successfully provides aqueous electron that effectively participate in bromate removal from water. Significant removal, 86%, of initially 39.0µM bromate was achieved by UV-254/sulfite under conditions that dominate aqueous electron based pathways. The high second-order rate constant of 5.3×109M−1s−1 determined proved high reactivity of aqueous electron with bromate. The kinetic and removal efficiency of bromate showed linear relationship with the rate of aqueous electron formation. An increase in kinetic and removal efficiency of bromate was observed with increasing initial sulfite concentration and decreasing bromate concentration. The impacts of different initial concentrations of the typical ions commonly found in water were studied in detail to extend the UV-254/sulfite-based process for potential practical applications. The lower molar absorptivity of bromate at 254nm determined proved insignificant removal of bromate under direct photolysis. The impacts of initial sulfite concentration on removal of bromate in UV-254/sulfite-based process also minimized role of direct photolysis. The cost evaluation and rapid decomposition of bromate into bromide proved UV-254/sulfite-based ARPs to be economical and highly rewarding in efficient decomposition of bromate and other inorganic oxyhalides.

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Removal of micropollutants in Moving Bed Biofilm reactors (MBBRs): Microbial-diversity-and-functional-relationships

Numerous pollutants such as pharmaceuticals and personal care products are continuously released into municipal wastewater treatment plants (WWTP). Present at concentration of nano- to milligram per liter, they are defined as micropollutants. Micropollutants are only partially removed, possibly due to design and operational limitation of conventional WWTP. Eventually, micropollutant parent compounds and transformation products are discharged into receiving water bodies, possibly causing acute and chronic toxic effects on aquatic organisms even at very low concentrations. Therefore, research currently focuses on the enhancement of conventional WWTPs via physical-chemical and biological treatment processes. Biofilm-based treatment processes, such as the Moving Bed Biofilm Reactor (MBBR), were shown to harbour bio-catalytic potential that can enhance the biotransformation of a number of micropollutants.
compared to conventional activated sludge. In MBBRs, biofilm grow on plastic carriers kept in suspension in the reactor basin via mechanical mixing or aeration, offering a suit of benefits, amongst all comparably small footprint. Despite few existing evidences in aerobic MBBR, an in-depth understanding of the fate of micropollutants in such systems under different operational conditions is still required. In this context, this PhD thesis investigated different optimization strategies using MBBRs towards the removal of 23 commonly detected micropollutants (i.e., pharmaceuticals) in municipal wastewater. Specifically, I studied the impact of (i) biofilm thickness on the diffusion, sorption and biotransformation of the selected pharmaceuticals in nitrifying MBBR; and (ii) of organic carbon quality and availability on micropollutant biotransformation in anoxic pre- and post-denitrifying MBBRs. In both case, the influence of (i) and (ii) on the microbial activity (nitrification and denitrification) and microbial community composition and diversity were investigated. The existence of possible relationships between microbial diversity (analyzed via 16S rRNA amplicon sequencing) and biotransformation of micropollutants was evaluated to investigate which microbial processes and factors underlie the removal of micropollutants. The PhD objectives were evaluated in long- and short-term experiments in three laboratory-scale MBBR systems for pre-denitrification (MBBR1), nitrification (MBBR2) and post-denitrification (MBBR3). Biokinetics of nitrification, denitrification and micropollutant biotransformation rate constants (kBio, L g-1 d-1) were estimated through batch experiments using Activated Sludge Models (ASMs) and ASM for Xenobiotics (ASM-X), respectively. In the pre-denitrifying MBBR1 study, denitrification, biotransformation of micropollutants and microbial community were evaluated in three-stage (S) and single-stage (U) MBBR configurations. The three-stage configuration produced a prolonged exposure of the biofilm to a gradient of organic carbon loading and complexity, leading to a significant differentiation of denitrification and biotransformation kinetics in the three MBBR sub-reactors. The highest and lowest biotransformation kinetics were found in the first and the last stage, respectively (up to 4-fold decrease for selected compounds), suggesting a possible correlation of micropollutant biotransformation with denitrification rates. The long term-operation with carbon availability and complexity gradient led to higher (p<0.05) biodiversity in the three-stage system, with a more diverse and even microbial community in the last stage. Specific taxa such as Candidate division WS6 and Deinococccales were selected in S, possibly due to oligotrophic conditions occurring in the last reactor stage. The influence of biofilm thickness was studied in nitrifying MBBR2 using newly developed Z-carriers that allow the control of defined biofilm thickness. The use of thinner biofilms (~50 µm), rather than thicker biofilms (>200 µm), had a positive effect on nitrification rates and on the biotransformation kinetics of a number of compound such as diclofenac (kBio up to 6 L g-1 d-1) and the three sulfonamide antibiotics. However, the biotransformation of more than 60% of targeted compounds was enhanced in thicker biofilms, that exhibited higher (p<0.05) microbial diversity and were more even. Additionally, a biofilm model was developed and calibrated to evaluate sorption and diffusion of micropollutants in nitrifying biofilms. Sorption was significant only for eight out of the targeted compounds. All compounds removed by sorption were predicted to carry a net positive charge at the experimental pH, suggesting the importance of electrostatic interactions on sorption in biofilms. Sorption coefficients Kd (L g-1) and effective diffusivity coefficients f increased with increasing biofilm thickness, suggesting reduced diffusion limitation and higher surface area accessibility in the thickest, least dense biofilm (~500 µm). Two types of commonly dosed degradable carbon sources (methanol and ethanol) were investigated in two parallel post-denitrifying systems (MBBR3). The methanol-dosed MBBR exhibited in the enhancement of kBio (up to 2.5-fold) for a number of micropollutants (nine out 23) compared to the ethanol-dosed MBBR, while for 10 compounds biokinetics were similar between the two reactors. The higher denitrification rates exhibited by the ethanol-dosed MBBR during batch experiments likely influenced the biotransformation of the sulfonamides antibiotics, in analogy with what observed in MBBR2. A strong cometabolic effect (i.e., an enhancement of micropollutant biotransformation in the presence of organic carbon) was observed for venlafaxine, carbamazepine, sulfamethoxazole and sulfamethizole. However, an increase in methanol or ethanol loading to the MBFRs during continuous-flow experiment did not influence the removal of the targeted micropollutants, most likely due to the short hydraulic residence time (2 hours) used in the study as well as in full-scale reactors. Diversity-function relationships (assessed through Pearson correlation analyses) were tested by comparing diversity estimators based on biomass-normalized biotransformation rates. A positive influence of biodiversity for most of the targeted compounds (~60%) was shown in MBBR2 study, while biotransformation of few compounds (diclofenac and sulfonamides) was positively associated to microbial activity (i.e., nitrification). Similarly, a positive association (p<0.05) with the specific denitrification rate was shown in MBBR1, while biotransformation of most of the detected pharmaceuticals in wastewater did not associate or negatively associated with biodiversity. The relationship between biodiversity and micropollutant biotransformation may depend on whether its biotransformation is catalysed by a narrow (i.e., performed by few species) or broad processes. It is likely that for highly redundant microbial processes (such as denitrification), micropollutant biotransformation may be catalysed by broadly distributed enzymes and pathways, and microbial diversity provides no benefit. Conversely, increasing biodiversity under nitrifying conditions may be necessary to increase the inclusion of microorganisms with specific functionality towards micropollutant biotransformation. Overall, the biotransformation rates were significantly enhanced in MBBR3 compared to MBBR1 and MBBR2 for the majority of micropollutants (~60%) suggesting the positive impact of easily degradable carbon sources (such as methanol or ethanol) on micropollutant removal. Finally, the removal of compounds such propranolol atenolol, citalopram, venlafaxine (under post-denitrifying conditions) and diclofenac (under aerobic conditions) was improved compared to conventional activated sludge. It can be thus concluded that MBBRs can offer a suitable technology that can be optimized for the removal of micropollutants in municipal wastewaters under a range of operating conditions (nitrifying, pre- and post-denitrifying).
Removal of pharmaceuticals in conventionally treated wastewater by a polishing Moving Bed Biofilm Reactor (MBBR) with intermittent feeding

Previous studies have demonstrated that aerobic moving bed biofilm reactors (MBBRs) remove pharmaceuticals better than activated sludge. Thus we used a MBBR system to polish the effluent of an activated sludge wastewater treatment plant. To overcome that effluent contain insufficient organic matter to sustain enough biomass, the biofilm was intermittently fed with raw wastewater.

The capacity of pharmaceutical degradation was investigated by spiking pharmaceuticals. Actual removal during treatment was assessed by sampling the inlets and outlets of reactors. The removal of the majority of pharmaceuticals was enhanced through the intermittent feeding of the MBBR. First-order rate constants for pharmaceutical removal, normalised to biomass, were significantly higher compared to other studies on activated sludge and suspended biofilms, especially for diclofenac, metoprolol and atenolol. Due to the intermittently feeding, degradation of diclofenac occurred with a half-life of only 2.1 hours and was thus much faster than any hitherto described wastewater bioreactor treatment.
Removal of pharmaceuticals in Moving Bed Biofilm Reactors – The impact of design and operating conditions

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Removal of pharmaceuticals in pre-denitrifying MBBR – Influence of organic substrate availability in single- and three-stage configurations

Due to the limited efficiency of conventional biological treatment, innovative solutions are being explored to improve the removal of trace organic chemicals in wastewater. Controlling biomass exposure to growth substrate represents an appealing option for process optimization, as substrate availability likely impacts microbial activity, hence organic trace chemical removal. This study investigated the elimination of pharmaceuticals in pre-denitrifying moving bed biofilm reactors (MBBRs), where biofilm exposure to different organic substrate loading and composition was controlled by reactor staging. A three-stage MBBR and a single-stage reference MBBR (with the same operating volume and filling ratio) were operated under continuous-flow conditions (18 months). Two sets of batch experiments (day 100 and 471) were performed to quantify and compare pharmaceutical removal and denitrification kinetics in the different MBBRs. Experimental results revealed the possible influence of retransformation (e.g., from conjugated metabolites) and enantioselectivity on the removal of selected pharmaceuticals. In the second set of experiments, specific trends in denitrification and biotransformation kinetics were observed, with highest and lowest rates/rate constants in the first (S1) and the last (S3) staged sub-reactors, respectively. These observations were confirmed by removal efficiency data obtained during continuous-flow operation, with limited removal (<10%) of recalcitrant pharmaceuticals and highest removal in S1 within the three-stage MBBR. Notably, biotransformation rate constants obtained for non-recalcitrant pharmaceuticals correlated with mean specific denitrification rates, maximum specific growth rates and observed growth yield values. Overall, these findings suggest that: (i) the long-term exposure to tiered substrate accessibility in the three-stage configuration shaped the denitrification and biotransformation capacity of biofilms, with significant reduction under substrate limitation; (ii) biotransformation of pharmaceuticals may have occurred as a result of cometabolism by heterotrophic denitrifying bacteria.

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Revising REACH guidance on information requirements and chemical safety assessment for engineered nanomaterials for aquatic ecotoxicity endpoints: recommendations from the EnvNano project

The European Chemical Agency (ECHA) is in the process of revising its guidance documents on how to address the challenges of ecotoxicological testing of nanomaterials. In these revisions, outset is taken in the hypothesis that ecotoxicological test methods, developed for soluble chemicals, can be made applicable to nanomaterials. European Research Council project EnvNano—Environmental Effects and Risk Evaluation of Engineered, which ran from 2011 to 2016, took another outset by assuming that: “The behaviour of nanoparticles in suspension is fundamentally different from that of chemicals in solution”. The aim of this paper is to present the findings of the EnvNano project and through these provide the scientific background for specific recommendations on how ECHA guidance could be further improved. Key EnvNano findings such as the need to characterize dispersion and dissolution rates in stock and test media have partially been addressed in the updated guidance. However, it has to be made clear that multiple characterization methods have to be applied to describe state of dispersion and dissolution over time and for various test concentration. More detailed information is called for on the specific characterization methods and techniques available and their pros and cons. Based on findings in EnvNano, we recommend that existing algal tests are supplemented with tests where suspensions of nanomaterials are aged for 1–3 days for nanomaterials that dissolve in testing media. Likewise, for daphnia tests we suggest to supplement with tests where (a) exposure is shortened to a 3 h pulse exposure in daphnia toxicity tests with environmentally hazardous metal and metal oxide nanomaterials prone to dissolution; and (b) food abundance is three to five times higher than normal, respectively. We further suggest that the importance of considering the impact of shading in algal tests is made more detailed in the guidance and that it is specified that determination of uptake, depuration and trophic transfer of nanomaterials for each commercialized functionalization of the nanomaterials is required. Finally, as an outcome of the project a method for assessing the regulatory adequacy of ecotoxicological studies of nanomaterials is
Revisiting conceptual stormwater quality models by reconstructing virtual state-variables

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**Abstract**

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Risk Perception of Plastic Pollution: Importance of Stakeholder Involvement and Citizen Science

Risk perception has a significant impact on how society reacts to a given risk. There have been cases where a mismatch between the actual risk and the perception of it has led to poor decisions on societal initiatives, such as inappropriate regulatory measures. It is therefore important that the perception of risk is based on an informed foundation acknowledging the biases and drivers that inevitably go with risk perception. Plastic pollution differs in regard to other classical risks, such as those posed by chemicals or genetically modified organisms (GMOs), since the pollution is more visible and already has a significant magnitude. At the same time, everyone is familiar with using plastic, and our daily lives are highly dependent on the use of plastic. This offers some potential to strengthen the societal risk perception and subsequently implement effective measures to address the pollution.

In this chapter, we define eight risk perception drivers (voluntariness, control, knowledge, timing, severity, benefit, novelty, and tangibility) and relate these drivers to plastic pollution. We discuss the process in which plastic pollution has been recognized as an important environmental problem by scientists, the public, and policy makers and elaborate on how the eight risk drivers have influenced this process. Plastic pollution has several of the characteristics that can enhance people’s perception of the risk as being important and which has generated great awareness of the problem. The chapter finally discusses how risk perception can be improved by greater stakeholder involvement and utilization of citizen science and thereby improve the foundation for timely and efficient societal measures.
Salinity-gradient energy driven microbial electrosynthesis of hydrogen peroxide

Hydrogen peroxide ($\text{H}_2\text{O}_2$) as a strong oxidant, is widely used in various chemical industries and environmental remediation processes. In this study, we developed an innovative method for cost-effective production of $\text{H}_2\text{O}_2$ by using a microbial reverse-electrodialysis electrolysis cell (MREC). In the MREC, electrical potential generated by the exoelectrogens and the salinity-gradient between salt and fresh water were utilized to drive the high-rate $\text{H}_2\text{O}_2$ production. Operational parameters such as air flow rate, pH, cathodic potential, flow rate of salt and fresh water were investigated. The optimal $\text{H}_2\text{O}_2$ production was observed at salt and fresh water flow rate of 0.5 mL min$^{-1}$, air flow rate of 12–20 mL min$^{-1}$, cathode potential of $-0.485 \pm 0.025$ V (vs Ag/AgCl). The maximum $\text{H}_2\text{O}_2$ accumulated concentration of $778 \pm 11$ mg L$^{-1}$ was obtained at corresponding production rate of $11.5 \pm 0.5$ mg L$^{-1}$ h$^{-1}$. The overall energy input for the synthesis process was $0.45 \pm 0.03$ kWh kg$^{-1} \text{H}_2\text{O}_2$. Cathode potential was the key factor for $\text{H}_2\text{O}_2$ production, which was mainly affected by the air flow rate. This work for the first time proved the potential of MREC as an efficient platform technology for simultaneous electrosynthesis of valuable chemicals and utilization of salinity-gradient energy.
Scenario-Neutral Simulation of Flood Risk for Multiple Drivers

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Screening for illicit drugs in pooled human urine and urinated soil samples and studies on the stability of urinary excretion products of cocaine, MDMA, and MDEA in wastewater by hyphenated mass spectrometry techniques
Monitoring population drug use through wastewater-based epidemiology (WBE) is a useful method to quantitatively follow trends and estimate total drug consumption in communities. Concentrations of drug biomarkers might be low in wastewater due to dilution; and therefore analysis of pooled urine (PU) is useful to detect consumed drugs and identify targets of illicit drugs use. The aims of the study were (1) to screen PU and urinated soil (US) samples collected at festivals for illicit drug excretion products using hyphenated techniques; (2) to develop and validate a hydrophilic interaction liquid chromatography – mass spectrometry / mass spectrometry (HILIC-MS/MS) method of quantifying urinary targets of identified drugs in wastewater; and (3) to conduct a 24 h stability study, using PU and US to better reflect the chemical environment for targets in wastewater. Cocaine (COC) and ecstasy-like compounds were the most frequently detected illicit drugs; an analytical method was developed to quantify their excretion products. Hydroxymethoxymethamphetamine (HMMA), 3,4-methylenedioxymethamphetamine (MDMA), 3,4-methylenedioxyamphetamine (MDA), HMMA sulfate (HMMA-S), benzoylecgonine (BE), and cocaethylene (CE) had 85–102% of initial concentration after 8 h of incubation, whereas COC and ecgonine methyl ester (EME) had 74 and 67% after 8 h, respectively. HMMA showed a net increase during 24 h of incubation (107%±27, n=8), possibly due to the cleavage of HMMA conjugates, and biotransformation of MDMA. The results suggest HMMA as analytical target for MDMA consumption in WBE, due to its stability in wastewater and its excretion as the main phase I metabolite of MDMA.

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Screening method to assess the greenhouse gas mitigation potential of old landfills, based on downwind methane concentration measurements

A nationwide effort is taking place in Denmark to mitigate methane emissions from landfills, by using biocovers. A large number of older landfills were found to be potential candidates for biocover implementation, but very little information was available for these sites to help evaluate if significant methane emissions occur. To assess these sites, we developed a low-cost and quick remote sensing methodology, whereby downwind methane concentrations from 91 landfills were measured using a mobile analytical platform, and emission rates were calculated using an inverse dispersion model. The method was found useful in gauging whether the sites were relevant for biocover implementation or not. The method is considered a screening technique, and alternative approaches such as the tracer gas dispersion method must be applied for emission quantification.

Seaweed as innovative feedstock for energy and feed – Evaluating the impacts through a Life Cycle Assessment

Offshore cultivation of seaweed provides an innovative feedstock for biobased products supporting blue growth in northern Europe. This paper analyzes two alternative exploitation pathways: energy and protein production. The first pathway is based on anaerobic digestion of seaweed which is converted into biogas, for production of electricity and heat, and digestate, used as fertilizer; the second pathway uses seaweed hydrolysate as a substrate for cultivation of heterotrophic microalgae. As a result the seaweed sugars are consumed while new proteins are produced enhancing the total output. We performed a comparative Life Cycle Assessment of five scenarios identifying the critical features affecting resource efficiency and environmental performance of the systems with the aim of providing decision support for the design of future industrial scale production processes. The results show that all scenarios provide environmental benefits in terms of mitigation of climate change, with biogas production from dried Laminaria digitata being the most favorable scenario, quantified as −18.7*10^2 kg CO2 eq./ha. This scenario presents also the lowest consumption of total cumulative energy demand, 1.7*10^4 MJ/ha, and even resulting in a net reduction of the fossil energy fraction, −1.9*10^4 MJ/ha compared to a
situation without seaweed cultivation. All scenarios provide mitigation of marine eutrophication thanks to bioextraction of nitrogen and phosphorus during seaweed growth. The material consumption for seeded lines has 2–20 times higher impact on human toxicity (cancer) than the reduction achieved by energy and protein substitution. However, minor changes in cultivation design, i.e. use of stones instead of iron as ballast to weight the seeded lines, dramatically reduces human toxicity (cancer). Externalities from the use of digestate as fertilizer affect human toxicity (non-cancer) due to transfer of arsenic from aquatic environment to agricultural soil. However concentration of heavy metals in digestate does not exceed the limit established by Danish regulation. The assessment identifies seaweed productivity as the key parameter to further improve the performance of the production systems which are a promising service provider of environmental restoration and climate change mitigation.

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Selective removal of heavy metal ions by disulfide linked polymer networks

Heavy metal contaminated surface water is one of the oldest pollution problems, which is critical to ecosystems and human health. We devised disulfide linked polymer networks and employed as a sorbent for removing heavy metal ions from contaminated water. Although the polymer network material has a moderate surface area, it demonstrated cadmium removal efficiency equivalent to highly porous activated carbon while it showed 16 times faster sorption kinetics compared to activated carbon, owing to the high affinity of cadmium towards disulfide and thiol functionality in the polymer network. The metal sorption mechanism on polymer network was studied by sorption kinetics, effect of pH, and metal complexation. We observed that the metal ions—copper, cadmium, and zinc showed high binding affinity in polymer network, even in the presence of competing cations like calcium in water.

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Setup for Scenario-free Modelling of Urban Flood Risk in Non-stationary Climate and Urban Development Conditions

An early flood warning system has been developed for urban catchments and is currently running in online operation in Copenhagen. The system is highly dependent on the quality of rainfall forecast inputs. An investigation of precipitation inputs from Radar Nowcast (RN), Numerical Weather Prediction (NWP) with assimilation of radar and cloud data (RA3), and Ensemble NWP with 25 members (S05) is conducted by comparing against rain gauge measurements and flood extent. Despite lower spatial and temporal resolution, the ensemble product seems promising for forecasting extreme events. A combination of the three forecast products is expected to yield the optimal input for flood warning.

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Simple control rules for mitigating $\text{N}_2\text{O}$ emissions in phase isolated full-scale WWTPs

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ABSTRACT

Simple control strategy for mitigating $\text{N}_2\text{O}$ emissions in phase isolated full-scale WWTPs

Nitrous oxide ($\text{N}_2\text{O}$) is a strong greenhouse gas (GHG) and ozone depleter, with a warming potential 300 times higher than carbon dioxide (CO2). 1.2% of the total anthropogenic $\text{N}_2\text{O}$ emissions are believed to originate from the wastewater treatment (WWT) sector. Conventional biological nutrient removal processes relying on nitrification and denitrification are known to produce $\text{N}_2\text{O}$. A one year long-term study of $\text{N}_2\text{O}$ production and emissions was performed at Lynetten, Denmark’s largest WWTP. Nitrification and denitrification takes place by alternating process conditions as well as influent and effluent flows in 20 pairs of interconnected and surface aerated reactors. The long-term data revealed that the $\text{N}_2\text{O}$ emissions contribute to as much as 30% of the total CO2 footprint from the WWTP. High ammonium concentrations and long aeration phases lead to high $\text{N}_2\text{O}$ production and emissions rates. Nitrification phases were identified to produce and emit most of the $\text{N}_2\text{O}$. High production and emissions were also associated with the afternoon loading peaks at the WWTP. During denitrification phases $\text{N}_2\text{O}$ was produced initially but consumed consequently. An effective control strategy was implemented, whereby $\text{N}_2\text{O}$ emissions were reduced from 0.8% to 0.3% of the nitrogen load during the mitigation period.

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Simplification of one-dimensional hydraulic networks by automated processes evaluated on 1D/2D deterministic flood models

Evaluation of pluvial flood risk is often based on computations using 1D/2D urban flood models. However, guidelines on choice of model complexity are missing, especially for one-dimensional (1D) network models. This study presents a new automatic approach for simplification of 1D hydraulic networks (SAHM) using trimming and merging techniques, with performance evaluated in a 1D/2D case study. Decreasing the number of elements in the 1D model by 66% yielded a 35% decrease in computation time of the coupled 1D/2D simulation. The simplifications increased flow in some downstream branches and removing nodes eliminated connection to some areas. This promoted errors in two-dimensional (2D) flood results with changes in spatial location of flooding in the reduced 1D/2D models. Applying delayed rain inputs to compensate for changes in travel time and preserving network volume by expanding node diameters did not improve overall results. Investigations on the expected annual damages (EAD) showed that differences in EAD are smaller than deviations in the simulated flooded areas, suggesting that spatial changes are limited to local displacements. Probably, minor improvements of the simplification procedure will further improve results of the reduced models.

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Single-Channel Recordings of K+ Channels Expressed in Saccharomyces Cerevisiae

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Social construction of stormwater control measures in Melbourne and Copenhagen: A discourse analysis of technological change, embedded meanings and potential mainstreaming

Urban stormwater systems in cities around the world are challenged by urbanization and climate change, and a range of Stormwater Control Measures (SCMs) are being implemented as solutions to these challenges. We developed a conceptual framework of technological stabilization based on Social Construction of Technology (SCOT) and Transition Science, and conducted 16 in-depth actor interviews as a basis for mapping the historical development of in the two cities. The SCMs applied in Melbourne and Copenhagen are similar, but using a new framework for technological stabilization we identify differences in their application due to different physical, organizational and cultural contexts in the two cities, drought being the main driver during the past decade in Melbourne (1997–2010) and pluvial flooding in Copenhagen (2007-). In Melbourne there is currently a strong integrated understanding of SCMs: after decades of “new technology” development, “testing” and “opportunity” seeking a large degree of “agreement” about stormwater management as a mainstreamed professional practice has arisen. In Copenhagen there are currently multiple conflicting understandings of SCMs and signs of an emerging integrated understanding that offers “opportunities” for further development and implementation. It is clear from Melbourne’s history that: successful full scale demonstration projects supported and developed by a wide range of actors helps building a common vision for SCM technologies, supportive policies across several governmental levels provide incentives for implementation, and inclusive actions in the closure process provides a sense of ownership for SCM technologies across disciplines.
Sorption and diffusion of micropollutants on/in biofilms: experimental observations and a model-based interpretation

In this study we investigated the diffusion and sorption of 22 pharmaceuticals in/on nitrifying biofilms of different thickness. Experimental observations were subject to model-based interpretation and the assessment of a sorption coefficient \( K_d \) and effective diffusivity coefficient \( f \). Three biofilm depths were obtained by using Z-carriers (AnoxKaldnes) as support, which allows tight control of biofilm thickness. Biofilms of increasing thickness had increased porosity (and thus decreasing density). Sorption was significant for the positively charged compounds at experimental pH (with few exceptions) and \( K_d \) increased with biofilm thickness. The effective diffusivity \( f \) negatively correlated with biofilm density, suggesting that diffusion of micropollutants in thinner biofilms could be limited. Overall, this study elucidated how biofilm thickness can positively influence sorption of micropollutants on biofilm as well as how diffusion limitation is strongly impact by biofilm characteristics (density and porosity) and the specific chemical.

Spatial bias and uncertainty in numerical weather predictions for urban runoff forecasts with long time horizons

Numerical Weather Predictions (NWP) can be used to forecast urban runoff with long lead times. However, NWP exhibit large spatial uncertainties and using forecasted precipitation directly above the catchment might therefore not be an ideal approach in an online setup. We use the Danish Meteorological Institute’s NWP ensemble and investigate a large spatial neighborhood around the catchment over a two-year period. When compared against in-sewer observations, runoff forecasts forced with precipitation from north-east of the catchment are most skillful. This highlights spatial biases in the coupled hydro-meteorological setup, which a forecaster should be aware of.

Statistical analysis of solid waste composition data: Arithmetic mean, standard deviation and correlation coefficients

Data for fractional solid waste composition provide relative magnitudes of individual waste fractions, the percentages of which always sum to 100, thereby connecting them intrinsically. Due to this sum constraint, waste composition data represent closed data, and their interpretation and analysis require statistical methods, other than classical statistics that are suitable only for non-constrained data such as absolute values. However, the closed characteristics of waste
composition data are often ignored when analysed. The results of this study showed, for example, that unavoidable animal-derived food waste amounted to 2.21 ± 3.12% with a confidence interval of (−4.03; 8.45), which highlights the problem of the biased negative proportions. A Pearson's correlation test, applied to waste fraction generation (kg mass), indicated a positive correlation between avoidable vegetable food waste and plastic packaging. However, correlation tests applied to waste fraction compositions (percentage values) showed a negative association in this regard, thus demonstrating that statistical analyses applied to compositional waste fraction data, without addressing the closed characteristics of these data, have the potential to generate spurious or misleading results. Therefore, compositional data should be transformed adequately prior to any statistical analysis, such as computing mean, standard deviation and correlation coefficients.

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.354 SNIP 2.044
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.739 SNIP 2.256 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.777 SNIP 2.482 CiteScore 3.43
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.822 SNIP 2.435 CiteScore 3.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.611 SNIP 2.184 CiteScore 2.91
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.698 SNIP 2.085 CiteScore 2.99
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.555 SNIP 1.78
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.502 SNIP 1.899
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.378 SNIP 2.13
Web of Science (2008): Indexed yes
Stochastic Greybox Modeling for Control of an Alternating Activated Sludge Process

We present a stochastic greybox model of a BioDenitro WWTP that can be used for short time horizon Model Predictive Control. The model is based on a simplified ASM1 model and takes model uncertainty into account. It estimates unmeasured state variables in the system, e.g. the inlet concentration or the sensor measurements in case of temporary sensor faults. This improves control performance without adding additional or redundant sensors. We fitted the parameters of the model to actual plant data and demonstrate the state estimation capabilities with this data set. The model now runs online at a WWTP in Denmark.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Department of Environmental Engineering, Urban Water Systems, Krüger A/S
Authors: Halvgaard, R. F. (Intern), Vezzaro, L. (Intern), Grum, M. (Ekstern), Munk-Nielsen, T. (Ekstern), Tychsen, P. (Ekstern), Madsen, H. (Intern)
Number of pages: 9
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WWTP, ASM1, Stochastic, Greybox, Alternating, BioDenitro
Electronic versions:
tr17_08_Halvgaard_R.pdf
Publication: Research › Report – Annual report year: 2017

Sustainability assessment of stormwater management systems

We quantify ecotoxicity impacts caused by different solutions to manage stormwater using life cycle assessment. As a novelty, we include emissions of a wide range of pollutants present in runoff. These emissions turn out to be of great importance, especially in decentralized, above surface systems.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Department of Management Engineering, Quantitative Sustainability Assessment
Sustainability assessment of stormwater management systems and the importance of pollutants in runoff

We develop a method to systematically include impacts caused by runoff discharge into the sustainability assessment of stormwater management systems. By defining priority pollutants and calculating mean concentrations, an average ecotoxicity impact per litre of runoff is calculated. Of all assessed substance groups present in runoff, metals cause the highest impacts. To integrate this method into holistic sustainability assessment, we assess the complete life cycle of a complex stormwater management. We show that runoff discharges have a high relative importance: The impacts exceed the combined impacts of implementation, maintenance and decommissioning of the stormwater management system.

Systematic Quantification of Biogas Potential in Urban Organic Waste

Currently, there is growing interest in introducing the separate collection of biowaste from households, restaurants and commercial and industrial sources for biological treatment and the recovery of energy and nutrients. Upcoming policies and legislations promote and incentivise the production of biogas from organic waste rather than incineration and landflling. The production of biogas from urban organic waste is expected to contribute to reaching the EU target of 20% of overall energy production and 10% of vehicle fuel derived from renewable sources by 2020. The Danish energy strategy is for Denmark to become a 100% fossil fuel-free nation by 2050. However, existing technical challenges and barriers must be overcome to make the production of biogas more attractive. In this respect, a systematic quantification of the biogas production potential of various urban organic waste sources is necessary, in order to analyse and improve processes for biogas production. Conventionally, the potential biogas production of organic waste sources is quantified through biochemical methane potential (BMP) analysis and anaerobic digestion in biogas reactors. However, the determination of BMP in batch incubation tests, and monitoring of production in laboratory reactors, for example, is considerably time-consuming and lasts from 30 up to 90 days, or sometimes even longer.

Analytical and modelling methods were combined to develop a rapid, reliable and robust method for the BMP prediction of urban organic waste sources. In total, the methane potentials of 87 urban organic waste samples were determined. In addition, 88 plant biomass samples were included in the dataset used for building a combined methane prediction model based on near-infrared reflectance spectroscopy (NIRS). The model was moderately successful in predicting the BMP of urban organic waste sources and could potentially replace traditional techniques currently employed for BMP measurement. The model provides firsthand estimations of BMP and biochemical transformation in fewer than 72 hours, and it could provide support to biogas plant operators seeking to characterise substrate quickly, thereby enabling rapid decisions to improve methane production, optimise feedstock management and help identify slowly degradable feedstock before making a decision on which materials to utilize in the digesters.
Termination of nanoscale zero-valent iron reactivity by addition of bromate as a reducing reactivity competitor

Remediation of contaminated groundwater by nanoscale zero-valent iron (nZVI) is widely becoming a leading environmentally friendly solution throughout the globe. Since a wide range of various nZVI-containing materials have been developed for effective remediation, it is necessary to determine an appropriate way to terminate the reactivity of any nZVI-containing material for a practical experimental procedure. In this study, bimetallic Ni/Fe-NPs were prepared to enhance overall reduction kinetics owing to the catalytic reactivity of nickel on the surface of nZVI. We have tested several chemical strategies in order to terminate nZVI reactivity without altering the concentration of volatile compounds in the solution. The strategies include surface passivation in alkaline conditions by addition of carbonate, and consumption of nZVI by a reaction competitor. Four halogenated chemicals, trichloroethylene, 1,1,1-trichloroethane, atrazine, and 4-chlorophenol, were selected and tested as model groundwater contaminants. Addition of carbonate to passivate the nZVI surface was not effective for trichloroethylene. Nitrate and then bromate were applied to competitively consume nZVI by their faster reduction kinetics. Bromate proved to be more effective than nitrate, subsequently terminating nZVI reactivity for all four of the tested halogenated compounds. Furthermore, the suggested termination method using bromate was successfully applied to obtain trichloroethylene reduction kinetics. Herein, we report the simple and effective method to terminate the reactivity of nZVI by addition of a reducing reactivity competitor.
Testing high resolution synthetic rainfall time series representing current and future climates on CSO and other indicators

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Aalborg University
Authors: Sørup, H. J. D. (Intern), Davidsen, S. (Intern), Löwe, R. (Intern), Thorndahl, S. L. (Forskerdatabase), Borup, M. (Intern), Arnbjerg-Nielsen, K. (Intern)
Pages: 93-94
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 14th IWA/IAHR international conference on urban drainage
Main Research Area: Technical/natural sciences
Conference: 14th IWA/IAHR International Conference on Urban Drainage 2017, Prague, Czech Republic, 10/09/2017 - 10/09/2017
Long term simulations, LTS, CSO, Climate change, Combined sewer overflow, Rainfall generator

Test of aerobic TCE degradation by willows (Salix viminalis) and willows inoculated with TCE-cometabolizing strains of Burkholderia cepacia

Trichloroethylene (TCE) is a widespread soil and groundwater pollutant and clean-up is often problematic and expensive. Phytoremediation may be a cost-effective solution at some sites. This study investigates TCE degradation by willows (S. viminalis) and willows inoculated with three strains of B. cepacia (301C, PR1-31 and VM1330-pTOM), using chloride formation as an indicator of dehalogenation. Willows were grown in non-sterile, hydroponic conditions for 3 weeks in chloride-free nutrient solution spiked with TCE. TCE was added weekly due to rapid loss by volatilization. Chloride and TCE in solution were measured every 2-3 days and chloride and metabolite concentrations in plants were measured at test termination. Based on transpiration, no tree toxicity of TCE exposure was observed. However, trees grown in chloride-free solution showed severely inhibited transpiration. No or very little chloride was formed during the test, and levels of chloride in TCE-exposed trees were not elevated. Chloride concentrations in chloride containing TCE-free nutrient solution doubled within 23 days, indicating active exclusion of chloride by root cell membranes. Only traces of TCE-metabolites were detected in plant tissue. We conclude that TCE is not, or to a limited extent (less than 3%), aerobically degraded by the willow trees. The three strains of B. cepacia did not enhance TCE mineralization. Future successful application of rhizo- and phytodegradation of TCE requires measures to be taken to improve the degradation rates.

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Water Resources Engineering, Aarhus University
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Number of pages: 12
Pages: 18320–18331
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Main Research Area: Technical/natural sciences

Publication information
Journal: Environmental Science and Pollution Research
Volume: 24
Issue number: 22
ISSN (Print): 0944-1344
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.66 SJR 0.813 SNIP 1.048
Web of Science (2016): Indexed yes
The applicability of chemical alternatives assessment for engineered nanomaterials

The use of alternatives assessment to substitute hazardous chemicals with inherently safer options is gaining momentum worldwide as a legislative and corporate strategy to minimize consumer, occupational, and environmental risks. Engineered nanomaterials represent an interesting case for alternatives assessment approaches as they can be considered both emerging “chemicals” of concern, as well as potentially safer alternatives to hazardous chemicals. However, comparing the hazards of nanomaterials to traditional chemicals or to other nanomaterials is challenging and critical elements in chemical hazard and exposure assessment may have to be fundamentally altered to sufficiently
address nanomaterials. The aim of this paper is to assess the overall applicability of alternatives assessment methods for nanomaterials and outline recommendations to enhance their use in this context. This paper focuses on the adaptability of existing hazard and exposure assessment approaches to engineered nanomaterials as well as strategies to design inherently safer nanomaterials. We argue that alternatives assessment for nanomaterials is complicated by the sheer number of nanomaterials possible. As a result, the inclusion of new data tools that can efficiently and effectively evaluate nanomaterials as substitutes are needed to strengthen the alternatives assessment process. However, we conclude that with additional tools to enhance traditional hazard and exposure assessment modules of alternatives assessment, such as the use of mechanistic toxicity screens and control banding tools, alternatives assessment can be adapted to evaluate engineered nanomaterials both as potential substitutes for chemicals of concern and to ensure safer nanomaterials are incorporated in the design of new products. This article is protected by copyright. All rights reserved
The Challenges of Applying Planetary Boundaries as a Basis for Strategic Decision-Making in Companies with Global Supply Chains

The Planetary Boundaries (PB) framework represents a significant advance in specifying the ecological constraints on human development. However, to enable decision-makers in business and public policy to respect these constraints in strategic planning, the PB framework needs to be developed to generate practical tools. With this objective in mind, we analyse the recent literature and highlight three major scientific and technical challenges in operationalizing the PB approach in decision-making: first, identification of thresholds or boundaries with associated metrics for different geographical scales; second, the need to frame approaches to allocate fair shares in the 'safe operating space' bounded by the PBs across the value chain and; third, the need for international bodies to co-ordinate the implementation of the measures needed to respect the Planetary Boundaries. For the first two of these challenges, we consider how they might be addressed for four PBs: climate change, freshwater use, biosphere integrity and chemical pollution and other novel entities. Four key opportunities are identified: (1) development of a common system of metrics that can be applied consistently at and across different scales; (2) setting 'distance from boundary' measures that can be applied at different scales; (3) development of global, preferably open-source, databases and models; and (4) advancing understanding of the interactions between the different PBs. Addressing the scientific and technical challenges in operationalizing the planetary boundaries needs be complemented with progress in addressing the equity and ethical issues in allocating the safe operating space between companies and sectors.

General information
State: Published
Organisations: Department of Environmental Engineering, Department of Management Engineering, Quantitative Sustainability Assessment, University of Surrey, Unilever R&D, Radboud University Nijmegen, Unilever R&D, CIRAIG, Stanford University, Humboldt-University of Berlin, Columbia University, University of Bayreuth, Stockholm University, UNEP, University of Technology, Sydney
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Publication information
Journal: Sustainability
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Article number: 279
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.96 SJR 0.524 SNIP 0.911
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 0.473 SNIP 0.926 CiteScore 1.78
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 0.499 SNIP 1.048 CiteScore 1.52
The competitive edge: competition and biofilm composition, an individual-based modelling approach

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, University of Birmingham, Friedrich Schiller University
Authors: Cockx, B. (Intern), Clegg, R. J. (Ekstern), Lang, S. (Ekstern), Kreft, J. (Ekstern), Smets, B. F. (Intern)
Number of pages: 3
Publication date: 2017
Event: Abstract from 10th International Conference on Biofilm Reactors, Dublin, Ireland.
Main Research Area: Technical/natural sciences
Electronic versions:
Abstract_B_Biofilms_dublin_2017_Cockx_et_al.pdf
Source: PublicationPreSubmission
Source-ID: 134953589
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

The complete genome sequence of Trueperella pyogenes UFV1 reveals a processing system involved in the quorum sensing signal response

We present here the complete genome sequence of Trueperella pyogenes UFV1. The 2.3-Mbp genome contains an extremely interesting AI-2 transporter and processing system related to the quorum-sensing signal response. This specific feature is described in this species for the first time and might be responsible for a new pathogenic behavior.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Universidade Federal de Vicosa, University of Padova
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Number of pages: 2
Publication date: 2017
Main Research Area: Technical/natural sciences
Publication information
Journal: Genome Announcements
Volume: 5
Issue number: 29
Article number: e00639-17
ISSN (Print): 2169-8287
Ratings:
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BFI (2017): BFI-level 1
Scopus rating (2016): CiteScore 0.41 SJR 0.217 SNIP 0.233
The effect of UV treatment on highly polluted and normal operated swimming pools

Water samples from 2 indoor public swimming pool facilities with significantly different organic matter concentrations in the recirculation were tested to evaluate UV-induced effects on water chemistry. The aim of the study was to investigate the impact of poor water quality due to increased organic carbon (TOC) and the potential effect of increased nitrate concentration on disinfection by-product (DBP) formation in pool water. Concentration change on total trihalomethanes (TTHM) was investigated utilising medium pressure UV treatment in conjunction with chlorine. Post-UV chlorine consumption increased, UV dose-dependently. The post-UV chlorination clearly induced TTHM formation in both polluted and normal operated pools. However, elevated TOC concentration did not increase significantly the DBP formation. Regarding the brominated fraction of the halogens in the formed TTHMs, it appeared to decrease when the sample was subjected to post-UV chlorination in the normal operated pool, having the opposite result in the highly polluted pool. The addition of nitrate (when subjected to irradiation it forms radicals) and the subsequent post-UV chlorination were contradicting with the radical mechanisms; nitrite shielded the water surface inhibiting the UV penetration and therefore less TTHMs were formed.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies
Authors: Spiliotopoulou, A. (Intern), Kaarsholm, K. M. S. (Intern), Andersen, H. R. (Intern)
Number of pages: 3
Publication date: 2017

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Main Research Area: Technical/natural sciences
Conference: 7th International Conference, Kos, Greece, 02/05/2017 - 02/05/2017
DBP formation, Medium pressure UV lamp, polluted pool, Trihalomethane
Source: PublicationPreSubmission
Source-ID: 137196005
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

The effect of UV treatment on highly polluted and normal operated swimming pools

"It should be light blue, transparent" (Mario Andrada, speakerman, Olympic Games, Rio, 2016) was the comment for the "green lake". Swimming pools are sensitive recirculating systems. A malfunction in water treatment units or a poor operating decision could possibly lead to health-endangering or aesthetically unacceptable conditions for swimmers, with a lengthy and expensive remediation.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies
Authors: Spiliotopoulou, A. (Intern), Kaarsholm, K. M. S. (Intern), Andersen, H. R. (Intern)
Number of pages: 1
Publication date: 2017

Event: Poster session presented at 7th International Conference, Kos, Greece.
Main Research Area: Technical/natural sciences
Electronic versions:
poster_PS_2017_FinalA0_Print_for_wall.pdf
Source: PublicationPreSubmission
Source-ID: 137196005
Publication: Research › Poster – Annual report year: 2017
The impact of anode acclimation strategy on microbial electrolysis cell treating hydrogen fermentation effluent

The impact of different anode acclimation methods for enhancing hydrogen production in microbial electrolysis cell (MEC) was investigated in this study. The anodes were first acclimated in microbial fuel cells using acetate, butyrate and corn stalk fermentation effluent (CSFE) as substrate before moving into MECs, respectively. Subsequently, CSFE was used as feedstock in all the three MECs. The maximum hydrogen yield with the anode pre-acclimated with butyrate ($5.21 \pm 0.24 \text{ L H}_2/\text{L CSFE}$) was higher than that pre-acclimated with acetate ($4.22 \pm 0.19 \text{ L H}_2/\text{L CSFE}$) and CSFE ($4.55 \pm 0.14 \text{ L H}_2/\text{L CSFE}$). The current density ($480 \pm 11 \text{ A/m}^3$) and hydrogen production rate ($4.52 \pm 0.13 \text{ m}^3/\text{m}^3/\text{d}$) with the anode pre-acclimated with butyrate were also higher than another two reactors. These results demonstrated that the anode biofilm pre-acclimated with butyrate has significant advantages in CSFE treatment and could improve the performance of hydrogen production in MEC.
The impact of mass transfer limitations and heterogeneity contrasts on the parameterization of longitudinal dispersion in numerical models

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Stanford University
Authors: Lee, J. (Ekstern), Rolle, M. (Intern), Kitanidis, P. (Ekstern)
Number of pages: 1
Publication date: 2017
Main Research Area: Technical/natural sciences
The release of silver nanoparticles from commercial toothbrushes

The use of silver nanoparticles (NPs) in commercial products has become increasingly common in the past decade, mostly due to their antimicrobial properties. Using Ag NP-containing articles may lead to particle release, which raises concern of human and environmental safety. The published literature addressing particle release is scarce, especially when it comes to quantifying exposure to NPs specifically. In this study, we have experimentally investigated the release of total Ag and Ag NP from commercially available toothbrushes i.e. biodegradable toothbrushes for adults and toothbrushes for children. Toothbrushes were immersed and abraded in tap water for 24 h corresponding to more than the whole intended usage time of a toothbrush. The total amount of released Ag was quantified by inductively coupled plasma-mass spectrometry (ICP-MS) analysis, and the Ag NPs were characterized by single particle ICP-MS and transmission electron microscopy (TEM). The median size of the released Ag NPs ranged from 42 to 47 nm, and the maximum total Ag release was 10.2 ng per toothbrush. The adult toothbrushes were generally releasing more total Ag and NPs than children toothbrushes. In conclusion, our results indicate that the use of Ag NP-impregnated toothbrushes can cause consumer as well as environmental exposure to Ag NPs.
The Role of Alternative Testing Strategies in Environmental Risk Assessment of Engineered Nanomaterials

Within toxicology there is a pressure to find new test systems and organisms to replace, reduce and refine animal testing. In nanoecotoxicology the need for alternative testing strategies (ATS) is further emphasized as the validity of tests and risk assessment practices developed for dissolved chemicals are challenged. Nonetheless, standardized whole organism animal testing is still considered the gold standard for environmental risk assessment. Advancing risk analysis of engineered nanomaterials (ENMs) through ATS was discussed in September 2014 at an international Society for Risk Analysis (SRA) workshop in Washington, D.C. and serves as the point of departure for this paper. Here we present the main outcomes by describing and defining the use of ATS for ENMs as well as discussing its future role in environmental risk science. We conclude that diversity in testing should be encouraged to avoid “selective ignorance” and that, through an iterative process with low-tier and high-tier testing, data-generation can be validated to ensure relevant endpoints. Furthermore, simplified screening of ENMs could enable early decision-making on material design, while complex multispecies studies should be utilized to skip uncertain environmental extrapolations and give rise to more accurate risk analysis.

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, University of California, University of Montana, RTI International, Duke University
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Number of pages: 11
Pages: 293-301
The role of metals in methane production from shredder waste in landfills

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Fathi Aghdam, E. (Intern), Scheutz, C. (Intern), Kjeldsen, P. (Intern)
Number of pages: 2
Publication date: 2017
Event: Abstract from 5th International Conference on Sustainable Solid Waste Management, Athens, Greece.
Main Research Area: Technical/natural sciences
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The shortfall of risk assessment for decision-making

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Hjorth, R. (Intern)
Number of pages: 2
Pages: 1109-1110
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Nature Nanotechnology
Volume: 12
Issue number: 12
The sun tiered modeling-based inhalation, dermal, oral and inadvertent oral exposure assessment framework for nanomaterials

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, National Research Center for Working Environment, Tampere University of Technology, Institute of Occupational Medicine (IOM)
Authors: Jensen, K. A. (Ekstern), Jensen, A. C. Ø. (Ekstern), Koivisto, A. J. (Ekstern), Dal Maso, M. (Ekstern), Kalevi Koponen, I. (Ekstern), Mackevica, A. (Intern), Hansen, S. F. (Intern), Kuipers, E. (Ekstern), Fransmann, W. (Ekstern), Sanchez, A. (Ekstern), Tongeren, M. V. (Ekstern)
Number of pages: 2
Publication date: 2017
The toxicity of plastic nanoparticles to green algae as influenced by surface modification, medium hardness and cellular adsorption

To investigate processes possibly underlying accumulation and ecological effects of plastic nano-particles we have characterized their interaction with the cell wall of green algae. More specifically, we have investigated the influence of particle surface functionality and water hardness (Ca2+ concentration) on particle adsorption to algae cell walls. Polystyrene nanoparticles with different functional groups (non-functionalized, −COOH and −NH2) as well as coated (starch and PEG) gold nanoparticles were applied in these studies. Depletion measurements and atomic force microscopy (AFM) showed that adsorption of neutral and positively charged plastic nanoparticles onto the cell wall of P. subcapitata was stronger than that of negatively charged plastic particles. Results indicated that binding affinity is a function of both inter-particle and particle-cell wall interactions which are in turn influenced by the medium hardness and particle concentration. Physicochemical modelling using DLVO theory was used to interpret the experimental data, using also values for interfacial surface free energies. Our study shows that material properties and medium conditions play a crucial role in the rate and state of nanoparticle bio-adsorption for green algae. The results show that the toxicity of nanoparticles can be better described and assessed by using appropriate dose metrics including material properties, complexation/agglomeration behavior and cellular attachment and adsorption. The applied methodology provides an efficient and feasible approach for evaluating potential accumulation and hazardous effects of nanoparticles to algae caused by particle interactions with the algae cell walls.

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Technical University of Denmark, Wageningen University, Danish Fundamental Metrology, Radboud University Nijmegen
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Number of pages: 10
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Main Research Area: Technical/natural sciences

Publication information
Journal: Aquatic Toxicology
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.38 SJR 1.612 SNIP 1.393
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.666 SNIP 1.175 CiteScore 3.79
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.597 SNIP 1.337 CiteScore 3.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.88 SNIP 1.503 CiteScore 4.06
ISI indexed (2013): ISI indexed yes
The value of DCIP geophysical surveys for contaminated site investigations

Geophysical methods are increasingly being used in contaminant hydrogeology to map lithology, hydraulic properties, and contaminant plumes with a high ionic strength. Advances in the Direct Current resistivity and Induced Polarization (DCIP) method allow the collection of high resolution three dimensional (3D) data sets. The DC resistivity can describe both soil properties and the water electrical conductivity, while the IP can describe the lithology and give information on hydrogeological properties.

The aim of the study was to investigate a large contaminant plume discharging to a stream from an old factory site by combining traditional geological, hydrological, and contaminant concentration data with DCIP surveys. The plume consisted of xenobiotic organic compounds and inorganics. The study assesses benefits and limitations of DCIP geophysics for contaminated site investigations.

A 3D geological model was developed from borehole logs and DCIP data as framework for the complex transport pathways near the meandering stream. IP data were useful in indicating the continuity and the changes in thickness of local clay layers between the borehole logs. The geological model was employed to develop a groundwater flow model describing groundwater flows to the stream. The hydraulic conductivity distribution was based on IP data, slug tests and grain size analysis. The distribution of contaminant concentrations revealed two chemically distinct plumes, separated by a clay layer, with different transport paths to the stream. The DC resistivity was useful in mapping ionic compounds, but also organic compounds whose spatial distribution coincided with the ionic compounds. A conceptual model describing the...
contaminant plume was developed, and it matched well with contaminant concentrations in stream water and below the streambed.

Surface DCIP surveys supported the characterization of the spatial variability in geology, hydraulic conductivity and contaminant concentration. Though DCIP data interpretation required additional borehole data, the DCIP survey reduced the number of boreholes required and helped design field campaigns. The results suggest DCIP surveys are useful and inexpensive tools, which has potential as an integrated part of contaminated site investigations.

General information
State: Published
Authors: Balbarini, N. (Intern), Rønde, V. K. (Intern), Maurya, P. K. (Ekstern), Møller, I. (Ekstern), McKnight, U. S. (Intern), Christiansen, A. (Ekstern), Binning, P. J. (Intern), Bjerg, P. L. (Intern)
Number of pages: 1
Publication date: 2017
Event: Abstract from 2017 AGU Fall Meeting, New Orleans, United States.
Main Research Area: Technical/natural sciences
Electronic versions:
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Source: PublicationPreSubmission
Source-ID: 140729984
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Three Decades of Volume Change of a Small Greenlandic Glacier Using Ground Penetrating Radar, Structure from Motion, and Aerial Photogrammetry

Glaciers in the Arctic are losing mass at an increasing rate. Here we use surface topography derived from Structure from Motion (SfM) and ice volume from ground penetrating radar (GPR) to describe the 2014 state of Aqqutikitsoq glacier (2.85 km) on Greenland's west coast. A photogrammetrically derived 1985 digital elevation model (DEM) was subtracted from a 2014 DEM obtained using land-based SfM to calculate geodetic glacier mass balance. Furthermore, a detailed 2014 ground penetrating radar survey was performed to assess ice volume. From 1985 to 2014, the glacier has lost 49.8 ± 9.4 10 m of ice, corresponding to roughly a quarter of its 1985 volume (148.6 ± 47.6 10 m) and a thinning rate of 0.60 ± 0.11 m a. The computations are challenged by a relatively large fraction of the 1985 DEM (∼50% of the glacier surface) being deemed unreliable owing to low contrast (snow cover) in the 1985 aerial photography. To address this issue, surface elevation in low contrast areas was measured manually at point locations and interpolated using a universal kriging approach. We conclude that ground-based SfM is well suited to establish high-quality DEMs of smaller glaciers. Provided favorable topography, the approach constitutes a viable alternative where the use of drones is not possible. Our investigations constitute the first glacier on Greenland's west coast where ice volume was determined and volume change calculated. The glacier's thinning rate is comparable to, for example, the Swiss Alps and underlines that arctic glaciers are subject to fast changes.

General information
State: Published
Organisations: Department of Environmental Engineering, Department of Civil Engineering, National Space Institute, Geodesy, Section for Geotechnics and Geology, Arctic Technology Centre, Technical University of Denmark, Natural History Museum of Denmark
Authors: Marcer, M. (Ekstern), Stentoft, P. A. (Intern), Bjerre, E. (Intern), Cimoli, E. (Ekstern), Bjørk, A. A. (Ekstern), Stenseng, L. (Intern), Machguth, H. (Intern)
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Web of Science (2016): Indexed yes
Timming of the compensation of winter respiratory carbon losses provides explanatory power for net ecosystem productivity of forests

Accurate predictions of net ecosystem productivity (NEPc) of forest ecosystems are essential for climate change decisions and requirements in the context of national forest growth and greenhouse gas inventories. However, drivers and underlying mechanisms determining NEPc (e.g. climate, nutrients) are not entirely understood yet, particularly when considering the influence of past periods.

Here we explored the explanatory power of the compensation day (cDOY) —defined as the day of year when winter net carbon losses are compensated by spring assimilation— for NEPc in 26 forests in Europe, North America, and Australia, using different NEPc integration methods.

We found cDOY to be a particularly powerful predictor for NEPc of temperate evergreen needle-leaf forests ($R^2 = 0.58$) and deciduous broadleaf forests ($R^2 = 0.68$). In general, the latest cDOY correlated with the lowest NEPc. The explanatory power of cDOY depended on the integration method for NEPc, forest type, and whether the site had a distinct winter net
respiratory carbon loss or not. The integration methods starting in autumn led to better predictions of NEPc from cDOY then the classical calendar method starting at January 1. Limited explanatory power of cDOY for NEPc was found for warmer sites with no distinct winter respiratory loss period.

Our findings highlight the importance of the influence of winter processes and the delayed responses of previous seasons’ climatic conditions on current year’s NEPc. Such carry-over effects may contain information from climatic conditions, carbon storage levels and hydraulic traits of several years back in time.

**General information**

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**Organisations:** Department of Environmental Engineering, Atmospheric Environment


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**Main Research Area:** Technical/natural sciences

**Publication Information**

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- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 3.36 SJR 1.996 SNIP 1.313
- Web of Science (2016): Indexed yes
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- Scopus rating (2015): SJR 2.288 SNIP 1.362 CiteScore 3.39
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 2.324 SNIP 1.349 CiteScore 3.27
- Web of Science (2014): Indexed yes
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- Scopus rating (2013): SJR 2.357 SNIP 1.44 CiteScore 3.38
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 2.365 SNIP 1.35 CiteScore 2.93
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 2.239 SNIP 1.301 CiteScore 3.03
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 2.449 SNIP 1.324
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 2.347 SNIP 1.359
- Web of Science (2009): Indexed yes
The present study deals with the application of an advanced oxidation process combining UV irradiation in the presence of the photocatalyst titanium dioxide (TiO₂), as an effective pretreatment method of wheat straw as means for increasing its biodegradability for increased biogas production by anaerobic digestion (AD). Especially attention was paid in oxidation of the lignin in straw, besides release the sugars from the lignocellulosic structure of straw. Specifically, four different TiO₂ concentrations (0.0, 0.5, 1.0, 1.5, and 2.0% (w/w) TiO₂) were tested at three different irradiation times (0, 1, 2, and 3 h). Products of lignin-fraction oxidation, namely, vanillic acid, ferullic acid and acetic acid were quantified for each set of pretreatment conditions. Subsequently, biochemical methane potentials (BMPs) assays were conducted under thermophilic conditions from differentially pretreated samples and the pretreatment with the best performance was further tested in continuous mode operation. From BMP assays, 1.5% (w/w) TiO₂/straw at 3 h of UV light exposure pretreatment resulted in 37% (p < 0.05) increase in methane yield and 25% in CSTRs. It was concluded that the presence of TiO₂ and the products of lignin oxidation did not inhibit the AD process. Finally, a simplified energy assessment showed that all pretreatment conditions become feasible when amounts of substrate to be treated are greater than the threshold value of 1.15 g.

**General information**

**State:** Published  
**Organisations:** Department of Environmental Engineering, Residual Resource Engineering, University of Arid Agriculture Rawalpindi  
**Authors:** Alvarado-Morales, M. (Intern), Tsapekos, P. (Intern), Awais, M. (Ekstern), Gulfraz, M. (Ekstern), Angelidaki, I. (Intern)  
**Pages:** 155-161  
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**Main Research Area:** Technical/natural sciences

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**Journal:** Anaerobe  
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BFI (2018): BFI-level 1
Total methane emission from five Icelandic landfills - Quantification using tracer gas dispersion method

**General information**
State: Published
Organisations: Department of Environmental Engineering, Air, Land & Water Resources
Authors: Fredenslund, A. M. (Intern), Scheutz, C. (Intern)

**Original language:** English

**Biogas, Ferullic acid, Lignin, Photocatalytic oxidation, Vanillic acid, Wheat straw**

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**Source:** FindIt
Source-ID: 2349019475
Publication: Research - peer-review › Journal article – Annual report year: 2017
Total methane loss from biogas plants, determined by tracer dispersion measurements
Methane losses from biogas plants are problematic, since methane emitted into the atmosphere contributes to global warming, and any losses may thus reduce the environmental benefits of biogas production. A tracer gas dispersion method was used to measure total methane emissions from seven biogas plants, and more measurement campaigns are planned. Emissions varied between 1.3 and 13.4 (kg CH4 h-1), and losses expressed in percentages of production varied between 0.3 and 6.4%. The tracer gas dispersion method was found to be useful in quantifying total methane emissions from biogas plants, whereas the detection and quantification of individual leaks at the plants require other methods.

Towards a domain-based framework for use of rainfall forecasts in control of integrated urban wastewater systems
An increasing number of Model Predictive Control (MPC) tools have recently been developed. These MPC methods utilize as input a wide range of rainfall forecasts, which differ in their characteristics and prediction skills. Operators need to identify the most appropriate MPC and rainfall forecast for their needs. A domain-based framework is proposed to distinguish between four operational domains, which consider the magnitude of the forecasted rain and the expected status of the system. The framework is presented by using selected Danish case studies as examples, and it will provide a support to operators in the implementation of MPC strategies.
Toxicity of 2,3,5,6-tetrachlorophenol to willow trees (Salix viminalis)

Chlorinated phenols have been intensively investigated from an eco-toxicological point of view, however almost nothing is known about toxicity of tetrachlorophenol (TeCP) to higher terrestrial plants. This paper applied the willow tree acute toxicity test to study the toxicity of 2,3,5,6-TeCP to willows Salix viminalis (S. viminalis) at neutral and acidic conditions (roughly pH 7 and 4) with inhibition of transpiration as toxic endpoint. At neutral pH the EC50 was >10Â mg Lâ”¹ while the EC50 at acidic conditions was 0.32 Â± 0.17Â mg Lâ”¹, clearly indicating that toxicity is exerted by the non-ionic chemical fraction. Standard tests running at neutral pH are therefore not capturing the full toxicity of weak acids and bases.
Toxicity of 56 substances to trees

Toxicity data of substances to higher plants is needed for the purpose of risk assessment, site evaluation, phytoremediation, and plant protection. However, the results from the most common phytotoxicity tests, like the OECD algae and Lemna test, are not necessarily valid for higher terrestrial plants. The willow tree toxicity test uses inhibition of transpiration (aside of growth and water use efficiency) of willow cuttings grown in spiked solutions or soils as end point to quantify toxicity. This overview presents results from 60 studies including 24 new unpublished experiments for 56 different chemicals or substrates. Highest toxicity (EC50 <1 mg/L) was observed from exposure to heavy metals like copper and cadmium. Also, organotins and free cyanide showed very high toxicity. The toxic effect of chlorophenols on willows was comparable to that on duck weed (Lemna) and green algae, while volatile compounds like chlorinated solvents or benzene, toluene, ethylbenzene, and xylene had less effect on trees than on these aquatic plants, due to volatilization from leaves and test media. In particular low (g/L range) toxicity was observed for tested nanomaterials. Effects of pharmaceuticals (typically weak acids or bases) depended strongly of the solution pH. Like for algae, baseline toxicity was observed for willows, which is related to the water solubility of the compounds, with absolute chemical activity ranging from 0.01 to 0.1, but with several exceptions. We conclude that the willow tree toxicity test is a robust method for relating uptake, accumulation, and metabolism of substances to the toxicity to trees.

General information

State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Clausen, L. P. W. (Intern), Trapp, S. (Intern)
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Scopus rating (2016): CiteScore 2.66 SJR 0.813 SNIP 1.048
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BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.879 SNIP 1.02 CiteScore 2.5
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.949 SNIP 1.178 CiteScore 2.57
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Tracking and understanding AMR dynamics across European urban water systems

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, University of Copenhagen, University of Newcastle, Newcastle University
Authors: Smets, B. F. (Intern), Dechesne, A. (Intern), Li, L. (Intern), Madsen, J. S. (Ekstern), Nesme, J. (Ekstern), Sørensen, S. J. (Ekstern), Quintela-Baluja, M. (Ekstern), Graham, D. (Ekstern)
Number of pages: 1
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Main Research Area: Technical/natural sciences
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Training the urban water engineers of the future – the challenge of stormwater TSS models

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, University of Lyon
Authors: Vezzaro, L. (Intern), Sandoval, S. (Ekstern), Bertrand-Krajewski, J. (Ekstern)
Pages: 1841-1847
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Proceedings of the 14th International Conference on Urban Drainage (14ICUD), Prague, Czech Republic, 10th-15th September 2017<br/>Authors:<br/>Vezzaro, L. (DTU: luve)<br/>Sandoval, S.<br/>Bertrand-Krajewski, J.-L
Source: PublicationPreSubmission
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Transformation and sorption of illicit drug biomarkers in sewer biofilms
In-sewer transformation of drug biomarkers (excreted parent drugs and metabolites) can be influenced by the presence of biomass in suspended form as well as attached to sewer walls (biofilms). Biofilms are likely the most abundant and biologically active biomass fraction in sewers. In this study, 16 drug biomarkers were selected, including the major human metabolites of mephedrone, methadone, cocaine, heroin, codeine and tetrahydrocannabinol (THC). Transformation and sorption of these substances were assessed in targeted batch experiments using laboratory-scale biofilm reactors operated under aerobic and anaerobic conditions. A one-dimensional model was developed to simulate diffusive transport, abiotic and biotic transformation and partitioning of drug biomarkers. Model calibration to experimental results allowed estimating transformation rate constants in sewer biofilms, which were compared to those obtained using in-sewer suspended biomass. Our results suggest that sewer biofilms can enhance the transformation of most compounds. Through scenario simulations, we demonstrated that the estimation of transformation rate constants in biofilm can be significantly biased if the boundary layer thickness is not accurately estimated. This study complements our previous investigation on the transformation and sorption of drug biomarkers in the presence of only suspended biomass in untreated sewage. A better understanding of the role of sewer biofilms—also relative to the in-sewer suspended solids—and improved prediction of associated fate processes can lead to more accurate estimation of daily drug consumption in urban areas in wastewater-based epidemiological assessments.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Department of Chemical and Biochemical Engineering, Environmental Chemistry, KWR Watercycle Research Institute, University of Amsterdam
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Pages: 10572–10584
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Scopus rating (2016): CiteScore 6.26 SJR 2.538 SNIP 1.889
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Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
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ISI indexed (2012): ISI indexed yes
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BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.964 SNIP 1.729
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.835 SNIP 1.803
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.943 SNIP 1.942
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.8 SNIP 1.927
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.541 SNIP 1.901
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.604 SNIP 2.014
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.863 SNIP 2.046
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.545 SNIP 2.071
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.353 SNIP 1.953
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.419 SNIP 1.977
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.474 SNIP 2.334
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 3.466 SNIP 2.359

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Clindamycin is widely prescribed for its ability to treat a number of common bacterial infections. Thus, clindamycin enters wastewater via human excretion or disposal of unused medication and widespread detection of pharmaceuticals in rivers proves the insufficiency of conventional wastewater treatment plants in removing clindamycin. Recently, it has been discovered that attached biofilm reactors, e.g., moving bed biofilm reactors (MBBRs) obtain a higher removal of pharmaceuticals than conventional sludge wastewater treatment plants. Therefore, this study investigated the capability of MBBRs applied in the effluent of conventional wastewater treatment plants to remove clindamycin. First, a batch experiment was executed with a high initial concentration of clindamycin to identify the transformation products. It was shown that clindamycin can be removed from wastewater by MBBR and the treatment process converts clindamycin into the, possibly persistent, products clindamycin sulfoxide and N-desmethyl clindamycin as well as 3 other mono-oxygenated products. Subsequently, the removal kinetics of clindamycin and the formation of the two identified products were investigated in batch experiments using MBBR carriers from polishing and nitrifying reactors. Additionally, the presence of these two metabolites in biofilm-free wastewater effluent was studied. The nitrifying biofilm reactor had a higher biological activity with k-value of 0.1813 h⁻¹ than the reactor with polishing biofilm (k = 0.0161 h⁻¹) which again has a much higher biological activity for removal of clindamycin than of the suspended bacteria (biofilm-free control). Clindamycin sulfoxide was the main transformation product which was found in concentrations exceeding 10% of the initial clindamycin concentration after 1 day of MBBR treatment. Thus, MBBRs should not necessarily be considered as reactors mineralizing clindamycin as they perform transformation reactions at least to some extent.
Treatment of Arctic Wastewater by Chemical Coagulation, UV and Peracetic Acid Disinfection

Conventional wastewater treatment plant exists in Greenland and raw wastewater is discharged directly to nearby waterbodies without treatment. We investigated the efficiency of physico-chemical wastewater treatment, in Kangerlussuaq, Greenland. Raw wastewater from Kangerlussuaq was treated by chemical coagulation and UV disinfection. By applying 7.5 mg Al/L polyaluminium chloride (PAX XL100), 73% of turbidity and 28% phosphate was removed from raw wastewater. E. coli and Enterococcus were removed by 4 and 2.5 log, respectively, when UV irradiation of 0.70 kWh/m3 was applied to coagulated wastewater. Furthermore, coagulated raw wastewater in Denmark, which has a chemical quality similar to Greenlandic wastewater, was disinfected by peracetic acid or UV irradiation. Removal of heterotrophic bacteria by applying 6 mg/L and 12 mg/L peracetic acid was 2.8 and 3.1 log, respectively. Similarly, removal of heterotrophic bacteria by applying 0.21 kWh/m3 and 2.10 kWh/m3 for UV irradiation was 2.1 and greater than 4 log, respectively. Physico-chemical treatment of raw wastewater followed by UV irradiation and/or peracetic acid disinfection showed the potential for treatment of arctic wastewater.

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State: Accepted/In press
Organisations: Department of Environmental Engineering, Water Technologies, Department of Civil Engineering, ARTEK, Section for Arctic Engineering and Sustainable Solutions, Technical University of Denmark
Authors: Chhetri, R. K. (Intern), Klupsch, E. (Ekstern), Andersen, H. R. (Intern), Jensen, P. E. (Intern)
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Coagulation, Poly aluminum chloride, Wastewater, Disinfection, Peracetic acid, UV irradiation, Arctic
**Treatment of dilute landfill gas by open biocover systems - column experiments**

**General information**
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark
Authors: Thomasen, T. B. (Ekstern), Scheutz, C. (Intern), Kjeldsen, P. (Intern)
Number of pages: 6
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**Tuning biomimetic membrane barrier properties by hydrocarbon, cholesterol and polymeric additives**

The barrier properties of cellular membranes are increasingly attracting attention as a source of inspiration for designing biomimetic membranes. The broad range of potential technological applications makes the use of lipid and lately also polymeric materials a popular choice for constructing biomimetic membranes, where the barrier properties can be controlled by the composition of the membrane constituent elements. Here we investigate the membrane properties reported by the light-induced proton pumping activity of bacteriorhodopsin (bR) reconstituted in three vesicle systems of different membrane composition. Specifically we quantify how the resulting proton influx and efflux rates are influenced by the membrane composition using a variety of membrane modulators. We demonstrate that by adding hydrocarbons to vesicles with reconstituted bR formed from asolectin lipids the resulting transmembrane proton fluxes changes proportional to the carbon chain length when compared against control. We observe a similar proportionality in single-component 1,2-Dioleoyl-sn-glycerol-3-phosphocholine (DOPC) model membranes when using cholesterol. Lastly we investigate the effects of adding the amphiphilic di-block co-polymer polytubutadiene-polyethyleneoxide (PB12-PEO10) to phospholipid membranes formed from DOPC, 1,2-Dioleoyl-sn-glycerol-3-phosphatidylethanolamine (DOPE), and 1,2-Dioleoyl-sn-glycerol-3-phosphatidylyserine (DOPS). The proton pumping activity of bR (measured as a change in extra-vesicular pH) in mixed lipid/PB12-PEO10 lipid systems is up to six-fold higher compared to that observed for bR containing vesicles made from PB12-PEO10 alone. Interestingly, bR inserts with apparent opposite orientation in pure PB12-PEO10 vesicles as compared to pure lipid vesicles. Addition of equimolar amounts of lipids to PB12-PEO10 results in bR orientation similar to that observed for pure lipids. In conclusion our results show how the barrier properties of the membranes can be controlled by the composition of the membrane. In particular the use of mixed lipid-polymer systems may pave the way for constructing biomimetic membranes tailored for optimal properties in various applications including drug delivery systems, biosensors and energy conservation technology.

**General information**
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Organisations: Department of Physics, Biophysics and Fluids, Quantum Physics and Information Techology, Department of Environmental Engineering, Water Technologies, University of Copenhagen, Lund University
Authors: Palanco, M. E. (Intern), Skovgaard, N. (Ekstern), Hansen, J. S. (Ekstern), Berg-Sørensen, K. (Intern), Hélix-Nielsen, C. (Intern)
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Publication date: 2017
Main Research Area: Technical/natural sciences
Ultrafine particles in inhabited areas in the Arctic - From very low to high concentrations

The Arctic is considered a pristine environment, where pollution mainly originates from global sources. The present study examines particle number concentrations (PNCs) and the main sources of airborne ultrafine particles (UFPs, d < 100 nm) in the town Sisimiut and two nearby settlements, Sarfannguit and Itilleq, in West Greenland. Measurements were carried out during three weeks in April and May 2016. Air temperatures during the measurements ranged from −4.4 to +8.7 °C. A portable condensation particle counter (P-Trak) was used for the measurements. Results showed that the lowest concentrations were found during days with high wind speeds, with the lowest PNC average of 72 ± 11 cm⁻³ (n = 9) (12 m/s). Background concentrations were usually low compared to more densely populated countries, with a couple of exceptions, where there was no clear cause for elevated PNCs in a background area East of Sisimiut. Measured PNCs in the flue gas in the waste incineration plant in Sisimiut showed up to 334,976 cm⁻³ and are expected to be higher in the gas after it is released through the chimney. Average PNCs up to 77,009 ± 43,880 cm⁻³ (n = 26) were measured by a road located by the harbor in Sisimiut, while subsequent measurements at the same location showed much lower PNCs. The presence of heavy machinery elevated PNCs highly during two measurement events, giving PNCs up to 270,993 cm⁻³ but dropping to 1180 cm⁻³ 10 min later, after the vehicle had passed by. A measurement event in Sisimiut Airport while an aircraft landed and departed showed an average PNC of 44,741 ± 85,094 cm⁻³ (n = 21). Two 24-h measurements resulted in average PNCs of 2960 ± 5704 cm⁻³ and 3935 ± 10,016 cm⁻³ respectively.

General information

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Organisations: Department of Civil Engineering, ARTEK, Section for Arctic Engineering and Sustainable Solutions, Department of Environmental Engineering, Atmospheric Environment, Technical University of Denmark, The Danish Ecological Council
Unmanned Aerial Vehicle observations of water surface elevation, depth and surface velocity

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Organisations: Department of Environmental Engineering, Water Resources Engineering, Photrack AG
Authors: Bandini, F. (Intern), Kittel, C. M. M. (Intern), Lüthi, B. (Ekstern), Garcia, M. (Intern), Bauer-Gottwein, P. (Intern)
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Urban runoff forecasting with ensemble weather predictions
This research shows how ensemble weather forecasts can be used to generate urban runoff forecasts up to 53 hours into the future. The results highlight systematic differences between ensemble members that needs to be accounted for when these forecasts are used in practice.

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Use of fluorescence spectroscopy to control ozone dosage in recirculating aquaculture systems
The aim of this study was to investigate the potential of fluorescence spectroscopy to be used as an ozone dosage determination tool in recirculating aquaculture systems (RASs), by studying the relationship between fluorescence intensities and dissolved organic matter (DOM) degradation by ozone, in order to optimise ozonation treatment. Water
samples from six different Danish facilities (two rearing units from a commercial trout RAS, a commercial eel RAS, a pilot RAS and two marine water aquariums) were treated with different O3 dosages (1.0–20.0 mg/L ozone) in bench-scale experiments, following which fluorescence intensity degradation was eventually determined. Ozonation kinetic experiments showed that RAS water contains fluorescent organic matter, which is easily oxidised upon ozonation in relatively low concentrations (0–5 mg O3/L). Fluorescence spectroscopy has a high level of sensitivity and selectivity in relation to associated fluorophores, and it is able to determine accurately the ozone demand of each system. The findings can potentially be used to design offline or online sensors based on the reduction by ozone of natural fluorescent-dissolved organic matter in RAS. The suggested indirect determination of ozone delivered into water can potentially contribute to a safer and more adequate ozone-based treatment to improve water quality.

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State: Published
Authors: Spiliotopoulou, A. (Intern), Martin, R. (Ekstern), Pedersen, L. (Intern), Andersen, H. R. (Intern)
Pages: 357-365
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Water Research
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BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 7.49 SJR 2.629 SNIP 2.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.689 SNIP 2.507 CiteScore 6.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.957 SNIP 2.727 CiteScore 6.13
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.693 CiteScore 6.02
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.966 SNIP 2.456 CiteScore 5.15
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.867 SNIP 2.374 CiteScore 5.43
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.582 SNIP 2.196
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.319 SNIP 2.225
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.065 SNIP 2.19
Web of Science (2008): Indexed yes
Using a time-lagged method to enhance Numerical Weather Prediction for urban drainage applications

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Krüger A/S
Authors: Courdent, V. (Ekstern), Pedersen, J. W. (Intern), Munk-Nielsen, T. (Ekstern), Mikkelsen, P. S. (Intern)
Pages: 1639-1642
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 14th IWA/IAHR international conference on urban drainage
Place of publication: Prague, Czech Republic
Publisher: IWA Publishing
Main Research Area: Technical/natural sciences
Conference: 14th IWA/IAHR International Conference on Urban Drainage 2017, Prague, Czech Republic, 10/09/2017 - 10/09/2017
Electronic versions:
Courdent_et_al._2017._ICUD_Proceedings.pdf
Source: PublicationPreSubmission
Source-ID: 138750170
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

UV-Vis spectrophotometry for Wastewater Resource Recovery with Algae Photobioreactors

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Technical University of Denmark, Swiss Federal Institute of Aquatic Science and Technology
Authors: Valverde Pérez, B. (Intern), Wágner, D. S. (Intern), Steidl, M. (Ekstern), Villez, K. (Ekstern), Plósz, B. G. (Intern)
Number of pages: 34
Publication date: 2017

Publication information
Media of output: Powerpoint
Degradation of mechanically sorted organic fraction (MSOF) of municipal solid waste in composting facilities is among the major contributors of volatile compounds (VCs) generation and emission, causes nuisance problems and health risks on site as well as in the vicinages. The aim of current study was to determine the seasonal (summer and winter) variation and human health risk assessment of VCs in the ambient air of different processing units in MSOF at composting plant in China. Average concentration of VCs was 58.50 and 138.03 mg/m³ in summer and winter respectively. Oxygenated compounds were found to be the highest concentration (46.78–91.89 mg/m³) with ethyl alcohol as the major specie (43.90–85.31 mg/m³) in the two seasons respectively. Nevertheless, individual non-carcinogenic (Hazard relation i.e HR < 1) and carcinogenic risk (CR < 1.0E-04) of the quantified VCs were within acceptable limit except naphthalene at biofilter unit. In addition, cumulative non-carcinogenic risk exceeded from the threshold limit both in summers and winters in all units except at biofilter unit during winter. Furthermore cumulative carcinogenic risk also exceeded at same unit during the summer season. Therefore special attention should be made to minimize cumulative non-carcinogenic and carcinogenic risk as people are well exposed to mixture of compounds, not to individual.

**General information**

State: Published

Organisations: Department of Environmental Engineering, Tsinghua University

Authors: Mustafa, M. F. (Ekstern), Liu, Y. (Ekstern), Duan, Z. (Intern), Guo, H. (Ekstern), Xu, S. (Ekstern), Wang, H. (Ekstern), Lu, W. (Ekstern)

Pages: 35-43

Publication date: 2017

Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Hazardous Materials

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 6.31 SJR 1.727 SNIP 2.045
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.651 SNIP 1.935 CiteScore 5.54
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.814 SNIP 2.269 CiteScore 5.21
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.822 SNIP 2.458 CiteScore 5.09
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.985 SNIP 2.467 CiteScore 4.73
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Waste prevention for sustainable resource and waste management

Although the 2Rs (reduce and reuse) are considered high-priority approaches, there has not been enough quantitative research on effective 2R management. The purpose of this paper is to provide information obtained through the International Workshop in Kyoto, Japan, on 11–13 November 2015, which included invited experts and researchers in several countries who were in charge of 3R policies, and an additional review of 245 previous studies. It was found that, regarding policy development, the decoupling between environmental pressures and economy growth was recognized as an essential step towards a sustainable society. 3R and resource management policies, including waste prevention, will play a crucial role. Approaches using material/substance flow analyses have become sophisticated enough to describe the fate of resources and/or hazardous substances based on human activity and the environment, including the final sink. Life-cycle assessment has also been developed to evaluate waste prevention activities. Regarding target products for waste prevention, food loss is one of the waste fractions with the highest priority because its countermeasures have significant upstream and downstream effects. Persistent organic pollutants and hazardous compounds should also be taken into account in the situation where recycling activities are globally widespread for the promotion of a material-cycling society.

General information

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Japan Environment Safety Corporation, Environment Policy Bureau, National Institute of Environmental Studies, Ehime University, TOWA Technology Corporation, German Federal Environment Agency, Technical University of Berlin, Politecnico di Milano, University of Toronto, National Institute of Environmental Research, Tsinghua University, National Taiwan University, Vietnam Academy of Science and Technology, University of New South Wales, Kyoto University
Wastewater-based epidemiology to assess pan-European pesticide exposure

Human biomonitoring, i.e. the determination of chemicals and/or their metabolites in human specimens, is the most common and potent tool for assessing human exposure to pesticides, but it suffers from limitations such as high costs and biases in sampling. Wastewater-based epidemiology (WBE) is an innovative approach based on the chemical analysis of specific human metabolic excretion products (biomarkers) in wastewater, and provides objective and real-time information.
on xenobiotics directly or indirectly ingested by a population. This study applied the WBE approach for the first time to evaluate human exposure to pesticides in eight cities across Europe. 24 h-composite wastewater samples were collected from the main wastewater treatment plants and analyzed for urinary metabolites of three classes of pesticides, namely triazines, organophosphates and pyrethroids, by liquid chromatography-tandem mass spectrometry. The mass loads (mg/day/1000 inhabitants) were highest for organophosphates and lowest for triazines. Different patterns were observed among the cities and for the various classes of pesticides. Population weighted loads of specific biomarkers indicated higher exposure in Castellon, Milan, Copenhagen and Bristol for pyrethroids, and in Castellon, Bristol and Zurich for organophosphates. The lowest mass loads (mg/day/1000 inhabitants) were found in Utrecht and Oslo. These results were in agreement with several national statistics related to pesticides exposure such as pesticides sales. The daily intake of pyrethroids was estimated in each city and it was found to exceed the acceptable daily intake (ADI) only in one city (Castellon, Spain). This was the first large-scale application of WBE to monitor population exposure to pesticides. The results indicated that WBE can give new information about the “average exposure” of the population to pesticides, and is a useful complementary biomonitoring tool to study population-wide exposure to pesticides.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS, Istituto di Ricerche Farmacologiche Mario Negri, University Jaume I, Norwegian Institute for Water Research, University of Bath, KWR Watercycle Research Institute, University of Antwerp, Swiss Federal Institute of Aquatic Science and Technology (Eawag)
Authors: Rousis, N. I. (Ekstern), Gracia-Lor, E. (Ekstern), Zuccato, E. (Ekstern), Bade, R. (Ekstern), Baz-Lomba, J. A. (Ekstern), Castrignanò, E. (Ekstern), Causanilles, A. (Ekstern), Covaci, A. (Ekstern), de Voogt, P. (Ekstern), Hernández, F. (Ekstern), Kasprzyk-Hordern, B. (Ekstern), Kinyua, J. (Ekstern), McCall, A. (Ekstern), Plősz, B. G. (Intern), Ramin, P. (Intern), Ryu, Y. (Ekstern), Thomas, K. V. (Ekstern), van Nuijs, A. (Ekstern), Yang, Z. (Ekstern), Castiglioni, S. (Ekstern)
Pages: 270-279
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Main Research Area: Technical/natural sciences

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Journal: Water Research
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.49 SJR 2.629 SNIP 2.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.689 SNIP 2.507 CiteScore 6.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.957 SNIP 2.727 CiteScore 6.13
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.693 CiteScore 6.02
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.966 SNIP 2.456 CiteScore 5.15
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.867 SNIP 2.374 CiteScore 5.43
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.582 SNIP 2.196
Water level observations from Unmanned Aerial Vehicles for improving estimates of surface water-groundwater interaction

Integrated hydrological models are usually calibrated against observations of river discharge and piezometric head in groundwater aquifers. Calibration of such models against spatially distributed observations of river water level can potentially improve their reliability and predictive skill. However, traditional river gauging stations are normally spaced too far apart to capture spatial patterns in the water surface, while spaceborne observations have limited spatial and temporal resolution. UAVs (Unmanned Aerial Vehicles) can retrieve river water level measurements, providing: i) high spatial resolution; ii) spatially continuous profiles along or across the water body; iii) flexible timing of sampling. A semi-synthetic study was conducted to analyse the value of the new UAV-borne datatype for improving hydrological models, in particular estimates of GW (Groundwater)- SW (Surface Water) interaction. Mølleåen River (Denmark) and its catchment were simulated using an integrated hydrological model (MIKE 11-MIKE SHE). Calibration against distributed surface water levels using the DiffeRential Evolution Adaptive Metropolis (DREAM) algorithm demonstrated a significant improvement in estimating spatial patterns and time series of GW-SW interaction. After water level calibration, the sharpness of the estimates of GW-SW time series improves of ca. 50% and RMSE (Root Mean Square Error) decreases by ca. 75% compared to a model calibrated against discharge only.
Weather radar rainfall data in urban hydrology

Application of weather radar data in urban hydrological applications has evolved significantly during the past decade as an alternative to traditional rainfall observations with rain gauges. Advances in radar hardware, data processing, numerical models, and emerging fields within urban hydrology necessitate an updated review of the state of the art in such radar rainfall data and applications. Three key areas with significant advances over the past decade have been identified: (1) temporal and spatial resolution of rainfall data required for different types of hydrological applications, (2) rainfall estimation, radar data adjustment and data quality, and (3) nowcasting of radar rainfall and real-time applications. Based on these three fields of research, the paper provides recommendations based on an updated overview of shortcomings, gains, and novel developments in relation to urban hydrological applications. The paper also reviews how the focus in
urban hydrology research has shifted over the last decade to fields such as climate change impacts, resilience of urban areas to hydrological extremes, and online prediction/warning systems. It is discussed how radar rainfall data can add value to the aforementioned emerging fields in current and future applications, but also to the analysis of integrated water systems.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Aalborg University, hydro & meteo GmbH & Co. KG, KU Leuven, Delft University of Technology, ETH Zurich
Authors: Thorndahl, S. (Ekstern), Einfalt, T. (Ekstern), Willems, P. (Ekstern), Nielsen, J. E. (Ekstern), ten Veldhuis, M. (Ekstern), Arnbjerg-Nielsen, K. (Intern), Rasmussen, M. R. (Ekstern), Molnar, P. (Ekstern)
Number of pages: 22
Pages: 1359-1380
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Hydrology and Earth System Sciences
Volume: 21
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Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 4.22 SJR 2.216 SNIP 1.624
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 2.225 SNIP 1.497 CiteScore 3.74
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 2.144 SNIP 1.635 CiteScore 3.71
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.859 SNIP 1.546 CiteScore 3.39
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 1.949 SNIP 1.567 CiteScore 3.18
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 1.493 SNIP 1.394 CiteScore 2.7
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.557 SNIP 1.334
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 1.658 SNIP 1.656
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 1.699 SNIP 1.431
- Scopus rating (2007): SJR 1.108 SNIP 1.146
- Scopus rating (2006): SJR 0.65 SNIP 0.79
- Scopus rating (2005): SJR 0.777 SNIP 0.738
- Web of Science (2005): Indexed yes
What can nanosafety learn from drug development? The feasibility of "safety by design"?

"Safety by design" (SbD) is an intuitively appealing concept that is on the rise within nanotoxicology and nanosafety research, as well as within nanotechnology research policy. It leans on principles established within drug discovery and development (DDD) and seeks to address safety early, as well as throughout product development. However, it remains unclear what the concept of SbD exactly entails for engineered nanomaterials (ENMs) or how it is envisioned to be implemented. Here, we review the concept as it is emerging in European research and compare its resemblance with the safety testing and assessment practices in DDD. From this comparison, it is clear that "safety" is not obtained through DDD, and that SbD should be considered a starting point rather than an end, meaning that products will still need to progress through thorough safety evaluations and regulation. We conclude that although risk reduction is clearly desirable, the way SbD is currently communicated tends to treat safety as an inherent material property and that this is fundamentally problematic as it represents a recasting and reduction of societal issues into technical problems. SbD therefore faces a multitude of challenges, from practical implementation to unrealistic stakeholder expectations.
**What type of shopping bag to use? Perspectives on the functionality and recycling of polymers**

**General information**

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Damgaard, A. (Intern), Bisinella, V. (Intern)
Number of pages: 1
Publication date: 2017

**Host publication information**

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Place of publication: Kgs. Lyngby, Denmark
Publisher: Technical University of Denmark (DTU)
Article number: Sustain Abstract P-4
Main Research Area: Technical/natural sciences
Conference: Sustain 2017, Kgs. Lyngby, Denmark, 06/12/2017 - 06/12/2017

**Electronic versions:**

ABSTRACT BOOK
SustainAbstracts2017c.compressed_138.pdf

**Whole-genome sequence of Starmerella bacillaris PAS13, a nonconventional enological yeast with antifungal activity**

Starmerella bacillaris is a fermentative yeast commonly found in vineyards. Here, we present the draft genome sequence of S. bacillaris PAS13, a nonconventional enological yeast with a potential role as a biocontrol agent. This gene sequence will provide insights into the genetic basis of yeast activity against gray mold disease (Botrytis cinerea).

**General information**

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Padova, Universidade Federal de Vicosa
Authors: Lemos Junior, W. J. F. (Ekstern), Treu, L. (Intern), Duarte, V. D. S. (Ekstern), Carlot, M. (Ekstern), Nadai, C. (Ekstern), Campanaro, S. (Ekstern), Giacomini, A. (Ekstern), Corich, V. (Ekstern)
Number of pages: 2
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Genome Announcements
Volume: 5
Issue number: 32
Article number: e00788
ISSN (Print): 2169-8287
Ratings:
Whole-Genome Sequences of Three Streptococcus macedonicus Strains Isolated from Italian Cheeses in the Veneto Region

We report here the genome sequences of three Streptococcus macedonicus strains isolated from different cheeses in the Veneto region of Italy. The presented data aim at increasing the scarce genomic information available for this species, which is frequently encountered in fermented foods and appears to be a promising technological microorganism.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Padua, Agricultural University of Athens, Technical University of Denmark
Authors: Treu, L. (Intern), de Diego-Díaz, B. (Ekstern), Papadimitriou, K. (Ekstern), Tsakalidou, E. (Ekstern), Giacomini, A. (Ekstern), Corich, V. (Ekstern)
Number of pages: 2
Publication date: 2017
Main Research Area: Technical/natural sciences

Wirelessly powered submerged-light illuminated photobioreactors for efficient microalgae cultivation

A novel submerged-light photobioreactor (SL-PBR) with free-floating, wireless internal light sources powered by near-field resonant inductive coupling was investigated using a quick (Chlorella vulgaris) and a slow (Haematococcus pluvialis) growing microalgal species. During testing of the SL-PBR, the yield on photons was 1.18 and 1.15 g biomass mol⁻¹ photons for C. vulgaris and H. pluvialis, respectively. At the same time, a conventional, externally illuminated PBR with the
same internal light intensity produced yields of 0.78 and 0.05 g biomass mol− 1 photons for C. vulgaris and H. pluvialis, respectively. Thus, the wireless internal light source was proven to be up to fivefold more effective light delivery system compared to the conventional illumination system. Meanwhile, it was discovered that some of the internal light sources had ceased to function, which might have caused underestimation of the true yield. Interestingly, the SL-PBR provided more uniform light to the culture and had the ability to reduce the presence of dark zones and the effect of self-shading. Thus, the SL-PBR showed potential, if subsequent prototype designs address the technical challenges identified during this study.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Residual Resource Engineering, Swiss Federal Institute of Technology
Authors: Murray, A. M. (Intern), Fotidis, I. (Intern), Isenschmid, A. (Ekstern), Haxthausen, K. R. A. (Ekstern), Angelidaki, I. (Intern)
Number of pages: 8
Pages: 244-251
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Main Research Area: Technical/natural sciences

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Journal: Algal Research
Volume: 25
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.45 SJR 1.442 SNIP 1.12
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.939 SNIP 1.596 CiteScore 5.53
Scopus rating (2014): SJR 1.945 SNIP 1.603 CiteScore 4.96
Scopus rating (2013): SJR 1.437 SNIP 1.129 CiteScore 4.17
ISI indexed (2013): ISI indexed no
Original language: English
Artificial light, Chlorella vulgaris, Haematococcus pulvialis, Internal illumination, Near field resonant inductive coupling
DOIs: 10.1016/j.algal.2017.05.015
Source: FindIt
Source-ID: 2370865313
Publication: Research - peer-review › Journal article – Annual report year: 2017

**WISE – Water Innovation SmE’s – Innovative solutions with in the water field**

**General information**

State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Godskesen, B. (Intern)
Pages: 43-43
Publication date: 2017

**Host publication information**

Title of host publication: Abstract proceedings - 11th annual meeting danish water forum
Place of publication: Frederiksberg
Publisher: University of Copenhagen
Editors: Flindt Jørgensen, L., Mosolf Larsen, T., Jensen, B. K.
Main Research Area: Technical/natural sciences
Conference: 11th Annual Meeting of Danish Water Forum, Copenhagen, Denmark, 30/01/2017
Electronic versions:
Abstract proceedings book
System and method to control H2O2 level in advanced oxidation processes
The present invention relates to a bio-electrochemical system (BES) and a method of in-situ production and removal of H2O2 using such a bio-electrochemical system (BES). Further, the invention relates to a method for in-situ control of H2O2 content in an aqueous system of advanced oxidation processes (AOPs) involving in-situ generation of hydroxyl radical (OH) by using such a bio-electrochemical system (BES) and to a method for treatment of wastewater and water disinfection. The bio-electrochemical system (BES) according to the invention comprises: - an aqueous cathode compartment comprising a first cathode and a second cathode, - an aqueous anode compartment comprising an anode at least partly covered in biofilm, wherein the first cathode is connected to a first circuit and the second cathode is connected to a second circuit, wherein the first and the second circuit are connected to the system by an external switch.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Angelidaki, I. (Intern), Zhang, Y. (Intern)
Publication date: 6 May 2016

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IPC: C25B 9/00 A I
Patent number: WO2016066648
Date: 06/05/2016
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Priority number: EP20140190480
Original language: English
Main Research Area: Technical/natural sciences
Source: espacenet
Source-ID: WO2016066648
Publication: Research › Patent – Annual report year: 2016

30 years of geophysical data - one groundwater model structure

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Aarhus University
Authors: Vilhelmsen, T. N. (Ekstern), Christiansen, A. V. (Ekstern), Foged, N. (Ekstern), Marker, P. A. (Intern), Auken, E. (Ekstern)
Pages: 35-35
Publication date: 2016

Host publication information
Title of host publication: 10th annual meeting of DWF16 : Abstracts
Publisher: Danish Water Forum
Main Research Area: Technical/natural sciences
Conference: 10th annual meeting of Danish Water Forum (DWF), Frederiksberg, Denmark, 28/01/2016 - 28/01/2016
Electronic versions:
DWF_30_years_of_geophysical_data_one_groundwater_model_structure.pdf
Publication: Research › Conference abstract in proceedings – Annual report year: 2016

A Bayesian belief network approach for assessing uncertainty in conceptual site models at contaminated sites
A key component in risk assessment of contaminated sites is in the formulation of a conceptual site model (CSM). A CSM is a simplified representation of reality and forms the basis for the mathematical modeling of contaminant fate and transport at the site. The CSM should therefore identify the most important site-specific features and processes that may affect the contaminant transport behavior at the site. However, the development of a CSM will always be associated with uncertainties due to limited data and lack of understanding of the site conditions. CSM uncertainty is often found to be a major source of model error and it should therefore be accounted for when evaluating uncertainties in risk assessments. We present a Bayesian belief network (BBN) approach for constructing CSMs and assessing their uncertainty at contaminated sites. BBNs are graphical probabilistic models that are effective for integrating quantitative and qualitative
information, and thus can strengthen decisions when empirical data are lacking. The proposed BBN approach facilitates a systematic construction of multiple CSMs, and then determines the belief in each CSM using a variety of data types and/or expert opinion at different knowledge levels. The developed BBNs combine data from desktop studies and initial site investigations with expert opinion to assess which of the CSMs are more likely to reflect the actual site conditions. The method is demonstrated on a Danish field site, contaminated with chlorinated ethenes. Four different CSMs are developed by combining two contaminant source zone interpretations (presence or absence of a separate phase contamination) and two geological interpretations (fractured or unfractured clay till). The beliefs in each of the CSMs are assessed sequentially based on data from three investigation stages (a screening investigation, a more detailed investigation, and an expert consultation) to demonstrate that the belief can be updated as more information becomes available.
Accelerated Molecular Dynamics Simulations of Phosphate Binding Proteins

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies
Authors: Truelsen, S. F. (Intern)
Number of pages: 1
Pages: 540A
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: Biophysical Journal
Volume: 110
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.06 SJR 1.946 SNIP 1.018
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.145 SNIP 1.173 CiteScore 3.3
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.203 SNIP 1.166 CiteScore 3.33
Web of Science (2014): Indexed yes
Acclimation of continuous biomethanation process to extremely high ammonia levels

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Tian, H. (Intern), Mancini, E. (Intern), Fotidis, I. (Intern), Angelidaki, I. (Intern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Adaptation, Ammonia inhibition, Anaerobic digestion, CSTR
Accounting for multiple functions in environmental life cycle assessment of storm water management solutions

The wide range of approaches to handle storm water runoff have varying effects on the environment. Local stormwater control measures for retention and treatment are increasingly used components in urban climate adaptation plans. Often, these solutions modify the multiple functions of urban environments by adding green and blue elements, and they change the water balance compared to traditional, underground approaches. Additionally, different implementation and maintenance processes are required. All of these transformations affect the environmental impacts of urban stormwater management (SWM) systems, which can be quantified using Life Cycle Assessment (LCA). This study aims to define the multiple functions provided by a SWM system at sub-catchment scale, and to assess the environmental impacts arising from fulfilling these functions. The approach is tested using the Nørrebro catchment in Copenhagen, Denmark, where extensive implementation of green infrastructure is planned to mitigate the adverse effects of climate change. This « green » scenario is compared to a traditional « grey » solution, utilizing pipes and basins. The environmental impacts, which are dominated by material production in both scenarios, are significantly lower for the « green » solution (35% down to 8% of the “grey” impacts). The allocation of impacts shows that the various functions of the SWM systems cause different impacts.

A certain shade of green: Can algal pigments reveal shading effects of nanoparticles?

A certain shade of green: Can algal pigments reveal shading effects of nanoparticles?
A conceptual framework for invasion in microbial communities

There is a growing interest in controlling—promoting or avoiding—the invasion of microbial communities by new community members. Resource availability and community structure have been reported as determinants of invasion success. However, most invasion studies do not adhere to a coherent and consistent terminology nor always include rigorous interpretations of the processes behind invasion. Therefore, we suggest that a consistent set of definitions and a rigorous conceptual framework are needed. We define invasion in a microbial community as the establishment of an alien microbial type in a resident community and argue how simple criteria to define aliens, residents, and alien establishment can be applied for a wide variety of communities. In addition, we suggest an adoption of the community ecology framework advanced by Vellend (2010) to clarify potential determinants of invasion. This framework identifies four fundamental processes that control community dynamics: dispersal, selection, drift and diversification. While selection has received ample attention in microbial community invasion research, the three other processes are often overlooked. Here, we elaborate on the relevance of all four processes and conclude that invasion experiments should be designed to elucidate the role of dispersal, drift and diversification, in order to obtain a complete picture of invasion as a community process.

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A conceptual framework for invasion in microbial communities
A consilience model to describe N2O production during biological N removal

Nitrous oxide (N2O), a potent greenhouse gas, is produced during biological nitrogen conversion in wastewater treatment operations. Complex mechanisms underlie N2O production by autotrophic and heterotrophic organisms, which continue to be unravelled. Mathematical models that describe nitric oxide (NO) and N2O dynamics have been proposed. Here, a first comprehensive model that considers all relevant NO and N2O production and consumption mechanisms is proposed. The model describes autotrophic NO production by ammonia oxidizing bacteria associated with ammonia oxidation and with nitrite reduction, followed by NO reduction to N2O. It also considers NO and N2O as intermediates in heterotrophic denitrification in a 4-step model. Three biological NO and N2O production pathways are accounted for, improving the capabilities of existing models while not increasing their complexity. Abiotic contributions from NH2OH and HNO2 reactions are also included. The consilient model structure can theoretically predict NO and N2O emissions under a wide range of operating conditions and will help develop mitigation strategies.

Acute and chronic effects from pulse exposure of D. magna to silver and copper oxide nanoparticles

Aquatic toxicity testing of nanoparticles (NPs) is challenged by their dynamic behavior in test suspensions. The resulting difficulties in controlling and characterizing exposure concentrations are detrimental to the generation of concentration-response data needed for hazard identification of NPs. This study explores the applicability of short-term (1, 2 and 3 h) pulse exposures as means to keep the exposure stable and at the same time disclose acute and chronic effects of AgNPs and CuONPs in D. magna. Dissolution, agglomeration and sedimentation were found to have less influence on exposure concentrations during 1–3 h pulses than for 24–48 h continuous exposures. For AgNPs, preparation of test suspensions in medium 24 h before toxicity testing (aging) increased stability during the short-term pulses. In pulse tests, organisms were exposed to the test materials, AgNPs and CuONPs for 1, 2 and 3 h, and afterwards transferred to clean medium and observed for 48 h (post-exposure period) for acute effects and for 21 d for chronic effects. AgNO3 and CuCl2 were used as reference materials for dissolved silver and copper, respectively. For all test materials, a 3 h pulse caused comparable immobility in D. magna (observed after 48 h post-exposure) as 24 h continuous exposure, as evidenced by overlapping 95% confidence intervals of EC50-values. In the 21 d post-exposure period, no trends in mortality or body length were identified. AgNP and AgNO3 pulses had no effect on the number of moltings, days to first live offspring or cumulated number of offspring, but the number of offspring increased for AgNPs (3 h pulse only). In contrast, CuONP and CuCl2 pulses decreased the number of moltings and offspring, and for CuONPs the time to first live offspring was prolonged.
After CuONP exposures, the offspring production decreased more with increasing concentrations than for CuCl2 exposures when taking the measured dissolved copper into account. This indicates a nanoparticle-specific effect for CuONPs, possibly related to the CuONPs accumulated in the gut of D. magna during the pulse exposure. Pulse exposure is an environmentally relevant exposure scenario for NPs, which for AgNPs and CuONPs enables more stable exposures and cause acute immobility of D. magna comparable to continuous 24 h exposures. Pulse exposure is likely relevant and applicable for other toxic and dissolving metal NPs, but this requires further research.
Acute toxicity of sea-dumped chemical munitions: Luminating the environmental toxicity of legacy compounds

As a result of the disarmament of Germany after the Second World War, 65,000 tons of chemical munitions were dumped in the Baltic Sea. Approximately 13,000 tons containing chemical warfare agents (CWAs) of which 11,000 tons were dumped in the Bornholm Basin east of Bornholm. This paper addresses the ecotoxicity of compounds actually present in the Bornholm dumpsite by obtaining novel acute ecotoxicity data. EC50 values were successfully obtained for 12 CWAs from acute tests using Allivibrio fischeri (Microtox™). The three most toxic compounds were α-chloroacetophenone, 2-chlorovinylarsonic acid and 1,2,5-trithiepane having EC50 values of 11.20, 31.20 and 1170 μg L−1, respectively. A. fischeri demonstrated hormesis when exposed to triphenylarsine and triphenylarsine oxide at concentrations of 100 and 50 mg L−1, respectively. Four different mixtures were assessed including compounds which were dissolvable: a mixture of sulphur mustard degradation products, a mixture of the three most toxic sulphur mustard compounds, a mixture of organoarsenical degradation products and a mixture of all compounds. The mixtures deviate by a factor of 1.5–2.5 from the prediction of the concentration addition model and hence, the mixtures demonstrate no sign of synergism or antagonism. The compounds presented in this study are mainly CWA.

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Adaptation of water resources systems to changing society and environment: a statement by the International Association of Hydrological Sciences
We explore how to address the challenges of adaptation of water resources systems under changing conditions by supporting flexible, resilient and low-regret solutions, coupled with on-going monitoring and evaluation. This will require improved understanding of the linkages between biophysical and social aspects in order to better anticipate the possible future co-evolution of water systems and society. We also present a call to enhance the dialogue and foster the actions of governments, the international scientific community, research funding agencies and additional stakeholders in order to develop effective solutions to support water resources systems adaptation. Finally, we call the scientific community to a renewed and unified effort to deliver an innovative message to stakeholders. Water science is essential to resolve the water crisis, but the effectiveness of solutions depends, inter alia, on the capability of scientists to deliver a new, coherent and technical vision for the future development of water systems.
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Scopus rating (2005): SJR 1.112 SNIP 1.242
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Addressing Current Challenges on Groundwater Model Structure through Effective Use of Geophysical Data
We wish to present a method for effective generation of structural models for groundwater flow simulations. The methodology is presented for two cases. A regional scale test, where geophysical data and borehole data is used for generating the regional scale hydrostratigraphy, and a local detailed case, where the same methodology is used to address the question of structural uncertainty.

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Organisations: Department of Environmental Engineering, Water Resources Engineering
Authors: Vilhelmsen, T. N. (Ekstern), Marker, P. A. (Intern), Foged, N. (Ekstern), Christiansen, A. V. (Ekstern), Auken, E. (Ekstern), Bauer-Gottwein, P. (Intern)
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Addressing structural uncertainty of groundwater model predictions with ensemble of automatically generated models from AEM geophysical data and borehole data

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Addressing water challenges on the North China Plain with hydroeconomic optimization
With its diverse environment and large population, China is facing water resource challenges, both in terms of quantity and quality. The North China Plain (NCP) is one of the world’s most densely populated areas and one of the highly water stressed regions of China. It counts for 15% of the Chinese GDP, from both industry and agriculture. The high water demand for especially irrigation has caused decade long groundwater depletion, ecosystem deterioration and high pollution loads in the region. To alleviate the water crisis of Northern China the South-North Water Transfer Project has been constructed. However, the project alone cannot solve the NCP’s water crisis.

A hydroeconomic optimization model has been developed for the NCP system. The model area represents the administrative area of the Hai River Commission. The challenges addressed are the spatio-temporal distribution of costs and curtailments from achieving a sustainable water allocation policy, especially focusing on groundwater abstraction and ecological minimum flows. Efficient linear programming solvers (LP) are used to enable adequate representation of the physical water delivery system and to move away from system simplifications. This enables the representation of links and interactions between the water resources system and the power system of Northern China. The multi-reservoir LP model is formulated as a flow path based optimization, which tracks each water delivery from supplier to receiver. This is useful for the exploration of optimal water allocation as well as water trading policies and other economic measures. The suggested setup is a move towards a more applicable and implementable model. A baseline run producing business-as-usual costs and deliveries across space and time is presented and compared with a model run including sustainability constraints. This shows changes in allocations and costs of ending groundwater depletion and keeping water quality criteria. It further reflects the conflict between sustainability and economic output of the energy, food and industrial sectors in a water resource management framework.

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Organisations: Department of Environmental Engineering, Water Resources Engineering, Chinese Academy of Sciences
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Advances in FACE and manipulation techniques
Experimental techniques to expose plants and ecosystems to elevated CO₂ have been around for decades, starting out with branch cuvettes, chambers and green houses and in the 90ies leading to the development of the FACE (Free Air Carbon Enrichment) technique, which has been and still is widely used. The FACE technique is used under field conditions and has been developed over the years to be applied for many types of ecosystems from low stature shrub, grass and arable lands to high stature forest trees. These experiments have provided extensive knowledge and data on CO₂ effects on individual plants and processes as well as whole terrestrial ecosystems. The ultimate goal of any experiment is to mimic future conditions and stress factors in a realistic and/or relevant way and to measure important and relevant responses at various spatial scales. FACE experiments are still facing some clear challenges when it comes to
the experimentation or scenarios typically tested as well as the response measurements performed, challenges that limits our knowledge and understanding and need to be addressed and overcome in the future. With respect to the experimentation and scenarios, a significant constraint for FACE experiments is the cost of the CO2 in such experiments which increases substantially with ring sizes and vegetation height as well as of course the number of replicates. FACE experiments can relatively easily be combined with other stress factors, but for every factor a full factorial combination doubles the costs. Consequently, very few combination studies exist and knowledge on interactions among CO2 and other factors is still very limited, and especially interactions with extreme weather events are largely unknown. However, recent data suggests that such interactions are important and may not be easily forecasted from single factor experiments. With respect to response measurements, a key scientific question is how elevated CO2 will affect the atmosphere-biosphere feedback. However, there are significant challenges associated with directly measuring the ecosystem carbon balance in FACE experiments, and despite numerous such experiments, there is a general lack of carbon feedback measurements.

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Advancing Alternative Analysis: Integration of Decision Science
Decision analysis—a systematic approach to solving complex problems—offers tools and frameworks to support decision making that are increasingly being applied to environmental challenges. Alternatives analysis is a method used in regulation and product design to identify, compare, and evaluate the safety and viability of potential substitutes for hazardous chemicals. Assess whether decision science may assist the alternatives analysis decision maker in comparing alternatives across a range of metrics. A workshop was convened that included representatives from government, academia, business, and civil society and included experts in toxicology, decision science, alternatives assessment, engineering, and law and policy. Participants were divided into two groups and prompted with targeted questions. Throughout the workshop, the groups periodically came together in plenary sessions to reflect on other groups’ findings. We conclude the further incorporation of decision science into alternatives analysis would advance the ability of companies and regulators to select alternatives to harmful ingredients, and would also advance the science of decision analysis. We advance four recommendations: (1) engaging the systematic development and evaluation of decision approaches and tools; (2) using case studies to advance the integration of decision analysis into alternatives analysis; (3) supporting transdisciplinary research; and (4) supporting education and outreach efforts.

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Advancing the Applicability of Alternatives Assessment for Engineered Nanomaterials

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Authors: Hjorth, R. (Intern), Hansen, S. F. (Intern), Jacobs, M. (Ekstern), Tickner, J. A. (Ekstern), Ellenbecker, M. (Ekstern), Baun, A. (Intern)
A global approach for sparse representation of uncertainty in Life Cycle Assessments of waste management systems

Purpose: Identification of key inputs and their effect on results from Life Cycle Assessment (LCA) models is fundamental. Because parameter importance varies greatly between cases due to the interaction of sensitivity and uncertainty, these features should never be defined a priori. However, exhaustive parametrical uncertainty analyses may potentially be complicated and demanding, both with analytical and sampling methods. Therefore, we propose a systematic method for selection of critical parameters based on a simplified analytical formulation that unifies the concepts of sensitivity and uncertainty in a Global Sensitivity Analysis (GSA) framework. Methods: The proposed analytical method based on the
calculation of sensitivity coefficients (SC) is evaluated against Monte Carlo sampling on traditional uncertainty assessment procedures, both for individual parameters and for full parameter sets. Three full-scale waste management scenarios are modelled with the dedicated waste LCA model EASETECH and a full range of ILCD recommended impact categories. Common uncertainty ranges of 10 % are used for all parameters, which we assume to be normally distributed. The applicability of the concepts of additivity of variances and GSA is tested on results from both uncertainty propagation methods. Then, we examine the differences in discernibility analyses results carried out with varying numbers of sampling points and parameters. Results and discussion: The proposed analytical method complies with the Monte Carlo results for all scenarios and impact categories, but offers substantially simpler mathematical formulation and shorter computation times. The coefficients of variation obtained with the analytical method and Monte Carlo differ only by 1 %, indicating that the analytical method provides a reliable representation of uncertainties and allows determination of whether a discernibility analysis is required. The additivity of variances and the GSA approach show that the uncertainty in results is determined by a limited set of important parameters. The results of the discernibility analysis based on these critical parameters vary only by 1 % from discernibility analyses based on the full set, but require significantly fewer Monte Carlo runs. Conclusions: The proposed method and GSA framework provide a fast and valuable approximation for uncertainty quantification. Uncertainty can be represented sparsely by contextually identifying important parameters in a systematic manner. The proposed method integrates with existing step-wise approaches for uncertainty analysis by introducing a global importance analysis before uncertainty propagation.

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Agricultural contamination in soil-groundwater-surface water systems in the North China Plain

The North China Plain is one of China’s major economic zones and one of the most densely populated areas in the country. It covers a broad expanse of eastern China, extending from just below Beijing in the north down towards the Yangtze River in the south. This alluvial plain region is also one of China’s main agricultural production zones, accounting for about one third of the national grain output. The dominant crop system is a winter wheat and summer maize rotation. Beginning in the 1980s, in an effort to increase agricultural productivity, China’s government heavily promoted the use of fertilizers and pesticides. Unfortunately, the lack of regulation or oversight has led to the overuse of these agrochemicals: current application rates (in kg/ha) are two- to threefold higher than in most developed countries, and this is taking its toll on the environment. Problems include severe surface water and groundwater pollution by nitrogen and pesticides, soil degradation, bioaccumulation of toxic compounds, and more. It is crucial for China to do improve the safeguarding of its water resources in order to sustain the livelihoods of its people and ensure safe supply of drinking water.

Recently, the Chinese government and the scientific research community have acknowledged the need for more sustainable production techniques, and increasing quantities of money and effort are being directed toward achieving this goal. There has already been a great deal of improvement in determining the appropriate amounts of agricultural inputs, such as irrigation and fertilizers, as well as the ideal times to apply them. In terms of pesticides, most studies have focused on pesticide residues, crop resistances, and on the efficient treatment of specific pests. Despite this groundwork, however, statistical records show that the application of agrochemicals per hectare continues to increase, and the water quality within the river basins of the North China Plain remains substantially worse than in other parts of the country.

Taking this background into consideration, this PhD study focused on four different objectives: (a) to quantify the nutrient loading in groundwater and surface water at a sample field site in order to understand their exchange and removal pathways; (b) to review the current use and monitoring of pesticides (and especially herbicides) in the NCP; (c) to assess the occurrence of selected herbicides at a sample field site in the NCP; and (d) to provide a new basis for discussion and guidance on how to address the issue of water pollution caused by the improper use of agrochemicals in China. For the field investigation, a study site located within the NCP with river water-groundwater interaction was chosen, and field work was performed between October 2012 and March 2014.

Results from the field study showed that fertilizer inputs were excessive, and could be reduced substantially. Contaminated river water was infiltrating – and carrying ammonium pollution – into the shallow groundwater. Additionally, nitrate was infiltrating from the surface into the aquifer. Anammox, denitrification, and cation exchange were the suggested dominant removal processes in the soil-surface water-groundwater system examined in this study, which showed a very high nitrogen removal capacity. However, if the composition of the river water were to change (if, for instance, the ammonium concentration were to decrease) the removal processes in the system would also be altered.
Consequently, further monitoring of nitrate pollution is suggested. Regarding pesticides, a literature review and data assessment revealed that the most commonly applied herbicides in the North China Plain wheat-maize cropping system are 2,4-D, acetochlor, and atrazine. Although 2,4-D and atrazine are listed in the Chinese Drinking Water Guideline, there is currently no systematic monitoring of these compounds taking place, and most research studies have focused on the monitoring of legacy pesticides such as hexachlorocyclohexanes (HCHs) and dichlorodiphenyltrichloroethanes (DDTs). In the river water and groundwater samples drawn during this study, mainly 2,4-D and atrazine residues, were discovered in concentrations of several µg/l (these results were consistent across all four sampling campaigns). Most of the pollution seemed to have been caused by the river water carrying pesticides into the groundwater system. This indicates that it may be important to pay more attention to the investigation of currently-used pesticides, especially in areas where surface water infiltrates into shallow aquifers.

The overall observation on agricultural activities in the North China plain was that much improvement is needed in educating farmers on sustainable production techniques and the proper application of agrochemicals. One way to increase farmers’ understanding and knowledge of the environmental impact of agriculture would be to shift to a more formal training regime, for example vocational education. One possible side effect of such a change could be to raise the status and income opportunities enjoyed by agricultural workers, thereby giving the younger generation an incentive to choose farming as a profession.

In conclusion, this PhD study gave insights into a more systemic understanding of nutrient degradation and the occurrence of particular herbicides at a specific field site. The research into the use and monitoring of pesticides in the North China Plain was reviewed and new recommendations were developed to enhance the dissemination of knowledge from environmental researchers to farmers.

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Algal toxicity of platinum nanoparticles - Implications of NP aggregation, dissolution and shading

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Organisations: Department of Environmental Engineering, Environmental Chemistry, Department of Chemistry, NanoChemistry, Organic Chemistry, Department of Micro- and Nanotechnology, Nano Bio Integrated Systems, University of Geneva, Technical University of Denmark
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Alternate switching between MFC and MEC for H2O2 synthesis and residual removal in Bioelectro-Fenton system
Sustainable H2O2 supply and elimination of residual H2O2 are two key challenges to the Fenton processes treating recalcitrant contaminants. In this study, an innovative Bioelectro-Fenton system capable of alternate switching between microbial electrolysis cell (MEC) and microbial fuel cell (MFC) mode of operation was developed to meet the challenges. In the MEC mode, H2O2 was electrochemically produced which reacts with Fenton’s reagent (Fe II) to form
hydroxyradical. The residual H₂O₂ (unused H₂O₂) is removed as electron acceptor by switching the system to MFC mode. Complete decolorization and mineralization of 50 mg L⁻¹ methylene blue (MB) was achieved in the MEC mode with apparent first order rate constants of 0.43 and 0.22 h⁻¹, respectively. After switching to the MFC mode, residual H₂O₂ of 180 mg L⁻¹ was removed at a removal rate of 4.61 mg L⁻¹ h⁻¹ while generating a maximum current density of 0.49 A m⁻². The MB degradation and residual H₂O₂ removal were affected by external resistance, cathode pH and initial MB concentration. Furthermore, the system performance was enhanced under stack operation. This study provides a proof-in-concept new system for efficient and cost-effective H₂O₂ control and recalcitrant pollutants removal.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Zhang, Y. (Intern), Angelidaki, I. (Intern)
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Alternative co-digestion scenarios for efficient fixed-dome reactor biomethanation processes
Many of the existing low-tech biogas reactors in the remote rural areas of developing countries have been abandoned due to the lack of substrates. This study investigated if unutilized biomasses are able to support an efficient biomethanation process with low carbon footprint, in these rural areas where low-tech reactors have been abandoned. Thus, the aims of this study were: a) to identify and evaluate alternative biomasses as anaerobic digestion substrates at a remote rural area site in India; b) to propose an efficient continuous biomethanation scenario for low-tech reactors; c) to assess the influence of the operational parameters on the stability of the anaerobic digestion process. The highest methane yield (137–159 NmL CH₄ L⁻¹) and co-digestion synergy (>20% more CH₄ than expected) were achieved by co-digestion of wastewater, cow manure, banana and rice by-products at 79.3/4.2/16.3/0.2 ww⁻¹ VS ratio, respectively. Three fixed-dome reactors, R30, R45 and R60, fed with all substrates, operated with hydraulic retention times of 30, 45, and 60 days and organic loading rates of 2.18, 1.46, and 1.09 g VS L⁻¹ d⁻¹, respectively (different co-digestion scenarios). R60 was the best continuous co-digestion scenario with 45% and 13% higher energy recovery from biomasses' utilization and 69% and 25% less greenhouse gas (GHG) emissions, compared to R30 and R45, respectively. These results indicate that it is possible to operate efficiently low-tech biogas reactors with utilized biomasses as anaerobic digestion substrates.

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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark
Authors: Fotidis, I. (Intern), Laranjeiro, T. (Ekstern), Angelidaki, I. (Intern)
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Scopus rating (2016): CiteScore 5.83 SJR 1.615 SNIP 2.382
Web of Science (2016): Indexed yes
A methodological approach to the design of optimising control strategies for sewer systems

This study focuses on designing an optimisation based control for sewer system in a methodological way and linking it to a regulatory control. Optimisation based design is found to depend on proper choice of a model, formulation of objective function and tuning of optimisation parameters. Accordingly, two novel optimisation configurations are developed, where the optimisation either acts on the actuators or acts on the regulatory control layer. These two optimisation designs are evaluated on a sub-catchment of the sewer system in Copenhagen, and found to perform better than the existing control; a rule based expert system. On the other hand, compared with a regulatory control technique designed earlier in Mollerup et al. (2015), the optimisation showed similar performance with respect to minimising overflow volume. Hence for operation of small sewer systems, regulatory control strategies can offer promising potential and should be considered along more advanced strategies when identifying novel solutions.
Ammonia inhibition on hydrogen enriched anaerobic digestion of manure under mesophilic and thermophilic conditions

Capturing of carbon dioxide by hydrogen derived from excess renewable energy (e.g., wind mills) to methane in a microbially catalyzed process offers an attractive technology for biogas production and upgrading. This bioconversion process is catalyzed by hydrogenotrophic methanogens, which are known to be sensitive to ammonia. In this study, the tolerance of the biogas process under supply of hydrogen, to ammonia toxicity was studied under mesophilic and thermophilic conditions. When the initial hydrogen partial pressure was 0.5 atm, the methane yield at high ammonia load (7 g NH₄⁺-N L⁻¹) was 41.0% and 22.3% lower than that at low ammonia load (1 g NH₄⁺-N L⁻¹) in mesophilic and thermophilic condition, respectively. Meanwhile no significant effect on the biogas composition was observed. Moreover, we found that hydrogenotrophic methanogens were more tolerant to the ammonia toxicity than acetoclastic methanogens in the hydrogen enriched biogas production and upgrading processes. The highest methane production yield was achieved under 0.5 atm hydrogen partial pressure in batch reactors at all the tested ammonia levels. Furthermore, the thermophilic methanogens at 0.5 atm of hydrogen partial pressure were more tolerant to high ammonia levels (≥5 g NH₄⁺-N L⁻¹), compared with mesophilic methanogens. The present study offers insight in developing resistant hydrogen enriched biogas production and upgrading processes treating ammonia-rich waste streams.
Ammonia - LCFA synergetic co-inhibition effect in manure-based continuous biomethanation process

In the current study it has been hypothesized that, when organic loading of an anaerobic reactor is increased, the additional cell biomass biosynthesis would capture more ammonia nitrogen and thereby reduce the ammonia toxicity. Therefore, the alleviation of the toxicity of high ammonia levels using lipids (glycerol trioleate-GTO) or carbohydrates (glucose-GLU) as co-substrates in manure-based thermophilic continuous stirred-tank reactors (RGTO and RGLU, respectively) was tested. At 5 g NH₄⁺-N L⁻¹, relative methane production of RGTO and RGLU, was 10.5% and 41% compared to the expected uninhibited production, respectively. At the same time control reactor (RCTL), only fed with manure, reached 32.7% compared to the uninhibited basis production. Therefore, it seems that using lipids to counteract the ammonia effect in CSTR reactors creates an “ammonia-LCFA (long chain fatty acids) synergetic co-inhibition” effect. Moreover, co-digestion with glucose in RGLU was more robust to ammonia toxicity compared to RCTL.

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Authors: Wang, H. (Intern), Fotidis, I. (Intern), Angelidaki, I. (Intern)
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Scopus rating (2014): SJR 2.41 SNIP 2.104 CiteScore 5.3
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.412 SNIP 2.503 CiteScore 5.97
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BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.389 SNIP 2.465 CiteScore 5.25
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.314 SNIP 2.508 CiteScore 5.56
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.086 SNIP 2.355
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.912 SNIP 2.231
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.734 SNIP 2.732
Web of Science (2008): Indexed yes
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Scopus rating (2006): SJR 1.315 SNIP 1.98
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.269 SNIP 2.006
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.197 SNIP 1.659
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.948 SNIP 1.639
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.882 SNIP 1.3
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Ammoniumproblemer på danske vandværker – overbevisende effekt af sporstoftilsætning

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Authors: Wagner, F. B. (Intern), Albrechtsen, H. (Intern), Borch Nielsen, P. (Ekstern), Boe-Hansen, R. (Ekstern)
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A Multimethod Approach for Investigating Algal Toxicity of Platinum Nanoparticles
The ecotoxicity of platinum nanoparticles (PtNPs) widely used in for example automotive catalytic converters, is largely unknown. This study employs various characterization techniques and toxicity end points to investigate PtNP toxicity toward the green microalgae Pseudokirchneriella subcapitata and Chlamydomonas reinhardtii. Growth rate inhibition occurred in standard ISO tests (EC50 values of 15–200 mg Pt/L), but also in a double-vial setup, separating cells from PtNPs, thus demonstrating shading as an important artifact for PtNP toxicity. Negligible membrane damage, but substantial oxidative stress was detected at 0.1–80 mg Pt/L in both algal species using flow cytometry. PtNPs caused growth rate inhibition and oxidative stress in P. subcapitata, beyond what was accounted for by dissolved Pt, indicating NP-specific toxicity of PtNPs. Overall, P. subcapitata was found to be more sensitive toward PtNPs and higher body burdens were measured in this species, possibly due to a favored binding of Pt to the polysaccharide-rich cell wall of this algal species. This study highlights the importance of using multimethod approaches in nanoecotoxicological studies to elucidate toxicity mechanisms, influence of NP-interactions with media/organisms, and ultimately to identify artifacts and appropriate end points for NP-ecotoxicity testing.

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Anaerobic modeling for improving synergy and robustness of a manure co-digestion process

Biogas production is becoming increasingly important in the environmental area because, besides treating wastewaters, it also generates energy. Co-digestion has become more and more powerful since it is possible, with the use of abundant and cheap substrates, to dilute the inhibitory effects of various other substrates, making the process of anaerobic digestion more efficient and stable. Biogas process modelling describes the kinetics and stoichiometry of different steps in the anaerobic digestion process. This mathematical modelling provides an understanding of the processes and interactions occurring inside the biogas system. The present work investigated the interactions between different simple co-substrates (carbohydrate, lipid and protein) and real co-substrates (corn silage, fodder beet, grass and wheat straw) under co-digestion with manure, in order to verify synergetic effects. Subsequently, some experiments were reproduced, in order to evaluate the synergy obtained in the previous simulation and validate the model.

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Scopus rating (2016): CiteScore 1.46 SJR 0.429 SNIP 0.965
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BFI (2015): BFI-level 1
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BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.411 SNIP 0.851 CiteScore 1.3
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.449 SNIP 0.91 CiteScore 1.26
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BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.465 SNIP 0.864 CiteScore 1.04
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BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.401 SNIP 0.75 CiteScore 1.23
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.387 SNIP 0.708
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.331 SNIP 0.628
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.334 SNIP 0.702
Scopus rating (2007): SJR 0.306 SNIP 0.67
Scopus rating (2006): SJR 0.225 SNIP 0.46
Scopus rating (2005): SJR 0.278 SNIP 0.524
Analyzing tree cores to detect petroleum hydrocarbon-contaminated groundwater at a former landfill site in the community of Happy Valley-Goose Bay, eastern Canadian subarctic

This research examines the feasibility of analyzing tree cores to detect benzene, toluene, ethylbenzene, and m, p, o-xylene (BTEX) compounds and methyl tertiary-butyl ether (MTBE) in groundwater in eastern Canada subarctic environments, using a former landfill site in the remote community of Happy Valley-Goose Bay, Labrador. Petroleum hydrocarbon contamination at the landfill site is the result of environmentally unsound pre-1990s disposal of households and industrial solid wastes. Tree cores were taken from trembling aspen, black spruce, and white birch and analyzed by headspace-gas chromatography-mass spectrometry. BTEX compounds were detected in tree cores, corroborating known groundwater contamination. A zone of anomalously high concentrations of total BTEX constituents was identified and recommended for monitoring by groundwater wells. Tree cores collected outside the landfill site at a local control area suggest the migration of contaminants off-site. Tree species exhibit different concentrations of BTEX constituents, indicating selective uptake and accumulation. Toluene in wood exhibited the highest concentrations, which may also be due to endogenous production. Meanwhile, MTBE was not found in the tree cores and is considered to be absent in the groundwater. The results demonstrate that tree-core analysis can be useful for detecting anomalous concentrations of petroleum hydrocarbons, such as BTEX compounds, in subarctic sites with shallow unconfined aquifers and permeable soils. This method can therefore aid in the proper management of contamination during landfill operations and after site closures.
A new tool for quantifying the hydrological effects of LID retrofit designs – the power of simplicity

We developed a new tool to address the needs of utility companies in the early planning and design phase of LID for retrofitting in existing urban areas, where a high degree of collaboration among stakeholders with different professional backgrounds is needed. The tool uses simplified methods to assist the user in quickly assessing two key overall performance indicators of a LID plan: 1. Return period for overflow, and 2. Impact on the annual water budget of the catchment. The tool currently allows combining three types of stormwater control measures (SCMs) commonly used in...
LID: permeable paving, bioretention units and local detention ponds. We present a case study to illustrate the usefulness of the tool in the context of climate change adaptation in Copenhagen and discuss further development plans including more SCMs, better user interface and assessing the uncertainties introduced by the simplifications in the tool.

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Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Lerer, S. M. (Intern), Sørup, H. J. D. (Intern), Arnbjerg-Nielsen, K. (Intern), Mikkelsen, P. S. (Intern)
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Low impact development, Water sensitive urban design, Sustainable urban drainage systems, Planning, Communication
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An innovative process for biogas upgrading by the microbial electrolysis cell
Biogas as an alternative energy source is getting more attention which can facilitate to reduce fossil fuel utilization and greenhouse gas emissions. However, biogas is a mixture of gases and typically composed of 60-70% v/v methane (CH₄) and 30-40% v/v carbon dioxide (CO₂), small amounts of hydrogen sulfide (H₂S) and other gases. Rude biogas exhibits a significantly low Wobbe index, heating value and energy efficiency which hinder its application. Therefore, CH₄ enrichment prior to use is crucial to improve the quality of biogas. In this work, a novel bipolar membrane-microbial electrolysis cell (BPMEC) was proposed to realize biogas upgrading. The system was composed of the anode, middle and cathode chamber which were separated by a bipolar membrane (BM) and an anion exchange membrane (AEM), respectively. With an external potential, water dissociation occurred and acid was produced in the middle chamber while electrolysis happened and alkali was generated in the cathode chamber. When rude biogas was injected into the cathode chamber, CO₂ was absorbed chemically into the solution and migrated via AEM as the form of CO₃²⁻ and HCO₃⁻ into the middle chamber where they reacted with H⁺ and CO₂ was regenerated and released from the solution. The gas flow rates were varied, as well as the external voltage. Results revealed the highest cathodic pH was 10.03±0.21 and the lowest pH in the middle chamber was 1.34±0.21. The highest CO₂ removal efficiency can be reached at 98.76±1.32% and the maximum CH₄ content can be 98.13±1.12% with 19.64 ml/h gas flow rate and 1.2 V external potential. Organic matter was removed remarkably and COD of the last day was below 60 mg/l. Hydrogen (H₂) was produced and collected in the enriched gas which is another benefit of the system. This study provides a simple, efficient and sustainable way to extend the application of electrochemical technology.

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Authors: Jin, X. (Intern), Li, X. (Intern), Zhao, N. (Intern), Angelidaki, I. (Intern), Zhang, Y. (Intern)
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An innovative way to determine on-site ozone delivery efficiency

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Main Research Area: Technical/natural sciences
An interdisciplinary approach to identify adaptation strategies that enhance flood resilience and urban liveability

This paper provides guidance on how to identify and design the most suitable climate adaptation strategies for enhancing the liveability and flood resilience of urban catchments. It presents findings from a case study of Elwood, a coastal Melbourne suburb regularly affected by flooding. The research integrates social science, architecture and environmental engineering to co-develop technical, design and policy solutions that respond to the local community’s vision for the future and are robust under a range of future climate, population and urban development scenarios. The paper shows that ensuring a city’s flood resilience involves a range of measures to retreat from, adapt to and defend against flooding; this necessarily requires an integrated approach and interdisciplinary expertise to develop adaptation pathways that are grounded in community aspirations and priorities, inspired by novel design solutions and informed by modelling of performance, robustness and economic viability.

A novel bioflocculation method to separate microalgal biomass cultivated on wastewater resources

Today, microbial drinking water quality is monitored through either time-consuming laboratory methods or indirect on-line measurements. Results are thus either delayed or insufficient to support proactive action. A novel, optical, on-line bacteria sensor with a 10-minute time resolution has been developed. The sensor is based on 3D image recognition, and the obtained pictures are analyzed with algorithms considering 59 quantified image parameters. The sensor counts individual suspended particles and classifies them as either bacteria or abiotic particles. The technology is capable of distinguishing and quantifying bacteria and particles in pure and mixed suspensions, and the quantification correlates with total bacterial counts. Several field applications have demonstrated that the technology can monitor changes in the concentration of bacteria, and is thus well suited for rapid detection of critical conditions such as pollution events in drinking water.
A novel way to verify the ozone dosing in the field

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State: Published
Authors: Spiliotopoulou, A. (Intern), Martin, R. (Ekstern), Andersen, H. R. (Intern)
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Anthropogenic phosphorus flows in Denmark: Quantification and critical analysis

Phosphorus (P) is an essential plant nutrient mined from the earth’s crust as phosphate rock. It cannot be substituted, making it a crucial resource for food production. For the EU, future phosphate scarcity is a potential geopolitical and strategic threat. An increasing worldwide phosphate demand is coupled with dependence on imports from a limited number of suppliers outside the EU-28, so that the EU updated its list of critical raw materials in 2014 to include phosphate rock. As a plant nutrient, P is not destroyed by human use, but dissipated into the environment, where it is a pollutant contributing to eutrophication of water bodies and soils. The anthropogenic P is open on the global scale, with global shipments of animal feed, fertiliser, and food; and on the local scale, through the inefficient use of fertiliser or animal manure by application in excess of plant P demand, and losses in waste and wastewater treatment due to insufficient recycling.

The focus of this PhD project was on the resource aspect, as opposed to the pollution aspect, of P in Denmark. The overall goal was to quantify and evaluate the country’s anthropogenic P flows, i.e. those flows caused or significantly influenced by human action, based on a comprehensive material flow analysis (MFA). MFA is a method widely applied to establish resource budgets within a spatial – such as a country – and temporal system boundary, establish a material balance, and handle data uncertainties and data conflicts.

When looking at P from a resource efficiency perspective, the most important flows to consider are those linked to agriculture, as a consumer and producer of large P flows, and waste/wastewater management, as the key processes for treating the resulting P-containing wastes. Country-wide average values regarding these processes hold limited informative value. Moreover, it became clear at the outset of the study that there were distinct differences between the P flows across regions of the country, especially between the east, with the largest urban agglomeration, and the northwest. Apart from population and industrial density, a contrast also exists in agricultural practice, with animal husbandry concentrated in the west and northwest, and the east being dominated by crop production. For the agriculture and waste management processes, the MFA was divided into 3 “typical” regions between the northwest (North Jutland), the east (Zealand and the capital region), and a middle part with more mixed characteristics (Mid-Jutland and Southern Denmark); the regional subdivisions formed a part of a complete country-scale MFA. As is typical for a European country, the Danish P budget showed a strong dependence on P imports in fertilisers and animal feed; with food products being the dominant export of P. The regional contrasts in agricultural P budgets were pronounced as expected, with a slight P deficit in the east and the largest per-hectare surplus, due to large amounts of manure, in the northwest. Manure was shown to hold the most salient potential for P recovery, yet stays quite local and adds to the surplus in the country’s northwest, posing a environmental problem. In the waste management system, two streams were identified to hold significant potential for P recovery. Sewage sludge, while already applied on land on a considerable scale, still holds potentially recoverable P not yet utilised today; and vegetable and animal kitchen and food waste from consumption currently not collected separately, with residues being lost to P recovery. These amounts are furthermore located in the east, with a slight P deficit in agricultural soils, suggesting themselves for substituting some fertiliser imports in the future. The total P quantities in these streams amounted to approximately 35% of concurrent mineral P imports.

Since MFA for regional resource budgets is often the groundwork for further analysis, the robustness and comparability of MFA studies’ outcomes when using them as sources of information is important. To this end, the MFA for Denmark was compared to a recent and methodically similar P MFA for Austria, and the effects of the structure of the data material and an MFA practitioner’s modelling choices on the outcomes identified and measured. It was demonstrated that the data available do, in fact, influence model layout. Moreover, the approach to assess uncertainty is subject to a certain degree of arbitrariness, and reflects the modeller’s belief in the quality of the data material. This, however, leads to incomparability of data quality between MFAs, as the comparison showed, since data uncertainties can be only evaluated against those in the same model. Lastly, data conflicts are normal in country-scale MFA; the extent of the necessary reconciliation of conflicting data provides a useful proxy measure for the quality of an MFA. Metadata matter; this comparison showed the quantitative effects of those aspects of MFAs not resulting from the real-world systems studied. The results thus gave a quantitative basis to requiring a transparent system definition and data characterisation in regional MFA beyond the case of P in Denmark.

A third part of this PhD project consisted of exploring the potentials for increased P recovery efficiency in the Danish anthroposphere based on the results of the initial MFA. An aspect of a secondary resource (recovered P fertiliser) is its ability to fulfil the functions of the resource substituted (mineral P fertiliser). For this purpose, the MFA system and values obtained in this study were adapted to reflect the typical values for availability of P from various material flows to crops, and to allow for transport of less bulky secondary-P material flows. An optimal distribution of recovered P flows (from sewage sludge and composted organic household waste) was then determined by formal optimization via linear programming. The outcome showed a gradual decline of both mineral P inputs, and net additions to soil P stocks, stabilising at a distinctly lower level than evident from the static MFA, due to P applied gradually becoming available for plants over time, showing a significantly higher (82%) potential for substituting mineral P imports than evident from the initial, static MFA (35%). While the potential improvements in closing the P cycle could be shown, this can, however, not be expected to change the reliance on imported P on one or another form.

General information

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Klinglmair, M. (Intern), Scheutz, C. (Intern), Astrup, T. F. (Intern)
A passive dosing method to determine fugacity capacities and partitioning properties of leaves

The capacity of leaves to take up chemicals from the atmosphere and water influences how contaminants are transferred into food webs and soil. We provide a proof of concept of a passive dosing method to measure leaf/polydimethylsiloxane partition ratios (Kleaf/PDMS) for intact leaves, using polychlorinated biphenyls (PCBs) as model chemicals. Rhododendron leaves held in contact with PCB-loaded PDMS reached between 76 and 99% of equilibrium within 4 days for PCBs 3, 4, 28, 52, 101, 118, 138 and 180. Equilibrium Kleaf/PDMS extrapolated from the uptake kinetics measured over 4 days ranged from 0.075 (PCB 180) to 0.371 (PCB 3). The Kleaf/PDMS data can readily be converted to fugacity capacities of leaves (Zleaf) and subsequently leaf/water or leaf/air partition ratios (Kleaf/water and Kleaf/air) using partitioning data from the literature. Results of our measurements are within the variability observed for plant/air partition ratios (Kplant/air) found in the literature. Log Kleaf/air from this study ranged from 5.00 (PCB 3) to 8.30 (PCB 180) compared to log Kplant/air of 3.31 (PCB 3) to 8.88 (PCB 180) found in the literature. The method we describe could provide data to characterize the variability in sorptive capacities of leaves that would improve descriptions of uptake of chemicals by leaves in multimedia fate models.

General information
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A Plume Scale Model of Chlorinated Ethene Degradation

Although much is known about the biotic degradation pathways of chlorinated solvents, application of the degradation mechanism at the field scale is still challenging [1]. There are many microbial kinetic models to describe the reductive dechlorination in soil and groundwater, however none of them have a degree of accuracy suitable for engineering purposes [2]. The objective of this project is thus to advance models of plume scale transport of chlorinated solvents in order to simulate state of the art field data.

The studied case is located at Fladehøjvej 1, Redekro in Southern Denmark. PCE has leaked from a dry cleaning facility, and a 2 km plume extends from the source in an unconfined aquifer of homogenous fluvioglacial sand. The area has significant iron deposits, most notably pyrite, which can abiotically degrade chlorinated ethenes. The source zone underwent thermal (steam) remediation in 2006; the plume has received no treatment. The evolution of the site has been intensely documented since before the source treatment. This includes microbial analysis – Dehalococcoides sp. and vcrA genes have been identified and quantified by qPCR – and dual carbon-chlorine isotope analysis [1].

This work combines batch and transport models using the software FeFlow and PHREEQC to model chlorinated ethene degradation at the Fladehøjvej site. The dechlorination element of the model is incorporated as monod-kinetic reactions [3]. The simulation will also account for the effect of competition for hydrogen as an electron donor with bacteria that utilize other electron acceptors [4].

At the time of the conference, the model developments will be presented. The results will increase the understanding of complex degradation processes within chlorinated solvent plumes.

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Organisations: Department of Environmental Engineering, Water Resources Engineering, Université de Neuchâtel, University of Neuchâtel
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Applying the "WSUD potential"-tool in the framework of the Copenhagen Climate Adaptation and Cloudburst Management Plans

Water Sensitive Urban Design (WSUD) is still in the "Opportunity"-phase of its stabilization process in Copenhagen, Denmark, indicating that there are controversies surrounding its proper use and the regulatory framework is not completely adapted to the new technology. In 2015 private land owners in Denmark could get up to 100% of the construction costs of climate adaptation measures funded by the utility companies, which resulted in a race to apply for this co-funding plan. In this study we briefly review the climate adaptation framework in Copenhagen, and then discuss how well different scenarios of WSUD in a case study area interact with this framework. The impacts of the different scenarios are assessed using the "WSUD-potential" tool, which builds upon the Three Points Approach. The results indicate that there is a schism between the city’s Cloudburst Management Plan on one side and its Climate Adaptation Plan and general service goal on the other side, which may result in over-sizing of the collective stormwater management system.

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Approaches for assessing sustainable remediation
Sustainable remediation seeks to reduce direct contaminant point source impacts on the environment, while minimizing the indirect cost of remediation to the environment, society and economy. This paper presents an overview of available approaches for assessing the sustainability of alternative remediation strategies for a contaminated site. Most approaches use multi-criteria assessment methods (MCA) to structure a decision support process. Different combinations of environmental, social and economic criteria are employed, and are assessed either in qualitative or quantitative forms with various tools such as life cycle assessment and cost benefit analysis. Stakeholder involvement, which is a key component of sustainable remediation, is conducted in various ways. Some approaches involve stakeholders directly in the evaluation or weighting of criteria, whereas other approaches only indirectly consider stakeholder preferences. MCA methods are very useful when comparing remediation alternatives, since they allow for a joint assessment of many types of indicators; however the available tools and methods differ substantially, for instance in their selection of indicators, approaches to stakeholder involvement and uncertainty analysis.

Aquatic Ecotoxicity Testing of Nanoparticles—The Quest To Disclose Nanoparticle Effects
The number of products on the market containing engineered nanoparticles (ENPs) has increased significantly, and concerns have been raised regarding their ecotoxicological effects. Environmental safety assessments as well as relevant and reliable ecotoxicological data are required for the safe and sustainable use of ENPs. Although the number of publications on the ecotoxicological effects and uptake of ENPs is rapidly expanding, the applicability of the reported data for hazard assessment is questionable. A major knowledge gap is whether nanoparticle effects occur when test organisms are exposed to ENPs in aquatic test systems. Filling this gap is not straightforward, because of the broad range of ENPs and the different behavior of ENPs compared to “ordinary” (dissolved) chemicals in the ecotoxicity test systems. The risk of generating false negatives, and false positives, in the currently used tests is high, and in most cases difficult to assess. This Review outlines some of the pitfalls in the aquatic toxicity testing of ENPs which may lead to misinterpretation of test results. Response types are also proposed to reveal potential nanoparticle effects in the aquatic test organisms.
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Organisations: Department of Environmental Engineering, Environmental Chemistry
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Aquatic ecotoxicity testing of nanoplastics - lessons learned from nanoecotoxicology

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Aquatic toxicity testing for hazard identification of engineered nanoparticles

Within the last few decades, major advances in the field of nanotechnology have enabled production of engineered nanoparticles (ENPs) for various applications and consumer products already available on the market. ENPs may exhibit unique and novel properties compared to their bulk counterparts, which is often related to a high surface-to-volume ratio. These properties have also caused concern amongst scientists and regulators, who have called for timely identification of the potential adverse effects of ENPs to human health and the environment. Despite intensive research on the aquatic toxicity of ENPs, the applicability of the generated data for hazard identification purposes is generally impaired by poor reproducibility and reliability of data, and limited understanding of the underlying effect mechanisms. Consequently, it has been questioned whether the standardized aquatic toxicity tests, developed for testing soluble compounds, are equally applicable for ENPs. The preconditions for aquatic toxicity tests include aqueous solubility of the chemical test compound and stability during incubation. These criteria are not met for ENPs, as they are suspended rather than dissolved in aqueous media. Moreover, ENPs undergo time-dependent transformation processes of agglomeration, dissolution, sedimentation, and interactions with organisms and their exudates. Together, these processes challenge the establishment of traditional concentration-response data by affecting both the exposure and the response axes. The actual exposure experienced by organisms may not be reflected by the ENP concentration in medium, commonly applied as the exposure metric, and the responses of organisms may result from various toxic and non-toxic mechanisms occurring simultaneously.

In this thesis, the challenges related to exposure control and response mechanisms in aquatic toxicity tests with ENPs are addressed through: 1) Exposure timing measures to minimize the transformation processes of ENPs during test incubation, and 2) Multi-dimensional approaches including investigations of other organisms responses than the traditionally applied, and determination of different exposure fractions such as the concentration of dissolved ions from ENPs and body burdens. Although these approaches are scientifically exploratory by nature, the aim is to generate data
applicable for regulatory hazard identification of ENPs. The focus has been on the algal growth rate inhibition test and acute and chronic toxicity tests with crustaceans, all commonly applied in a regulatory context.

The exposure timing measures included aging of ENPs in test media prior to incubation, and/or shortened exposure duration. For algae, shorter exposure duration was obtained through the application of an acute 2h 14C-assimilation test. For daphnids, a short-term (1-3h) pulse exposure was applied, followed by transfer of the organisms to pure medium, where acute and chronic effects were monitored according to standard guidelines during 48h and 21 days respectively. These approaches assisted to minimize the ENP transformation during incubation, but also influenced the toxicity. While aging of ENPs may both increase and decrease toxicity, the shortened exposure mainly appeared to involve a risk of underestimating, or in worst case overlooking chronic effects in algae and daphnids. Thus, more sensitive endpoints may be relevant for algal tests with shortened exposure, such as oxidative stress, found to occur within few hours’ exposure to certain ENPs. The traditional endpoints of algal growth rate inhibition and daphnia immobility were found to be confounded by physical effects. As examples, the algal growth rate can be inhibited by ENPs physically obstructing the light available to the algae (shading), and the immobility of daphnids may partly result from ENPs adsorbed to these organisms’ exterior. In addition to different effect mechanisms, several exposure fractions are available to interact with the organisms, including ENPs adsorbed to or internalized into the organisms/cells, suspended ENPs and ions dissolved from the ENPs. Together, these various exposure fractions and the multiple effect mechanisms complicate the establishment of traditional concentration-response relationships that are based on a single response and exposure dose-metric. A multi-dimensional approach is therefore suggested for aquatic toxicity testing of ENPs for hazard identification purposes. This includes investigation of both physical and cellular effects in organisms in addition to the traditional endpoints. Also, the different exposure fractions of ENPs should be considered including the adsorbed and internalized fractions in organisms, as well as the dissolved and total concentrations in the medium. In practice it is neither unambiguous nor straightforward to determine the different exposure fractions and effect mechanisms, thus some consensus on the best available practices would be beneficial, as well as harmonization of testing approaches in a regulatory context. Ultimately, a multi-dimensional approach may assist to identify which organism responses and exposure fractions are related and improve our understanding of the concentration-response data generated from aquatic toxicity tests with ENPs.

**General information**

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**Aquatische Ökotoxizität von Nanopartikeln – Versuche zur Aufklärung von Nanopartikeleffekten**

Over the last decade the number of products on the market containing engineered nanoparticles (ENPs) has increased significantly and concerns have been raised regarding the potential for ecotoxicological effects of ENPs. To promote safe and sustainable use of ENPs, environmental safety assessments are needed and for this purpose relevant and reliable ecotoxicological data is demanded. While the literature on ecotoxicological effects and uptake of ENPs is rapidly expanding, the applicability of reported data of ENPs for hazard assessment purposes is questionable. A major knowledge gap is whether nanoparticle effects occur when test organisms are exposed to ENPs in aquatic test systems. This knowledge gap is not straightforward to fill, due to the high variability in ENP types, and the different behavior of ENPs compared to “ordinary” (dissolved) chemicals in the ecotoxicity test systems. The risk of generating false negative, as well as false positive, results in the currently used tests is high, but in most cases difficult to assess. This literature review outlines some of the pitfalls in aquatic toxicity testing of ENPs which may lead to misinterpretation of test results. Furthermore, the review proposes response types to account for in order to reveal potential nanoparticle effects in the aquatic test organisms used for risk assessments of ENPs.

**General information**

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Assessing ecological competition for electron donor within a groundwater microbial community that contains organohalide-respiring bacteria

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Assessment of Coastal and Urban Flooding Hazards Applying Extreme value Analysis and Multivariate Statistical techniques A Case study in Elwood, Australia

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Assessment of Coastal and Urban Flooding Hazards Applying Extreme value Analysis and Multivariate Statistical techniques - A Case study in Elwood, Australia

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Assessment of kitchen waste compost from Sisimiut for use as plant growth medium or landfill biocover

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Assessment of The Most Sustainable "Management Scenario" For An Old Pesticide Dumpsite

Background and objectives
In the 1950's and early 60's several hundreds tons of chemical waste were deposited in a dumpsite located on the west coast of Denmark. In 1973 and again in 1981 the dumpsite was partly remediated by excavation of contaminated sand. However, more than 100 tons of organophosphorous insecticides (primarily ethyl-parathion) and other chemicals remained in the subsurface and posed a threat to the aquatic environment in the North Sea.

In 2006, the dumpsite was encapsulated to a depth of 14 meters by an iron sheet piling, to stop leaching of chemicals to the North Sea. The environmental authorities in Denmark have since then been working on developing remediation methods that can be used to clean-up the site. The overall objective for a future remediation (or management scenario) is to ensure that there is no risk to the aquatic environment.

Approach
Four remediation methods (management scenarios) were found suitable to fulfill the objective; (1) Excavation of the site followed by thermal soil treatment, (2) In situ alkaline hydrolysis, (3) In situ steam enhanced extraction and (4) Continued encapsulation of the site (no removal of contaminants). The cost varied from 33 mio. EURO (solution 1) to 0.13 mio. EURO/year (solution 4).
One management scenario had to be recommended to the decision-makers (the regional politicians) in the Central Denmark Region – so which one of the four solutions are the most sustainable?

In order to improve decision-making, a multi-criteria assessment method for comparing the sustainability of the remediation alternatives was developed and applied. The model considers cost and effect of remediation, but also time, environmental and societal impacts and involves stakeholders in the derivation of criteria weights.

Results
The use of the multi-criteria method provided insight into how the four management scenarios compare to each other in terms of remedial effect, cost, time use and external impacts to environment and society.

Surprisingly, the sustainability assessment showed that excavation and thermal treatment of the soil was the most sustainable solution, although it was by far more expensive and had the highest secondary effects on the environment. The result of the sustainability assessment played an important part in the decision-making process when the politicians in Central Denmark Region decided on which management scenario to choose for the future.

The presentation will describe the four management scenarios, the sustainability assessment and how it was actually used in the political decision-making process in Denmark.
Behavior and chronic toxicity of two differently stabilized silver nanoparticles to Daphnia magna

While differences in silver nanoparticle (AgNP) colloidal stability, surface potential, or acute aquatic toxicity for differently stabilized AgNP have often been reported, these have rarely been studied in long-term ecotoxicity tests. In the current study, we investigated the chronic toxicity of AgNP to Daphnia magna over a 21-day period with two different stabilizers (citrate and detergent), representative for charge and sterical stabilizers, respectively. This was coupled with a series of short-term experiments, such as mass balance and uptake/depuration testing, to investigate the behavior of both types of AgNP during a typical media exchange period in the D. magna test for chronic toxicity. As expected, the sterically stabilized AgNP were more stable in the test medium, also in the presence of food; however, a higher uptake of silver after 24 h exposure of the charge stabilized AgNP was found compared to the detergent-stabilized AgNP (0.046 ± 0.006 μg Ag μg DW−1 and 0.023 ± 0.005 μg Ag μg DW−1, respectively). In accordance with this, the higher reproductive effects and mortality were found for the charge-stabilized than for the sterically-stabilized silver nanoparticles in 21-d tests for chronic toxicity. LOEC was 19.2 μg Ag L−1 for both endpoints for citrate-coated AgNP and >27.5 μg Ag L−1 (highest tested concentration for detergent-stabilized AgNP). This indicates a link between uptake and toxicity. The inclusion of additional short-term experiments on uptake and depuration is recommended when longer-term chronic experiments with nanoparticles are conducted.
Biochemical methane potential of kraft bleaching effluent and codigestion with other in-mill streams
A biochemical methane potential assay was conducted to investigate the anaerobic digestibility of bleaching effluent from hardwood kraft pulping and the potential of codigestion with other effluents from an integrated pulp and paper mill. Four in-mill streams were tested individually and in combination: total bleaching effluent, alkaline bleaching effluent, Kraft evaporator condensate, and chemithermomechanical pulping effluent. The total bleaching effluent, consisting of the chlorine dioxide bleaching and alkaline bleaching effluents, exhibited the highest potential for organic matter degradation and methane generation. Chemical oxygen demand (COD) removal ranged from 57%-76%, and methane generation was 220-280 mL/g COD contained in the wastewater, depending on the degree of dilution. When codigestion was tested, the composite consisting of total bleaching effluent, chemithermomechanical pulping effluent, and Kraft condensate was most efficient in terms of COD removal (51%) and methane generation (200 mL/g COD contained in the wastewater). The total bleaching effluent is the largest contributor to the overall amount of wastewater at this mill; it contains relatively low concentrations of anaerobic inhibitors such as adsorbable organic halogens (36 mg/L), total sulfur (170 mg/L), and resin and fatty acids (3.2 mg/L). Therefore, the total bleaching effluent from hardwood kraft pulping may be considered for full-scale anaerobic wastewater treatment, either as a singular stream or as part of a composite stream including other in-mill effluents.

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Authors: Andersen, H. R. (Intern)
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Biodegradation of volatile hydrocarbons in five surface waters tested as composed mixtures in the μg/L range

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Biodegradation of volatile hydrocarbons in five surface waters tested as composed mixtures in the μg/L range

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Biodiversity positively associates with biofilm thickness in Moving Bed Biofilm Reactors (MBBRs) – implications on micropollutant removal and nitrification

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Authors: Torresi, E. (Intern), Christensson, M. (Ekstern), Smets, B. F. (Intern), Fowler, S. J. (Ekstern), Polesel, F. (Intern), Andersen, H. R. (Intern), Plósz, B. G. (Intern)
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Biofilm Thickness Influences Biodiversity in Nitrifying MBBRs-Implications on Micropollutant Removal
In biofilm systems for wastewater treatment (e.g., moving bed biofilms reactors-MBBRs) biofilm thickness is typically not under direct control. Nevertheless, biofilm thickness is likely to have a profound effect on the microbial diversity and activity, as a result of diffusion limitation and thus substrate penetration in the biofilm. In this study, we investigated the impact of biofilm thickness on nitrification and on the removal of more than 20 organic micropollutants in laboratory-scale nitrifying MBBRs. We used novel carriers (Z-carriers, AnoxKaldnes) that allowed controlling biofilm thickness at 50, 200, 300, 400, and 500 μm. The impact of biofilm thickness on microbial community was assessed via 16S rRNA gene amplicon sequencing and ammonia monooxygenase (amoA) abundance quantification through quantitative PCR (qPCR).

Results from batch experiments and microbial analysis showed that (i) the thickest biofilm (500 μm) presented the highest specific biotransformation rate constants (kbio, L g(-1) d(-1)) for 14 out of 22 micropollutants; (ii) biofilm thickness positively associated with biodiversity, which was suggested as the main factor for the observed enhancement of kbio; (iii) the thinnest biofilm (50 μm) exhibited the highest nitrification rate (gN d(-1) g(-1)), amoA gene abundance and kbio values for some of the most recalcitrant micropollutants (i.e., diclofenac and targeted sulfonamides). Although thin biofilms favored nitrification activity and the removal of some micropollutants, treatment systems based on thicker biofilms should be considered to enhance the elimination of a broad spectrum of micropollutants.

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Antioxidants (i.e., phenols) and fertilizer very attractive. This was demonstrated to have the potential to increase the cost-concentration of inorganic nutrients in the solid residue recovered after enzymatic hydrolysis, making co-production of succinic acid yield and titer. A maximum succinic acid yield of 91.9% (g g⁻¹ of total sugars) corresponding to 70.5% of the for feed. Seasonal variations in the content of carbohydrates, and fermentable sugars, had a significant impact on the human consumption, while the concentrations of total arsenic (up to 63.3 mg kg⁻¹ DM) may restrict utilization as ingredient. Analyses showed that high concentrations of iodine (up to 5,011 mg kg⁻¹ DM) in the biomass may be of concern for general compared to traditional vegetables. Regarding safety regulations, however, the main conclusions on the mineral content increased significantly from 1.3% dry matter (DM) in May to 10.8% DM in November. Similarly, the maximum essential amino acid (EAA) score was found in November (68.9%). Thus, results suggest an apparent mismatch between harvest time for human consumption (May) and the highest nutritional value of the protein in the biomass (November). The essential amino acid (EAA) score was found in November (68.9%). Thus, results suggest an apparent mismatch between harvest time for human consumption (May) and the highest nutritional value of the protein in the biomass (November). The growth of epiphytes from July to November makes the biomass unsuitable for human consumption, thus biomass meant to be used as feed should be harvested in May. Protein content increased significantly from 1.3% dry matter (DM) in May to 10.8% DM in November. Similarly, the maximum essential amino acid (EAA) score was found in November (68.9%). Thus, results suggest an apparent mismatch between harvest time for human consumption (May) and the highest nutritional value of the protein in the biomass (November). The growth of epiphytes did not change the amino acid content or EAA score. However, the protein content and composition did not comply with the requirements for standard protein ingredients for fish feed (i.e., fishmeal, soymeal). The lipid concentration varied from 0.62%–0.88% DM in July to 3.33%–3.35% DM in November (p<0.05). Additionally, macroalgal cultivation over two growing seasons enhanced the biomass yield and thus value, but not the bioremediation capacity. Harvest time had a significant impact in overall chemical composition, while cultivation site did not generally result in marked differences. The growth of epiphytic organisms from July to November makes the biomass unsuitable for human consumption, thus biomass meant to be used as feed should be harvested in May. Protein content increased significantly from 1.3% dry matter (DM) in May to 10.8% DM in November. Similarly, the maximum essential amino acid (EAA) score was found in November (68.9%). Thus, results suggest an apparent mismatch between harvest time for human consumption (May) and the highest nutritional value of the protein in the biomass (November). The growth of epiphytes did not change the amino acid content or EAA score. However, the protein content and composition did not comply with the requirements for standard protein ingredients for fish feed (i.e., fishmeal, soymeal). The lipid concentration varied from 0.62%–0.88% DM in July to 3.33%–3.35% DM in November (p<0.05). Polysaturated fatty acids (PUFA’s) made up more than half of the fatty acids with a maximum in July (52.3%–54.0% fatty acid methyl esters). This including the most appreciated health beneficial PUFA’s, eicosapentaenoic (EPA; 20:5n-3) and docosahexaenoic acid (DHA; 22:6n-3), but also arachidonic (ARA) and stearidonic acid (SDA). Season of harvest is important for the choice of lipid quantity and quality, but the macroalga provides better sources of EPA, DHA and long-chain (LC)-PUFA’s in general compared to traditional vegetables. Regarding safety regulations, however, the main conclusions on the mineral analyses showed that high concentrations of iodine (up to 5,001 mg kg⁻¹ DM) in the biomass may be of concern for human consumption, while the concentrations of total arsenic (up to 63.3 mg kg⁻¹ DM) may restrict utilization as ingredient for feed. Seasonal variations in the content of carbohydrates, and fermentable sugars, had a significant impact on the succinic acid yield and titer. A maximum succinic acid yield of 91.9% (g g⁻¹ of total sugars) corresponding to 70.5% of the theoretical maximum yield was achieved; while succinic acid titer amounted up to 36.8 g L⁻¹ with maximum productivity of 3.9 g L⁻¹ h⁻¹. The high content of total phenolic compounds in the macroalga (July-August: 5-1% DM), and high concentration of inorganic nutrients in the solid residue recovered after enzymatic hydrolysis, makes co-production of antioxidants (i.e., phenols) and fertilizer very attractive. This was demonstrated to have the potential to increase the cost-
effectiveness of the biorefinery facility. This study gives comprehensive information of the bioremediation potential of S. latissima cultivated commercially in the inner Danish waters. Year-round data show that harvest time can be effectively used to optimize the bioremediation capacity, and the biomass yield and application/value. The macroalga can be a source of valuable proteins, specific amino acids and food; however, high concentrations of iodine and total arsenic may be of concern regarding food and feed safety regulations, respectively. On the other hand, S. latissima is a promising feedstock for fermentation-based succinic acid production with co-production of phenols, and fertilizers.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, National Food Institute, Research Group for Bioactives – Analysis and Application
Authors: Silva Marinho, G. (Intern), Angelidaki, I. (Intern), Holdt, S. L. (Intern)
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Publisher: Technical University of Denmark, DTU Environment
Original language: English
Main Research Area: Technical/natural sciences
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**Bringing modelling to life: current research in an introductory MSc modelling course**

**General information**

State: Published
Authors: Binning, P. J. (Intern), Trapp, S. (Intern), Rolle, M. (Intern), Vezzaro, L. (Intern)
Number of pages: 2
Publication date: 2016
Event: Abstract from 5th DTU Biennial for Teaching and Learning, Lyngby, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:

Binning_UndervisningsBiennale_Abstract_3_.pdf
Source: PublicationPreSubmission
Source-ID: 127838368
Publication: Research › Conference abstract for conference – Annual report year: 2016

**Can we enhance the biotransformation of pharmaceutical micropollutants by controlling biofilm thickness in MBBR?**

**General information**

State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Environmental Chemistry, AnoxKaldnes AB
Authors: Torresi, E. (Intern), Polesel, F. (Intern), Andersen, H. R. (Intern), Smets, B. F. (Intern), Christensson, M. (Ekstern), Plósz, B. G. (Intern)
Number of pages: 5
Publication date: 2016
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Main Research Area: Technical/natural sciences
Electronic versions:

Abstract_extended_EWA_symposium_Elena_Torresi.pdf
Source: PublicationPreSubmission
Source-ID: 140791274
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

**Challenges in microbial ecology: Building predictive understanding of community function and dynamics**

The importance of microbial communities (MCs) cannot be overstated. MCs underpin the biogeochemical cycles of the earth's soil, oceans and the atmosphere, and perform ecosystem functions that impact plants, animals and humans. Yet our ability to predict and manage the function of these highly complex, dynamically changing communities is limited. Building predictive models that link MC composition to function is a key emerging challenge in microbial ecology. Here, we
argue that addressing this challenge requires close coordination of experimental data collection and method development with mathematical model building. We discuss specific examples where model-experiment integration has already resulted in important insights into MC function and structure. We also highlight key research questions that still demand better integration of experiments and models. We argue that such integration is needed to achieve significant progress in our understanding of MC dynamics and function, and we make specific practical suggestions as to how this could be achieved.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies
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Journal: I S M E Journal
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2016): CiteScore 8.91 SJR 4.771 SNIP 2.188
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 6.087 SNIP 2.363 CiteScore 9.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 5.056 SNIP 2.181 CiteScore 8.42
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 4.71 SNIP 2.175 CiteScore 8.62
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.673 SNIP 2.07 CiteScore 8.02
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.536 SNIP 1.777 CiteScore 6.5
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.245 SNIP 1.626
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.563 SNIP 1.445
Web of Science (2009): Indexed yes
Changes in Climate Extremes and Catastrophic Events in the Mongolian Plateau from 1951 to 2012

The spatiotemporal changes in 21 indices of extreme temperature and precipitation for the Mongolian Plateau from 1951 to 2012 were investigated on the basis of daily temperature and precipitation data from 70 meteorological stations. Changes in catastrophic events, such as droughts, floods, and snowstorms, were also investigated for the same period. The correlations between catastrophic events and the extreme indices were examined. The results show that the Mongolian Plateau experienced an asymmetric warming trend. Both the cold extremes and warm extremes showed greater warming at night than in the daytime. The spatial changes in significant trends showed a good homogeneity and consistency in Inner Mongolia. Changes in the precipitation extremes were not as obvious as those in the temperature extremes. The spatial distributions in changes of precipitation extremes were complex. A decreasing trend was shown for total precipitation from west to east as based on the spatial distribution of decadal trends. Drought was the most serious extreme disaster, and prolonged drought for longer than 3 yr occurred about every 7-11 yr. An increasing trend in the disaster area was apparent for flood events from 1951 to 2012. A decreasing trend was observed for the maximum depth of snowfall from 1951 to 2012, with a decreased average maximum depth of 10 mm from the 1990s.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Chinese Academy of Sciences
Authors: Wang, L. (Ekstern), Yao, Z. (Ekstern), Jiang, L. (Intern), Wang, R. (Ekstern), Wu, S. (Ekstern), Liu, Z. (Ekstern)
Number of pages: 14
Pages: 1169-1182
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: Journal of Applied Meteorology and Climatology
Volume: 55
Issue number: 5
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.73 SJR 1.796 SNIP 1.183
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.87 SNIP 1.405 CiteScore 2.68
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.946 SNIP 1.428 CiteScore 2.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.962 SNIP 1.516 CiteScore 2.47
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Characterisation of source-separated organic waste for composting in Sisimiut, Greenland

General information
State: Published
Organisations: Department of Civil Engineering, ARTEK, Section for Arctic Engineering and Sustainable Solutions, Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark
Authors: Díez, L. (Ekstern), Kirkelund, G. M. (Intern), Scheutz, C. (Intern)
Number of pages: 2
Pages: 100-101
Publication date: 2016

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Title of host publication: ARTEK Event 2016 – International Conference Sanitation in Cold Climate Regions
Publisher: Arctic Technology Centre, DTU Technical University of Denmark
ISBN (Print): 9788778774316
Main Research Area: Technical/natural sciences
Electronic versions:
Book_of_Abstracts_Artek_Event_2016.pdf

Bibliographical note
Byg Report R-340
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016

Characterisation of the biochemical methane potential (BMP) of individual material fractions in Danish source-separated organic household waste
This study is dedicated to characterising the chemical composition and biochemical methane potential (BMP) of individual material fractions in untreated Danish source-separated organic household waste (SSOHW). First, data on SSOHW in
different countries, available in the literature, were evaluated and then, secondly, laboratory analyses for eight organic material fractions comprising Danish SSOHW were conducted. No data were found in the literature that fully covered the objectives of the present study. Based on laboratory analyses, all fractions were assigned according to their specific properties in relation to BMP, protein content, lipids, lignocellulose biofibres and easily degradable carbohydrates (carbohydrates other than lignocellulose biofibres). The three components in lignocellulose biofibres, i.e. lignin, cellulose and hemicellulose, were differentiated, and theoretical BMP (TBMP) and material degradability (BMP from laboratory incubation tests divided by TBMP) were expressed. Moreover, the degradability of lignocellulose biofibres (the share of volatile lignocellulose biofibre solids degraded in laboratory incubation tests) was calculated. Finally, BMP for average SSOHW composition in Denmark (untreated) was calculated, and the BMP contribution of the individual material fractions was then evaluated. Material fractions of the two general waste types, defined as "food waste" and "fibre-rich waste," were found to be anaerobically degradable with considerable BMP. Material degradability of material fractions such as vegetation waste, moulded fibres, animal straw, dirty paper and dirty cardboard, however, was constrained by lignin content. BMP for overall SSOHW (untreated) was 404mL CH4 per g VS, which might increase if the relative content of material fractions, such as animal and vegetable food waste, kitchen tissue and dirty paper in the waste, becomes larger.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Naroznova, I. (Intern), Møller, J. (Intern), Scheutz, C. (Intern)
Number of pages: 10
Pages: 39-48
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: Waste Management
Volume: 50
ISSN (Print): 0956-053X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.354 SNIP 2.044
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.739 SNIP 2.256 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.777 SNIP 2.482 CiteScore 3.43
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.822 SNIP 2.435 CiteScore 3.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.611 SNIP 2.184 CiteScore 2.91
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.698 SNIP 2.085 CiteScore 2.99
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.555 SNIP 1.78
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.502 SNIP 1.899
Characteristic Rain Events – A tool to enhance amenity values in SUDS-design

To overcome the challenge of designing good-looking open detention/retention areas in the urban landscape that can manage stormwater runoff from both the large, rare events and the frequent smaller events without looking empty and oversized a new approach referred to as Characteristic Rain Events (CRE) is proposed. The idea of the CRE is to demonstrate the water dynamics of a detention/retention area in a number of characteristic situations, in this way allowing the designer to work in a more tangible way with the design. Based on historical rain series single events are selected, representing the day-to-day domain, the design domain and the extreme domain as defined in the Three Point Approach (3PA). In this paper the ability of CRE to unfold the water dynamics of a detention/retention area is investigated by applying four CRE to a fictive rain garden including frequent, short event, a frequent long event, a seldom heavy event and a rare extreme event, and comparing resulting numbers for time with standing water, water depth, retention volume, overflow volume etc. The CRE approach is concluded to hold potential for improving the design process and thus the final design of detention-retention areas.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, University of Copenhagen
Authors: Smit Andersen, J. (Ekstern), Lerer, S. M. (Intern), Sørup, H. J. D. (Intern), Backhaus, A. (Ekstern), Jensen, M. B. (Ekstern)
Number of pages: 4
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Place of publication: Lyon, France
Main Research Area: Technical/natural sciences
Conference: 9th International Conference on Planning and Technologies for Sustainable Urban Water Management (NOVATECH), Lyon, France, 28/06/2016 - 28/06/2016
Amenity value, Design tool, Landscape design, Three point approach, Transdisciplinarity
Electronic versions:
1D1P13_230AND.pdf
Source: PublicationPreSubmission
Source-ID: 124242819
Characterization of chlorinated solvent contamination in limestone using innovative FLUTe® technologies in combination with other methods in a line of evidence approach

Characterization of dense non-aqueous phase liquid (DNAPL) source zones in limestone aquifers/bedrock is essential to develop accurate site-specific conceptual models and perform risk assessment. Here innovative field methods were combined to improve determination of source zone architecture, hydrogeology and contaminant distribution. The FACT™ is a new technology and it was applied and tested at a contaminated site with a limestone aquifer, together with a number of existing methods including wire-line coring with core subsampling, FLUTe® transmissivity profiling and multilevel water sampling. Laboratory sorption studies were combined with a model of contaminant uptake on the FACT™ for data interpretation. Limestone aquifers were found particularly difficult to sample with existing methods because of core loss, particularly from soft zones in contact with chert beds. Water FLUTe™ multilevel groundwater sampling (under two flow conditions) and FACT™ sampling and analysis combined with FLUTe® transmissivity profiling and modeling were used to provide a line of evidence for the presence of DNAPL, dissolved and sorbed phase contamination in the limestone fractures and matrix. The combined methods were able to provide detailed vertical profiles of DNAPL and contaminant distributions, water flows and fracture zones in the aquifer and are therefore a powerful tool for site investigation. For the limestone aquifer the results indicate horizontal spreading in the upper crushed zone, vertical migration through fractures in the bryozoan limestone down to about 16–18 m depth with some horizontal migrations along horizontal fractures within the limestone. Documentation of the DNAPL source in the limestone aquifer was significantly improved by the use of FACT™ and Water FLUTe™ data.
Characterization of membrane foulants at ambient temperature anaerobic membrane bioreactor treating low-strength industrial wastewater

The large volume of industrial low-strength wastewaters has a potential for biogas production through conventional anaerobic digestion (AD), limited though by the need of heating and concentrating of the wastewaters. The use of anaerobic membrane bioreactor (AnMBR) combining membrane filtration with anaerobic biological treatment at low temperature could not only reduce the operational cost of AD, but also alleviate environmental problems. However, at low temperature the AnMBR may suffer more fouling due to the increased extracellular polymeric substances production excreted by bacteria hampering the application of the process for the industrial wastewater treatment. In order to solve or reduce the fouling problem it is necessary to have a good insight into the processes that take place both on and in the membrane pores during filtration. Therefore, the objective of this study is to contribute to a better understanding of organic and biofouling in AnMBR. An AnMBR consisting of external PVDF membrane was operated at 25°C and fed with synthetic dairy wastewater. Intensity, morphology and composition of foulants were determined using Scanning Electron Microscopy coupled with X-ray Energy Dispersive Spectrometry (EDS), Fourier Transform Infrared Spectrometry (ATR-FTIR), Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES), Ion chromatography (IC), zeta potential, and adenosine triphosphate measurements. Based on membrane autopsies, it can be concluded that prevailing fouling is mainly of biological and organic origin. SEM observations demonstrated presence of numerous bacteria incorporated with the fouling layer composed of mainly proteins, carbohydrates and lipids as revealed by ATR-FTIR measurements. Furthermore the amounts of ions found by EDS & ICP-OES analysis do not support scaling layer formation.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Lund Institute of Technology, University of Maribor
Authors: Zarebska, A. (Intern), Kjerstadius, H. (Ekstern), Petrinic, I. (Ekstern), Buksek, H. (Ekstern), Korenak, J. (Ekstern), Jansen, J. L. C. (Ekstern), Hélix-Nielsen, C. (Intern)
Climatic controls on leaf litter decomposition across European forests and grasslands revealed by reciprocal litter transplantation experiments

Carbon (C) and nitrogen (N) cycling under future climate change is associated with large uncertainties in litter decomposition and the turnover of soil C and N. In addition, future conditions (especially altered precipitation regimes and warming) are expected to result in changes in vegetation composition, and accordingly in litter species and chemical composition, but it is unclear how such changes could potentially alter litter decomposition. Litter transplantation experiments were carried out across six European sites (four forests and two grasslands) spanning a large geographical and climatic gradient (5.6-11.4 degrees C in annual temperature, 511-878mm in precipitation) to gain insight into the climatic controls on litter decomposition as well as the effect of litter origin and species. The decomposition k rates were overall higher in warmer and wetter sites than in colder and drier sites, and positively correlated with the litter total specific leaf area. Also, litter N content increased as less litter mass remained and decay went further. Surprisingly, this study demonstrates that climatic controls on litter decomposition are quantitatively more important than species or site of origin. Cumulative climatic variables, precipitation, soil water content and air temperature (ignoring days with air temperatures below zero degrees Celsius), were appropriate to predict the litter remaining mass during decomposition (M-r). M-r and cumulative air temperature were found to be the best predictors for litter carbon and nitrogen remaining during the decomposition. Using mean annual air temperature, precipitation, soil water content and litter total specific leaf area as parameters we were able to predict the annual decomposition rate (k) accurately.

General information
State: Published
Organisations: Department of Environmental Engineering, Atmospheric Environment, University of Antwerp, University of Helsinki, ECN, University of Sassari, Hungarian Meteorological Service, Centre for Ecology and Hydrology, Estonian Academy of Sciences
Number of pages: 13
Pages: 1621-1633
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication Information
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.25 SJR 2.328 SNIP 1.305
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.453 SNIP 1.324 CiteScore 4.04
Co-digestion of food and garden waste with mixed sludge from wastewater treatment in continuously stirred tank reactors

Co-digestions of urban organic waste were conducted to investigate the effect of the mixing ratio between sludge, food waste, grass clippings and green waste at different hydraulic retention times (HRTs). Compared to the digestion of 100% sludge, the methane yield increased by 48% and 35%, when co-digesting sludge with food waste, grass clippings and garden waste with a corresponding % VS of 10:67.5:15.75:6.75 (R1) and 10:45:31.5:13.5 (R2), respectively. The methane yield remained constant at around 425 and 385 NmL CH₄/g VS in R1 and R2, respectively, when the reactors were operated at HRTs of 15, 20 and 30 days. However, the methane yield dropped significantly to 356 (R1) and 315 (R2) NmL CH₄/g VS when reducing the HRT to 10 days, indicating that the process was stressed. Since the methane production rate improved significantly with decreasing HRT, the trade-off between yield and productivity was obtained at 15 days HRT.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Fitamo, T. M. (Intern), Boldrin, A. (Intern), Boe, K. (Intern), Angelidaki, I. (Intern), Scheutz, C. (Intern)
Pages: 245-254
Co-digestion of microalgae and activated sludge following a novel bioflocculation method

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Residual Resource Engineering, Technical University of Denmark
Authors: Wagner, D. S. (Intern), Radovici, M. (Ekstern), Angelidaki, I. (Intern), Valverde Perez, B. (Intern), Plösz, B. G. (Intern)
Number of pages: 1
Publication date: 2016
Event: Poster session presented at Young Algaeneers Symposium, 2016, Malta.
Main Research Area: Technical/natural sciences
Electronic versions:
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Source: PublicationPreSubmission
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Publication: Research - peer-review › Poster – Annual report year: 2016

Combined Sewer Overflow pretreatment with chemical coagulation and a particle settler for improved peracetic acid disinfection

Full scale disinfection by peracetic acid (PAA) was achieved on Combined Sewer Overflow (CSO) water, which was pre-treated physically by a fast settling-filtration unit. Disinfection of untreated CSO water using PAA was compared to treatment using a particle separator (HydroSeparator®) and additional coagulation with poly-aluminum-chloride. Disinfection for Enterococcus increased with the applied dose of PAA and additional improvement was achieved when it was preceded by chemical coagulation with 5 mg L−1 poly-aluminum-chloride. When Enterococcus was reduced by treatment in the HydroSeparator, followed by PAA treatment during a CSO event, the treatment was sufficient to maintain microbial quality in the recipient water.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Bonnerup Consult ApS
Authors: Chhetri, R. K. (Intern), Bonnerup, A. (Ekstern), Andersen, H. R. (Intern)
Pages: 372-379
Publication date: 2016
Main Research Area: Technical/natural sciences

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Volume: 37
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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.3 SJR 1.119 SNIP 1.442
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.945 SNIP 1.423 CiteScore 3.74
BFI (2014): BFI-level 1
Combined use of meio- and macrobenthic indices to assess complex chemical impacts on a stream ecosystem

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Ecossa, Aarhus University, Bielefeld University
Authors: McKnight, U. S. (Intern), Sonne, A. T. (Intern), Rasmussen, J. J. (Ekstern), Traunspurger, W. (Ekstern), Höss, S. (Ekstern), Bjerg, P. L. (Intern)
Number of pages: 1
Publication date: 2016

Host publication information
Title of host publication: Geophysical Research Abstracts
Volume: 18
Main Research Area: Technical/natural sciences
Conference: European Geosciences Union General Assembly 2016, Vienna, Austria, 17/04/2016 - 17/04/2016
Electronic versions:
EGU2016_11980.pdf

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Activities:
European Geosciences Union General Assembly 2016
Publication: Research - peer-review » Conference abstract in proceedings – Annual report year: 2017

Combining Envisat and CryoSat-2 altimetry to inform hydrodynamic models
Decreasing availability of in-situ river monitoring data can be met with increasing availability and quality of satellite altimetry data over rivers. CryoSat-2 is an altimeter mission launched in 2010 by the European Space Agency (ESA). With its unique drifting orbit, common procedures of working with satellite altimetry data over rivers cannot be easily applied. This work presents a way of informing a hydrologic-hydrodynamic model of the Brahmaputra River with CryoSat-2 altimetry. For one, CryoSat-2 data with its high spatial resolution was used to calibrate water levels in the 1D hydrodynamic model. For the other, a data assimilation framework was developed and applied, showing promising results for assimilation.
experiments with real and synthetic CryoSat-2 data.

**General information**
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, National Space Institute, DHI Hørsholm, DHI Denmark
Authors: Schneider, R. (Intern), Nygaard Godiksen, P. (Ekstern), Ridler, M. (Ekstern), Villadsen, H. (Intern), Madsen, H. (Ekstern), Bauer-Gottwein, P. (Intern)
Number of pages: 5
Publication date: 2016

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Title of host publication: Proceedings Living Planet Symposium 2016
Publisher: European Space Agency
Editor: Ouwehand, L.
Article number: 1407

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ESA Living Planet Symposium 2016
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**Combining Envisat and CryoSat-2 altimetry to inform hydrodynamic models**
Remote sensing provides valuable data for parameterization and updating of hydrological models, for example water level measurements of inland water bodies from satellite radar altimeters. Many studies have used satellite altimetry data from repeat-orbit missions such as Envisat, ERS or Jason, or synthetic wide-swath altimetry data as expected from the SWOT mission. This study is one of the first hydrologic applications of altimetry data from a drifting orbit satellite mission, namely CryoSat-2. CryoSat-2 is equipped with the SIRAL instrument, a new type of radar altimeter similar to SRAL on Sentinel-3. CryoSat-2 SARIn level 2 data is used to improve a 1D hydrodynamic model of the Brahmaputra river basin in South Asia set up in the DHI MIKE 11 software. CryoSat-2 water levels were extracted over river masks derived from Landsat imagery. After discharge calibration, simulated water levels were fitted to the CryoSat-2 data: In a first step, the average simulated water levels along the river were calibrated to the CryoSat-2 data by adapting the hydrodynamic cross section datums. Subsequently the simulated water level amplitudes were fitted to those obtained from Envisat virtual station time series by adapting the cross section shapes. The water level was only calibrated for the Brahmaputra in the Assam valley due to a lack of Envisat data further upstream. Despite the steep and rugged terrain in the upstream part of the Brahmaputra, the CryoSat-2 data was found usable after a Landsat river mask was applied. After calibration a hydrodynamic model with accurate spatio-temporal representation of water levels is obtained.

This is a prerequisite for real-time model updating by assimilation of CryoSat-2 altimetry or multi-mission data in general. For this task, a data assimilation framework has been developed and linked with the MIKE 11 model, enabling the integration of any kind of water level measurements. It is a flexible framework that can assimilate water level data which are arbitrarily distributed in time and space. Different types of error models and data assimilation methods can easily be used and tested. Furthermore, it is not only possible to update the water level of the hydrodynamic model, but also the states of the rainfall-runoff models providing the forcing of the hydrodynamic model. The setup has been used to assimilate CryoSat-2 observations over the Assam valley for the years 2010 to 2013, testing different data assimilation methods and model error representations. Performance improvement in terms of discharge forecast due to the assimilation of satellite altimetry data was then evaluated.

**General information**
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Combining Equilibrium Sampling with Non-Target Analysis of Hydrophobic Complex Mixtures in a Complex Matrix

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, University of Copenhagen
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Community Structure in Methanogenic Enrichments Provides Insight into Syntrophic Interactions in Hydrocarbon-Impacted Environments

The methanogenic biodegradation of crude oil involves the conversion of hydrocarbons to methanogenic substrates by syntrophic bacteria and subsequent methane production by methanogens. Assessing the metabolic roles played by various microbial species in syntrophic communities remains a challenge, but such information has important implications for bioremediation and microbial enhanced energy recovery technologies. Many factors such as changing environmental conditions or substrate variations can influence the composition and biodegradation capabilities of syntrophic microbial communities in hydrocarbon-impacted environments. In this study, a methanogenic crude oil-degrading enrichment culture was successively transferred onto the single long chain fatty acids palmitate or stearate followed by their parent alkanes, hexadecane or octadecane, respectively, in order to assess the impact of different substrates on microbial community composition and retention of hydrocarbon biodegradation genes. 16S rRNA gene sequencing showed that a reduction in substrate diversity resulted in a corresponding loss of microbial diversity, but that hydrocarbon biodegradation genes (such as assA/masD encoding alkylsuccinate synthase) could be retained within a community even in the absence of hydrocarbon substrates. Despite substrate-related diversity changes, all communities were dominated by hydrogenotrophic and acetotrophic methanogens along with bacteria including Clostridium sp., members of the Deltaproteobacteria, and a number of other phyla. Microbial co-occurrence network analysis revealed a dense network of interactions amongst syntrophic bacteria and methanogens that were maintained despite changes in the substrates for methanogenesis. Our results reveal the effect of substrate diversity loss on microbial community diversity, indicate that many syntrophic interactions are stable over time despite changes in substrate pressure, and show that syntrophic interactions amongst bacteria themselves are as important as interactions between bacteria and methanogens in complex methanogenic communities.

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State: Published
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Web of Science (2018): Indexed yes
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Comparative analysis of taxonomic, functional, and metabolic patterns of microbiomes from 14 full-scale biogas reactors by metagenomic sequencing and radioisotopic analysis

Background

Biogas production is a very complex process due to the high complexity in diversity and interactions of the microorganisms mediating it, and only limited and diffuse knowledge exists about the variation of taxonomic and functional patterns of microbiomes across different biogas reactors, and their relationships with the metabolic patterns. The present study used metagenomic sequencing and radioisotopic analysis to assess the taxonomic, functional, and metabolic patterns of microbiomes from 14 full-scale biogas reactors operated under various conditions treating either sludge or manure.

Results

The results from metagenomic analysis showed that the dominant methanogenic pathway revealed by radioisotopic analysis was not always correlated with the taxonomic and functional compositions. It was found by radioisotopic experiments that the acetoclastic methanogenic pathway was dominant, while metagenomics analysis showed higher relative abundance of hydrogenotrophic methanogens. Principal coordinates analysis showed the sludge-based samples were clearly distinct from the manure-based samples for both taxonomic and functional patterns, and canonical correspondence analysis showed that the both temperature and free ammonia were crucial environmental variables shaping the taxonomic and functional patterns. The study further the overall patterns of functional genes were strongly correlated with overall patterns of taxonomic composition across different biogas reactors.

Conclusions

The discrepancy between the metabolic patterns determined by metagenomic analysis and metabolic pathways determined by radioisotopic analysis was found. Besides, a clear correlation between taxonomic and functional patterns was demonstrated for biogas reactors, and also the environmental factors that shaping both taxonomic and functional genes patterns were identified.

General information

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
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Main Research Area: Technical/natural sciences
Comparative measurement and quantitative risk assessment of alcohol consumption through wastewater-based epidemiology: An international study in 20 cities

Quantitative measurement of drug consumption biomarkers in wastewater can provide objective information on community drug use patterns and trends. This study presents the measurement of alcohol consumption in 20 cities across 11 countries through the use of wastewater-based epidemiology (WBE), and reports the application of these data for the risk assessment of alcohol on a population scale using the margin of exposure (MOE) approach. Raw 24-h composite wastewater samples were collected over a one-week period from 20 cities following a common protocol. For each sample a specific and stable alcohol consumption biomarker, ethyl sulfate (EtS) was determined by liquid chromatography coupled to tandem mass spectrometry. The EtS concentrations were used for estimation of per capita alcohol consumption in each city, which was further compared with international reports and applied for risk assessment by MOE. The average per capita consumption in 20 cities ranged between 6.4 and 44.3 L/day/1000 inhabitants. An increase in alcohol consumption during the weekend occurred in all cities, however the level of this increase was found to differ. In contrast to conventional data (sales statistics and interviews), WBE revealed geographical differences in the level and pattern of actual alcohol consumption at an inter-city level. All the sampled cities were in the "high risk" category (MOE.
Comparison of pharmaceutical, illicit drug, alcohol, nicotine and caffeine levels in wastewater with sale, seizure and consumption data for 8 European cities

BACKGROUND:
Monitoring the scale of pharmaceuticals, illicit and licit drugs consumption is important to assess the needs of law enforcement and public health, and provides more information about the different trends within different countries. Community drug use patterns are usually described by national surveys, sales and seizure data. Wastewater-based epidemiology (WBE) has been shown to be a reliable approach complementing such surveys.

METHOD:
This study aims to compare and correlate the consumption estimates of pharmaceuticals, illicit drugs, alcohol, nicotine and caffeine from wastewater analysis and other sources of information. Wastewater samples were collected in 2015 from 8 different European cities over a one week period, representing a population of approximately 5 million people. Published pharmaceutical sale, illicit drug seizure and alcohol, tobacco and caffeine use data were used for the comparison.

RESULTS:
High agreement was found between wastewater and other data sources for pharmaceuticals and cocaine, whereas amphetamines, alcohol and caffeine showed a moderate correlation. methamphetamine and 3,4-methylenedioxymethamphetamine (MDMA) and nicotine did not correlate with other sources of data. Most of the poor correlations were explained as part of the uncertainties related with the use estimates and were improved with other complementary sources of data.

CONCLUSIONS:
This work confirms the promising future of WBE as a complementary approach to obtain a more accurate picture of substance use situation within different communities. Our findings suggest further improvements to reduce the uncertainties associated with both sources of information in order to make the data more comparable.

General information
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Main Research Area: Technical/natural sciences

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Comparison of the organic waste management systems in the Danish-German border region using life cycle assessment (LCA)

This study assessed the management of the organic household waste in the Danish-German border region and points out major differences between the systems and their potential effects on the environment using life cycle assessment (LCA). The treatment of organic waste from households in the Danish-German border region is very different on each side of the border; the Danish region only uses incineration for the treatment of organic household waste while the German region includes combined biogas production and composting, mechanical and biological treatment (MBT) and incineration. Data on all parts of the organic waste treatment was collected including waste composition data and data from treatment facilities and their respective energy systems. Based on that the organic waste management systems in the border region were modelled using the EASETECH waste management LCA-model. The main output is a life cycle assessment showing large differences in the environmental performance of the two different regions with the Danish region performing better in 10 out of 14 impact categories. Furthermore, the importance of the substituted district heating systems was investigated showing an impact up to 34% of the entire system for one impact category and showing large difference between each heating system substituted, e.g. in "Global Warming" the impact was from -16 to -1.1 milli person equivalent/tonne treated.
waste from substitution of centralised hard coal and decentralised natural gas, respectively.
Additionally, the mass of avoidable and unavoidable food waste per household and per person discarded in Danish households containing more than one person should particularly aim at households containing more than one person. This suggests that campaigns and initiatives targeting food waste reduction should particularly aim at households containing more than one person. This suggests that campaigns and initiatives targeting food waste reduction should particularly aim at households containing more than one person.

The mass of avoidable food waste discarded per household increased in line with household size. However, there was no resource recovery. This occurred in most of Danish households, which suggests that initiatives to reduce avoidable food waste should be developed in line with household size. However, there was no resource recovery.

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Waste was sampled directly from source, in order to attribute the waste data accurately to the geographical areas and types of household generating the waste. Sampling and contamination errors were minimised by avoiding sieving and the mass reduction of waste before manual sorting. Consequently, the waste was collected without compacting. Additionally, the entire sample was manually sorted into 10-50 waste fractions organised according to a three-level approach. This detailed waste fractions list facilitated the comparison of waste data with various objectives.

Analysis revealed that Danish residual household waste constitutes mainly food waste (42 – 45% mass per wet basis). Misplaced recyclable materials in residual waste bins, such as paper, board, glass, metal and plastic, amounted to 20% (mass per wet basis) of residual household waste. Moreover, special waste, such as hazardous waste, batteries and WEEE, was also misplaced in residual household bins, accounting for 0.4-0.8% of the total. Although the proportion of misplaced special waste was relatively small, these material fractions can have dire impacts on the environment when they are not disposed of appropriately.

Statistical analysis indicated that separating food waste residue from packaging during waste sorting was unnecessary, because this separation did not significantly influence overall waste composition, the percentage of food waste or packaging waste fractions. Furthermore, the difference in waste composition between municipalities was not significant. These results suggest that waste composition data obtained from one municipality could be applied to other municipalities in the same area (provided that municipalities share the same source segregation scheme), although socio-economic aspects between municipalities were not analysed.

Food waste consists of avoidable and unavoidable food waste. Here, “avoidable” food waste is defined as food that could be eaten but instead was thrown away regardless of the reason, whereas “unavoidable” food waste is food that would not be edible under normal circumstances (e.g. bones, banana peel, etc.). Food waste was estimated at 183 kg per household per year (86 kg per person per year), of which 103 kg per household (48 kg per person) per year was avoidable food waste and 80 kg per household (38 kg per person) per year was unavoidable food waste. These food waste fractions occurred in most of Danish households, which suggests that initiatives to reduce avoidable food waste should be combined with policies that promote the efficient treatment of unavoidable food waste, to ensure plant nutrient and resource recovery.

The mass of avoidable food waste discarded per household increased in line with household size. However, there was no statistical evidence that a household containing one person throws away more avoidable food waste per person than households containing more than one person. This suggests that campaigns and initiatives targeting food waste reduction should particularly aim at households containing more than one person.

Additionally, the mass of avoidable and unavoidable food waste per household and per person discarded in Danish
houses was significantly influenced neither by periodic variation nor by geographical variations. Waste analysis from kitchens in office areas showed that food waste generation amounted to 23 kg per employee per year, of which 20 kg per employee was source-segregated. This suggests that only 11% of food waste was misplaced in residual waste, which itself amounted to 10 kg per employee per year and consisted of 29% paper, 23% plastic and 24% misplaced food waste. Thus, sorting efficiency was estimated at 89% of food waste, accompanied by extremely high purity (99%). These results indicate that the 60% recycling target formulated by the Danish Government for food waste generated by the service sector should be achievable.

General information
State: Published
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Composition of waste materials and recyclables
As the valorization of waste has become a main objective of modern waste management a variety of waste technologies were developed and the complexity of management systems increased. Maximizing environmental benefits in one part of the system may lead to burdens in another. Environmentally sound decisions in waste planning thus require a holistic and systematic assessment of environmental impacts of different waste management options. Such assessment requires reliable information on the physical and chemical waste properties to model the flows of waste materials and substances throughout the entire waste management system. The aim of this PhD project was to improve the understanding of factors influencing the quality of waste composition data during waste characterization and application in the environmental assessment of waste management systems. Reviewing existing waste characterization studies revealed that a large variety of waste characterization approaches and analytical methods has been employed. The most frequently used approach was the chemical analysis of directly sampled waste materials which offers the highest flexibility for waste characterization studies. Direct waste analysis involves several steps to prepare the samples mechanically and/or chemically for final analysis. Not all sample preparation methods are equally well suited for specific waste characterization purposes. The correctness of results and practical feasibility of sample preparation was strongly affected by the material type of the sample and the physico-chemical parameter to be analyzed. For example, studies examining mechanical sample preparation methods suggest that plastic fractions are especially prone to de-mixing effects and that differing mechanical properties within a sample (e.g. plastic and metal) can lead to biased results. In the experimental part of this PhD project the milling of plastics and metals was especially challenging and alternative methods for preparation and analysis should be investigated. Furthermore, chemical sample preparation by means of acid digestion was found to severely affect the element content resulting from chemical analysis. Although the suitability of standardized HF-containing methods can be generally confirmed, these methods led to considerable underestimations of the element content for some combinations of element and waste material. Appropriate selection of acid digestion methods thus needs to take the waste material and the elements to be analyzed into account. The dataset obtained during this PhD project provides information on the performance for six relevant acid mixtures for nine different waste material fractions and 64 elements and can support the selection of appropriate acid digestion method for future waste characterization studies and the comparison of data across existing studies. A consistent dataset for 73 physico-chemical parameters in 49 residual and 24 source-segregated Danish household waste fractions was obtained and is now available for future modelling and assessment of waste management systems. The analyzed fractions were selected based on material properties with relevance for potential recycling processes. The physico-chemical analysis revealed chemical differences between residual and source-segregated samples for several fractions. The results for parameters associated with organic matter confirmed the idea of cross-contaminated recyclables in residual waste, whereas the results for heavy metals and trace elements were more complex. For many fractions rather high metal contents were found to be intrinsic properties of the recyclables. For example, the Sb content in PET packaging was 250-270 mg/kgTS. In some cases metal contents in source-segregated fractions were higher than in the respective fractions from residual waste. Rare earth elements (REE) were quantified in all analyzed material fractions and considerably high concentrations (e.g. the Ce content in ceramics was 72 mg/kgTS) were associated with mineral and soil-like materials. This “natural background” concentrations need to be considered when concluding on the origin of REE which are typically associated with electronic/hazardous waste. In general the use of primary physico-chemical waste characterization data for the environmental assessment of waste management systems is always preferable because many factors such as fraction definition and sampling point can be controlled. Anyhow, value ranges (as opposed to single values) should be considered due to the possibility of systematic bias (e.g. resulting from specific characterization methods) and “natural” variation. Commonly reported measurement
uncertainties are not suitable to capture such effects. Thus secondary data should be considered when deriving uncertainty ranges and more research is necessary to quantify systematic effects of different characterization methods. Considering the extensive time and costs related to physico-chemical waste characterization it is likely that environmental assessment of waste management systems will continue to draw on secondary data from literature. For some parameters the values reported in literature were found to differ significantly. The wide range of values in literature for physico-chemical properties of individual waste materials were shown to severely affect the results of the life cycle assessment (LCA) of waste management systems, although the parameters had relatively low sensitivity. This emphasizes that sensitivity alone is not an appropriate indicator to identify critical parameters for LCA modelling. Using the literature value ranges for complete uncertainty analysis physico-chemical parameters contributed substantially to the output uncertainty of the modelling results and were in many cases more important than technology and scenario specific parameters. By selecting well-fitting data from literature the input value ranges could be potentially narrowed. Suggestions for physico-chemical data selection for environmental assessment and related uncertainty analysis are presented. At this point, however, low data availability and the large variety of used waste characterization methods limit the quantification and ranking of influencing factors via statistical data analysis of literature data. Nevertheless, it was found that the regional context of the data origin appeared to be less or equally important than other potential influencing factors (such as e.g. analytical methods, waste management system, natural variation, etc.). To consider the influence of such factors on secondary data but also primary data, LCA of waste management systems should always include a systematic uncertainty analysis for physico-chemical waste properties which needs to be based on both sensitivity and realistic uncertainty ranges for the individual physico-chemical parameters.
Computational fluid dynamic analysis of concentration polarization and water flux optimization in spiral wound modules

General information
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Organisations: Department of Environmental Engineering, Water Technologies
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Concurrent elevation of CO₂, O₃ and temperature severely affects oil quality and quantity in rapeseed
Plant oil is an essential dietary and bio-energy resource. Despite this, the effects of climate change on plant oil quality remain to be elucidated. The present study is the first to show changes in oil quality and quantity of four rapeseed cultivars in climate scenarios with elevated [CO₂], [O₃] and temperature (T) combined and as single factors. The combination of environmental factors resembled IPCC’s ‘business as usual’ emission scenario predicted for late this century. Generally, the climate scenarios reduced the average amounts of the six fatty acids (FAs) analysed, though in some treatments single FAs remained unchanged or even increased. Most reduced was the FA essential for human nutrition, C18:3-ω3, which decreased by 39% and 45% in the combined scenarios with elevated [CO₂]+T+[O₃] and [CO₂]+T, respectively. Average oil content decreased 3–17%. When [CO₂] and T were elevated concurrently, the seed biomass was reduced by half, doubling the losses in FAs and oil content. This corresponded to a 58% reduction in the oil yield per hectare, and C18:3-ω3 decreased by 77%. Furthermore, the polyunsaturated FAs were significantly decreased. The results indicate undesirable consequences for production and health benefits of rapeseed oil with future climate change. The results also showed strong interactive effects of CO₂, T and O₃ on oil quality, demonstrating why prediction of climate effects requires experiments with combined factors and should not be based on extrapolation from single factor experiments.

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Contamination Sources in Kangerlussuaq, Greenland

General information
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Organisations: Department of Environmental Engineering, Urban Water Systems, Department of Civil Engineering, ARTEK, Section for Arctic Engineering and Sustainable Solutions
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Control banding tools for occupational exposure assessment of nanomaterials - Ready for use in a regulatory context?

The development, production and application of engineered nanomaterials are becoming more and more widespread. Because researchers, developers and industrial workers are the first in line to be exposed to potentially hazardous nanomaterials, appropriate occupational exposure assessment is a key area of concern. Therefore, a number of Control Banding (CB)-based tools have been developed in order to assess and manage the potential risks associated with occupational exposure to nanomaterials. In this paper we provide a comparative analysis of different nanomaterial-specific types of control-banding/risk prioritization tools (the Control Banding Nanotool, IVAM Technical Guidance, Stoffenmanager Nano, ANSES CB Tool, NanoSafer, and the Precautionary Matrix) in order to evaluate their use-domains; types, extent, use and availability of input parameters; their output format; and finally their potential use and maturity in regard to meeting the minimum requirements for occupational exposure assessment under REACH and the conceptual source-transmission-receptor model by Schneider et al. (2011). This was done through an analysis including a literature review and use of the tools. It was found that the tools were developed for different purposes, with different application domains and inclusion criteria. The exposure assessments and derived risk levels are based on different concepts and assumptions and outputs in different formats. The use of requested input parameters for exposure assessment differ greatly among the tools. Therefore, direct inter-comparison and combination of the different models into a larger holistic framework is not immediately possible. Harmonization of input parameters and output could allow establishment of an exposure assessment framework with different levels of information requirements.
Control of wastewater N$_2$O emissions by balancing the microbial communities using a fuzzy-logic approach

In this work, a fuzzy-logic controller for minimization of the nitrous oxide emission from wastewater treatment plants is developed and tested in a simulation environment. The controller is designed in order to maintain a balance between production and consumption of nitrite by AOB and NOB microorganisms respectively. Thus, accumulation of nitrite is prevented and AOB denitrification, the main N$_2$O producer, is drastically slowed down. The controller is designed to adjust the oxygen supply according to a measured parameter which typically indicates the ratio of the activity of NOB over AOB. The controller is tested on a benchmark simulation model describing the production of N$_2$O during both AOB denitrification and HB denitrification. Comparisons between simulation results of open-loop and closed-loop have revealed the potential of the controller to significantly reduce the amount of N$_2$O emitted (approximately 35%). On the other side, this reduction of N$_2$O was accompanied by an increase in the aeration costs. Moreover, a plant performance evaluation under dynamic disturbances shows that the effluent quality is compromised due to higher requirements of organic carbon by denitrifying heterotrophs. The controller can therefore be considered effective for the reduction of N$_2$O production by AOB but would need to be coupled with a secondary control strategy ensuring a complete oxidation of the nitrogen oxides by heterotrophs to have a good effluent quality.

Control structure design for resource recovery using the enhanced biological phosphorus removal and recovery (EBP2R) activated sludge process

Nowadays, wastewater is considered as a set of resources to be recovered rather than a mixture of pollutants that should be removed. Many resource recovery schemes have been proposed, involving the use of novel technologies whose controllability is poorly studied. In this paper we present a control structure for the novel enhanced biological phosphorus removal and recovery (EBP2R) process, which is currently under development. The aim of the EBP2R is to maximize phosphorus recovery through optimal green micro-algal cultivation, which is achieved by controlling the nitrogen to phosphorus ratio (N-to-P ratio) fed to the algae. Process control structures are developed for a sequencing batch reactor (SBR) and a continuous flow reactor system (CFS). Results, obtained using the Benchmark Simulation Model No. 1 (BSM1) dynamic input disturbance time series, suggest that the SBR can maintain a stable N-to-P ratio in the effluent (16.9 ± 0.07) and can recover about 72% of the influent phosphorus. The phosphorus recovered by the CFS is limited by the influent nitrogen (65% of the influent phosphorus load). Using the CFS configuration the effluent N-to-P ratio cannot be effectively controlled (16.45 ± 2.48). Therefore, it is concluded that the SBR is the most effective reactor configuration for the EBP2R process. Importantly, the designed control structures rely on control loops that do not require chemical dosing for nutrient management, thereby reducing the environmental footprint of the EBP2R process. The proposed control strategies can be applied to other phosphorus recovery schemes where short sludge age EBPR systems play an important role.
Copper deficiency can limit nitrification in biological rapid sand filters for drinking water production

Incomplete nitrification in biological filters during drinking water treatment is problematic, as it compromises drinking water quality. Nitrification problems can be caused by a lack of nutrients for the nitrifying microorganisms. Since copper is an important element in one of the essential enzymes in nitrification, we investigated the effect of copper dosing on nitrification in different biological rapid sand filters treating groundwater. A lab-scale column assay with filter material from a water works demonstrated that addition of a trace metal mixture, including copper, increased ammonium removal compared to a control without addition. Subsequently, another water works was investigated in full-scale, where copper influent concentrations were below 0.05 μg Cu L-1 and nitrification was incomplete. Copper dosing of less than 5 μg Cu L-1 to a full-scale filter stimulated ammonium removal within one day, and doubled the filter's removal from 0.22 to 0.46 g NH4-N m-3 filter material h-1 within 20 days. The location of ammonium and nitrite oxidation shifted upwards in the filter, with an almost 14-fold increase in ammonium removal rate in the filter's top 10 cm, within 57 days of dosing. To study the persistence of the stimulation, copper was dosed to another filter at the water works for 42 days. After dosing was stopped, nitrification remained complete for at least 238 days. Filter effluent concentrations of up to 1.3 μg Cu L-1 confirmed that copper fully penetrated the filters, and determination of copper content on filter media revealed a buildup of copper during dosing. The amount of copper stored on filter material gradually decreased after dosing stopped; however at a slower rate than it accumulated. Continuous detection of copper in the filter effluent confirmed a release of copper to the bulk phase. Overall, copper dosing to poorly performing biological rapid sand filters increased ammonium removal rates significantly, achieving effluent concentrations of below 0.01 mg NH4-N L-1, and had a long-term effect on nitrification performance.

General information
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Copper dosing stimulates nitrification in full-scale biological drinking water filters

General information
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Organisations: Department of Environmental Engineering, Urban Water Systems, Krüger A/S
Authors: Wagner, F. B. (Intern), Borch Nielsen, P. (Ekstern), Boe-Hansen, R. (Ekstern), Albrechtsen, H. (Intern)
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Copper dosing to biological rapid sand filters increases nitrifier activity and abundance

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Organisations: Department of Environmental Engineering, Urban Water Systems, Krüger A/S
Authors: Wagner, F. B. (Intern), Borch Nielsen, P. (Ekstern), Boe-Hansen, R. (Ekstern), Albrechtsen, H. (Intern)
Cross-validation of equilibrium sampling and non-equilibrium passive sampling methods in PCB contaminated sediments

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Wang, A. (Ekstern), Nørgaard Schmidt, S. (Intern), Bridges, T. S. (Ekstern), Gidley, P. (Ekstern), Lotufo, G. (Ekstern), Ruiz, C. (Ekstern), Kennedy, A. (Ekstern), Rogers, N. (Ekstern), Ghosh, U. (Ekstern), Burgess, R. (Ekstern), Fernandez, L. (Ekstern), Mayer, P. (Intern)
Pages: 504-504
Publication date: 2016

CryoSat-2 radar altimetry for monitoring surface water in China

Surface water bodies (lakes, reservoirs and rivers) are key components of the water cycle and are important water sources. Water level and storage vary greatly under the impacts of climate change and human activities. A national-scale surface water monitoring dataset for China is not available. The spatio-temporal pattern of surface water dynamics is poorly known due to insufficient in situ monitoring capabilities and restricted access to monitoring data. In comparison with other satellites, the 369 day repeat orbit enables Cryosat-2 to monitor smaller water bodies than other satellites and the SIRAL sensor has higher precise than conventional altimeters. We investigated water level variations for large lakes, reservoirs and rivers during the period of 2010 - 2015 using Cryosat-2 altimetry data. Water storage changes for 759 water bodies were estimated, and the contribution of surface water storage (SWS) changes to terrestrial water storage (TWS) was evaluated in combination with results from the Gravity Recovery and Climate Experiment (GRACE). Moreover, water level dynamics in the Yangtze and Yellow Rivers were mapped. Results show that 1) surface water levels change significantly at regional scale, i.e. declining in Junggar Basin, Huai River Basin and Hubei Province while rising in North Tibetan Plateau and Songnen Plain; 2) SWS change affects TWS variation greatly, especially in Tibetan Plateau; 3) TWS in Songhua River basin has been fluctuating strongly over the past decade and the North China Plain maintained a consistently decreasing trend in TWS (~ 20 mm/yr); 4) Change observed in Songnen Plain is also seen from SongLiao Water Resources Bulletin.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, National Space Institute, Geodesy
Authors: Jiang, L. (Intern), Bauer-Gottwein, P. (Intern), Nielsen, K. (Intern), Andersen, O. B. (Intern)
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Main Research Area: Technical/natural sciences
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Cultivation of microalgae in industrial wastewaters

Microalgae production for the purpose of clearing wastewater has been researched for at least half a century. Such systems have a dual benefit: first, they prevent nutrients from entering water bodies and causing eutrophication; second, they transform sunlight and carbon dioxide into a biomass that has many potential uses. Unfortunately, the current high costs of cultivation have limited the development and exploitation of such systems, resulting in only a few full-scale algae wastewater treatment installations and a small industry based mostly around food and pigments. This thesis contributes to a growing body of knowledge with the aim to make algae cultivation viable for the production of sustainable products. Specific contributions include: improvement in the methods of screening the growth potential of different microalgae species; identification of an industrial wastewater that allows good algae growth; knowledge about the mixotrophic utilization of chemical energy present in organic waste; demonstration of a method to optimize efficiency of culture growth and nutrient removal; and biochemical characterization of the produced biomass.

When designing algae cultivation, one challenge is that there are many potential combinations which must empirically screened. Tens of thousands of microalgae species have been identified so far and there are numerous waste-stream that potentially could be of interest. A screening system was developed using the microplate as cultivation vessel and measurement cuvette. Fluorescence was demonstrated to be an order of magnitude more sensitive than optical density for detecting biomass growth, which increased the length of time in which exponential growth was observable from hours to days. This enabled growth rate-light intensity (µ-I) curves to be measured in microplates which were found to be equivalent to those obtained in typical lab-scale photobioreactors. As µ-I curves are the key biological input to an already existing model, it was validated that low density microplate cultivations can be used to make predictions about industrially relevant autotrophic cultivation.

When algae are grown within a wastewater treatment plant, the use of the chemical energy stored in the organic carbon dissolved in the wastewater could also be a useful option. Conventional aerobic sewage treatment expends much energy in breaking down the biomass to CO2. However, various anaerobic treatment methods would result in effluent containing dissolved organic molecules suitable for algae species that have the ability to grow as mixo- or heterotrophs. Chlorella sorokiniana was cultivated in a lab scale photobioreactor under daily light dark cycles and various timing strategies were tested for adding acetate at concentrations that can be obtained in waste streams of 1 – 2 g L-1. The results showed that the fastest growth occurred when adding the acetate at night (cyclic autotrophy/heterotrophy). However adding the acetate during the day (mixotropy) also improved growth compared to autotrophic controls.

Industrial wastewater was used as cultivation medium of Chlorella sorokiniana. The culture was able to grow at high rates up to a density of 4 g L-1. The deceleration-stat technique was used to create a series of pseudo-steady states to give information about the expected results of continuous cultivation of microalgae in the selected wastewater. At light intensities of 2100 and 200 μmol photon m-2 s-1 the algae grew at a rate of over 5 and 1.67 g L-1day-1, respectively. The corresponding removal rates of nitrogen were 238 and 93 mg L-1day-1 and 40 and 19 mg L-1day-1 for phosphorous. Ammonium removal varied from below 40% to 99%, while phosphate removal was always nearly total. When the biomass was characterized, it was found that fertilizer value N and P content increased with growth rate. For animal feed, the amino acid content was about 40% of biomass. The content of the nutritionally important α-Linoleic fatty acid increased when light intensity and dilution rate were higher. Valuable pigments lutein, carotene and other carotenoids were higher in low-light conditions.

The results from this thesis demonstrate that industrial wastewater can be a suitable replacement for algae cultivation medium. The screening method developed will reduce the cost of identifying the best conditions to test at lab scale. The D-stat method offers a way to identify the best conditions for biomass production and nutrient removal. Various options for heterotrophic and mixotrophic utilization of waste organic carbon in effluents are identified. Further advances in microalgae cultivation and processing will be needed for the production of sustainable products from wastewater in the future.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, National Food Institute, Research Group for Bioactives – Analysis and Application
Authors: van Wagenen, J. M. (Intern), Angelidaki, I. (Intern), De Francisci, D. (Intern), Holdt, S. L. (Intern)
Number of pages: 49
Publication date: 2016
Current uses of nanomaterials in biocidal products and treated articles in the EU

Nanomaterials (NMs) are currently being used for a wide variety of products, and a number of them are utilized as biocides due to their antimicrobial or antifungal properties. Little is known to what extent these biocides are available on the market as consumer products. In the EU, the Biocidal Product Regulation (BPR) lays out a list of requirements that manufacturers of biocidal products have to comply with before they can place their products on the market. It is not entirely clear which commercially available articles in the EU have been treated with or incorporate NMs to provide biocidal properties to the product. To obtain an insight into what biocidal products are on the EU market, we used The Nanodatabase (nanodb.dk) for analyzing which NMs are being used and what product categories they represent. In this paper, we address the issue of the current uses of NMs in biocidal products and discuss how they are currently regulated under the BPR. Even though the BPR already entails nanospecific provisions, correct labelling of biocidal products containing NMs is virtually non-existent. By using The Nanodatabase, it was possible to identify 88 biocidal products containing NMs available on the EU market, none of which had the specific labelling required by the BPR. The analysis of biocidal products pinpoints the challenges and limitations for obtaining a reasonable overview of the current uses of NMs in biocidal products as defined in the BPR.

Deeper insight into the structure of the anaerobic digestion microbial community; the biogas microbiome database is expanded with 157 new genomes

This research aimed to better characterize the biogas microbiome by means of high throughput metagenomic sequencing and to elucidate the core microbial consortium existing in biogas reactors independently from the operational conditions. Assembly of shotgun reads followed by an established binning strategy resulted in the highest, up to now, extraction of microbial genomes involved in biogas producing systems. From the 236 extracted genome bins, it was remarkably found that the vast majority of them could only be characterized at high taxonomic levels. This result confirms that the biogas...
microbiome is comprised by a consortium of unknown species. A comparative analysis between the genome bins of the current study and those extracted from a previous metagenomic assembly demonstrated a similar phylogenetic distribution of the main taxa. Finally, this analysis led to the identification of a subset of common microbes that could be considered as the core essential group in biogas production.
De novo biofilm community assembly from tap water source communities favors Nitrotoga over Nitrospira under elevated nitrite surface loading

Four main processes are considered to drive microbial community assembly: selection, drift, dispersal and speciation. These processes occur simultaneously, but the extent to which each process contributes to community assembly is unclear in natural communities. We exposed a high-throughput flow-through biofilm system to continuous immigration from a tap water metacommunity while applying different nitrite surface loading rates. After 63 days of operation, we extracted biofilms and analyzed the community composition via Illumina MiSeq targeting the 16S rRNA gene. Previous studies have shown that Nitrospira is the dominant nitrite oxidizing genus in low nitrite environments. Hence, we postulated that by elevating the nitrite surface loading we would select for NOB with lower nitrite affinity than Nitrospira. We observed different dominant NOB species under different loading rates. While in the metacommunity, Nitrotoga and Nitrospira were found at near equal abundances, in the biofilm community, elevated nitrite loading strongly selected for Nitrotoga over Nitrospira. The biofilms were also significantly different in their alpha-diversity (p<0.001) and beta-diversity, and the evenness and richness of the biofilm community decreased significantly (p=0.004) compared to the metacommunity. These observations indicate that the selection towards Nitrotoga and Nitrospira dominated community assembly under different nitrite loadings. Lastly, we compared our observations of community composition with that predicted by neutral community assembly model. The predictions did not match the community structure observed in the biofilms (p=0.31), providing further evidence of the importance of selection during community assembly.
Depth investigation of rapid sand filters for drinking water production reveals strong stratification in nitrification biokinetic behavior

The biokinetic behavior of NH4+ removal was investigated at different depths of a rapid sand filter treating groundwater for drinking water preparation. Filter materials from the top, middle and bottom layers of a full-scale filter were exposed to various controlled NH4+ loadings in a continuous-flow lab-scale assay. NH4+ removal capacity, estimated from short term loading up-shifts, was at least 10 times higher in the top than in the middle and bottom filter layers, consistent with the stratification of Ammonium Oxidizing Bacteria (AOB). AOB density increased consistently with the NH4+ removal rate, indicating their primarily role in nitrification under the imposed experimental conditions. The maximum AOB cell specific NH4+ removal rate observed at the bottom was at least 3 times lower compared to the top and middle layers. Additionally, a significant up-shift capacity (4.6 and 3.5 times) was displayed from the top and middle layers, but not from the bottom layer at increased loading conditions. Hence, AOB with different physiological responses were active at the different depths. The biokinetic analysis predicted that despite the low NH4+, removal capacity at the bottom layer, the entire filter is able to cope with a 4-fold instantaneous loading increase without compromising the effluent NH4+.

Ultimately, this filter up-shift capacity was limited by the density of AOB and their biokinetic behavior, both of which were strongly stratified.
Destruction of disinfection byproducts and their precursors in swimming pool water by combined UV treatment and ozonation

Both UV treatment and ozonation are used to reduce different types of disinfection byproducts (DBP) in swimming pools. UV treatment is most common as it is particularly efficient in removing the repulsive chlorine like smelling chloramines (combined chlorine). UV treatment of a pool water increased chlorine reactivity and formation of chlor-organic DBP such as trihalomethanes. Based on the similar selective reactivity of ozone and chlorine we hypothesized that the created reactivity towards chlorine by UV treatment of dissolved organic matter in pool water might also be expressed as an increased reactivity towards ozone and that ozonation might saturate the chlorine reactivity created by UV treatment and mitigate the increased DBP formation. By experimentally treating pool water samples, we found that UV treatment makes pool water highly reactive to ozone. The created reactivity towards chlorine decreases dose dependently with ozone dosage prior to contact with chlorine. Furthermore, the kinetics of ozone in UV treated pool water changed drastically from a half-life in excess of 20 min to complete consumption in less than 2 min. We discovered that ozonation in UV treated pool water induced formation of some DBPs that are not commonly reported in pool water where trichloronitromethane is noteworthy as it is genotoxic. Therefore, we performed repeated treatment experiments consisting of combined UV/ozone treatment interleaved with chlorination for 24 h the genotoxicity created during the ozone treatment was removed by the
UV treatments. Based on the experimental results, a treatment system is proposed with a UV system placed in a side stream to the recirculation flow followed by an ozone dosing point and a small reaction chamber with a volume that allow 1-2 min reaction time before returning to the main recirculation flow. This side-stream UV/ozone treatment will improve the swimming pool water quality.

Developing Fast and Reliable Flood Models
State-of-the-art flood modelling in urban areas are based on distributed physically based models. However, their usage is impeded by high computational demands and numerical instabilities, which make calculations both difficult and time consuming. To address these challenges we develop and test a cheaper-to-run surrogate model, which aims to emulate the response of an original model. The surrogate model is set up by lumping the original model into compartments. These are confined areas in which the volume is modelled by surrogates. We develop two types of surrogates: (i) The drainage system is modelled by response surface surrogates, which are empirical data driven models. These are trained using the volume-discharge relations by piecewise linear functions. (ii) The surface flooding is modelled by lower-fidelity physically based surrogates, which are based on surface depressions and flow paths. A surrogate model is set up for a case study area in Aarhus, Denmark, to replace a MIKE FLOOD model. The drainage surrogates are able to reproduce the MIKE URBAN results for a set of rain inputs. The coupled drainage-surface surrogate model lacks details in the surface description which reduces its overall accuracy. The model shows no instability, hence larger time steps can be applied, which reduces the computational time by more than a factor 1400. In conclusion, surrogate models show great potential for usage in urban water modelling.

Development of an early warning system for water supply networks based on automated ATP monitoring
General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Tatari, K. (Intern), Hansen, C. (Ekstern), Rasmussen, A. (Ekstern), Ryan, T. (Ekstern), Desmuillez, M. (Ekstern), Albrechtsen, H. (Intern)
Number of pages: 1
Publication date: 2016
Event: Abstract from 10th Nordic Drinking Water Conference, Reykjavik, Iceland.
Development of solid supports for electrochemical study of biomimetic membrane systems

Biomimetic membranes are model membrane systems used as an experimental tool to study fundamental cellular membrane physics and functionality of reconstituted membrane proteins. By exploiting the properties of biomimetic membranes resembling the functions of biological membranes, it is possible to construct biosensors for high-throughput screening of potential drug candidates. Among a variety of membrane model systems used for biomimetic approach, lipid bilayers in the form of black lipid membranes (BLMs) and lipo-polymersomes (vesicle structures composed of lipids and polymers), both with reconstituted membrane spanning proteins, are attractive tools. However, BLMs suffer from intrinsic fragility, therefore requiring techniques to increase their robustness and stability. This PhD thesis presents strategies to construct solid supports for electrochemical studies of two biomimetic membrane systems, BLMs and protein-loaded lipopolymersomes.

The solid support for BLMs was constructed as a reusable device comprising an ethylene tetrafluoroethylene (ETFE) aperture array supported by an in situ polymerized hydrogel covalently attached to both the ETFE and a gold electrode microchip. The hydrogel facilitated BLM formation without the need of manual painting and increased membrane stability in comparison with freestanding membranes. The functionality of the hydrogel supported BLMs (hsBLMs) were demonstrated by electrochemical impedance spectroscopic (EIS) characterization of incorporated ion transporter valinomycin. The presented work also includes a comprehensive EIS analysis and cryological scanning electron microscopic (cryo-SEM) imaging of hydrogels formulated in various molar ratios (1:100; 1:200; 1:400) of the cross-linker poly(ethylene glycol)dimethacrylate (PEGDMA) and 2-hydroxyethyl methacrylate (HEMA) monomers.

Lipo-polymersomes have proved to be suitable for reconstitution of a model G-protein coupled receptor (GPCR) - bacteriorhodopsin (bRh). The bRh-loaded lipo-polymersomes were interfaced to gold electrodes using two different strategies, layer-by-layer deposited polyelectrolyte cushion directly on a gold electrode microchip and on a polyethersulfone (PES) support grafted by in situ polymerized hydrogel. Both strategies proved to be suitable for immobilization of functional bRh loaded lipo-polymersomes. Amperometric monitoring showed that the PES membrane support facilitated recording of a steady-state photocurrent while only a transient photocurrent peak was recorded on the polyelectrolyte cushion without a PES membrane.

This PhD thesis also comprises the design and fabrication process of a modular microfluidic system with automated fluid delivery (micropumps and valves), providing a possibility for future applications of biomimetic membranes in the form of hsBLMs and polymersomes.

This thesis presents both strategies for formulation robust biomimetic membrane systems and devices, which could be developed further to construct biosensor technology for high-throughput screening of drug candidates.

General information
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Organisations: Department of Micro- and Nanotechnology, Bioanalytics, Department of Environmental Engineering, Water Technologies
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Diffusion, Coulombic interactions and multicomponent ionic transport of charged species in saturated porous media
Diffusion and compound-specific mixing significantly affect conservative and reactive transport in groundwater at different scales, not only under diffusion-dominated regimes but also under advection-dominated flow through conditions [1]. When dissolved species are charged, besides the magnitude of their aqueous diffusion coefficients also the electrostatic interactions significantly affect solute displacement. We investigated electrostatic interactions between ionic species under flow-through conditions resulting in multicomponent ionic dispersion: the dispersive fluxes of the different ions in the pore water are cross-coupled due to the effects of Coulombic interactions. Such effects are illustrated in flow-through experiments in saturated porous media. Simple strong electrolytes (i.e., salts and strong acid solutions) were selected as tracers and their transport was studied under different advection-dominated conditions in homogeneous and heterogeneous porous media [2-3]. The model-based interpretation of the experimental results is challenging since it requires a multicomponent ionic formulation with an accurate description of local hydrodynamic dispersion and explicitly accounting for the cross-coupling of dispersive fluxes due to the Coulombic interactions between the ions in the pore water [4-5].
Diffusive-dispersive mass transfer in the capillary fringe: Impact of water table fluctuations and heterogeneities

Diffusive–dispersive mass transfer in the capillary fringe is important for many groundwater quality issues such as transfer of volatile compounds into (and out of) the groundwater, the supply of oxygen for aerobic degradation of hydrocarbons as well as for precipitation of minerals (e.g. iron hydroxides). 2D-laboratory scale experiments were used to investigate the transfer of oxygen into groundwater under non-reactive and reactive conditions, at steady state and with water table fluctuations. Results show that transfer of oxygen is limited by transverse dispersion in the capillary fringe and the dispersion coefficients are the same as below the water table. Water table fluctuations cause temporarily increased fluxes of oxygen into groundwater during draining conditions and entrapped air after water table rise. High-permeability inclusions in the capillary fringe enhance mass transfer of oxygen to the underlying anoxic groundwater by increased dispersion due to flow focusing and by significant air trapping in the coarse material inclusions.

Disentangling ecosystem stressors along a river continuum covering a pollution gradient

Disentangling ecosystem stressors along a river continuum covering a pollution gradient
Does reactor staging influence microbial structure and functions in biofilm systems? The case of pre-denitrifying MBBRs

To date, a number of treatment technologies and configurations have been tested to improve the elimination of conventional and trace (e.g., pharmaceutical residues) pollutants via biological wastewater treatment. Bioreactor staging and the moving bed biofilm reactor (MBBR) technology have emerged as promising bioengineered solutions (Plósz et al., 2010) for this purpose. In this study, we combined the two solutions and investigated microbial functions (heterotrophic denitrification, pharmaceutical removal) and structure of the microbial community in staged MBBRs for pre-denitrification. A three-stage MBBR system (S1+S2+S3), fed with pre-clarified wastewater, was operated at laboratory-scale with (i) controlled biomass exposure to organic substrate (COD); and (ii) enhanced the physical retention of biomass, thus inducing adaptation to different substrate exposure conditions. During long-term operation (~500 days) of the three-stage MBBR under continuous-flow conditions, biofilm samples were collected to assess the temporal evolution of the microbial structure in terms of functional gene abundance and biodiversity. A set of batch experiments (day 471) was performed to assess denitrification and pharmaceutical removal in each MBBR, following prolonged biofilm exposure to specific COD availability.

Results from batch experiments showed declining denitrification potential and pharmaceutical biotransformation rate constants ($k_{bio}$, L gTSS$^{-1}$ d$^{-1}$) from MBBR S1 (exposed to highest COD availability) to S3 (exposed to lowest availability). These findings indicate that the exposure to tiered substrate availability influenced the capacity of utilizing a different range of carbon sources in each MBBR, thus impacting denitrification and pharmaceutical biotransformation. Preliminary analysis on the microbial community based on qPCR (quantitative polymerase chain reaction) showed differences in the abundance of genes (nirS, nirK, nosZ) encoding for denitrifying enzymes in the three staged MBBRs. Further microbial characterization through 16S RNA sequencing (Illumina) is currently under investigation to determine whether differences in microbial functions should be associated to differences in the microbial diversity in the three MBBRs.

Downscaling future precipitation extremes to urban hydrology scales using a spatio-temporal Neyman–Scott weather generator
Drivers of flood damage on event level

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Drivers of flood damage on event level
Flood risk is dynamic and influenced by many processes related to hazard, exposure and vulnerability. Flood damage increased significantly over the past decades, however, resulting overall economic loss per event is an aggregated indicator and it is difficult to attribute causes to this increasing trend. Much has been learned about damaging processes during floods at the micro-scale, e.g. building level. However, little is known about the main factors determining the amount of flood damage on event level. Thus, we analyse and compare paired flood events, i.e. consecutive, similar damaging floods that occurred in the same area. In analogy to ‘Paired catchment studies’ - a well-established method in hydrology to understand how changes in land use affect streamflow – we will investigate how and why resulting flood damage in a region differed between the first and second consecutive flood events. One example are the 2002 and 2013 floods in the Elbe and Danube catchments in Germany. The 2002 flood caused the highest economic damage (EUR 11600 million) due to a natural hazard event in Germany. Damage was so high due to extreme flood hazard triggered by extreme precipitation and a high number of resulting dyke breaches. Additionally, exposure hotspots like the city of Dresden at the Elbe river as well as some smaller municipalities at the river Mulde (e.g. Grimma, Eilenburg, Bitterfeld, Dessau) were severely impacted. However, affected parties and authorities learned from the extreme flood in 2002, and many governmental flood risk programs and initiatives were launched. Considerable improvements since 2002 occurred on many levels that deal with flood risk reduction and disaster response, in particular in 1) increased flood prevention by improved spatial planning, 2) an increased number of property-level mitigation measures, 3) more effective early warning and improved coordination of disaster response and 4) a more targeted maintenance of flood defence systems and their deliberate relocation. Thus, despite higher hydrological severity damage due to the 2013 flood was significantly lower than in 2002. In our international comparative paired event study we investigate under which circumstances similar or contrasting processes occurred and hope to identify common key processes which determine flood damage on event level.

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Dynamic bioconversion mathematical modelling and simulation of urban organic waste co-digestion in continuously stirred tank reactor

The application of anaerobic digestion (AD) as process technology is increasing worldwide: the production of biogas, a versatile form of renewable energy, from biomass and organic waste materials allows mitigating greenhouse gas emission from the energy and transportation sectors while treating waste. However, the successful operation of AD processes is challenged by economic and technological issues. To overcome these barriers, mathematical modelling of the bioconversion process can provide support to develop strategies for controlling and optimizing the AD process. The objective of this study was to apply a dynamic mathematical model to simulate the co-digestion of different urban organic wastes (UOW). The modelling was based on experimental activities, during which two reactors (R1, R2) were operated at hydraulic retention times (HRT) of 30, 20, 15, 10 days, in thermophilic conditions (55 oC). Sludge, food waste, grass clippings, garden waste were co-digested with VS-based mixing ratios of 10:67.5:15.75:6.75 and 10:45:31.5:13.5 in R1 and R2 respectively. The BioModel (Angelidaki et al., 1999) was then employed with minor modifications of model parameters. The model outputs were validated with experimental results using AD of mixed sludge as single substrate and UOW as co-substrate. The process parameters values were reasonably predicted by the model, showing good correlation with the measured data. Identification of optimal scenarios for co-digestion of UOW, with changing HRT and feedstock compositions, was performed with multi-parameter pareto optimization. The results of the optimization demonstrated that tradeoff between productivity, methane yield and stable process operation should be taken in to consideration.

Dynamic functional characterization and phylogenetic changes due to Long Chain Fatty Acids pulses in biogas reactors

The process stability of biogas plants is often deteriorated by the accumulation of Long Chain Fatty Acids (LCFA). The microbial community shifts due to LCFA disturbances have been poorly understood as the molecular techniques used were not able to identify the genome characteristics of uncultured microorganisms, and additionally, the presence of limited number of reference genomes in public databases prevented the comprehension of specific functional roles.
characterizing these microorganisms. The present study is the first research which deciphers by means of high throughput shotgun sequencing the dynamics of the microbial community during an inhibitory shock load induced by single pulses of unsaturated LCFA at two different concentrations (i.e. 2g/L-reactor and 3g/L-reactor). The metagenomic analysis showed that only the microbes associated with LCFA degradation could encode proteins related to “chemotaxis” and “flagellar assembly”, which promoted the ability to move towards the LCFA sources so as to degrade them. Moreover, the syntrophic interactions found between Syntrophomonas sp. together with Methanosarcina sp. were possibly assigned to the menaquinone-electron transfer. Finally, it was proven that a previously exposed to LCFA inoculum is more efficient in the degradation process of LCFA due to the specialization of the microbial consortium.

Dynamic gauge adjustment of high-resolution X-band radar data for convective rain storms: Model-based evaluation against measured combined sewer overflow

Numerous studies have shown that radar rainfall estimates need to be adjusted against rain gauge measurements in order to be useful for hydrological modelling. In the current study we investigate if adjustment can improve radar rainfall
estimates to the point where they can be used for modelling overflows from urban drainage systems, and we furthermore investigate the importance of the aggregation period of the adjustment scheme. This is done by continuously adjusting X-band radar data based on the previous 5–30 min of rain data recorded by multiple rain gauges and propagating the rainfall estimates through a hydraulic urban drainage model. The model is built entirely from physical data, without any calibration, to avoid bias towards any specific type of rainfall estimate. The performance is assessed by comparing measured and modelled water levels at a weir downstream of a highly impermeable, well defined, 64 ha urban catchment, for nine overflow generating rain events. The dynamically adjusted radar data perform best when the aggregation period is as small as 10–20 min, in which case it performs much better than static adjusted radar data and data from rain gauges situated 2–3 km away.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Krüger A/S
Authors: Borup, M. (Intern), Grum, M. (Ekstern), Linde, J. J. (Ekstern), Mikkelsen, P. S. (Intern)
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- Scopus rating (2013): SJR 1.71 SNIP 1.997 CiteScore 3.36
- ISI indexed (2013): ISI indexed yes
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- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
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- Scopus rating (2011): SJR 1.753 SNIP 1.858 CiteScore 3.16
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- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 1.784 SNIP 1.714
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 2.018 SNIP 1.835
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 1.922 SNIP 1.758
- Web of Science (2008): Indexed yes
Dynamics of N$_2$O production pathways in a full-scale activated sludge system analysed by $^{15}$N/$^{18}$O dual isotope labelling

**General information**

State: Published
Organisations: Department of Environmental Engineering, Water Technologies, University of Southern Denmark, Max Planck Institute
Authors: Ma, C. (Ekstern), Jensen, M. M. (Intern), Smets, B. F. (Intern), Lavik, G. (Ekstern), Thamdrup, B. (Ekstern)
Pages: 82-83
Publication date: 2016

**Host publication information**

Title of host publication: Microbial ecology and water engineering & biofilms specialist groups (MEWE2016)
Place of publication: Copenhagen, Denmark
Publisher: IWA
Main Research Area: Technical/natural sciences
Conference: MEWE and biofilms IWA specialist conference, Copenhagen, Denmark, 04/09/2016 - 04/09/2016
Electronic versions:
MEWE2016_AbstractBookma.pdf

Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Dynamic tracer dispersion method: A tool for measuring the total methane emission from individual Danish landfills

**General information**

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, FORCE Technology
Authors: Mønster, J. (Intern), Fuglsang, K. (Ekstern), Scheutz, C. (Intern)
Number of pages: 2
Publication date: 2016
Event: Abstract from Conference and Exhibition on Emissions Monitoring 2016 (CEM), Lissabon, Spain.
Main Research Area: Technical/natural sciences
Electronic versions:
J_Moenster_PAPER_CEM2016_final.pdf

Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Dynamic tracer dispersion method: A tool for measuring the total methane emission from individual Danish landfills

**General information**
Ecological patterns, diversity and core taxa of microbial communities in groundwater-fed rapid gravity filters

Here, we document microbial communities in rapid gravity filtration units, specifically serial rapid sand filters (RSFs), termed prefilter (PFs) and after-filters (AFs), fed with anoxic groundwaters low in organic carbon to prepare potable waters. A comprehensive 16S rRNA-based amplicon sequencing survey revealed a core RSF microbiome comprising few bacterial taxa (29–30 genera) dominated by Nitrospirae, Proteobacteria and Acidobacteria, with a strikingly high abundance (75–87±18%) across five examined waterworks in Denmark. Lineages within the Nitrospirae genus consistently comprised the second most and most abundant fraction in PFs (27±23%) and AFs (45.2±23%), respectively, and were far more abundant than typical proteobacterial ammonium-oxidizing bacteria, suggesting a physiology beyond nitrite oxidation for Nitrospirae. Within the core taxa, sequences closely related to types with ability to oxidize ammonium, nitrite, iron, manganese and methane as primary growth substrate were identified and dominated in both PFs (73.6±6%) and AFs (61.4±21%), suggesting their functional importance. Surprisingly, operational taxonomic unit richness correlated strongly and positively with sampling location in the drinking water treatment plant (from PFs to AFs), and a weaker negative correlation held for evenness. Significant spatial heterogeneity in microbial community composition was detected in both PFs and AFs, and was higher in the AFs. This is the first comprehensive documentation of microbial community diversity in RSFs treating oligotrophic groundwaters. We have identified patterns of local spatial heterogeneity and dispersal, documented surprising energy–diversity relationships, observed a large and diverse Nitrospirae fraction and established a core RSF microbiome.
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 4.71 SNIP 2.175 CiteScore 8.62
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.673 SNIP 2.07 CiteScore 8.02
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.536 SNIP 1.777 CiteScore 6.5
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.245 SNIP 1.626
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.563 SNIP 1.445
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.97 SNIP 0.766
Web of Science (2008): Indexed yes
Original language: English
Ecology, Evolution, Behavior and Systematics, Microbiology
Electronic versions:
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Links:
http://www.nature.com.proxy.findit.dtu.dk/ismej/journal/vaop/ncurrent/full/ismej201616a.html

Relations
Activities:
DNA and RNA SIP reveal ammonium and nitrite oxidizers in groundwater fed biofilters
DNA and RNA SIP reveal nitrifiers in groundwater fed biofilters
Source: FindIt
Source-ID: 2298597137
Publication: Research - peer-review › Journal article – Annual report year: 2016

Ecological patterns of nitrifiers in the urban water cycle

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Urban Water Systems
Authors: Diwan, V. (Intern), Dechesne, A. (Intern), Smets, B. F. (Intern), Albrechtsen, H. (Intern)
Pages: 89-89
Publication date: 2016

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Title of host publication: The Danish Microbiological Society Annual Congress 2016 : Programme & Abstracts
Place of publication: Copenhagen
Publisher: American Society for Microbiology
Article number: P80
Main Research Area: Technical/natural sciences
Conference: Danish Microbiological Society Annual Congress 2016, Copenhagen, Denmark, 14/11/2016 - 14/11/2016
Electronic versions:
Programme & Abstracts book
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016
Effect of climate change on stormwater runoff characteristics and treatment efficiencies of stormwater retention ponds; a case study from Denmark using TSS and Cu as indicator pollutants. SpringerPlus, 5:1984, 1-12.

This study investigated the potential effect of climate changes on stormwater pollution runoff characteristics and the treatment efficiency of a stormwater retention pond in a 95 ha catchment in Denmark. An integrated dynamic stormwater runoff quality and treatment model was used to simulate two scenarios: one representing the current climate and another representing a future climate scenario with increased intensity of extreme rainfall events and longer dry weather periods. 100-year long high-resolution rainfall time series downscaled from regional climate model projections were used as input. The collected data showed that total suspended solids (TSS) and total copper (Cu) concentrations in stormwater runoff were related to flow, rainfall intensity and antecedent dry period. Extreme peak intensities resulted in high particulate concentrations and high loads but did not affect dissolved Cu concentrations. The future climate simulations showed an increased frequency of higher flows and increased total concentrations discharged from the catchment. The effect on the outlet from the pond was an increase in the total concentrations (TSS and Cu), whereas no major effect was observed on dissolved Cu concentrations. Similar results are expected for other particle bound pollutants including metals and slowly biodegradable organic substances such as PAH. Acute toxicity impacts to downstream surface waters seem to be only slightly affected. A minor increase in yearly loads of sediments and particle-bound pollutants is expected, mainly caused by large events disrupting the settling process. This may be important to consider for the many stormwater retention ponds existing in Denmark and across the world.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Environmental Chemistry
Authors: Sharma, A. K. (Intern), Vezzaro, L. (Intern), Birch, H. (Intern), Arnbjerg-Nielsen, K. (Intern), Mikkelsen, P. S. (Intern)
Number of pages: 12
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Main Research Area: Technical/natural sciences

Publication information
Journal: SpringerPlus
Volume: 5
Article number: 1984
ISSN (Print): 2193-1801
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.433 SNIP 0.731 CiteScore 1.3
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.433 SNIP 0.562 CiteScore 1.02
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.313 SNIP 0.551 CiteScore 0.83
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.146 SNIP 0.282 CiteScore 0.51
Original language: English
Clima change effets, Stormwater runoff quality, Dynamic model Treatment, TSS , Copper
Electronic versions:
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DOI:
10.1186/s40064-016-3103-7
Links:
Source: PublicationPreSubmission
Source-ID: 127229162
Publication: Research - peer-review › Journal article – Annual report year: 2016

Effect of ozonation of swimming pool water on formation of volatile disinfection by-products - A laboratory study
Ozonation experiments were performed using unchlorinated tap water used for filling municipal swimming pools, actual pool water and pool water polluted by addition of fresh tap water and artificial body fluid to evaluate ozone kinetics and water quality effects on formation of volatile disinfection byproducts during subsequent chlorination.
The ozone reaction was observed to behave according to first order kinetics. For tap water half-life was 4 min whilst
polluted and unpolluted pool water exhibited half-life of 8 and 11 min, respectively. When ozonation dosage was repeated half-life of ozone was approximated 17-19 min in all samples. Subsequent chlorination revealed ozone removed reactivity of dissolved organic carbon toward chlorine for tap and polluted pool water, decreasing formation rate of trihalomethanes (TTHM). In pool water higher rates of TTHM formation was observed after the initial ozone dosage, however this decreased with subsequent treatments. For tap and polluted pool water, ozone reacted directly with the pollutants resulting in a short ozone half-life, removing reactivity towards chlorine oxidation and preventing TTHM production. Conversely for pool water samples, due to the long half-life of ozone, the molecule decomposed to hydroxyl radicals. These in turn reacted with aqueous organic matter increasing chlorine reactivity and rates of TTHM formation. Formation of other non-regulated volatile byproducts (e.g. dichloracetonitrile, trichloropropanone and trichloronitromethane) was observed to increase in pool water with ozone treatment. Thus, ozonation dosage regimes should be designed such that ozone mostly oxidizes fresh pollutants before chlorine is able to react with it.

General information
State: Published
Authors: Hansen, K. M. S. (Intern), Spiliotopoulou, A. (Intern), Cheema, W. A. (Intern), Andersen, H. R. (Intern)
Number of pages: 13
Pages: 277-285
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Journal: Chemical Engineering Journal
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.34
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 5.68
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.92
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 4.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.92
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.96
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Web of Science (2008): Indexed yes
Effects of anti-androgens cyproterone acetate, linuron, vinclozolin, and p,p’-DDE on the reproductive organs of the copepod Acartia tonsa

The study was performed to detect the effects of anti-androgenic compounds on the reproduction. In this paper alterations observed in the marine calanoid copepod Acartia tonsa exposed to environmental concentrations of cyproterone acetate (CPA), linuron (LIN), vinclozolin (VIN), and 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene (p,p’-DDE) for 21 days covering a full life cycle are described. Histological alterations were studied with a focus on reproductive organs, gonad and accessory sexual glands. Exposure to ≥1.2 µg L−1 CPA caused degeneration of spermatocytes and deformation of the spermatophore in males. In a single male exposed to 33 µg L−1 CPA, an ovotestis was observed. In CPA exposed females, enhancement of oogenesis, increase in apoptosis and a decrease in proliferation occurred. Exposure of males to ≥12 µg L−1 LIN caused degenerative effects in spermatogonia, spermatocytes and spermatids, and at 4.7 µg L−1 LIN, the spermatophore wall displayed an irregular formation. In LIN exposed females, no such structural alterations were found; however, the proliferation index was reduced at 29 µg L−1 LIN. At an exposure concentration of ≥100 µg L−1 VIN, distinct areas in male gonad were stimulated, whereas others displayed a disturbed spermatogenesis and a deformed spermatophore wall. In VIN exposed female A. tonsa, no effects were observed. Male A. tonsa exposed to p,p’-DDE displayed an impairment of spermatogenesis in all stages with increased degrees of apoptosis. In p,p’-DDE-exposed females, a statistical significant increase of the proliferation index and an intensification of oogenesis were observed at 0.0088 µg L−1.

General information

State: Published
Organisations: Department of Environmental Engineering, Laboratory for Aquatic Research and Comparative Pathology, University of Ioannina, University of Milan
Authors: Watermann, B. T. (Ekstern), Albanis, T. A. (Ekstern), Galassi, S. (Ekstern), Gnass, K. (Ekstern), Kusk, K. O. (Intern), Sakkas, V. A. (Ekstern), Wollenberger, L. (Intern)
Number of pages: 10
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Publication date: 2016
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.52 SJR 0.511 SNIP 0.649
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.513 SNIP 0.677 CiteScore 1.34
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.546 SNIP 0.657 CiteScore 1.23
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.52 SNIP 0.605 CiteScore 1.2
Effects of gasification biochar on plant-available water capacity and plant growth in two contrasting soil types

Abstract Gasification biochar (GB) contains recalcitrant carbon that can contribute to soil carbon sequestration and soil quality improvement. However, the impact of GB on plant-available water capacity (AWC) and plant growth in diverse soil types still needs to be explored. A pot experiment with spring barley (Hordeum vulgare L.) was conducted to investigate the effect of soil amendment by 1% straw and wood gasification biochar (SGB and WGB), respectively, on AWC and plant growth responses under two levels of water supply in a temperate sandy loam and a coarse sandy subsoil. In the sandy loam, the reduced water regime significantly affected plant growth and water consumption, whereas the effect was less pronounced in the coarse sand. Irrespective of the soil type, both GBs increased AWC by 17–42%, with the highest absolute effect in the coarse sand. The addition of SGB to coarse sand led to a substantial increase in plant biomass under both water regimes: shoot growth by 40–165% and root growth by 50–57%. However, no positive effects were achieved by the addition of WGB. In the sandy loam, soil application of GB had no or negative effects on plant growth. Our results suggest that SGB has considerable potential for enhancing crop productivity in coarse sandy soils by increasing soil water retention and improving root development.

General information

State: Published
Organisations: Department of Chemical and Biochemical Engineering, Department of Environmental Engineering, Atmospheric Environment, Roskilde University, University of Copenhagen
Authors: Hansen, V. (Forskerdatabase), Hauggaard-Nielsen, H. (Forskerdatabase), Petersen, C. T. (Forskerdatabase), Mikkelsen, T. N. (Intern), Müller-Stöver, D. S. (Forskerdatabase)
Number of pages: 9
Pages: 1-9
Publication date: 2016
Gasification biochar, Available water capacity, Coarse sand, Barley, Shoot and root growth, Soil structure

DOIs:
10.1016/j.still.2016.03.002
Source: FindIt
Source-ID: 2303005032
Publication: Research - peer-review › Journal article – Annual report year: 2016

Effektiv bionedbrydning af lægemidler i spildevand ved biofilm basered teknologi

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Teknologisk Institut, Krüger A/S, Aarhus University, Det Nye Universitetshospital
Pages: 29-30
Efficiency of stormwater control measures for combined sewer retrofitting under varying rain conditions: Quantifying the Three Points Approach (3PA)

We present a method to assess and communicate the efficiency of stormwater control measures for retrofitting existing urban areas. The tool extends the Three Points Approach to quantitatively distinguish three rainfall domains: (A) rainwater resource utilisation, (B) urban stormwater drainage pipe design, and (C) pluvial flood mitigation. Methods for calculating efficiencies are defined recognizing that rainfall is both a valuable resource and a potential problem. Efficiencies are quantified in relation to rainfall volume, supplied potable water volume and volume of wastewater treated. A case study from Denmark is used to illustrate how the efficiency varies between the rainfall domains. The method provides a means for communicating some important quantitative aspects of stormwater control measures among engineers, planners and decision makers working with management of water resources, stormwater drainage and flood risks.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Sørup, H. J. D. (Intern), Lerer, S. M. (Intern), Arnbjerg-Nielsen, K. (Intern), Mikkelsen, P. S. (Intern), Rygaard, M. (Intern)
Pages: 19-26
Publication date: 2016
Main Research Area: Technical/natural sciences
Energy footprints in the urban water cycle

General information
State: Published
Authors: Rygaard, M. (Intern), Brudler, S. (Intern), Hélix-Nielsen, C. (Intern), Nøhr Bak, S. (Ekstern)
Pages: 45-53
Publication date: 2016

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Title of host publication: DTU International Energy Report 2016: The Energy-Water-Food Nexus - from local to global aspects
Place of publication: kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Editors: Senderberg Petersen, L., Hvidtvedt Larsen, H.
Chapter: 6
Main Research Area: Technical/natural sciences
Electronic versions:
DTU_INTERNATIONAL_ENERGY_REPORT_2016_2_.pdf
Publication: Commissioned - peer-review › Report chapter – Annual report year: 2016

Energy recovery from water and food sector residual resources

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Department of Chemical and Biochemical Engineering, CHEC Research Centre
Enhanced performance of a biomimetic membrane for Na$_2$CO$_3$ crystallization in the scenario of CO$_2$ capture

Membrane assisted crystallization (MACr) offers an innovative platform for crystallizing Na$_2$CO$_3$, allowing its reuse after CO$_2$ capture from flue gases by an alkaline solution (i.e., NaOH). In this study, the biomimetic aquaporin Inside™ membrane AIM60 was employed to enhance water removal, facilitating Na$_2$CO$_3$ crystallization. The water channel in the active layer, comprising aquaporin proteins, and the strong wettability of membrane substrate assist a better performance. For instance, the water flux of AIM60 membrane for concentrating a 1.89molL$^{-1}$ Na$_2$CO$_3$ solution (osmotic pressure of 94.8bar) in forward osmosis (FO) mode was 6.62Lm$^{-2}$h$^{-1}$ and 3.25Lm$^{-2}$h$^{-1}$ in pressure retarded osmosis (PRO) mode when a 5.13molL$^{-1}$ NaCl solution (osmotic pressure of 304.9bar) was employed as the draw solution. This demonstrates that the AIM60 FO membrane outperformed the previously reported dense reverse osmosis membrane (0.21Lm$^{-2}$h$^{-1}$ in FO mode and 0.16Lm$^{-2}$h$^{-1}$ in PRO mode) and a porous hydrophobic hollow fiber membrane (0.08Lm$^{-2}$h$^{-1}$) under the same operating conditions. Crystallization utilizing the AIM60 membrane in an osmotic crystallizer was achieved without noticeable membrane scaling or degradation. Furthermore, a proper control of the supersaturation level induces crystallization of Na$_2$CO$_3$·10H$_2$O crystals with a purity of 99.94%. Hence, the aquaporin Inside™ FO membrane may be a promising alternative to existing methods for Na$_2$CO$_3$ crystallization for its application in a CO$_2$ capture scenario.
Enhancing the removal of pharmaceuticals in biological wastewater treatment: Is MBBR the answer?

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Environmental Chemistry, Aarhus University, AnoxKaldnes AB
Authors: Torresi, E. (Intern), Polesel, F. (Intern), Escola Casas, M. (Ekstern), Smets, B. F. (Intern), Andersen, H. R. (Intern), Bester, K. (Ekstern), Christensson, M. (Ekstern), Plósz, B. G. (Intern)
Number of pages: 1
Publication date: 2016
Event: Abstract from International Conference on Emerging Contaminants (EmCon2016) and Micropollutants (WiOW2016) in the Environment, Sydney, Australia.
Environmental assessment of biowaste management in the Danish-German border region

The treatment of organic waste from households has gained significant interest in recent years. Each country in the EU and the rest of the world treat their organic waste in many different ways, and Denmark and Germany are no exemption in this regard. The treatment of household organic waste in these two countries has taken a very different turn in the last century. Denmark has been incinerating organic household waste as part of a residual waste policy for more than a century, but it has only attempted biological treatment to a limited extent. Germany, on the other hand, has focused intensely on source separation followed by biological treatment and a mixture of incineration and mechanical and biological treatment for any organic matter remaining in residual waste. In recent years, Denmark has increased its focus on moving away from incineration and increasing material recycling, both on its own initiative and also incentivised by the EU’s 50% recycling target for 2020. This focus includes recycling organic waste from households as well as dry recyclable waste fractions.

This PhD project was carried out as a cross-border partnership with five waste management companies, three located in Denmark and two in Germany, all with the wish to increase the source separation and treatment of organic household waste. The current practice in the Danish border region does not include source separation, and all organic household waste is incinerated as part of the residual waste. The German region already has a well-established source separation system, but it wants to increase its efficiency.

The main aim of this Ph.D. thesis was to compare current organic waste management systems across the Danish-German border with future scenarios intended for the treatment of organic waste using LCA. The outcome of the project was a recommendation to waste management companies through life cycle assessment and experimental work at a biological treatment plant.

A major part of the PhD study was collecting data on all aspects of the waste management chain. Waste generation through to collection, transportation, treatment and final disposal were analysed. The most detailed analysis took place at a combined biogas and composting plant, where solid and liquid samples were taken and air emissions measured through whole-site fugitive emissions. The assessments were done by using a combination of material flow analysis, substance flow analysis, life cycle inventories and life cycle assessments, using the EASETECH modelling software.

The life cycle assessment assessed the management of organic household waste in the Danish-German border region. The main output was a life cycle assessment showing large differences in the environmental performance of the two different regions, with the Danish region performing better in most impact categories. Furthermore, the importance of the energy systems was investigated, showing that a large influence on the results was the surrounding energy system.

Besides comparing the two regions’ current performances to each other, they were compared to four future scenarios featuring increased source separation and different biological treatments. In this case the life cycle assessment was used as a planning tool for a future waste management system where environmental hotspots could be identified for both current and possible future systems. In all cases, the results showed that local conditions can play a major role in where
the system can be improved, and conclusions made on an overall level (all five waste management companies together) can lead to suboptimal decisions; it is therefore important to look at each waste management company individually. Major differences in environmental performance were seen when changing from incineration or mechanical and biological treatment to biological treatment, such as increased savings of phosphorous and increased loadings of ammonia. Most important for the environmental performance of the biological treatment facilities were high biogas production and low fugitive methane, nitrous oxide and ammonia emissions.

Fugitive emissions measured at a combined biogas and composting plant were very significant and led to a turnaround in the environmental performance of the plant, going from a saving in greenhouse gas potential to a loading when including the measured emissions and applying the life cycle assessment principles.

Ultimately, increasing the source separation of organic household waste for the five waste management companies is a viable option, if the focus of the companies is on flexible fuel (biogas), compost production and subsequent resource savings. However, the picture is not clear, as the current waste management system (mainly incineration) is already working well, and in some cases it outperforms the biological treatment option.

Environmental impacts of flood control measures in climate change adaptation strategies

Because of climatic changes, large investments are needed to keep flood risk at an acceptable level in urban areas. Increasing dimensions of underground sewer systems and retention basins are increasingly supplemented with multi-functional approaches, aimed at managing water locally and/or route it on the surface without harming assets. When evaluating different adaptation approaches, a cost assessment is typically carried out, while environmental impacts usually are not considered. To close this gap, a Life Cycle Assessment (LCA) based method is developed, which allows to quantify environmental impacts of different storm water management strategies. It is tested with two different adaptation strategies for the Nørrebro catchment in Copenhagen, Denmark: A Cloudburst Management Plan (CMP), which uses a multi-functional approach and combines green infrastructure with subsurface pipes, and a Subsurface scenario (SSA), which uses only pipes and underground retention basins. To ensure comparability, flood safety levels for different rain events are defined, which have to be met in both scenarios. The environmental impacts are calculated for eight different categories, including climate change, resource depletion, eutrophication and acidification. The case study shows significantly lower impacts for the multi-functional, green infrastructure CMP, compared to the SSA. Among the installations, those measures which are installed to ensure no water on the surface during rain events with a return period of 10 years and handling small events with a return period of up to 0.2 years cause by far the largest share of the total environmental impacts in both scenarios (up to 96% for the CMP, and up to 84% for the SSA). In contrast, measures aimed at handling extreme events with a return period of up to 100 years only contribute up to 4% of the environmental impacts for the CMP and less than 1% for the SSA. Our method helps explain how the handling of everyday events and extreme rain events affect the environmental sustainability of climate change adaptation and it enables cities to consider the environmental sustainability of climate change adaptation solutions in the planning process.
Environmental implications of the use of agro-industrial residues for biorefineries: application of a deterministic model for indirect land-use changes

Biorefining agro-industrial biomass residues for bioenergy production represents an opportunity for both sustainable energy supply and greenhouse gas (GHG) emissions mitigation. Yet, is bioenergy the most sustainable use for these residues? To assess the importance of the alternative use of these residues, a consequential life-cycle assessment (LCA) of 32 energy-focused biorefinery scenarios was performed based on eight selected agro-industrial residues and four conversion pathways (two involving bioethanol and two biogas). To specifically address indirect land-use changes (iLUC) induced by the competing feed/food sector, a deterministic iLUC model, addressing global impacts, was developed. A dedicated biochemical model was developed to establish detailed mass, energy, and substance balances for each biomass conversion pathway, as input to the LCA. The results demonstrated that even for residual biomass, environmental savings from fossil fuel displacement can be completely out-balanced by iLUC, depending on the feed value of the biomass residues. This was the case of industrial residues brewer's grain, beet residues, potato pulp, and whey. Overall, the GHGs from iLUC impacts were quantified to 4.1 t CO2-eq.ha-1demanded y-1 corresponding to 1.2-1.5 t CO2 t-1 dry biomass used for energy. Only bioenergy from straw and wild grass was shown to perform better than the alternative use, as no competition with the feed sector was involved. Biogas for heat-and-power production was the best performing pathway, in a short-term context. Focusing on transport fuels, bioethanol was generally preferable to biomethane considering conventional biogas upgrading technologies. Based on the results, agro-industrial residues cannot be considered burden-free simply because they are a residual biomass and careful accounting of alternative utilization is a pre-requisite to assess the sustainability of a given use. In this endeavor, the iLUC factors and biochemical model proposed herein can be used as templates and directly applied to any bioenergy consequential study involving demand for arable land.
Environmental life cycle assessment of urban storm water management

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Brudler, S. (Intern), Arnbjerg-Nielsen, K. (Intern), Rygaard, M. (Intern)
Pages: 10-10
Publication date: 2016

Host publication information
Title of host publication: 10th annual meeting of DWF16 : Abstracts
Publisher: Danish Water Forum
Main Research Area: Technical/natural sciences
Conference: 10th annual meeting of Danish Water Forum (DWF), Frederiksberg, Denmark, 28/01/2016 - 28/01/2016
Electronic versions:
DWF_Environmental_life_cycle_assessment_of_urban_storm_water_management.pdf
Source: PublicationPreSubmission
Source-ID: 123100538
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016

Environmental Phosphorus Recovery Based on Molecular Bioscavengers: From Quantum Mechanics to Continuum Physics

Phosphorus is a ubiquitous element of all known life and as such it is found throughout numerous key molecules related to various cellular functions. The supply of phosphorus is tightly linked to global food security, since phosphorus is used to produce agricultural fertilizers, without which it would not be possible to feed the world population. Sadly, the current supply of phosphorus is based on the gradual depletion of limited fossil reserves, and some estimates predict that within 15-25 years we will consume more phosphorus than we can produce. There is therefore a strong international pressure to develop sustainable phosphorus practices as well as new technologies for phosphorus recovery.

Nature has spent billions of years refining proteins that interact with phosphates. This has inspired the present work where the overall ambitions are: to facilitate the development of a recovery technology based on biological phosphorus scavengers, to examine fundamental molecular system aspects relevant for such a technology, and to motivate the use of computational techniques throughout an iterative design process of such a technology. A wide spectrum of computational methods, from atomic-scale quantum calculations to macro-scale fluid simulations, are employed to hint at the potential of a recovery technology based on molecular bioscavengers.

As a first approach, data mining is used to obtain statistical information about how proteins in nature interact with phosphate groups, thereby revealing characteristic amino acid distributions of the binding sites. Quantum mechanical methods are used to investigate how phosphate moieties are described using electronic structure methods, and molecular dynamics in combination with quantum mechanics are used to show how the dynamical interaction between phosphates and proteins can be described – it is found that certain commonly used computational methods, including B3LYP, are ill-suited for characterizing interactions with phosphate groups, but nevertheless that phosphate-protein interactions can efficiently be quantified using other methods, e.g. wB97XD or PM6. Finally, it is shown how computational fluid dynamics can be used to optimize large-scale industrial processes using an open-source model, which we have made freely available online to the membrane community, and the advantages/disadvantages of different potential physical implementations of the proposed scavenger technology are discussed.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies
Authors: Gruber, M. F. (Intern), Hélix-Nielsen, C. (Intern)
Number of pages: 66
Publication date: 2016
Environmental risk assessment and management of engineered nanomaterials - The role of ecotoxicity testing

In 2004, the first article on ecotoxicity of engineered nanomaterials (ENMs) was published, subsequently giving birth to the field of nanoecotoxicology. Today, approximately a thousand peer-reviewed articles have been published on the topic albeit many challenges remain within the field. Central to these is the continued examination of the applicability of ecotoxicity testing to encompass the testing of particles, as the tests originally are developed for dissolved chemicals. Furthermore, the ability of such testing to inform environmental risk assessment and environmental risk management, including the applicability of these concepts, has been questioned.

The present thesis provides an overview of the challenges facing ecotoxicity testing of ENMs and investigates whether we can rely on such testing to inform risk assessment and eventually management of the potential environmental risk of ENMs.

Although the Organisation for Economic Co-operation and Development (OECD) launched a seven year long testing programme around the use of standardized OECD test guidelines (TGs) for ENMs, which concluded that the TGs are generally applicable to ENMs, this thesis argues that it is not possible to offer any conclusions based on their analysis. Efforts within nanoecotoxicology are focused on modifying existing TGs to improve the stability and dispersion of suspended ENMs, although it is paramount to acknowledge that the underlying assumption of the dissolved nature of the test compound is violated. Furthermore, several dilemmas - so called-double binds - should also be acknowledged as they dictate the limitations of standardization and therefore also its ability to guide risk assessment.

The paradigm of conducting in vivo animal toxicity testing and extrapolating the data to either humans or the environment is gradually being replaced with a focus on in silico and in vitro studies with an even greater need for and reliance on extrapolation. However, in this thesis it is argued that within ecotoxicity, whole organism models remain at the foundation of environmental risk assessment, and as such, they are likely to remain in use for nanoecotoxicology. Indeed, the use of more complex in vivo systems such as microcosms and mesocosms are recommended to enable and validate current risk assessment practices. But just as envisioned in human toxicology, an integrated approach must be pursued to reap the benefits of simplified as well as more complex testing systems, each fit for purpose for different tasks.

It is concluded that it is not possible to conduct environmental risk assessment of ENMs with a satisfactory level of certainty, primarily due to knowledge gaps and the uncertainty imbedded in current ecotoxicity data. Albeit with time better data will be available, it is important that tools encompassing uncertainty are utilized to facilitate decision-support. As the risk constituted by ENMs cannot be quantified, the use, need and ability of risk management options to encompass the potential risk are similarly challenged. This should invoke a precautionary stance on the use of ENMs.

Within the field of nanotoxicology the concept of creating ‘safety by design’ has received much attention, arguably both due to these risk assessment and management issues, but also in spite of them. Instead of focusing on managing complexity and uncertainty, the rise of ‘safety by design’ indicates that the field is going towards a more deterministic approach with a misplaced promise to solve these management issues scientifically. Finally, identifying risky ENMs and safer alternatives through alternatives assessment should be encouraged. Importantly, in doing so we will also be forced to look at risk in combination with benefits, as addressing risk in isolation rarely leaves room for resolving societal issues.

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Water Resources Engineering
Authors: Hjorth, R. (Intern), Baun, A. (Intern), Broholm, M. M. (Intern), Hansen, S. F. (Intern)
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Environmental risk assessment of chemicals and nanomaterials — The best foundation for regulatory decision-making?
Environmental risk assessment (ERA) is often considered as the most transparent, objective and reliable decision-making tool for informing the risk management of chemicals and nanomaterials. ERAs are based on the assumption that it is possible to provide accurate estimates of hazard and exposure and, subsequently, to quantify risk. In this paper we argue that since the quantification of risk is dominated by uncertainties, ERAs do not provide a transparent or an objective foundation for decision-making and they should therefore not be considered as a “holy grail” for informing risk management. We build this thesis on the analysis of two case studies (of nonylphenol and nanomaterials) as well as a
historical analysis in which we address the scientific Foundation for ERAs. The analyses show that ERAs do not properly address all aspects of actual risk, such as the mixture effect and the environmentally realistic risk from nanomaterials. Uncertainties have been recognised for decades, and assessment factors are used to compensate for the lack of realism in ERAs. The assessment factors’ values were pragmatically determined, thus lowering the scientific accuracy of the ERAs. Furthermore, the default choice of standard assay for assessing a hazard might not always be the most biologically relevant, so we therefore argue that an ERA should be viewed as a pragmatic decision-making tool among several, and it should not have a special status for informing risk management. In relation to other relevant decision-making tools we discuss the use of chemical alternative assessments (CAAs) and the precautionary principle.

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State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Roskilde University
Authors: Syberg, K. (Ekstern), Hansen, S. F. (Intern)
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Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.635 SNIP 1.847 CiteScore 4.2
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Scopus rating (2010): SJR 1.644 SNIP 1.513
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
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Web of Science (2008): Indexed yes
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Environmental risk assessment of poorly soluble substances: Improved tools for assessing biodegradation, (de)sorption, and modeling

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Organisations: Department of Environmental Engineering, Environmental Chemistry, RWTH Aachen University
Authors: Stibany, F. (Ekstern), Smith, K. (Ekstern), Trapp, S. (Intern), Schäffer, A. (Ekstern)
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Equilibrium sampling in a semi in situ pot experiment to measure freely dissolved concentrations of hydrophobic organic compounds

**General information**
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Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Bartolome, N. (Ekstern), Hilber, I. (Ekstern), Schulin, R. (Ekstern), Mayer, P. (Intern), Witt, G. (Ekstern), Bucheli, T. (Ekstern)
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Establishing bio-mitigation systems at landfills for reducing greenhouse gas emission – State-of-the-art

**General information**
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Kjeldsen, P. (Intern), Scheutz, C. (Intern)
Number of pages: 8
Publication date: 2016
Event: Abstract from Global Waste Management Symposium 2016, California, United States.
Main Research Area: Technical/natural sciences
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GWMS2016_Paper_Kjeldsen.pdf
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Establishing drinking water biofilms with varying alpha-diversity?

**General information**
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Urban Water Systems
Authors: Kinnunen, M. (Intern), Dechesne, A. (Intern), Gülay, A. (Intern), Albrechtsen, H. (Intern), Smets, B. F. (Intern)
Number of pages: 3
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Estimating mass discharge of contaminant plumes downstream of landfills: Benefits of geophysics

**General information**
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Organisations: Department of Environmental Engineering, Water Resources Engineering, Aarhus University, Geological Survey of Denmark and Greenland
Authors: Balbarini, N. (Intern), Maurya, P. K. (Ekstern), Rønde, V. K. (Intern), Christiansen, A. (Ekstern), Bjerg, P. L. (Intern), Klint, K. (Ekstern), Binning, P. J. (Intern)
Number of pages: 1
Estimation of long-term environmental inventory factors associated with land application of sewage sludge

Land application of sewage sludge has a number of advantages over other alternatives, but is also associated with environmental impacts. To make proper assessments of different sludge treatments, it is crucial to have reliable estimates of emissions after the application of different sludge types. However, because of the complexity of the agricultural production system, it is difficult to estimate emissions consistently under different conditions. In the current paper, a mechanistic agro-ecosystem model was calibrated to be able to simulate different sludge types stabilized using different techniques. Subsequently, 100 year model simulations were used to provide emission factors as well as harvest and carbon sequestration factors (collectively called environmental inventory factors) under a variety of environmental conditions. Environmental inventory factors were calculated under both high crop response conditions (i.e. when nitrogen was limiting) and low crop response conditions (i.e. when nitrogen was not limiting). The average high response nitrogen harvest factor over the tested environmental conditions was ranging from 0.06 to 0.30 for the different sludge types included. This means that if an additional 1 kg of nitrogen is applied with sludge, between 0.06 and 0.30 kg additional nitrogen is harvested. This is considerably lower than for mineral fertilizer with an average value of 0.63. The low response harvest factors were considerably lower, ranging from 0.03 to 0.13. The emission factor for nitrous oxide nitrogen was ranging from 0.024 to 0.034, consistently being higher under high response conditions. For nitrogen leaching to the groundwater, the high response emission factor ranged from 0.20 to 0.50 for the different sludge types while the low response were slightly higher ranging from 0.18 to 0.55. The average carbon sequestration factor across the different environmental conditions ranged from 0.03 to 0.05 for the different sludge types. In conclusion, the approach using an agro-ecosystem model to estimate inventory factors associated with land application of sludge under varying conditions proved very powerful and would have been virtually impossible by experimental means.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Copenhagen
Authors: Bruun, S. (Ekstern), Yoshida, H. (Intern), Nielsen, M. P. (Ekstern), Jensen, L. S. (Ekstern), Christensen, T. H. (Intern), Scheutz, C. (Intern)
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.609 SNIP 2.383 CiteScore 5.57
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.661 SNIP 2.477 CiteScore 4.6
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 1.644 SNIP 2.581 CiteScore 4.47
ISI indexed (2013): ISI indexed yes
Estimation of marginal costs at existing waste treatment facilities

This investigation aims at providing an improved basis for assessing economic consequences of alternative Solid Waste Management (SWM) strategies for existing waste facilities. A bottom-up methodology was developed to determine marginal costs in existing facilities due to changes in the SWM system, based on the determination of average costs in such waste facilities as function of key facility and waste compositional parameters. The applicability of the method was demonstrated through a case study including two existing Waste-to-Energy (WtE) facilities, one with co-generation of heat and power (CHP) and another with only power generation (Power), affected by diversion strategies of five waste fractions (fibres, plastic, metals, organics and glass), named “target fractions”. The study assumed three possible responses to waste diversion in the WtE facilities: (i) biomass was added to maintain a constant thermal load, (ii) Refused-Derived-Fuel (RDF) was included to maintain a constant thermal load, or (iii) no reaction occurred resulting in a reduced waste throughput without full utilization of the facility capacity. Results demonstrated that marginal costs of diversion from WtE were up to eleven times larger than average costs and dependent on the response in the WtE plant. Marginal cost of diversion were between 39 and 287€Mg⁻¹ target fraction when biomass was added in a CHP (from 34 to 303€Mg⁻¹ target fraction in the only Power case), between -2 and 300€Mg⁻¹ target fraction when RDF was added in a CHP (from -2 to 294€Mg⁻¹ target fraction in the only Power case) and between 40 and 303€Mg⁻¹ target fraction when no reaction happened in a CHP (from 35 to 296€Mg⁻¹ target fraction in the only Power case). Although average costs at WtE facilities were highly influenced by energy selling prices, marginal costs were not (provided a response was initiated at the WtE to keep constant the utilized thermal capacity). Failing to systematically address and include costs in existing waste facilities...
in decision-making may unintendedly lead to higher overall costs at societal level. To avoid misleading conclusions, economic assessment of alternative SWM solutions should not only consider potential costs associated with alternative treatment but also include marginal costs associated with existing facilities.
Ethical aspects of life cycle assessments of diets

Since the turn of the century a growing chorus of researchers has been espousing reduced meat and dairy intake as a partial strategy to transition towards a sustainable food system. Many of these studies have been predicated on a life-cycle assessment (LCA) methodology and though transparent in communicating their work within that framework, it has largely gone unmentioned that LCA involves a number of choices by the assessor and LCA methodology developers that are ultimately subjective. This study uses a consequential LCA of the average Danish diet in comparison to model vegetarian and vegan diets, leveraging the cultural perspectives afforded by the ReCiPe methodology, as starting point to explore the ways that subjectivity influences the LCA process and to test the robustness of the results against these different viewpoints. Mirroring earlier studies, we find vegetarian and vegan diets generally perform better environmentally compared to a standard Danish diet, but that there was minimal difference between the two no-meat options. Results were resilient to varying cultural perspectives applied in the model. LCA methodology, though loaded with value judgments, remains a dependable tool for assessing environmental dietary performance, but is less suited for estimating environmental pressures that are highly dependent on local conditions (e.g. chemical toxicity).
EU Regulation of Nanobiocides: Challenges in Implementing the Biocidal Product Regulation (BPR)

The Biocidal Products Regulation (BPR) contains several provisions for nanomaterials (NMs) and is the first regulation in the European Union to require specific testing and risk assessment for the NM form of a biocidal substance as a part of the information requirements. Ecotoxicological data are one of the pillars of the information requirements in the BPR, but there are currently no standard test guidelines for the ecotoxicity testing of NMs. The overall objective of this work was to investigate the implications of the introduction of nano-specific testing requirements in the BPR and to explore how these might be fulfilled in the case of copper oxide nanoparticles. While there is information and data available in the open literature that could be used to fulfill the BPR information requirements, most of the studies do not take the Organisation for Economic Co-operation and Development’s nanospecific test guidelines into consideration. This makes it difficult for companies as well as regulators to fulfill the BPR information requirements for nanomaterials. In order to enable a nanospecific risk assessment, best practices need to be developed regarding stock suspension preparation and
Evaluating robustness of a diesel-degrading bacterial consortium isolated from contaminated soil

It is not known whether diesel-degrading bacterial communities are structurally and functionally robust when exposed to different hydrocarbon types. Here, we exposed a diesel-degrading consortium to model either alkanes, cycloalkanes or aromatic hydrocarbons as carbon sources to study its structural resistance. The structural resistance was low, with changes in relative abundances of up to four orders of magnitude, depending on hydrocarbon type and bacterial taxon. This low resistance is explained by the presence of hydrocarbon-degrading specialists in the consortium and differences in growth kinetics on individual hydrocarbons. However, despite this low resistance, structural and functional resilience were high, as verified by re-exposing the hydrocarbon-perturbed consortium to diesel fuel. The high resilience is either due to the short exposure time, insufficient for permanent changes in consortium structure and function, or the ability of some consortium members to be maintained during exposure on degradation intermediates produced by other members. Thus, the consortium is expected to cope with short-term exposures to narrow carbon feeds, while maintaining its structural and functional integrity, which remains an advantage over biodegradation approaches using single species cultures.
Evaluating Sorting and Reuse Potentials for Household Waste in Sisimiut, Greenland

General information
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Organisations: Department of Civil Engineering, ARTEK, Section for Arctic Engineering and Sustainable Solutions, Department of Environmental Engineering, Residual Resource Engineering, Environmental Chemistry, Technical University of Denmark
Authors: Kirkelund, G. M. (Intern), Hendriksen, K. (Intern), Scheutz, C. (Intern), Møller, J. (Intern), Hammershej, R. H. (Intern), Thomas, L. F. T. (Ekstern), Henning, M. V. (Ekstern), Diez, L. (Ekstern)
Evaluation of a membrane bioreactor system as post-treatment waste water treatment for better removal of micropollutants

Organic micropollutants such as pharmaceuticals are persistent pollutants that are only partially degraded in waste water treatment plants (WWTPs). In this study, a membrane bioreactor (MBR) system was used as a polishing step on a full-scale WWTP, and its ability to remove micropollutants was examined together with the development and stability of the microbial community. Two stages of operation were studied during a period of 9 months, one with (S1) and one without (S2) the addition of exogenous organic micropollutants. Ibuprofen and naproxen had the highest degradation rates with values of 248 μg/gVSS·h and 71 μg/gVSS·h, whereas diclofenac was a more persistent OMP (7.28 μg/gVSS·h). Mineralization of 14C-labeled organic micropollutants' in batch kinetic experiments indicates that higher removal rates (∼0.8 ng/mgSS·h) with a short lag phase can be obtained when artificial addition of organic micropollutants was performed. Similar microbial populations dominated S1 and S2, despite the independent operations. Hydrogenophaga, Nitrospira, p55-a5, the actinobacterial Tetradsphaera, Propionicimonas, Fodinicola, and Candidatus Microthrix were the most abundant groups in the polishing MBR. Finally, potential microbial candidates for ibuprofen and naproxen degradation are proposed.
Evaluation of a new pulping technology for pre-treating source-separated organic household waste prior to anaerobic digestion

A new technology for pre-treating source-separated organic household waste prior to anaerobic digestion was assessed, and its performance was compared to existing alternative pre-treatment technologies. This pre-treatment technology is based on waste pulping with water, using a specially developed screw mechanism. The pre-treatment technology rejects more than 95% (wet weight) of non-biodegradable impurities in waste collected from households and generates biopulp ready for anaerobic digestion. Overall, 84-99% of biodegradable material (on a dry weight basis) in the waste was recovered in the biopulp. The biochemical methane potential for the biopulp was 469±7 mL CH₄/g ash-free mass. Moreover, all Danish and European Union requirements regarding the content of hazardous substances in biomass intended for land application were fulfilled. Compared to other pre-treatment alternatives, the screw-pulping technology showed higher biodegradable material recovery, lower electricity consumption and comparable water consumption. The higher material recovery achieved with the technology was associated with greater transfer of nutrients (N and P), carbon (total and biogenic) but also heavy metals (except Pb) to the produced biomass. The data generated in this study could be
used for the environmental assessment of the technology and thus help in selecting the best pre-treatment technology for source separated organic household waste.

**General information**

State: Published  
Organisations: Department of Environmental Engineering, Residual Resource Engineering, KomTek Miljø  
Authors: Naroznova, I. (Intern), Møller, J. (Intern), Larsen, B. (Ekstern), Scheutz, C. (Intern)  
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Web of Science (2018): Indexed yes  
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Web of Science (2017): Indexed yes  
BFI (2016): BFI-level 2  
Scopus rating (2016): CiteScore 4 SJR 1.354 SNIP 2.044  
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Scopus rating (2011): SJR 1.698 SNIP 2.085 CiteScore 2.99  
ISI indexed (2011): ISI indexed yes  
Web of Science (2011): Indexed yes  
BFI (2010): BFI-level 1  
Scopus rating (2010): SJR 1.555 SNIP 1.78  
Web of Science (2010): Indexed yes  
BFI (2009): BFI-level 1  
Scopus rating (2009): SJR 1.502 SNIP 1.899  
Web of Science (2009): Indexed yes  
BFI (2008): BFI-level 2  
Scopus rating (2008): SJR 1.378 SNIP 2.13  
Web of Science (2008): Indexed yes  
Scopus rating (2007): SJR 1.035 SNIP 1.767  
Web of Science (2007): Indexed yes  
Scopus rating (2006): SJR 1.046 SNIP 1.749  
Web of Science (2006): Indexed yes  
Scopus rating (2005): SJR 1.059 SNIP 1.65
Evaluation of Maximum a Posteriori Estimation as Data Assimilation Method for Forecasting Infiltration-Inflow Affected Urban Runoff with Radar Rainfall Input

High quality on-line flow forecasts are useful for real-time operation of urban drainage systems and wastewater treatment plants. This requires computationally efficient models, which are continuously updated with observed data to provide good initial conditions for the forecasts. This paper presents a way of updating conceptual rainfall-runoff models using Maximum a Posteriori estimation to determine the most likely parameter constellation at the current point in time. This is done by combining information from prior parameter distributions and the model goodness of fit over a predefined period of time that precedes the forecast. The method is illustrated for an urban catchment, where flow forecasts of 0–4 h are generated by applying a lumped linear reservoir model with three cascading reservoirs. Radar rainfall observations are used as input to the model. The effects of different prior standard deviations and lengths of the auto-calibration period on the resulting flow forecast performance are evaluated. We were able to demonstrate that, if properly tuned, the method leads to a significant increase in forecasting performance compared to a model without continuous auto-calibration. Delayed responses and erratic behaviour in the parameter variations are, however, observed and the choice of prior distributions and length of auto-calibration period is not straightforward.

General information
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Organisations: Department of Environmental Engineering, Urban Water Systems, Department of Applied Mathematics and Computer Science, Krüger A/S
Authors: Wied Pedersen, J. (Intern), Lund, N. S. V. (Intern), Borup, M. (Intern), Löwe, R. (Intern), Poulsen, T. S. (Ekstern), Mikkelsen, P. S. (Intern), Grum, M. (Ekstern)
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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 2.05 SJR 0.548 SNIP 1.079
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.522 SNIP 1.043 CiteScore 1.96
Evaluation of minerals and vitamins in the Danish cultivated sugar kelp

Seaweeds are known for their nutraceutical applications, but also the ability to accumulate e.g. very high iodine concentrations and toxic heavy metals. In this study, cultivated Saccharina latissima (sugar kelp) harvested year-round was analysed for minerals (incl. heavy metals) and vitamins (vit A and E) to evaluate the nutritional value, possible risks and harvest time for optimized value and application. Rope cultivated sugar kelp was sampled both in close proximity to a blue mussel and fish farm (IMTA) and in a reference/control site, both outside Horsens fjord in Denmark, and freeze dried and stored frozen for further analyses. Sugar kelp biomass was sampled (n=3) at 2 m depth in 2013-2014. Surprisingly high concentrations of K and Ca (up to more than 100 and 150 g/kg DW, respectively) were found, along with other trace metals: Cr, Fe, Mn, Co, Cu, Na, Zn, and Se. Undesirable elements such as Pb, Hg, and inorganic As were below legislative threshold values for edible seaweed in France and food supplements in EU, whereas Cd concentrations in some seasons were above the French limits. However, a 70 kg person would need an intake of 0.77-2.0 kg DW of sugar kelp to reach the provisional tolerable weekly intake limit set for Cd. The iodine was found in so high levels (up to 5 g/kg) that this will be the limiting element for intake of sugar kelp. Moreover, the concentrations of total As found from September to March were above the EU regulatory levels for feed ingredients (40 mg/kg DW. Pb and Cd concentrations were below threshold values. The vitamin E (alpha-tocopherol) concentrations (6-25 mg/kg DW) were similar to what is found in broccoli. Generally the year-round variations were due season, and not between the two locations (reference and IMTA), so harvest time is important for optimized use, and may be conflicting with highest yields of sugar kelp. High concentrations of iodine and total As may be of concern regarding food and feed regulations, respectively.

General information

State: Published
Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application, Research Group for Nano-Bio Science, Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark
Authors: Silva Marinho, G. (Intern), Holdt, S. L. (Intern), Sloth, J. J. (Intern), Jacobsen, J. (Ekstern), Angelidaki, I. (Intern)
Number of pages: 1
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were performed at 49 outlet ports. These measurements allowed quantifying the spreading and dilution of the solute plumes at the outlet cross section. Direct evidence of plume spiraling and visual proof of helical flow was obtained by freezing and slicing the porous media at different cross sections and observing the dye-tracer distribution. We simulated flow and transport to interpret our experimental observations and investigate the effects of helical flow on mixing-controlled reactive transport. The simulation results were evaluated using metrics of reactive mixing such as the critical dilution index and the length of continuously injected steady-state plumes. The results show considerable reaction enhancement, quantified by the remarkable decrease of reactive plume lengths (up to four times) in helical flows compared to analogous scenarios in uniform flows.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, University of Tubingen
Authors: Ye, Y. (Ekstern), Chiogna, G. (Ekstern), Cirpka, O. A. (Ekstern), Grathwohl, P. (Ekstern), Rolle, M. (Intern)
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Scopus rating (2015): SJR 1.047 SNIP 0.978 CiteScore 1.89
Web of Science (2015): Indexed yes
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Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.311 SNIP 1.239 CiteScore 2.28
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ISI indexed (2012): ISI indexed yes
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Scopus rating (2011): SJR 1.485 SNIP 1.225 CiteScore 2.28
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Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.69 SNIP 1.215
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.694 SNIP 1.259
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BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.96 SNIP 1.314
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.926 SNIP 1.332
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.787 SNIP 1.324
Web of Science (2006): Indexed yes
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Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.672 SNIP 1.214
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.371 SNIP 1.166
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.25 SNIP 1.241
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.063 SNIP 1.429
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Scopus rating (2000): SJR 1.877 SNIP 1.252
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Experiments and inverse modeling to plant uptake and degradation of eight emerging organic contaminants

General information
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Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Hurtado, C. (Ekstern), Trapp, S. (Intern), Bayona, J. (Ekstern)
Pages: 161-161
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Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016

Explanatory analysis of the relationship between atmospheric circulation and occurrence of flood generating events in a coastal city
The aim of this study is to enhance the understanding of the occurrence of flood generating events in urban areas by analyzing the relationship between large-scale atmospheric circulation and extreme precipitation events, extreme sea water level events and their simultaneous occurrence, respectively. To describe the atmospheric circulation we used the Lamb circulation type (LCT) classification and re-grouped it into Lamb circulation classes (LCC). The daily LCCs/LCTs were connected with rare precipitation and water level events in Aarhus, a Danish coastal city. Westerly and cyclonic LCCs (W, C, SW, and NW) showed a significantly high occurrence of extreme precipitation. Similarly, for extreme water level events westerly LCCs (W and SW) showed a significantly high occurrence. Significantly low occurrence of extreme precipitation and water level events was obtained in easterly LCCs (NE, E, and SE). For concurrent events significantly high occurrence was obtained in LCC W. We assessed the change in LCC occurrence frequency in the future based on two regional climate models (RCMs). The projections indicate that the westerly directions in LCCs are expected to increase in the future. Consequently, simultaneous occurrence of extreme water level and precipitation events is expected to increase in the future as a result of change in LCC frequencies. The RCM projections for LCC frequencies are uncertain because the representation of current LCCs is poor; a large number of days cannot be classified and the frequencies of the days that can be classified differ from the observed time series. This article is protected by copyright. All rights reserved.
In the present study, alginate extraction from the brown seaweed Sargassum muticum was studied using single factor analysis. Response Surface Methodology-Central Composite Rotatory design (RSM-CCRD) was performed to reduce and optimize extraction temperature, alkali concentration, and consumption of solvent. Different interaction effect of three extraction factors of temperature (60–100 °C), alkali (1–5 %), and aqueous ethanol (70–100 %) were studied to reduce residual waste. The result showed that the optimum extraction yield (13.57 %) was obtained with 86 °C temperature, 3 % alkali, and 93 % ethanol. A second order polynomial equation using multiple regression analysis was developed, and the predicted extraction yield showed a high coefficient of determination (R² = 0.98) with the experimental alginate yield. The functionality of extracted alginate and residual supernatant left over after extraction were evaluated for total polyphenols and its antioxidant capacity. The extracted alginate was further characterized using fluorescence spectrophotometer and nuclear magnetic resonance spectroscopy. The 1H NMR data revealed that extracted alginate has an M/G ratio of 1.08 and η<1.
Fate of cocaine drug biomarkers in sewer system: the role of suspended solids in biotransformation and sorption

Biochemical processes determining the fate of micropollutants in wastewater are not limited to treatment plants (WWTPs), occurring also in sewer systems after discharge by excretion. In-sewer processes are associated mainly to the presence of biofilm attached on pipelines and suspended solids in raw sewage. Among existing micropollutants, in-sewer fate assessment is specifically relevant to illicit drugs, impacting the calculation of consumption levels in catchments according to the wastewater-based epidemiology approach (Zuccato et al., 2005). However, there is still a knowledge gap on the fate of illicit drugs in sewer systems. This study aims at assessing the role of suspended solids on the biotransformation and sorption in raw sewage of eight illicit drug biomarkers (cocaine, heroin, methadone, mephedrone, ketamine, methamphetamine, MDMA and THC and their urinary metabolites).

Separate sets of batch experiments were performed to assess biotransformation and sorption of illicit drugs under aerobic and anaerobic conditions, prevailing in sewer systems. Biotransformation experiments were started by spiking a mixture of standards in methanol to batch reactors (final concentration of 10 μg L-1). Nine samples (240 ml) were taken over 48 h. Immediately after collection, samples were spiked with deuterated standards (final concentration 360 ngL-1) and stored at -20°C. Control experiments were also performed using mineral water under same experimental conditions of biotransformation experiments. Sorption experiments were performed according to the same procedure and with inactivation of biomass using sodium azide (0.05% v/v). Sample preparation and analysis consisted of solid phase extraction (SPE) with Oasis HLB cartridges followed by liquid chromatography coupled to high resolution mass spectrometry. The Activated Sludge Model for Xenobiotics (ASM-X) (Plösz et al., 2013) was used to simulate biotransformation and sorption of spiked chemicals. Monte Carlo method employing Latin Hypercube Sampling (LHS) of
parameter space was used to estimate first-order abiotic (kabiotic, d⁻¹) and pseudo-first-order biotransformation rate constants (kbio, L g⁻¹ d⁻¹), with root mean square normalized error as objective function. Sorption coefficients (Kd) were calculated from the decrease of aqueous concentrations during experiments.

Experimental and modelling results are illustrated in Figure 1 and Table 1, which summarize experimental results and estimated parameter values for cocaine (COC) and its major metabolites benzoylecgonine (BE), ecygonine-methyl-ester (EME) and cocaethylene (CE). Our results suggest the formation of BE from COC and CE. COC transformation to CE and EME was assumed negligible (Plósz et al., 2013; Bisceglia and Lippa, 2014). A comparison of results from different experiments showed that abiotic transformation was overall prevalent under both redox conditions. Under anaerobic condition, in particular, transformation was almost completely associated to abiotic processes. Biotransformation rate constants (kbio) could not be estimated and should be considered negligible. These evidences are in agreement with earlier studies illustrating that chemical hydrolysis plays a major role in the transformation of cocaine biomarkers (Bisceglia and Lippa 2014). In addition, limited sorption for EME (Kd=0.7 L g⁻¹) and BE (Kd=0.1 L g⁻¹) and no sorption for COC and CE were observed.
Background

Plant breeding is crucial in creating organic crop production systems that can better cope with interacting stresses such as pests and diseases (especially seed-borne diseases), weeds and the increasingly erratic and unpredictable variation in climate and weather. In this context, COBRA aimed to support and develop organic plant breeding and seed production...
with a focus on increasing the use and potential of plant material with high genetic diversity in cereals (wheat and barley) and grain legumes (pea and faba bean), through coordinating, linking and expanding existing breeding and research. Although systems based on high, within-crop diversity have shown promising results in organic systems and are now subject to intensive research, their benefits cannot be exploited currently, due to agronomic, regulatory and other hurdles. Also, it is currently unclear which plant breeding approaches, high diversity or otherwise, are most efficient to breed varieties for organic agriculture. To help these aims, COBRA’s work was arranged into a management workpackage to coordinate the work and the following five sub-programmes:

1. To improve methods ensuring seed quality and health

   Progress was made in handling individual seeds in terms of their actual and potential resistance to seed-borne disease. One of the most important problems, bunt of wheat, was advanced considerably in terms of the ‘gene for gene’ interaction between host and pathogen and in observing the performance of the, currently, most effective resistance genes. Wheat populations, grown over two generations, did not change in their response to bunt. In barley, progress was made in identifying and confirming known and novel resistances to a range of the most important seed-borne diseases. Benign sprays were confirmed as potentially useful for Ascochyta blight control in peas.

2. To determine the potential to increase resilience, adaptability, and overall performance in organic systems by using crop diversity at various levels

   Valuable progress was made in confirming, expanding and understanding the resilience of the performance of composite cross populations of wheat. A wide range of molecular markers were identified in barley which will help in selecting genotypes adapted to expected future changes in climate and weather. Progress was also made with organic trials of grain legumes. The early 6 of 54 development stages of composite cross populations in the field is now better understood in relation to nutrient use efficiency.

3. To improve breeding efficiency and to develop novel breeding methods to enhance and maintain crop diversity

   A range of different technologies has been improved for selecting within composite cross populations using NIR spectrometry, colour markers and molecular markers; many of these are non-destructive. Of more immediate value, new composite cross populations involving winter and spring wheat genotypes and including bunt resistant genotypes have now been made. Progress has also been made with bulk breeding of peas, although single genotypes may still be preferred for cropping applications.

4. To identify and remove structural barriers to organic plant breeding and seed production

   It was important to bring together interested individuals and groups from different European countries to cover available experience and discuss further developments. Most importantly, this was also done directly in consultation with DGSanco, and booklets on the discussions and findings were published and distributed.

5. To improve networking and dissemination in organic plant breeding

   COBRA successfully established and utilised its website, produced regular newsletters and undertook training and farm days throughout the life of the project to raise the awareness of the project and to also communicate and discuss the finds and outcomes of the work undertaken by its various partners.

Conclusion.

COBRA’s strength is its focus on coordinating, linking and expanding ongoing organic breeding activities in cereals and grain legumes across Europe, drawing together experts from previously separated areas.

General information

State: Published

Organisations: Department of Chemical and Biochemical Engineering, Rise National Laboratory for Sustainable Energy, Department of Environmental Engineering, The Organic Research Centre (ORC), Aegean Agricultural Research Institute (AARI), Agrologica, L’Associazione Italiana per l’Agricoltura Biologica (AIAB), University of Natural Resources and Life Sciences, Vienna (BOKU), Centro di Ricerca p. i. Produzioni Foraggere e Lattiero-Case, Centre de Recherche Public Gabriel Lippmann (CRP-GL), INAGRO, INRA Institut National de La Recherche Agronomique, Technical Institute of Organic Farming (ITAB), Institute for Sustainable Development (ISD), JNK Plant Breeding, University of Kassel, Lantmannen, Nordic Seed A/S, SRUC, Sejet Plantbreeding, Swedish University of Agricultural Sciences, Technische Universität München, Seges Knowledge Centre for Agriculture, Bayerische Landesanstalt für Landwirtschaft, University of Udine, University of Maribor, Universität Gent, Oikos - Organic Norway, Forschungsinstitut fur Biologischen Landbau, Graminor, Estonian Crop Research Institute, Organic Seed Producers, State Priekuli Plant Breeding Institute, State Stende Cereal Breeding Institute, Hungarian Academy of Sciences, Saatzucht Donau GesmbH & CoKG, Nordic Genetic Resource Center, Louis Bolk Institute, Humboldt-University of Berlin, Aalborg Universitet København, Aarhus University, Norwegian Institute for Agricultural and Environmental Research, University of Copenhagen, MTT Agrifood Research


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Flood risk assessment as an integral part of urban planning

General information
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Organisations: Department of Environmental Engineering, Urban Water Systems, Monash University, DHI Water and Environment
Authors: Löwe, R. (Intern), Urich, C. (Ekstern), Sto Domingo, N. (Ekstern), Mark, O. (Ekstern), Deletic, A. (Ekstern), Arnbjerg-Nielsen, K. (Intern)
Number of pages: 1
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Flux behaviour under different operational conditions in osmosis process
The transport of water molecules across a semi-permeable membrane is driven by the osmotic pressure difference between feed and draw solution. Two different operational modes can be distinguished, namely FO mode when the active membrane layer is facing the wastewater (feed), and PRO mode when the active membrane layer is facing draw solution. Osmosis process can be affected by several factors, such as operating conditions (temperature and cross flow velocity), feed and draw solution properties, and membrane characteristics. These factors can significantly contribute to the efficiency of the process itself. In order to implement the osmosis process on an industrial scale, process economy need to be taken into consideration, as well as the desired final product quality. Membrane performance can be evaluated based on the water permeability and the selectivity of the membrane. The permeability coefficient (A) defined as the water flux through the membrane will be experimentally determined. Likewise selectivity of the membrane (B) will be measured, which will tell us about membrane retention properties of certain substances dissolved in feed solution. The aim of the study is to determine water flux and reverse salt flux through the semi-permeable membrane at FO and PRO modes using two types of membranes and using three different draw solutions (NaCl, MgCl2, and CaCl2). The process efficiency at different conditions will be assessed based on physical and chemical analysis such as pH, conductivity, and total dissolved solids. Taken together our results can contribute understanding of the how performance of asymmetric FO membranes can be enhanced by feed and draw properties, membrane characteristics and operational conditions.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, University of Maribor
Authors: Korenak, J. (Ekstern), Zarebska, A. (Intern), Buksek, H. (Ekstern), Hélix-Nielsen, C. (Intern), Petrinic, I. (Ekstern)
Number of pages: 1
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Food waste from Danish households: Generation and composition
Sustainable solutions for reducing food waste require a good understanding of food waste generation and composition, including avoidable and unavoidable food waste. We analysed 12 tonnes of residual household waste collected from 1474 households, without source segregation of organic waste. Food waste was divided into six fractions according to avoidability, suitability for home-composting and whether or not it was cooked, prepared or had been served within the household. The results showed that the residual household waste generation rate was 434 ± 18 kg per household per
year, of which 183 ± 10 kg per year was food waste. Unavoidable food waste amounted to 80 ± 6 kg per household per year, and avoidable food waste was 103 ± 9 kg per household per year. Food waste mass was influenced significantly by the number of occupants per household (household size) and the housing type. The results also indicated that avoidable food waste occurred in 97% of the households, suggesting that most Danish households could avoid or at least reduce how much they generate. Moreover, avoidable and unavoidable food waste was more likely to be found in houses containing more than one person than in households with only one occupant.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Econet A/S
Authors: Edjabou, M. E. (Intern), Petersen, C. (Ekstern), Scheutz, C. (Intern), Astrup, T. F. (Intern)
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Scopus rating (2016): CiteScore 4 SJR 1.354 SNIP 2.044
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BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.739 SNIP 2.256 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
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Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.822 SNIP 2.435 CiteScore 3.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.611 SNIP 2.184 CiteScore 2.91
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Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.698 SNIP 2.085 CiteScore 2.99
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
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Scopus rating (2010): SJR 1.555 SNIP 1.78
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.502 SNIP 1.899
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.378 SNIP 2.13
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.035 SNIP 1.767
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General information
State: Published
Authors: Bjerg, P. L. (Intern), Johnsen, A. R. (Ekstern), Jessen Rasmussen, J. (Ekstern), Jensen, P. N. (Ekstern)
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DTU_Geus_DCE_2016_Videnskabelig_udredning_af_international_viden_om_skifergas_relateret_til_en_dansk_kontekst.pdf
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Forureningsundersøgelser i kalkmagasiner: metoder til karakterisering af forureningsfordeling

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Region Hovedstaden
Authors: Fjordbøge, A. S. (Intern), Broholm, M. M. (Intern), Mosthaf, K. (Intern), Janniche, G. S. (Intern), Binning, P. J. (Intern), Bjerg, P. L. (Intern), Skov, B. H. (Intern), Kern-Jespersen, H. (Ekstern)
Number of pages: 2
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Publisher: ATV Jord og Grundvand
Main Research Area: Technical/natural sciences
Conference: 07/03/2016 - 07/03/2016
Electronic versions:
1_2_3_Mette_Broholm.pdf
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Forward osmosis treatment of effluents from anaerobic digestion: correlation between membrane performance and biogas potential

General information
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Organisations: Department of Environmental Engineering, Water Technologies, Residual Resource Engineering, Technical University of Denmark
Authors: Schneider, C. (Intern), Sathyadev Rajmohana, R. (Ekstern), Tsapekos, P. (Intern), Angelidaki, I. (Intern), Zarebska, A. (Intern), Hélix-Nielsen, C. (Intern)
Pages: 514-518
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Title of host publication: Conference handbook 9th international membrane science & technology conference
Place of publication: Adelaide, Australia
Main Research Area: Technical/natural sciences
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Fremstilling af et højværdisubstrat til biogasproduktion ved sampulpning af have/parkaffald og kildesorteret organisk dagrenovation vha. Ecogiteknologien
**Full scale amendment of a contaminated wood impregnation site with iron water treatment residues**

Iron water treatment residues (Fe-WTR) are a free by-product of the treatment of drinking water with high concentration of iron oxides and potential for arsenic sorption. This paper aims at applying Fe-WTR to a contaminated site, measuring the reduction in contaminant leaching, and discussing the design of delivery and mixing strategy for soil stabilization at field scale and present a cost-effective method of soil mixing by common contractor machinery. Soil contaminated by As, Cr, and Cu at an abandoned wood impregnation site was amended with 0.22% (dw) Fe-WTR. To evaluate the full scale amendment a 100 m² test site and a control site (without amendment) were monitored for 14 months. Also soil analysis of Fe to evaluate the degree of soil and Fe-WTR mixing was done. Stabilization with Fe-WTR had a significant effect on leachable contaminants, reducing pore water As by 93%, Cu by 91% and Cr by 95% in the upper samplers. Dosage and mixing of Fe-WTR in the soil proved to be difficult in the deeper part of the field, and pore water concentrations of arsenic was generally higher. Despite water logged conditions no increase in dissolved iron or arsenic was observed in the amended soil. Our field scale amendment of contaminated soil was overall successful in decreasing leaching of As, Cr and Cu. With minor improvements in the mixing and delivery strategy, this stabilization method is suggested for use in cases, where leaching of Cu, Cr and As constitutes a risk for groundwater and freshwater.
Functional traits of urban trees: Air pollution mitigation potential

In an increasingly urbanized world, air pollution mitigation is considered one of most important issues in city planning. Urban trees help to improve air quality by facilitating widespread deposition of various gases and particles through the provision of large surface areas as well as through their influence on microclimate and air turbulence. However, many of these trees produce wind-dispersed pollen (a known allergen) and emit a range of gaseous substances that take part in photochemical reactions - all of which can negatively affect air quality. The degree to which these air-quality impacts are manifested depends on species-specific tree properties: that is, their "traits". We summarize and discuss the current knowledge on how such traits affect urban air pollution. We also present aggregated traits of some of the most common tree species in Europe, which can be used as a decision-support tool for city planning and for improving urban air-quality models.

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Web of Science (2017): Indexed Yes
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Scopus rating (2016): CiteScore 3.85 SJR 4.779 SNIP 3.631
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 5.233 SNIP 3.238 CiteScore 3.34
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 4.607 SNIP 3.227 CiteScore 4.32
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 4.172 SNIP 2.776 CiteScore 3.67
Gap-filling of dry weather flow rate and water quality measurements in urban catchments by a time series modelling approach

Flow rate and water quality dry weather time series in combined sewer systems might contain an important amount of missing data due to several reasons, such as failures related to the operation of the sensor or additional contributions during rainfall events. Therefore, the approach hereby proposed seeks to evaluate the potential of the Singular Spectrum Analysis (SSA), a time-series modelling/gap-filling method, to complete dry weather time series. The SSA method is tested by reconstructing 1000 artificial discontinuous time series, randomly generated from real flow rate and total suspended solids (TSS) online measurements (year 2007, 2 minutes time-step, combined system, Ecully, Lyon, France). Results show up the potential of the method to fill gaps longer than 0.5 days, especially between 0.5 days and 1 day (mean NSE > 0.6) in the flow rate time series. TSS results still perform very poorly. Further analysis at different temporal scales might be needed.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, University of Lyon
Authors: Sandoval, S. (Ekstern), Vezzaro, L. (Intern), Bertrand-Krajewski, J. (Ekstern)
Number of pages: 4
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Generation of organic waste from institutions in Denmark: case study of the Technical University of Denmark
As a response to the growing pressure on the supply chains, developing a resource-efficient circular economy will be fundamental to satisfy the future demands for material resources. In this context, the Danish Government, in 2013, launched its Resource Strategy Plan, mandating that, by 2018 at least 60% of organic waste – that cannot be prevented or reduced – generated by service sector, should be source-segregated and collected separately. In order to establish the
baseline of the current situation, and to allow for any evaluation of performance against target indicators, data on solid waste generation and composition are required.

The overall aim of this study was to quantify the potential for source-segregated organic waste as well as mixed waste from institution.

This study was carried at the Department of Environmental Engineering at Technical University of Denmark. In the course of this study, two plastic waste bins of 60 L each were placed in the kitchens: organic waste bins and mixed waste bins. Organic waste and mixed waste from these kitchens were collected and weighed separately, on a daily basis, during 133 working days (29 weeks). However, waste was not sampled during weekends and public holidays, when the offices were officially closed. Furthermore, the composition of source-segregated organic waste was analysed to investigate its purity. During the sampling period, the number of employees coming to work at the department was recorded. These data were used to investigate any relationship between mass of discarded waste (source-segregated organic and mixed waste) and the number of employee coming to work at the department.

The result showed that 20 to 60 days (e.g. working days) should be considered to obtain reliable data when sampling waste from an institution.

We found a significant correlation between mass of source-segregated organic waste and the number of employees coming to work at the department (0.70 with 95% HDI 0.6 and 0.78). Similarly, there was a significant correlation between mixed waste and number of employees (0.49 with 95% HDI 0.3 and 0.62).

The generate rates of source-segregated organic waste amounted to 23 ± 5 kg/employee/year, of which 20 ± 5 kg/employee/year was source-segregated, with a considerably high purity of 99%. Mixed waste amounted to 10 ± 5 kg/employee/year.

These results show that source-segregated organic waste from institutions offers promising potential. They also suggest that recycling target for source-segregated organic waste might be achievable with reasonable logistical ease in institution areas.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
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Generation of synthetic influent data to perform (micro)pollutant wastewater treatment modelling studies

The use of process models to simulate the fate of micropollutants in wastewater treatment plants is constantly growing. However, due to the high workload and cost of measuring campaigns, many simulation studies lack sufficiently long time series representing realistic wastewater influent dynamics. In this paper, the feasibility of the Benchmark Simulation Model No. 2 (BSM2) influent generator is tested to create realistic dynamic influent (micro)pollutant disturbance scenarios. The presented set of models is adjusted to describe the occurrence of three pharmaceutical compounds and one of each of its metabolites with samples taken every 2-4h: the anti-inflammatory drug ibuprofen (IBU), the antibiotic sulfamethoxazole (SMX) and the psychoactive carbamazepine (CMZ). Information about type of excretion and total consumption rates forms the basis for creating the data-defined profiles used to generate the dynamic time series. In addition, the traditional influent characteristics such as flow rate, ammonium, particulate chemical oxygen demand and temperature are also modelled using the same framework with high frequency data. The calibration is performed semi-automatically with two different methods depending on data availability. The 'traditional' variables are calibrated with the Bootstrap method while the pharmaceutical loads are estimated with a least squares approach. The simulation results demonstrate that the BSM2 influent generator can describe the dynamics of both traditional variables and pharmaceuticals. Lastly, the study is complemented with: 1) the generation of longer time series for IBU following the same catchment principles; 2) the study of the impact of in-sewer SMX biotransformation when estimating the average daily load; and, 3) a critical discussion of the results, and the future opportunities of the presented approach balancing model structure/calibration procedure complexity versus predictive capabilities.

**General information**

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Organisations: Department of Chemical and Biochemical Engineering, CAPEC-PROCESS, Department of Environmental Engineering, Water Technologies, University of Girona, Lund University
Number of pages: 13
GHG emission factors for bioelectricity, biomethane, and bioethanol quantified for 24 biomass substrates with consequential life-cycle assessment

Greenhouse gas (GHG) emission savings from biofuels dramatically depend upon the source of energy displaced and the effects induced outside the energy sector, for instance land-use changes (LUC). Using consequential life-cycle assessment and including LUC effects, this study provides GHG emission factors (EFs) for bioelectricity, biomethane, and bioethanol produced from twenty-four biomasses (from dedicated crops to residues of different origin) under a fossil and a non-fossil energy system. Accounting for numerous variations in the pathways, a total of 554 GHG EFs were quantified. The results showed that, important GHG savings were obtained with residues and seaweed, both under fossil and non-fossil energy systems. For high-yield perennial crops (e.g. willow and Miscanthus), GHG savings were achieved only under fossil energy systems. Biofuels from annual crops and residues that are today used in the feed sector should be discouraged, as LUC GHG emissions exceeded any GHG savings from displacing conventional energy sources. (C) 2016 Elsevier Ltd. All rights reserved.
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GISMOWA - GIS assisted monitoring of drinking water quality

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
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Global warming potential of material fractions occurring in source-separated organic household waste treated by anaerobic digestion or incineration under different framework conditions

This study compared the environmental profiles of anaerobic digestion (AD) and incineration, in relation to global warming potential (GWP), for treating individual material fractions that may occur in source-separated organic household waste (SSOHW). Different framework conditions representative for the European Union member countries were considered. For AD, biogas utilisation with a biogas engine was considered and two potential situations investigated – biogas combustion with (1) combined heat and power production (CHP) and (2) electricity production only. For incineration, four technology options currently available in Europe were covered: (1) an average incinerator with CHP production, (2) an average incinerator with mainly electricity production, (3) an average incinerator with mainly heat production and (4) a state-of-the-art incinerator with CHP working at high energy recovery efficiencies. The study was performed using a life cycle assessment in its consequential approach. Furthermore, the role of waste-sorting guidelines (defined by the material fractions allowed for SSOHW) in relation to GWP of treating overall SSOHW with AD was investigated. A case-study of treating 1tonne of SSOHW under framework conditions in Denmark was conducted. Under the given assumptions, vegetable food waste was the only material fraction which was always better for AD compared to incineration. For animal food waste, kitchen tissue, vegetation waste and dirty paper, AD utilisation was better unless it was compared to a highly efficient incinerator. Material fractions such as moulded fibres and dirty cardboard were attractive for AD, albeit only when AD with CHP and incineration with mainly heat production were compared. Animal straw, in contrast, was always better to incinerate. Considering the total amounts of individual material fractions in waste generated within households in Denmark, food waste (both animal and vegetable derived) and kitchen tissue are the main material fractions allowing GWP mitigation with AD when it is compared to incineration. The inclusion of other material fractions in SSOHW sorting guidelines may be considered of less importance.
GlobWetland Africa: Implementing Sustainable Earth Observation Based Wetland Monitoring Capacity in Africa and Beyond

Lack of data, appropriate information and challenges in human and institutional capacity put a serious constraint on effective monitoring and management of wetlands in Africa. Conventional data are often lacking in time or space, of poor quality or available at locations that are not necessarily representative for wetlands. Therefore, the Ramsar secretariat, the global coordinating body of the Ramsar Convention on Wetlands, has long recommended making more use of new and innovative technologies, such as those offered by remote sensing. Yet, access to suitable remote sensing data for monitoring wetlands in Africa has also traditionally been constrained either because of high costs or, especially in Equatorial Africa, owing to frequent cloud cover. To meet these challenges the European Space Agency has launched GlobWetland Africa as a major initiative to facilitate the exploitation of satellite observations for the conservation, wiseuse and effective management of wetlands in Africa and to provide African stakeholders with the necessary EO methods and tools to better fulfil their commitments and obligations towards the Ramsar Convention on Wetlands.

The main objective of GlobWetland Africa (GW-A) is to provide the major actors involved in the implementation of the Ramsar Convention of Wetlands in Africa with EO methods and tools to better assess the conditions of wetlands under their areas of jurisdiction/study, and to better monitor their trends over time. To this end, an open source wetland observing system, referred to as the GW-A Toolbox, will be developed, implemented and validated for a series of geo-information products over a number of representative pilot sites in North, West, Central and East Africa. The GW-A toolbox unifies proven and stable open source software into a single graphical user interface that will enable the users to: [i] access and exploit Sentinel data and other relevant contributing missions e.g. ERS, ENVISAT, Landsat and ALOS; [ii] operationally map, assess and inventorize wetlands through a number of dedicated wetland information products and indicators needed for effective wetland management and decision support, [iii] receive a freely available, open, flexible and modifiable framework for easy establishment of new wetland observatories, for easy integration in existing observatory infrastructures and for easy adaptation to new requirements, e.g. changes in management processes.

General information
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Organisations: Department of Environmental Engineering, Water Resources Engineering, European Space Agency, DHI GRAS, GeoVille, ITC, Brockmann Consult
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Grain protein concentration and harvestable protein under future climate conditions. A study of 108 spring barley accessions
In the present study a set of 108 spring barley (H. vulgare L.) accessions were cultivated under predicted future levels of temperature and [CO2] as single factors and in combination (IPCC, AR5, RCP8.5). Across all genotypes, elevated [CO2] (700 ppm day/night) slightly decreased protein concentration by 5%, while elevated temperature (+5 °C day/night) substantially increased protein concentration by 29%. The combined treatment increased protein concentration across accessions by 8%. This was an increase less than predicted from strictly additive effects of the individual treatments. Despite the increase in grain protein concentration, the decrease in grain yield at combined elevated temperature and elevated [CO2] resulted in 23% less harvestable protein. There was variation in the response of the 108 accessions, which
might be exploited to at least maintain if not increase harvestable grain protein under future climate change conditions.
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GrundRisk, Beregningsmodel til risikovurdering af grundvandstruende forureninger: Miljøprojekt nr. 1865

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Organisations: Department of Environmental Engineering, Water Resources Engineering, University of Copenhagen, Miljøstyrelsen
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Grundrisk - ny beregningsmodel til risikovurdering af grundvandstruende forureninger

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Harvesting microalgae using activated sludge can decrease polymer dosing and enhance methane production via co-digestion in a bacterial-microalgal process

Third generation biofuels, e.g. biofuels production from algal biomass, have gained attention due to increased interest on global renewable energy. However, crop-based biofuels compete with food production and should be avoided. Microalgal cultivation for biofuel production offers an alternative to crops and can become economically viable when combined with the use of used water resources. Besides nutrients and water, harvesting microalgal biomass represents one of the major costs related to biofuel production and thus efficient and cheap solutions are needed. In bacterial-algal systems, there is the potential to produce energy by co-digesting the two types of biomass. We present an innovative approach to recover microalgal biomass via a two-step flocculation using bacterial biomass after the destabilisation of microalgae with conventional cationic polymer. A short solids retention time (SRT) enhanced biological phosphorus removal (EBPR) system was combined with microalgal cultivation. Two different bacterial biomass removal strategies were assessed whereby bacterial biomass was collected from the solid-liquid separation after the anaerobic phase and after the aerobic phase. Microalgal recovery was tested by jar tests where three different chemical coagulants in coagulation-flocculation tests (AlCl3, PDADMAC and Greenfloc 120) were assessed. Furthermore, jar tests were conducted to assess the microalgal biomass recovery by a two-step flocculation method, involving chemical coagulants in the first step and bacterial biomass used in the second step to enhance the flocculation. Up to 97% of the microalgal biomass was recovered using 16 mg polymer/g algae and 0.1 g algae/g bacterial biomass. Moreover, the energy recovery by the short-SRT EBPR system combined with microalgal cultivation was assessed via biomethane potential tests. Up to 560 ± 24 mL
CH4/gVS methane yield was obtained by co-digesting bacterial biomass collected after the anaerobic phase and microalgal biomass. The energy recovery in terms of methane production obtained in the short-SRT EBPR system is about 40% of the influent chemical energy.

**General information**

State: Published
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High-frequency Observations of the Isotopic Composition of Soil, Stem and Root Respiration in a Danish Beech Forest

**General information**
State: Published
Organisations: Department of Environmental Engineering, Atmospheric Environment
Authors: Brændholt, A. (Intern), Larsen, K. S. (Intern), Ibrom, A. (Intern), Pilegaard, K. (Intern)
Number of pages: 1
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Main Research Area: Technical/natural sciences
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Publication: Research - peer-review › Poster – Annual report year: 2016

High-resolution rainfall time series for future climate

**General information**
How active ingredient localisation in plant tissues determines the targeted pest spectrum of different chemistries

BACKGROUND:
The efficacies of four commercial insecticides and of two research compounds were tested against aphids (Aphis craccivora and Myzus persicae), whiteflies (Bemisia tabaci) and red-spotted spider mites (Tetranychus urticae) in intrinsic (oral administration), curative (direct contact spray) and translaminar (arthropods infested on untreated leaf underside) assays. With a new translaminar model, the transport across the leaf cuticle and tissues and the electrochemical distribution of test compounds in cellular compartments and apoplast were calculated.

RESULTS:
The comparison of both information sets revealed that the intracellular localisation of active ingredients determines the performance of test compounds against different target pests because of different feeding behaviours: mites feed on mesophyll, and aphids and whiteflies mostly in the vascular system. Polar compounds have a slow adsorption into leaf cells and thus a favourable distribution into apoplast and xylem sap. Slightly lipophilic bases get trapped in vacuoles, which is a less suited place to control hemipteran pests but appropriate to control mites. Non-favourable cellular localisation led to a strong reduction in translaminar efficacy against phloem feeders.

CONCLUSION:
Prediction and optimisation of intracellular localisation of pesticides add valuable new information for targeted bioavailability and can indicate directions for improved pesticide design. © 2015 Society of Chemical Industry.
How can we make Fickian dispersion models useful in practice?

**General information**

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Organisations: Department of Environmental Engineering, Water Resources Engineering, Stanford University

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Publication date: 2016

Event: Abstract from AGU Fall meeting 2016, San Francisco, United States.
How important is drinking water exposure for the risks of engineered nanoparticles to consumers?
This study explored the potential for engineered nanoparticles (ENPs) to contaminate the UK drinking water supplies and established the significance of the drinking water exposure route compared to other routes of human exposure. A review of the occurrence and quantities of ENPs in different product types on the UK market as well as release scenarios, their possible fate and behaviour in raw water and during drinking water treatment was performed. Based on the available data, all the ENPs which are likely to reach water sources were identified and categorized. Worst case concentrations of ENPs in raw water and treated drinking water, using a simple exposure model, were estimated and then qualitatively compared to available estimates for human exposure through other routes. A range of metal, metal oxide and organic-based ENPs were identified that have the potential to contaminate drinking waters. Worst case predicted concentrations in drinking waters were in the low- to sub-µg/l range and more realistic estimates were tens of ng/l or less. For the majority of product types, human exposure via drinking water was predicted to be less important than exposure via other routes. The exceptions were some clothing materials, paints and coatings and cleaning products containing Ag, Al, TiO2, Fe2O3 ENPs and carbon-based materials.
How molecular internal-geometric parameters affect PB-PEO polymersome size in aqueous solution

Amphiphilic polybutadiene polyethylene oxide (PB-PEO) is one of the best known chemistries to form stable vesicular morphologies, stated as polymersomes, in aqueous environment. Mimicking cell membranes, these structures self-assemble in an “amphiphilic window” determined by 0.15 < f < 0.35 where f is the ratio between the hydrophilic block volume and the entire diblock volume. However the polymersome size distribution also depends on molecular weight (Mn) and in order to gain insight on how f and Mn together determine polymersome size, we prepared PB-PEO diblock copolymers with different block lengths and analyzed vesicle morphology via Dynamic light scattering (DLS) and Freeze-fracture transmission electron microscopy (FF-TEM). We found three main regimes: high f / low Mn with polymersomes of mixed diameter, high f / high Mn with mainly large polymersomes and low f, with mainly small polymersomes. In the first region, the polymersomes are highly polydisperse. There is a tendency towards increased diameter with increasing f and Mn. Taken together our findings can help to identify how polymersome self-assembly can be controlled to achieve size distribution specificity alleviating the need for subsequent tuning of size via extrusion. This can pave the way for cost-effective upscaling of polymersome production for biomedical and biomimetic applications. ©
How much biochar does gasification energy need to be carbon neutral?

Indirect land use changes (iLUC) from bioenergy emerge whenever an energy crop is planted in arable land. Due to their overarching magnitude from a life-cycle perspective, they have been repeatedly recommended to be included in bioenergy’s greenhouse gas (GHG) accountings, despite their challenging quantification and inherent uncertainties. Marginal or abandoned lands have been often quoted as the solution to avoid these undesired effects from bioenergy. However, land abandonment and marginalization is to a large extent a socio-economic process, and thus heavily depends on specific, constantly changing socio-political context and economic circumstances in place. We suggest a carbon negative bioenergy system that compensates for potential iLUC emissions and losses in soil organic carbon (SOC). A consequential life cycle assessment on willow bioenergy has been performed, distinguishing marginal and arable land scenarios. Specific soil types and their estimated SOC changes have been considered [9], as well as iLUC emissions for the arable case. Taking the study case of a willow plantation combined with a medium-scale gasification plant in Denmark, we illustrate the biochar needed from the process in order to remain carbon neutral. The time scopes assessed are 20 and 100 years and it is assumed a fossil fuel (FF) free Denmark beyond 2050 as targeted by government (no FF displacement occurs after 2050). Results show that willow on marginal land remains carbon negative (4% biochar fraction) for the short term, while as much as 31.8% of biochar (or 0.95 Mg C ha⁻¹ yr⁻¹) would be necessary in 100 years to be carbon neutral (taking natural vegetation as reference baseline). As for arable land willow, a biochar fraction of 34.1% (or 2.32 Mg C ha⁻¹ yr⁻¹) would be necessary in the short term to compensate for iLUC emissions, while a 4% would suffice to make it carbon negative in the long term, as iLUC “dilutes” over 100 years. To achieve such high biochar fractions (>10%), lower process temperatures are needed, which affect negatively the long-term stability of biochar. This can put at risk the claimed GWP reduction benefits. This study did not consider impacts on other environmental aspects as ecosystem services and biodiversity, which are deemed to be rather important and significant for iLUC.

General information
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Organisations: Department of Environmental Engineering, Atmospheric Environment, Department of Management Engineering, Quantitative Sustainability Assessment
How preparation and modification parameters affect PB-PEO polymersome properties in aqueous solution

The effect of formation and modification methods on the physical properties of polymersomes is critical for their use in applications relying on their ability to mimic functional properties of biological membranes. In this study, we compared two formation methods for polymersomes made from polybutadiene-polyethylene oxide diblock copolymers: detergent-mediated film rehydration (DFR) and solvent evaporation (SE). DFR-prepared polymersomes showed a three times higher permeability compared to SE-prepared polymersomes as revealed by stopped-flow light scattering. SE-prepared polymersomes broke down faster to structures <50 nm diameter when processed with extrusion, which was more pronounced at 5 mg mL⁻¹, compared to 10, 20, and 25 mg mL⁻¹. Our results indicate that the bilayer of SE-prepared polymersomes has a lower apparent fluidity. We also investigated the role of n-octyl-β-d-glucopyranoside (OG), a detergent typically used for reconstitution of membrane proteins into lipid bilayers. Specifically, we compared dialysis and biobeads for OG removal to investigate the influence of these methods on bilayer conformation and polymer rearrangement following detergent removal. There was no significant difference found between method, temperature, or time within each method. Our findings provide insight on how biocompatible polymersome production affects the physical properties of the resulting polymersomes.
How to Determine the Environmental Exposure of PAHs Originating from Biochar

Biochars are obtained by pyrolyzing biomass materials and are increasingly used within the agricultural sector. Owing to the production process, biochars can contain polycyclic aromatic hydrocarbons (PAHs) in the high mg/kg range, which makes the determination of the environmental exposure of PAHs originating from biochars relevant. However, PAH sorption to biochar is characterized by very high (10^4–10^6 L/kg) or extreme distribution coefficients (KD) (>10^6 L/kg), which makes the determination of exposure scientifically and technically challenging. Cyclodextrin extractions, sorptive bioaccessibility extractions, Tenax extractions, contaminant traps, and equilibrium sampling were assessed and selected methods used for the determination of bioavailability parameters for PAHs in two model biochars. Results showed that: (1) the KD values of typically 10^6–10^9 L/kg made the biochars often act as sinks, rather than sources, of PAHs. (2) Equilibrium sampling yielded freely dissolved concentrations (pg–ng/L range) that were below or near environmental background levels. (3) None of the methods were found to be suitable for the direct measurement of the readily desorbing fractions of PAHs (i.e., bioaccessibility) in the two biochars. (4) The contaminant-trap method yielded desorption-resistant PAH fractions of typically 90–100%, implying bioaccessibility in the high μg/kg to low mg/kg range.

General information
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Organisations: Department of Environmental Engineering, Environmental Chemistry, Agroscope ISS, Aarhus University, Norwegian Geotechnical Institute
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Publication information
Groundwater is an important source for drinking water in all corners of the globe, and in places like Denmark, it is the primary source for drinking water. Climate change and population growth will only lead to further dependence on groundwater as the supply for drinking water. However, the expanding population and industrialization of human civilization also leads to environmental consequences affecting groundwater sources. Storm-water and agricultural runoff, industrial spillage and dumping, acid mine drainage, and leakage from landfills are a few prime examples of routes of contamination for pollutants to enter groundwater systems. In order to make these contaminated water sources viable for human consumption, the use of reactive iron (i.e. Fe0 or zero-valent iron), and in particular nanoscale zero-valent iron
Taking place in the nZVI corrosion process. Finally, novel materials combining three different technologies were developed to elucidate better methods for delivering nZVI to a water contaminant and the underlying mechanisms. Various composite materials provided increased colloidal stability and reactivity for nZVI. Various washing and storage strategies of the MgAC coated nZVI were investigated. They were: washing the particles immediately after synthesis with a NaHCO₃ buffer, washing the particles after storing with a NaHCO₃ buffer, and washing the particles immediately after synthesis with a MgAC solution. For all the particle reactivity tests done, it was apparent that washing the particles after storing was detrimental to the material. The colloidal stability, reactive iron, and reactivity towards nitrate dropped rapidly through one week of storage. The other strategies, where washing was done immediately was able to preserve the three aforementioned properties much more efficiently though one week of storage, with MgAC washed particles faring better of the two. This pre-washing technique removes residual reactants in the synthesis mixture that can corrode the iron, and furthermore, pre-washing with MgAC adds more of the stabilizer to the material that protects the nZVI even more. Moreover, by looking deeper into the characteristics of uncoated nZVI, depending on the washing method, allowed for more insight to the nature of the mechanisms taking place during storage. It was observed that washing nZVI with MilliQ water after synthesis created an environment where the particles were slightly more oxidized from the start, which led to an increased formation of an iron-hydroxide shell during storage. Not washing nZVI or washing with the reductant NaBH₄ prohibited initial oxidation, leading to subsequent iron-oxide formation during storage. This is important, because the hydroxide shell promotes more electron transfer, whereas the oxide shell acts as a deactivation layer. The increased electron transfer then allowed for higher reactivity during storage, up to one week.

To make comparison and quantification for researchers, a simple and effective method to assess the reactivity of nZVI is extremely important. And, as it is now, most of the reactivity characterization methods are often analytically intensive, requiring expensive equipment, and often don’t respond uniformly to different nZVI-based materials. This study sought to solve this problem, by developing a simple colorimetric assay that is capable to taking a degradation product produced by nZVI reacting with a compound, and creating a color reaction detectable with a simple spectrophotometer. This was done by utilizing the indophenol reaction, which uses phenol and selected other reagents to produce a blue color. Phenol can be produced from the dehalogenation of 4-chlorophenol by nZVI, and to a greater extent by bimetallic nickel-nZVI. That simple method was then optimized to reduce reagent volumes, nickel concentration, and to broaden the range of detectable compounds. These compounds capable of being used in the color assay with the same set of reagents were ultimately aniline, ammonium, and phenol; all of which can be produced by the degradation reaction from nZVI. Finally, to compare the applicability of the colorimetric assay to common halogenated groundwater contaminants; it was compared to the dehalogenation of TCE, TCA, and atrazine. The colorimetric assay performed similarly to the degradation of those chlorinated compounds; meaning the assay can be a simple tool to assess the reactivity of any nZVI when ultimately targeting more difficult to analyze compounds in real-world sources.

Ultimately, the primary goal of this PhD study was to develop a robust nanocomposite material containing nZVI for water treatment systems. Taking the lessons learned from initial composite work using MgAC and COPs, the final material combined granular activated carbon with COP and nZVI. After a lengthy process in developing a method to chemically graft COP material to the surface of activated carbon, it was possible to impregnate that composite material with nZVI. Because of the activated carbon backbone, the final material proved to be an extremely robust material with the structural integrity to be used in a packed-bed column that is common when treating high volumes of water. Although, continued optimization of the material is necessary, preliminary results when adsorbing and degrading contaminants were very promising, outperforming activated carbon alone and just the carbon impregnated with nZVI. Also, a bonus effect was achieved in the process. In that the entire composite material, in particular the COP attached to the surface of the carbon, acted as a protective barrier from the effects of oxidation. The carbon-COP-nZVI composites exhibited nearly 100% reactive iron content upon synthesis, compared to much lower amounts in other reported nZVI composites or the carbon-nZVI produced in this study having only 80% reactive iron content.

The results of this PhD project were concluded in various advances in the application and assessment of nZVI and nZVI composite materials. Various composite materials provided increased colloidal stability and reactivity for nZVI. Various washing and storage strategies elucidated better methods for delivering nZVI to a water contaminant and the underlying mechanisms taking place in the nZVI corrosion process. Finally, novel materials combining three different technologies were developed.
to eventually lead to a robust water treatment system capable of degrading typically hard to remediate water pollutants.

**General information**

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**Relations**

Projects:  
Hybridized reactive iron-containing nano-materials for water purification

**Hyperspatial mapping of water, energy and carbon fluxes with Unmanned Aerial Vehicles**

Having spatially distributed estimates of energy, water and carbon fluxes between the land and the atmosphere is of critical importance for improving water resource management, agricultural production, weather forecasting, and climate prediction. Traditionally, satellite based remote sensing data of vegetation or temperature has been used as inputs into land surface models (LSMs). However, the coarse resolution of satellite based remote sensing (3-90 km) data could not accurately capture spatial heterogeneity in fluxes due to changes in topography, soil types, and vegetation. With significant advances in navigation, flight control, miniaturized platforms and sensors, Unmanned Aerial Vehicles (UAVs) can provide ultra-high spatial resolution imagery (1 cm to 1 m). This presents a good opportunity to improve land surface modeling. From this perspective, our study explores the possibility to incorporate UAV-based remote sensing into LSMs. A site growing an energy crop with field sensors (eddy covariance, radiation or soil moisture) at DTU-Risø is chosen for the pilot study. A hexacopter (Tarot) equipped with a six band multispectral camera (Visible and near infrared), a thermal camera and a digital camera regularly flew over the flux site. In the near future, a smart UAV platform combining rotary and fixed wing functionality will be used as platform. The imagery acquired by UAVs will be used to retrieve the vegetation indices and land surface temperature. These data used for land surface modeling to estimate biomass, plant diseases or stress, water uptake.

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Main Research Area: Technical/natural sciences  
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Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

**Identification and Application of Surrogate Models for Urban Drainage Modelling**

**General information**

State: Published  
Organisations: Department of Environmental Engineering, Urban Water Systems  
Authors: Thrysøe, C. (Intern), Borup, M. (Intern), Arnbjerg-Nielsen, K. (Intern)  
Pages: 37-37  
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Host publication Information
Identification of abiotic and biotic reductive dechlorination in a chlorinated ethene plume after thermal source remediation by means of isotopic and molecular biology tools

Thermal tetrachloroethylene (PCE) remediation by steam injection in a sandy aquifer led to the release of dissolved organic carbon (DOC) from aquifer sediments resulting in more reduced redox conditions, accelerated PCE biodegradation, and changes in microbial populations. These changes were documented by comparing data collected prior to the remediation event and eight years later. Based on the premise that dual C-Cl isotope slopes reflect ongoing degradation pathways, the slopes associated with PCE and TCE suggest the predominance of biotic reductive dechlorination near the source area. PCE was the predominant chlorinated ethene near the source area prior to thermal treatment. After thermal treatment, cDCE became predominant. The biotic contribution to these changes was supported by the presence of Dehalococcoides sp. DNA (Dhc) and Dhc targeted rRNA close to the source area. In contrast, dual C-Cl isotope analysis together with the almost absent VC 13C depletion in comparison to cDCE 13C depletion suggested that cDCE was subject to abiotic degradation due to the presence of pyrite, possible surface-bound iron (II) or reduced iron sulphides in the downgradient part of the plume. This interpretation is supported by the relative lack of Dhc in the downgradient part of the plume. The results of this study show that thermal remediation can enhance the biodegradation of chlorinated ethenes, and that this effect can be traced to the mobilisation of DOC due to steam injection. This, in turn, results in more reduced redox conditions which favor active reductive dechlorination and/or may lead to a series of redox reactions which may consecutively trigger biotically induced abiotic degradation. Finally, this study illustrates the valuable complementary application of compound-specific isotopic analysis combined with molecular biology tools to evaluate which biogeochemical processes are taking place in an aquifer contaminated with chlorinated ethenes.
Identifying novel nitrifying bacteria in rapid gravity sand filters using stable isotope probing

**General information**

**State:** Published

**Organisations:** Department of Environmental Engineering, Water Technologies, Urban Water Systems, University of Southern Denmark

**Authors:** Fowler, J. (Intern), Gülay, A. (Intern), Tatari, K. (Intern), Thamdrup, B. (Ekstern), Albrechtsen, H. (Intern), Sørensen, S. J. (Ekstern), Smets, B. F. (Intern)
Imaging geochemical heterogeneities using inverse reactive transport modeling: An example relevant for characterizing arsenic mobilization and distribution

The spatial distribution of reactive minerals in the subsurface is often a primary factor controlling the fate and transport of contaminants in groundwater systems. However, direct measurement and estimation of heterogeneously distributed minerals are often costly and difficult to obtain. While previous studies have shown the utility of using hydrologic measurements combined with inverse modeling techniques for tomography of physical properties including hydraulic conductivity, these methods have seldom been used to image reactive geochemical heterogeneities. In this study, we focus on As-bearing reactive minerals as aquifer contaminants. We use synthetic applications to demonstrate the ability of inverse modeling techniques combined with mechanistic reactive transport models to image reactive mineral lenses in the subsurface and quantify estimation error using indirect, commonly measured groundwater parameters. Specifically, we simulate the mobilization of arsenic via kinetic oxidative dissolution of As-bearing pyrite due to dissolved oxygen in the ambient groundwater, which is an important mechanism for arsenic release in groundwater both under natural conditions and engineering applications such as managed aquifer recharge and recovery operations. The modeling investigation is carried out at various scales and considers different flow-through domains including (i) a 1D lab-scale column (50 cm), (ii) a 2D lab-scale setup (60 cm x 30 cm) and (iii) a 2D field-scale domain (20 x 4 m). In these setups, synthetic dissolved oxygen data and forward reactive transport simulations are used to image the spatial distribution of As-bearing pyrite using the Principal Component Geostatistical Approach (PCGA) for inverse modeling. (C) 2015 Elsevier Ltd. All rights reserved.
Impact of bacterial activity on turnover of insoluble hydrophobic substrates (phenanthrene and pyrene)—Model simulations for prediction of bioremediation success

Many attempts for bioremediation of polycyclic aromatic hydrocarbon (PAH) contaminated sites failed in the past, but the reasons for this failure are not well understood. Here we apply and improve a model for integrated assessment of mass transfer, biodegradation and residual concentrations for predicting the success of remediation actions. First, we provide growth parameters for Mycobacterium rutilum and Mycobacterium pallens growing on phenanthrene (PHE) or pyrene (PYR) degraded the PAH completely at all investigated concentrations. Maximum metabolic rates $v_{\text{max}}$ and growth rates $\mu$ were similar for the substrates PHE and PYR and for both strains. The investigated Mycobacterium species were not superior in PHE degradation to strains investigated earlier with this method. Real-world degradation scenario simulations including diffusive flux to the microbial cells indicate: that (i) bioaugmentation only has a small, short-lived effect; (ii) Increasing sorption shifts the remaining PAH to the adsorbed/sequestered PAH pool; (iii) mobilizing by solvents or surfactants resulted in a significant decrease of the sequestered PAH, and (iv) co-metabolization e.g. by compost addition can contribute significantly to the reduction of PAH, because active biomass is maintained at a high level by the compost. The model therefore is a valuable contribution to the assessment of potential remediation action at PAH-polluted sites.

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Helmholtz Centre for Environmental Research
Authors: Rein, A. (Intern), Adam, I. K. (Ekstern), Miltner, A. (Ekstern), Brumme, K. (Ekstern), Kästner, M. (Ekstern), Trapp, S. (Intern)
Number of pages: 10
Impact of influent quality on green microalgal cultivation with used water resources – experimental assessment combined with image analysis

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Technical University of Denmark
Authors: Wágner, D. S. (Intern), Valverde Pérez, B. (Intern), Cazzaniga, C. (Ekstern), Steidl, M. (Ekstern), Dechesne, A. (Intern), Plósz, B. G. (Intern)
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Main Research Area: Technical/natural sciences
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Impact of Meteorological Parameters on Extracted Methane Concentration at Landfills

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Fathi Aghdam, E. (Intern), Scheutz, C. (Intern), Kjeldsen, P. (Intern)
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Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Impact of multicomponent ionic transport on pH fronts propagation in saturated porous media
Multicomponent ionic interactions have been increasingly recognized as important factors for the displacement of charged species in porous media under both diffusion- [1,2] and advection-dominated flow regimes [3,4]. In this study we investigate the propagation of pH fronts during multicomponent ionic transport in saturated porous media under flow-through conditions. By performing laboratory bench-scale experiments combined with numerical modeling we show the important influence of Coulombic effects on proton transport in the presence of ionic admixtures. The experiments were performed in a quasi two-dimensional flow-through setup under steady-state flow and transport conditions. Dilute solutions of hydrochloric acid with MgCl2 (1:2 strong electrolyte) were used as tracer solutions to experimentally test the effect of electrochemical cross-coupling on the migration of diffusive/dispersive pH fronts. We focus on two experimental scenarios, with different composition of tracer solutions, causing remarkably different effects on the propagation of the acidic fronts with relative differences in the penetration depth of pH fronts of 36% between the two scenarios and of 25% and 15% for each scenario with respect to the transport of ions at liberated state (i.e. without considering the charge effects). Also significant differences in the dilution of the distinct ionic plumes, quantified using the flux-related dilution index at the laboratory bench scale [5], were measured at the outflow of the flow-through system. The dilution of the pH plumes also changed considerably (26% relative difference) in the two flow-through experiments only due to the different composition of the pore water solution and to the electrostatic coupling of the ions in the flow-through setups. Numerical transport simulations were performed to interpret the laboratory experiments. The simulations were based on a
Multicomponent ionic formulation accurately capturing the Coulombic interactions between the transported ions in the flow-through system. The results of purely forward simulations show a very good agreement with the high-resolution measurements performed at the outlet of the flow-through setup and illustrate the importance of charge effects on pH fronts propagation in porous media.

**General information**

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Organisations: Department of Environmental Engineering, Water Resources Engineering, University of Tubingen
Authors: Muniruzzaman, M. (Ekstern), Rolle, M. (Intern)
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Impacts of urban development and climate change in exposing cities to pluvial flooding

Urban areas are characterized by very high concentrations of people and economic activities and are thus particularly vulnerable to flooding during extreme precipitation. Urban development and climate change are among the key drivers of changes in the exposure of cities to the occurrence and impacts of pluvial flooding. Cities are often dominated by large areas of impervious surfaces, that is, man-made sealed surfaces which water cannot penetrate, and increases in these – for example, as a consequence of urban development – can cause elevated run-off volumes and flood levels during precipitation. Climate change is expected to affect the intensity and frequency of extreme precipitation, with increases projected for many regions, including most parts of Europe.

**General information**

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Organisations: Department of Management Engineering, Systems Analysis, Department of Environmental Engineering, Urban Water Systems, Department of Applied Mathematics and Computer Science, Dynamical Systems
Authors: Kaspersen, P. S. (Intern), Drews, M. (Intern), Arnbjerg-Nielsen, K. (Intern), Madsen, H. (Intern)
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Improving methane production from digested manure biofibers by mechanical and thermal alkaline pretreatment

Animal manure digestion is associated with limited methane production, due to the high content in fibers, which are hardly degradable lignocellulosic compounds. In this study, different mechanical and thermal alkaline pretreatment methods were applied to partially degradable fibers, separated from the effluent stream of biogas reactors. Batch and continuous experiments were conducted to evaluate the efficiency of these pretreatments. In batch experiments, the mechanical pretreatment improved the degradability up to 45%. Even higher efficiency was shown by applying thermal alkaline pretreatments, enhancing fibers degradability by more than 4-fold. In continuous experiments, the thermal alkaline pretreatment, using 6% NaOH at 55 °C was proven to be the most efficient pretreatment method as the methane production was increased by 26%. The findings demonstrated that the methane production of the biogas plants can be increased by further exploiting the fraction of the digested manure fibers which are discarded in the post-storage tank.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Padua
Authors: Tsapekos, P. (Intern), Kougias, P. (Intern), Frison, A. (Ekstern), Raga, R. (Ekstern), Angelidaki, I. (Intern)
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Scopus rating (2014): SJR 2.41 SNIP 2.104 CiteScore 5.3
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Scopus rating (2013): SJR 2.412 SNIP 2.503 CiteScore 5.97
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Scopus rating (2012): SJR 2.389 SNIP 2.465 CiteScore 5.25
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Scopus rating (2011): SJR 2.314 SNIP 2.508 CiteScore 5.56
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Web of Science (2011): Indexed yes
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Scopus rating (2010): SJR 2.086 SNIP 2.355
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BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.912 SNIP 2.231
Web of Science (2009): Indexed yes
Improving the energy balance of grass-based anaerobic digestion through harvesting optimization

Meadows, marginal and environmentally sensitive areas are often considered as the source to find the needed organic feedstock for the proliferated full-scale biogas plant. However, the anaerobic digestion (AD) of biomass from these areas is connected with specific challenges, originated from their complex lignocellulosic structure. Thus, pretreatment methods are typically applied in order to disrupt their rigid matrix and improve the digestibility.

Despite the fact that a lot of research has already focused on various pretreatment methods for lignocellulosic substrates, their overall process efficiency is still doubted and thus, they are not widely used in full-scale biogas plants. In addition, these methods are typically associated with increased costs or energy demands. Hence, there is a need to find effective and cost-efficient solutions that boost biomass decomposition. In this concept, one way to improve the overall process efficiency is to minimize the number of individual process steps prior to feeding the biomass to the reactor.

The present study examined the effect of full-scale harvesting machines (i.e., a simple front mounted disc mower and a disc mower equipped additionally with a number of coarse barbs) to simultaneously mow and mechanically pretreat two different lignocellulosic substrates. Thus, ensiled meadow grass was initially examined at the first experimental set up. Regarding the second field test, an area sowed with regularly cultivated grass was harvested. In order to determine the treatment with the best energy balance, the energy demand during harvesting was compared to the practical methane yield. The biomethanation process was evaluated using triplicate batch assays under thermophilic conditions following the guidelines of the biochemical methane potential (BMP) protocol.

The findings showed that methane production can efficiently be enhanced by mechanical pretreatment applied at the harvesting step. More specifically, the most effective treatment yielded more than 10% increase in the bioenergy production from both examined grass silages. Our study demonstrates that the appropriate harvester can improve the energy output by approximately 2.4 GJ/ha under optimal conditions and subsequently, the overall sustainability of grass-based AD.
Including Bioconcentration Kinetics for the Prioritization and Interpretation of Regulatory Aquatic Toxicity Tests of Highly Hydrophobic Chemicals

Worldwide, regulations of chemicals require short-term toxicity data for evaluating hazards and risks of the chemicals. Current data requirements on the registration of chemicals are primarily based on tonnage and do not yet consider properties of chemicals. For example, short-term ecotoxicity data are required for chemicals with production volume greater than 1 or 10 tons according to REACH, without considering chemical properties. Highly hydrophobic chemicals are characterized by low water solubility and slow bioconcentration kinetics, which may hamper the interpretation of short-term toxicity experiments. In this work, internal concentrations of highly hydrophobic chemicals were predicted for standard acute ecotoxicity tests at three trophic levels, algae, invertebrate, and fish. As demonstrated by comparison with maximum aqueous concentrations at water solubility, chemicals with an octanol-water partition coefficient (Kow) greater than 10(6) are expected to reach sufficiently high internal concentrations for exerting effects within the test duration of acute tests with fish and invertebrates, even though they might be intrinsically toxic. This toxicity cutoff was explained by the slow uptake, i.e., by kinetics, not by thermodynamic limitations. Predictions were confirmed by data entries of the OECD’s screening information data set (SIDS) (n = 746), apart from a few exceptions concerning mainly organometallic substances and those with inconsistency between water solubility and Kow. Taking error propagation and model assumptions into account, we thus propose a revision of data requirements for highly hydrophobic chemicals with log Kow

Other text

Improving the prediction of in-sewer transformation of illicit drug biomarkers by identifying a new modelling framework

In the context of wastewater-based epidemiology, uncertainties associated with in-sewer transformation are often not considered. However, sewer systems are biological reactors in which the concentration of organic pollutants (primary pollutants, e.g. COD, and secondary pollutants, e.g. illicit drugs) is altered during transport. Although reduced stability of several drug biomarkers was shown in raw sewage and biofilm, evidence on the type of transformation (biotic or abiotic) and the effect of different redox conditions on transformation is currently insufficient. In this study, the biotransformation and abiotic transformation of 16 illicit drugs were assessed in wastewater and mineral water, respectively. The targeted illicit drugs were: cocaine and its metabolites benzoylecgonine, ecgonine methyl ester, and cocaethylene; heroin and its metabolites 6-monoacetylmorphine, morphine, and morphine-3-β-D-glucuronide; codeine and its metabolite norcodeine; methadone and its metabolite 2-ethylidene-1,5-dimethyl-3,3-diphenylpyrrolidine (EDDP); mephedrone; and tetrahydrocannabinol (THC) and its metabolites 11-hydroxy-Δ9-THC (THCOH), and 11-nor-9-carboxy-Δ9-THC (THCCOOH). All the transformation studies were performed using batch experiments under both aerobic and anaerobic conditions, while concomitantly assessing the degradation of primary pollutants. Furthermore, sorption to suspended solids and to reactor walls was also considered and quantified. The transformation of primary pollutants and illicit drugs in wastewater was simulated using Wastewater Aerobic/anaerobic Transformations in Sewers model (WATS)1 extended with the Activated Sludge Model for Xenobiotic trace chemicals (ASM-X)2. In addition, abiotic and biotic transformation pathways (based on available literature studies and statistical analysis) were considered for each drug biomarker. Our results suggest that ignoring the dynamics of biomass growth would result in significant overestimation (up to 385%) of aerobic biotransformation rate constants, whereas no significant difference was observed for anaerobic rate constants. Furthermore, abiotic transformation was found to be the main transformation mechanism for THC (aerobic conditions); mephedrone, methadone, cocaine, ecgonine methyl ester, cocaethylene, THCOH and THCCOOH (anaerobic conditions). By use of the proposed model the uncertainty of predicting illicit drug concentration at the excretion point can be reduced and hence the accuracy of back-calculation of illicit drug use in catchments can be improved.

General information

State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Environmental Chemistry
Authors: Ramin, P. (Intern), Brock, A. L. (Intern), Polesel, F. (Intern), Torresi, E. (Intern), Plösz, B. G. (Intern)
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7.4: Short-term toxicity tests can be limited to algae that generally have the highest uptake rate constants, whereas the primary focus of the assessment should be on persistence, bioaccumulation, and long-term effects.
Increased levels of the oxidative stress biomarker 8-iso-prostaglandin F2α in wastewater associated with tobacco use

Wastewater analysis has been demonstrated to be a complementary approach for assessing the overall patterns of drug use by a population while the full potential of wastewater-based epidemiology has yet to be explored. F2-isoprostanes are a prototype wastewater biomarker to study the cumulative oxidative stress at a community level. In this work, 8-iso-prostaglandin F2α (8-iso-PGF2α) was analysed in raw 24h-composite wastewater samples collected from 4 Norwegian and 7 other European cities in 2014 and 2015. Using the same samples, biomarkers of alcohol (ethyl sulfate) and tobacco (trans-3'-hydroxycotinine) use were also analysed to investigate any possible correlation between 8-iso-PGF2α and the consumption of the two drugs. The estimated per capita daily loads of 8-iso-PGF2α in the 11 cities ranged between 2.5 and 9.9 mg/day/1000 inhabitants with a population-weighted mean of 4.8 mg/day/1000 inhabitants. There were no temporal trends observed in the levels of 8-iso-PGF2α, however, spatial differences were found at the inter-city level correlating to the degree of urbanisation. The 8-iso-PGF2α mass load was found to be strongly associated with that of trans-3'-hydroxycotinine while it showed no correlation with ethyl sulfate. The present study shows the potential for 8-iso-PGF2α as a wastewater biomarker for the assessment of community public health.

General information
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Organisations: Department of Environmental Engineering, Water Technologies
Authors: Ryu, Y. (Ekstern), Gracia-Lor, E. (Ekstern), Bade, R. (Ekstern), Baz-Lomba, J. A. (Ekstern), Bramness, J. G. (Ekstern), Castiglioni, S. (Ekstern), Castrignanò, E. (Ekstern), Causanilles, A. (Ekstern), Covaci, A. (Ekstern), de Voogt, P. (Ekstern), Hernandez, F. (Ekstern), Kasprzyk-Hordern, B. (Ekstern), Kinyua, J. (Ekstern), McCall, A. (Ekstern), Ort, C. (Ekstern), Plósz, B. G. (Intern), Ramin, P. (Intern), Rousis, N. I. (Ekstern), Reid, M. J. (Ekstern), Thomas, K. V. (Ekstern)
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Influence of data choices in Life Cycle Assessment of waste management systems

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Henriksen, T. (Intern), Astrup, T. F. (Intern), Damgaard, A. (Intern)
Pages: 26-26
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Host publication information
Title of host publication: SETAC Europe 26th Annual Meeting - abstract book
Place of publication: Nantes, France
Publisher: SETAC Europe
Main Research Area: Technical/natural sciences
Conference: SETAC Europe 26th Annual Meeting, France, 22/05/2016 - 22/05/2016
Electronic versions:
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Publication: Research - peer-review › Journal article – Annual report year: 2016

Influence of dissolved organic carbon on biodegradation of pharmaceuticals by suspended biofilms in wastewater

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Aarhus University
Authors: Tang, K. (Intern), Escola Casas, M. (Ekstern), Bester, K. (Forskerdatabase), Andersen, H. R. (Intern)
Number of pages: 2
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 2nd Young Water Professionals Denmark Conference and Workshop
Publisher: IWA
Main Research Area: Technical/natural sciences
Conference: 2nd Young Water Professionals Denmark Conference and Workshop, Aarhus, Denmark, 10/03/2016 - 10/03/2016

Relations
Activities:
2nd Young Water Professionals Denmark Conference and Workshop
Influence of feed composition and membrane fouling on forward osmosis performance

Clean water is a basic human need. However, rapid population growth and climate change result in an increase of water demand, whereas the resources of potable water are shrinking.

One of the solutions could be to use membrane technology to reclaim clean and safe drinking water from wastewater. Nonetheless, the existing membrane technologies often face fouling problem that lowers the economic viability of the membrane application in industrial scale.

Recent development in the membrane technology indicates that forward osmosis (FO) has a high potential for wastewater treatment, producing high quality water [1]. Compared to other pressure driven membrane processes, forward osmosis (FO) membranes suffered less severe fouling due to the lack of hydraulic pressure [2]. Furthermore, novel biomimetic membranes incorporating Aquaporins, highly selective water channels, became commercially available. These membranes were reported to achieve remarkable results in terms of water flux and solute rejection, though little is known whether they are suitable for wastewater treatment.

The objective of this study is to investigate 1) which types of wastewater can be treated by FO using biomimetic Aquaporin membranes, 2) which draw solution is most suitable for this application and 3) the extent and nature of the fouling.

All experiments were conducted in a bench-scale FO setup using NaCl, MgCl2, NaOAc as a draw solution and different anaerobic digestion effluents as a feed. The effluents were characterised at the beginning and at the end of each experiment, regarding their total solids (TS), volatile solids (VS), total suspended solids (TSS), particle size distribution, Total Kjeldahl Nitrogen (TKN), Total available nitrogen (TAN), total organic carbon (TOC) and total phosphate (TP). The fouled membranes were analysed by Scanning Electron Microscope with Energy-dispersive X-ray spectroscopy (SEM-EDS), Fourier transform infrared spectroscopy (FTIR), ATP analysis and inductively coupled plasma optical emission spectrometry (ICP-OES). Our preliminary experimental results indicate that there is a correlation between the effluent composition and the fouling potential. Taken together our results can contribute understanding of how fouling can be mitigated by considering various feed pretreatment methods.
Influence of pH and media composition on suspension stability of silver, zinc oxide, and titanium dioxide nanoparticles and immobilization of Daphnia magna under guideline testing conditions

In aquatic toxicity testing of engineered nanoparticles (ENPs) the process of agglomeration is very important as it may alter bioavailability and toxicity. In the present study, we aimed to identify test conditions that are favorable for maintaining stable ENP suspensions. We evaluated the influence of key environmental parameters: pH (2-12) and ionic strength using M7, Soft EPA (S EPA) medium, and Very Soft EPA (VS EPA) medium; and observed the influence of these parameters on zeta potential, zeta average, and acute immobilization of Daphnia magna for three different ENPs. Despite being sterically stabilized, test suspensions of silver (Ag) ENPs formed large agglomerates in both VS EPA and M7 media; and toxicity was found to be higher in VS EPA medium due to increased dissolution. Low-agglomerate suspensions for zinc oxide (ZnO) could be obtained at pH 7 in VS EPA medium, but the increase in dissolution caused higher toxicity than in M7 medium. Titanium dioxide (TiO2) ENPs had a point of zero charge in the range of pH 7-8. At pH 7 in VS EPA, agglomerates with smaller hydrodynamic diameters (similar to 200 nm) were present compared to the high ionic strength M7 medium where hydrodynamic diameters reached micrometer range. The stable suspensions of TiO2 ENPs caused immobilization of D. magna, 48-h EC50 value of 13.7 mg L-1 (95% CI, 2.4 mg-79.1 mg L-1); whereas no toxicity was seen in the unstable, highly agglomerated M7 medium suspensions, 48-h EC50 > 100 mg L-1. The current study provides a preliminary approach for methodology in testing and assessing stability and toxicity of ENPs in aquatic toxicity tests of regulatory relevance. (C) 2016 Elsevier Inc. All rights reserved.
Influences of mechanical pre-treatment on the non-biological treatment of municipal wastewater by forward osmosis

Municipal wastewater treatment commonly involves mechanical, biological and chemical treatment steps as state-of-the-art technologies for protecting the environment from adverse effects. The biological treatment step consumes the most energy and can create greenhouse gases. This study investigates municipal wastewater treatment without the biological treatment step, including the effects of different pre-treatment configurations, e.g., direct membrane filtration before forward osmosis. Forward osmosis was tested using raw wastewater and wastewater subjected to different types of mechanical pre-treatment, e.g., microsieving and microfiltration permeation, as a potential technology for municipal wastewater treatment. Forward osmosis was performed using thin-film-composite, Aquaporin Inside(TM) and HTI membranes with NaCl as the draw solution. Both types of forward osmosis membranes were tested in parallel for the different types of pre-treated feed and evaluated in terms of water flux and solute rejection, i.e., biochemical oxygen demand and total and soluble phosphorus contents. The Aquaporin and HTI membranes achieved a stable water flux with rejection rates of more than 96% for biochemical oxygen demand and total and soluble phosphorus, regardless of the type of mechanical pre-treated wastewater considered. This result indicates that forward osmosis membranes can tolerate exposure to municipal waste water and that the permeate can fulfil the Swedish discharge limits for small- and medium-sized wastewater treatment plants.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Lund University, Aquaporin A/S
Authors: Hey, T. (Ekstern), Zarebska, A. (Intern), Bajraktari, N. (Intern), Vogel, J. (Ekstern), Hélix-Nielsen, C. (Intern), La Cour Jansen, J. (Ekstern), Jönsson, K. (Ekstern)
Pages: 1-10
Publication date: 2016
Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Informing groundwater model hydrostratigraphy with airborne time-domain electromagnetic data and borehole logs

Hydrological models of groundwater systems and integrated hydrological systems are commonly used tools to manage groundwater resources and support decision making. The models are utilized to quantitatively support management of water supply from well fields; perform dewatering calculations for construction sites; quantify groundwater contamination in time and space; estimate ecological impacts of anthropogenic or climatic stresses; characterize salt-water intrusion phenomena, etc. Applications can be at scales of tens to thousands of square kilometers. The reliability of numerical groundwater models is closely related to the quality and amount of hydrological and geological data available to inform the modeling process. This is particularly true for lithological and geological data required to map the 3-D distribution of aquifer materials, which is also called the hydrostratigraphy. A major challenge for groundwater modelers is that the hydrostratigraphy, which is one of the most critical parameterizations of groundwater models, is based on properties for which direct information is inherently difficult to obtain. The uncertainty resulting from this is non-trivial to estimate and thus rarely quantifiable.

Airborne time-domain electromagnetic (AEM) data obtained using novel methods of data acquisition and processing are attractive because the resulting electrical resistivity models of the subsurface can be obtained at a lateral resolution unmet by geological data while covering areas of hundreds of square kilometers. Application of geophysical data in hydrology however is challenged by the necessary petrophysical translation of the measured physical property into a hydrological property.

The PhD study investigated an approach to incorporate structural information contained in large AEM data sets directly into the groundwater modeling process. The work focuses on reproducibility and objectivity, which is typically lacking in traditional interpretations of AEM and lithological information, and the approaches presented in this thesis are to a large extent automatic. An approach that integrates EM data and borehole lithological information directly into groundwater models is proposed. The approach builds on a clay-fraction inversion which is a spatially variable translation of resistivity values from EM data into clay-fraction values using borehole lithological information. Hydrostratigraphical units are obtained through a k-means cluster analysis of the principal components of resistivity and clay-fraction values. Under the assumption that the units have uniform hydrological properties, the units constitute the hydrostratigraphy for a groundwater model. Only aquifer structures are obtained from geophysical and lithological data, while the estimation of the hydrological properties of the units is inversely derived from the groundwater model and hydrological data.

A synthetic analysis was performed to investigate the principles underlying the clustering approach using three petrophysical relationships between electrical conductivity and hydraulic conductivity. Aquifer structures obtained from clustering on electrical conductivity and clay fraction resulted in mismatch with the true pumping well capture isochrone of 8 to 13 percent. Results for clustering only on electrical conductivity were not stable.

The approach was first tested for the 156 km² large integrated hydrological model of the Danish case study Norsminde. The hydrological performance in terms of fit to the transient hydraulic head observations and stream discharge observations results in root mean square errors of 2.0 m and -0.79 m, and mean errors of 0.28 m³s⁻¹ and -0.011 m³s⁻¹ for head and discharge respectively. Benchmarking against comparable Danish models reported in scientific papers confirmed good hydrological performance.

The automatic hydrostratigraphical modeling approach was extended to quantify the uncertainty of groundwater model predictions. An ensemble of equally likely hydrostratigraphical models was simulated at locations with no data to parameterize the entire model domain, using indicator variograms. The method was applied to the 46 km² groundwater model of the Danish site Kasted. Hydrological performance of 75 realizations in terms of fit to steady-state hydraulic head observations and base-flow estimates correspond to root mean square errors around 5.5 m and mean errors of -0.2 m, and percentage errors around 0 to -4 respectively. Differences in local scale connectivity/dis-connectivity of aquifer materials resulted in a probabilistic well catchment area. Results indicate 85% probability that the well catchment area extends beyond the well catchment area determined from a manually developed deterministic geology.

The applications to Norsminde and Kasted sites, combined with the theoretical insight gained from the synthetic analysis, show promising results for direct integration of AEM data into the groundwater modeling process using cluster analysis. Because the presented methods are reproducible and time saving due to being highly automatized, the methods potentially have commercial value.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Niels Bohr Institute
Authors: Marker, P. A. (Intern), Bauer-Gottwein, P. (Intern), Mosegaard, K. (Ekstern)
Number of pages: 69
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Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark, DTU Environment
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Publication: Research › Ph.D. thesis – Annual report year: 2016
Innovative microbial electrochemical process for H₂O₂ synthesis and residual H₂O₂ removal for wastewater treatment

Sustainable H₂O₂ synthesis and residual H₂O₂ removal are key challenges to the treatment of recalcitrant wastewater using Fenton processes. In this study, an innovative bioelectrochemical system was developed to meet the challenges by alternate switching between microbial electrolysis cell (MEC) and microbial fuel cell (MFC) mode of operation. In the MEC mode, H₂O₂ was produced and then reacted with Fenton's reagent (Fe II) to form hydroxyradical. When the system was switched to MFC mode, the unused H₂O₂, as residual is removed at the cathode as electron acceptor. For wastewater containing 50 mg L⁻¹ methylene blue (MB), complete decolorization and mineralization was achieved in the MEC mode with apparent first order rate constants of 0.43 and 0.22 h⁻¹, respectively. After switching the system to the MFC mode, unused H₂O₂ at concentration of 180 mg L⁻¹ was removed. The removal rate was 4.61 mg L⁻¹ h⁻¹ while maximum current density of 0.49 A m⁻² was generated. The MB degradation and removal of unused H₂O₂ were affected by different operational parameters such as external resistance, cathode pH and initial MB concentration. Furthermore, stack operation greatly improved the system performance. This study for the first time demonstrated an efficient and cost-effective bioelectrochemical system for H₂O₂ generation, residual removal and treatment of recalcitrant pollutants.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Zhang, Y. (Intern), Angelidaki, I. (Intern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Links:
http://www.sustain.dtu.dk/

Bibliographical note
Sustain Abstract W-4
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

In-situ biogas upgrading in thermophilic granular UASB reactor: key factors affecting the hydrogen mass transfer rate

Biological biogas upgrading coupling CO₂ with external H₂ to form biomethane opens new avenues for sustainable biofuel production. For developing this technology, efficient H₂ to liquid transfer is fundamental. This study proposes an innovative setup for in-situ biogas upgrading converting the CO₂ in the biogas into CH₄, via hydrogenotrophic methanogenesis. The setup consisted of a granular reactor connected to a separate chamber, where H₂ was injected. Different packing materials (rashig rings and alumina ceramic sponge) were tested to increase gas-liquid mass transfer. This aspect was optimized by liquid and gas recirculation and chamber configuration. It was shown that by distributing H₂ through a metallic diffuser followed by ceramic sponge in a separate chamber, having a volume of 25% of the reactor, and by applying a mild gas recirculation, CO₂ content in the biogas dropped from 42 to 10% and the final biogas was upgraded from 58 to 82% CH₄ content.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Bassani, I. (Intern), Kougias, P. (Intern), Angelidaki, I. (Intern)
Number of pages: 7
Pages: 485-491
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: Bioresource Technology
Volume: 221
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.94 SJR 2.191 SNIP 1.91
Web of Science (2016): Indexed yes
Integrated assessment of sources, chemical stressors and stream quality along a groundwater fed stream system

General information
Integrated characterization of the development in natural attenuation of a PCE plume over 7 years after thermal remediation of the source zone with use of dual stable isotope and molecular microbial techniques

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Université de Neuchâtel, SiREM, Region Syddanmark, University of Neuchâtel
Authors: Broholm, M. M. (Intern), Badin, A. (Ekstern), Jakobsen, C. S. (Ekstern), Dennis, P. (Ekstern), Just, N. (Ekstern), Hunkeler, D. (Ekstern)
Pages: 48-48
Publication date: 2016

Host publication information
Title of host publication: 9th IAHS conference on groundwater quality - abstract book
Place of publication: Shenzhen, China
Main Research Area: Technical/natural sciences
Conference: Shenzhen, China, 24/07/2016 - 24/07/2016
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Integrated environmental and economic assessment of waste management systems
The Solid Waste Management (SWM) sector has evolved from a simple control of emissions towards a resource recovery sector while still being constrained by strict emission regulations. For that waste authorities are paying increased attention to the waste hierarchy as a set of priorities for solid waste treatment options to boost this shift towards higher resource recovery. In this hierarchy, waste prevention has the highest priority, followed by re-use and recycling options, and what cannot be recycled should be energy recovered; and, finally, the least favoured option is disposal in landfills. However, the waste hierarchy does not consider the local needs/conditions of each geographical area, and it cannot be used to identify sustainable SWM options by itself. Environmental impact assessment can help with this task as holistic decision-support tool. Nevertheless, waste authorities need economic assessment of SWM systems alongside environmental impacts assessment to take budget constrains into account.

In light of the need for combined environmental and economic assessment of SWM, this PhD thesis developed a consistent and comprehensive method for integrated environmental and economic assessment of SWM technologies and systems. The method resulted from developing further the generic Life Cycle Costing (LCC) framework suggested by Hunkeler et al. (2008) and Swarr et al. (2011) to apply it on the field of SWM. The method developed includes: two modelling approaches (Accounting and Optimization), three cost approaches (Conventional, Environmental and Societal LCCs) and two goal perspectives (Planning and Analysis).
• The modelling approach describes how the scenarios are defined. The “Accounting approach” defines the technological pathway of each scenario before the study is performed, while in the “Optimization approach” the scenarios are the results of an optimization process.
• The cost approach describes cost principles and level of LCA integration. Conventional and Environmental LCCs are financial assessments, i.e. include marketed goods/services, but while Environmental LCCs include environmental impacts in a parallel LCA, Conventional LCCs do not. Societal LCC is a welfare economic assessment, i.e. includes marketed goods/services and effects outside the economic system (externality costs).
• The goal perspective differentiates between “Analysis” and “Planning” perspective. Analysis LCCs evaluate current status of a SWM system, while Planning LCCs focusses on the consequences a change in a system with respect to the status quo.
The applicability of the LCC framework was tested through four case studies from which the following conclusions can be drawn:

- Organic source-segregation incurs financial and social costs mainly related to the cost of bags and bins used by households, as well as extra collection costs related to the additional collection scheme for organics collection as well as extra cost of residual waste collection (compared with mixed waste).

- The environmental benefits related to food waste prevention (due to avoided food production) could be overtaken by the environmental loads associated with the alternative consumptions purchased with the savings generated from the prevented (unpurchased) food. This could be avoided if prevention campaigns were accompanied by other policies aiming at reducing the impact of alternative consumption patterns. The inclusion of these income effects is especially critical when the alternatives being compared in an LCC have significant differences on the use of scarce resources such as income, land and time. In these cases, LCC studies should be supplemented by specific analysis of potential behavioural changes in consumption patterns (defining alternative consumptions) associated with the SWM systems being assessed.

- Recycling and prevention strategies can have significant economic consequences in existing waste facilities whose operation will have to be adjusted based on the waste changes. Marginal costs of diversion strategies in existing WtE facilities depend completely on the response in such facility. However, regardless of the response type, it was demonstrated that marginal costs of diversion are several times different than average costs. Hence, when performing Planning LCC the dynamics of the SWM system (including effects in existing waste facilities) should be taken into account to avoid misleading conclusions.

- Optimization of SWM using Societal LCC demonstrated that the social optimal solution results from balancing economic and externality costs. Contrary, optimizing using either economic costs or externality costs lead to socially suboptimal solutions.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Martínez Sanchez, V. (Intern), Astrup, T. F. (Intern)
Number of pages: 53
Publication date: 2016

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Publisher: Technical University of Denmark, DTU Environment
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions: WWW_Version. Embargo ended: 26/03/2016
Publication: Research › Ph.D. thesis – Annual report year: 2016

Integrated production of cellulosic bioethanol and succinic acid from industrial hemp in a biorefinery concept
The aim of this study was to develop integrated biofuel (cellulosic bioethanol) and biochemical (succinic acid) production from industrial hemp (Cannabis sativa L.) in a biorefinery concept. Two types of pretreatments were studied (dilute-acid and alkaline oxidative method). High cellulose recovery (> 95%) as well as significant hemicelluloses solubilization (49-59%) after acid-based method and lignin solubilization (35-41%) after alkaline H2O2 method were registered. Alkaline pretreatment showed to be superior over the acid-based method with respect to the rate of enzymatic hydrolysis and ethanol productivity. With respect to succinic acid production, the highest productivity was obtained after liquid fraction fermentation originated from steam treatment with 1.5% of acid. The mass balance calculations clearly showed that 149 kg of EtOH and 115 kg of succinic acid can be obtained per 1 ton of dry hemp. Results obtained in this study clearly document the potential of industrial hemp for a biorefinery.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Bielsko-Biała
Authors: Kuglarz, M. (Ekstern), Alvarado-Morales, M. (Intern), Karakashev, D. B. (Intern), Angelidaki, I. (Intern)
Pages: 639-647
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Main Research Area: Technical/natural sciences

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Journal: Bioresource Technology
Volume: 200
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Integration of freshwater impact in lifecycle assessment of three water supply technologies

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Water Resources Engineering
Authors: Gejl, R. N. (Intern), Bjerg, P. L. (Intern), Rasmussen, J. (Ekstern), Rygaard, M. (Intern)
Number of pages: 17
Publication date: 2016

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Media of output: Powerpoint
Original language: English
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark, DTU Environment
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 127552510
Publication: Research › Sound/Visual production (digital) – Annual report year: 2016

Integrering af ferskvandspåvirkning i livscyklusvurdering af tre vandteknologier

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Water Resources Engineering
Authors: Gejl, R. N. (Intern), Bjerg, P. L. (Intern), Rasmussen, J. (Ekstern), Rygaard, M. (Intern)
Number of pages: 16
Publication date: 2016

Publication information
Media of output: Powerpoint
Original language: Danish
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark, DTU Environment
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 127552520
Publication: Research › Sound/Visual production (digital) – Annual report year: 2016

Inter-comparison of statistical downscaling methods for projection of extreme flow indices across Europe

The effect of methods of statistical downscaling of daily precipitation on changes in extreme flow indices under a plausible future climate change scenario was investigated in 11 catchments selected from 9 countries in different parts of Europe. The catchments vary from 67 to 6171km² in size and cover different climate zones. 15 regional climate model outputs and 8 different statistical downscaling methods, which are broadly categorized as change factor and bias correction based methods, were used for the comparative analyses. Different hydrological models were implemented in different catchments to simulate daily runoff. A set of flood indices were derived from daily flows and their changes have been evaluated by comparing their values derived from simulations corresponding to the current and future climate. Most of the implemented downscaling methods project an increase in the extreme flow indices in most of the catchments. The catchments where the extremes are expected to increase have a rainfall-dominated flood regime. In these catchments, the downscaling methods also project an increase in the extreme precipitation in the seasons when the extreme flows occur. In catchments where the flooding is mainly caused by spring/summer snowmelt, the downscaling methods project a decrease in the extreme flows in three of the four catchments considered. A major portion of the variability in the projected changes in the extreme flow indices is attributable to the variability of the climate model ensemble, although the statistical downscaling methods contribute 35–60% of the total variance.

General information
State: Published
Organisations: Department of Environmental Engineering, Deutsches Geoforschungszentrum, Norwegian Water Resources and Energy Directorate, DHI Denmark, Vrije Universiteit Brussel, University of Potsdam, Lithuanian Energy Institute, University of Thessaly, Czech University of Life Sciences Prague, Polish Academy of Sciences, Middle East Technical University
Authors: Hundecha, Y. (Ekstern), Sunyer Pinya, M. A. (Intern), Lawrence, D. (Ekstern), Madsen, H. (Ekstern), Willems, P. (Ekstern), Bürger, G. (Ekstern), Kriauciūnienė, J. (Ekstern), Loukas, A. (Ekstern), Martinkova, M. (Ekstern), Osuch, M. (Ekstern), Vasiliades, L. (Ekstern), von Christierson, B. (Ekstern), Vormoor, K. (Ekstern), Yücel, I. (Ekstern)
International Implications of Labeling Foods Containing Engineered Nanomaterials

To provide greater transparency and comprehensive information to consumers regarding their purchase choices, the European Parliament and the Council have mandated via Regulation 1169/2011 that foods containing engineered nanomaterials (ENMs) be labeled. This review covers the main concerns related to the use of ENMs in foods and the potential impacts that this type of food labeling might have on diverse stakeholder groups, including those outside the European Union (EU), e.g., in the United States. We also provide recommendations to stakeholders for overcoming existing challenges related to labeling foods containing ENMs. The revised EU food labeling requirements will likely result in a number of positive developments and a number of challenges for stakeholders in both EU and non-EU countries. Although labeling of foods containing ENMs will likely improve transparency, provide more information to facilitate consumer decisions, and build trust among food safety authorities and consumers, critical obstacles to the successful implementation of these labeling requirements remain, including the need for (i) harmonized information requirements or regulations between countries in different regions of the world, (ii) clarification of the regulatory definitions of the ENMs to be used for food labeling, (iii) robust techniques to detect, measure, and characterize diverse ENMs in food matrices, and (iv) clarification of the list of ENMs that may be exempt from labeling requirements, such as several food additives used for decades. We recommend that food industries and food safety authorities be more proactive in communicating with the public and consumer groups regarding the potential benefits and risks of using ENMs in foods. Efforts should be made to improve harmonization of information requirements between countries to avoid potential international trade barriers.

General information

State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, RTI International
Authors: Grieger, K. D. (Ekstern), Hansen, S. F. (Intern), Mortensen, N. P. (Ekstern), Cates, S. (Ekstern), Kowalcyk, B. (Ekstern)
Pages: 830-842
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Main Research Area: Technical/natural sciences

Publication information

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.68 SJR 0.759 SNIP 0.82
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.96 SNIP 1.031 CiteScore 2.03
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.91 SNIP 0.957 CiteScore 1.94
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
**Introduktion**

**General information**

State: Published
Authors: Hansen, S. F. (Intern), Johnsen, A. R. (Ekstern), Jensen, P. N. (Ekstern)
Pages: 9-10
Publication date: 2016
Inverse modeling of the biodegradation of emerging organic contaminants in the soil-plant system

Understanding the processes involved in the uptake and accumulation of organic contaminants into plants is very important to assess the possible human risk associated with. Biodegradation of emerging contaminants in plants has been observed, but kinetic studies are rare. In this study, we analyse experimental data on the uptake of emerging organic contaminants into lettuce derived in a greenhouse experiment. Measured soil, root and leaf concentrations from four contaminants were selected within the applicability domain of a steady-state two-compartment standard plant uptake model: bisphenol A (BPA), carbamazepine (CBZ), triclosan (TCS) and caffeine (CAF). The model overestimated concentrations in most cases, when no degradation rates in plants were entered. Subsequently, biodegradation rates were fitted so that the measured concentrations were met. Obtained degradation kinetics are in the order, BPA < CAF = TCS < CBZ in roots, and BPA = TCS < CBZ.
Investigating comammox Nitrospira in rapid sand filters via metagenomics and single-cell genomics

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Department of Bio and Health Informatics, Metagenomics, Aarhus University
Authors: Palomo, A. (Intern), Fowler, J. (Intern), Gülay, A. (Intern), Rasmussen, S. (Intern), Schramm, A. (Ekstern), Sicheritz-Pontén, T. (Intern), Smets, B. F. (Intern)
Pages: 20-21
Publication date: 2016

Host publication information
Title of host publication: Microbial ecology and water engineering & biofilms specialist groups (MEWE2016)
Place of publication: Copenhagen, Denmark
Publisher: IWA
Main Research Area: Technical/natural sciences
Conference: MEWE and biofilms IWA specialist conference, Copenhagen, Denmark, 04/09/2016 - 04/09/2016

Original language: English
Environmental Chemistry, Chemistry (all), Dissipation, Emerging organic contaminants, Kinetics, Model, Plants, Contamination, Degradation, Energy dissipation, Enzyme kinetics, Inverse problems, Models, Plants (botany), Risk assessment, Room and pillar mining, Uncertainty analysis, Additional knowledge, Degradation kinetics, Emerging contaminant, Greenhouse experiments, Leaf concentrations, Uptake and accumulations, Biodegradation
Electronic versions:
Hurtado_et_al_2016.pdf
DOIs:
10.1016/j.chemosphere.2016.04.134
Source: FindIt
Source-ID: 2304346732
Publication: Research - peer-review » Journal article – Annual report year: 2016
Is the IP response related to geology or contaminants in a leachate plume at the Grindsted Landfill, Denmark?

Contaminants in leachate plumes from landfills and other contaminated sites are a threat to the environment. Efficient site characterization methods are needed. The perspectives of the IP method are investigated in combination with geological sampling and chemical analyses of water samples. Along a leachate plume from a landfill hosting both household and chemical waste, borehole IP data, geological samples, grain size, and contaminant concentrations in water samples are examined for correlations related to geology and concentrations of contaminants. Results relating the Cole-Cole parameters with sediment types and pore water resistivity representing the concentrations of the contaminants show that the formation resistivity primarily is controlled by the contaminant concentrations while the IP parameters primarily are related to the clay content and grain size distribution of sandy sediments at the site.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering
Authors: Møller, I. (Ekstern), Maurya, P. K. (Ekstern), Balbarini, N. (Intern), Fiandaca, G. (Ekstern), Christiansen, A. V. (Ekstern), Holm, H. (Intern), Rønde, V. (Intern), Klint, K. E. (Ekstern), Auken, E. (Ekstern), Bjerg, P. L. (Intern)
Number of pages: 3
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Main Research Area: Technical/natural sciences
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JAGG 2 - Vertikal transport ned til førstkommende betydelige magasin: Miljøprojekt nr. 1828, 2016

Denne rapport, som omhandler risikovurdering af jordforureninger, giver en gennemgang af de processer, der har væsentligt betydning for vertikal stoftransport under både mættede og umættede forhold.

Eksisterende risikoværktøjer og programmer, der specifikt omhandler risikovurdering af den umættede zone, er gennemgået, og der er foretaget anbefalinger vedrørende beregningsudtryk for 4 konceptuelle modeller, A-D, der repræsenterer typiske forureningssituationer. De opstillede beregningsudtryk for model A og C er til indarbejdning i Miljøstyrelsens risikovurderingsværktøj JAGG2.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Residual Resource Engineering, Technical University of Denmark, NIRAS A/S
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Original language: Danish
Series: Miljøprojekt
Volume: 2016
Number: 1828
Main Research Area: Technical/natural sciences
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Source: PublicationPreSubmission
Source-ID: 122974208
Publication: Commissioned › Report – Annual report year: 2016
Joint interpretation of enantiomer and stable isotope fractionation for chiral pesticides degradation

Chiral pesticides are important contaminants affecting the health and functioning of aquatic systems. The combination of stable isotope and enantiomer analysis techniques has been recently proposed to better characterize the fate of these contaminants in natural and engineered settings. We introduce a modeling approach with the aim of unifying and integrating the interpretation of isotopic and enantiomeric fractionation. The model is based on the definition of enantiomer-specific isotopologues and jointly predicts the evolution of concentration, enantiomer fractionation, as well as changes in stable isotope ratios of different elements. The method allows evaluating different transformation pathways and was applied to investigate enzymatic degradation of dichlorprop (DCPP), enzymatic degradation of mecoprop methyl ester (MCPPM), and microbial degradation of α-hexachlorocyclohexane (α-HCH) by different bacterial strains and under different redox conditions. The model accurately reproduces the isotopic and enantiomeric data observed in previous experimental studies and precisely captures the dual-dimensional trends characterizing different reaction pathways. Furthermore, the model allows testing possible combinations of enantiomer analysis (EA), compound specific isotope analysis (CSIA), and enantiomer specific isotope analysis (ESIA) to identify and assess isotope and enantiomer selective reaction mechanisms.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering
Authors: Jin, B. (Intern), Rolle, M. (Intern)
Number of pages: 9
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Volume: 105
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
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Web of Science (2016): Indexed yes
Scopus rating (2016): CiteScore 7.49 SJR 2.629 SNIP 2.558
Web of Science (2014): Indexed yes
BFI (2015): BFI-level 2
Web of Science (2015): Indexed yes
Scopus rating (2015): SJR 2.689 SNIP 2.507 CiteScore 6.63
Web of Science (2014): Indexed yes
BFI (2014): BFI-level 2
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Scopus rating (2014): SJR 2.957 SNIP 2.727 CiteScore 6.13
Web of Science (2013): Indexed yes
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Web of Science (2013): Indexed yes
Scopus rating (2013): SJR 2.956 SNIP 2.693 CiteScore 6.02
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.867 SNIP 2.374 CiteScore 5.43
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.582 SNIP 2.196
Web of Science (2010): Indexed yes
Joint optimization of regional water-power systems

Energy and water resources systems are tightly coupled; energy is needed to deliver water and water is needed to extract or produce energy. Growing pressure on these resources has raised concerns about their long-term management and highlights the need to develop integrated solutions. A method for joint optimization of water and electric power systems was developed in order to identify methodologies to assess the broader interactions between water and energy systems. The proposed method is to include water users and power producers into an economic optimization problem that minimizes the cost of power production and maximizes the benefits of water allocation, subject to constraints from the power and hydrological systems. The method was tested on the Iberian Peninsula using simplified models of the seven major river basins and the power market. The optimization problem was successfully solved using stochastic dual dynamic programming. The results showed that current water allocation to hydropower producers in basins with high irrigation productivity, and to irrigation users in basins with high hydropower productivity was sub-optimal. Optimal allocation was achieved by managing reservoirs in very distinct ways, according to the local inflow, storage capacity, hydropower productivity, and irrigation demand and productivity. This highlights the importance of appropriately representing the water users’ spatial distribution and marginal benefits and costs when allocating water resources optimally. The method can handle further spatial disaggregation and can be extended to include other aspects of the water-energy nexus.

General information

State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Water Resources Engineering, SINTEF, DHI Hørsholm
Authors: Cardenal, S. J. P. (Intern), Mo, B. (Ekstern), Gjelsvik, A. (Ekstern), Riegels, N. D. (Ekstern), Arnbjerg-Nielsen, K. (Intern), Bauer-Gottwein, P. (Intern)
Pages: 200-207
Publication date: 2016
Main Research Area: Technical/natural sciences
<table>
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<td>2011</td>
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<td>2004</td>
<td>BFI-level 1</td>
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<td>Indexed yes</td>
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<td>2003</td>
<td>BFI-level 1</td>
<td>SJR 1.416 SNIP 0.909</td>
<td>Indexed yes</td>
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Original language: English

Hydropower, Irrigation, Water-energy models, Stochastic dual dynamic programming, Water-energy nexus, Water Science and Technology, Dynamic programming, Electric power systems, Hydroelectric power, Optimization, Productivity, Reservoirs (water), Stochastic models, Stochastic systems, Economic optimization, Long-term management, Optimization problems, Spatial disaggregation, Water energy, Water resources systems, Water resources

DOIs:
Kinetics of nitrate adsorption and reduction by nano-scale zero valent iron (NZVI): Effect of ionic strength and initial pH

Kinetic models for pollutants reduction by Nano-scale Zero Valent Iron (NZVI) were tested in this study to gain a better understanding and description of the reaction. Adsorption kinetic models and a heterogeneous catalytic reaction kinetic equation were proposed for nitrate removal and for ammonia generation, respectively. A widely used pseudo-first-order reaction model was a poor fit for nitrate removal in an iron-limiting condition and for ammonia generation in an excess iron condition. However, in this study, pseudo-first-order and pseudo-second-order adsorption kinetic equations were a good fit for nitrate removal; in addition, a Langmuir-Hinshelwood kinetic equation was able to successfully describe ammonia generation, regardless of the NZVI dose, the ionic strength, and the initial pH. These results strongly indicate that nitrate reduction by NZVI is a heterogeneous catalytic reaction, and that the kinetic models can be used in diverse conditions. The kinetic parameters correlate well with the reaction condition, unless the NZVI dose was greatly increased or unless the NZVI surface was significantly changed at a very high initial pH.

Land Use in LCIA: an absolute scale proposal for Biotic Production Potential

Environmental impacts caused by land occupation and transformation have been bypassed in many LCA studies due to soils’ multifunctionality and the interconnectedness between the ecosystem services they provide. These inherent modelling complexities have traditionally forced LCA practitioners to content with a mere quantification of Land Use (LU), as surface area and duration (in m² or ha and years) appropriated by humans, without further analysis of the impact
pathways derived from those land uses. Milà i Canals established the first comprehensive, basic framework for taking soil quality aspect into LCIA that reached acceptance among the LCA community. Through contributions from UNEP-SETAC’s special task force on LU, great progress has ensued in developing further such LCIA. Building on the latest proposal by Koellner et al. and with the aim of bringing the Planetary Boundaries thinking into LCA, the present study proposes a single absolute scale for the midpoint impact category (MIC) of Biotic Production Potential (BPP). It is hypothesized that, for an ecosystem in equilibrium (where NPP equals decay), such an ecosystem has reached the maximum biotic throughput subject to site-specific conditions and no externally added inputs. The original ecosystem (or Potential Natural Vegetation) of a certain land gives then the maximum BPP with no additional, downstream or upstream, impacts. This Natural BPP is proposed as the maximum BPP in a hypothetical Absolute Scale for LCA’s Land Use framework. It is argued that this maximum BPP is Nature’s optimal solution through evolution-adaptation mechanisms, which provides the maximum matter throughput subject to the rest of environmental constraints (without further impacts). As a consequence, this scale rises a Land Use Optimality Point that suggests the existence of a limit regarding the maximization of divergent objectives with bioenergy. It will be attempted to model that beyond this point, and for the land available within a country, if the objective of Climate Change mitigation through bioenergy is further maximized, then the Fossil Fuel displacing objective will decrease, and vice versa.

General information
State: Published
Organisations: Department of Environmental Engineering, Atmospheric Environment, Department of Management Engineering, Quantitative Sustainability Assessment
Authors: Saez de Bikuna Salinas, K. (Intern), Ibrom, A. (Intern), Hauschild, M. Z. (Intern)
Number of pages: 1
Publication date: 2016
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Main Research Area: Technical/natural sciences
Electronic versions:
Abstract_SETAC_Revised.pdf
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

LCA of management strategies for RDF incineration and gasification bottom ash based on experimental leaching data
The main characteristics and environmental properties of the bottom ash (BA) generated from thermal treatment of waste may vary significantly depending on the type of waste and thermal technology employed. Thus, to ensure that the strategies selected for the management of these residues do not cause adverse environmental impacts, the specific properties of BA, in particular its leaching behavior, should be taken into account. This study focuses on the evaluation of potential environmental impacts associated with two different management options for BA from thermal treatment of Refuse Derived Fuel (RDF): landfilling and recycling as a filler for road sub bases. Two types of thermal treatment were considered: incineration and gasification. Potential environmental impacts were evaluated by life-cycle assessment (LCA) using the EASETECH model. Both non-toxicity related impact categories (i.e. global warming and mineral abiotic resource depletion) and toxic impact categories (i.e. human toxicity and ecotoxicity) were assessed. The system boundaries included BA transport from the incineration/gasification plants to the landfills and road construction sites, leaching of potentially toxic metals from the BA, the avoided extraction, crushing, transport and leaching of virgin raw materials for the road scenarios, and material and energy consumption for the construction of the landfills. To provide a quantitative assessment of the leaching properties of the two types of BA, experimental leaching data were used to estimate the potential release from each of the two types of residues. Specific attention was placed on the sensitivity of leaching properties and the determination of emissions by leaching, including: leaching data selection, material properties and assumptions related to emission modeling. The LCA results showed that for both types of BA, landfilling was associated with the highest environmental impacts in the non-toxicity related categories. For the toxicity related categories, the two types of residues behaved differently. For incineration BA the contribution of metal leaching to the total impacts had a dominant role, with the highest environmental loads resulting for the road scenario. For the gasification BA, the opposite result was obtained, due to the lower release of contaminants observed for this material compared to incineration BA. Based on the results of this study, it may be concluded that, depending on the type of BA considered, its leaching behavior may significantly affect the results of a LCA regarding its management strategies.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Rome
Authors: Gianfilippo, M. D. (Ekstern), Costa, G. (Ekstern), Pantini, S. (Ekstern), Allegrini, E. (Intern), Lombardi, F. (Ekstern), Astrup, T. F. (Intern)
Pages: 285-298
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication information
Journal: Waste Management
Volume: 47
Issue number: Part B
Legacy of a Chemical Factory Site: Contaminated Groundwater Impacts Stream Macroinvertebrates

Legislative and managing entities of EU member states face a comprehensive task because the chemical and ecological impacts of contaminated sites on surface waters must be assessed. The ecological assessment is further complicated by the low availability or, in some cases, absence of ecotoxicity data for many of the compounds occurring at contaminated sites. We studied the potential impact of a contaminated site, characterised by chlorinated solvents, sulfonamides, and barbiturates, on benthic macroinvertebrates in a receiving stream. Most of these compounds are characterised by low or unknown ecotoxicity, but they are continuously discharged into the stream by way of a long-lasting source generating long-term chronic exposure of the stream biota. Our results show that taxonomical density and diversity of especially sediment dwelling taxa were reduced by 50% at the sampling sites situated in the primary inflow zone of the contaminated GW. Moreover, macroinvertebrate communities at these sampling sites could be distinguished from those at upstream control sites and sites situated along a downstream dilution gradient using multidimensional scaling. Importantly, macroinvertebrate indices currently used did not identify this impairment, thus underpinning an urgent need for developing suitable tools for the assessment of ecological effects of contaminated sites in streams.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Aarhus University
Authors: Rasmussen, J. J. (Ekstern), McKnight, U. S. (Intern), Sonne, A. T. (Intern), Wiberg-Larsen, P. (Ekstern), Bjerg, P. L. (Intern)
Pages: 219-230
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Archives of Environmental Contamination and Toxicology
Volume: 70
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ISSN (Print): 0090-4341
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.826 SNIP 0.95 CiteScore 2.36
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.846 SNIP 0.879 CiteScore 1.99
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.912 SNIP 1.126 CiteScore 2.13
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.984 SNIP 1.043 CiteScore 2.16
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.016 SNIP 1.084 CiteScore 2.06
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.053 SNIP 1.006 CiteScore 2.04
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.993 SNIP 0.988
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.124 SNIP 0.975
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.159 SNIP 1.026
Life cycle assessment as development and decision support tool for wastewater resource recovery technology

Life cycle assessment (LCA) has been increasingly used in the field of wastewater treatment where the focus has been to identify environmental trade-offs of current technologies. In a novel approach, we use LCA to support early stage research and development of a biochemical system for wastewater resource recovery. The freshwater and nutrient content of wastewater are recognized as potential valuable resources that can be recovered for beneficial reuse. Both recovery and reuse are intended to address existing environmental concerns, for example, water scarcity and use of non-renewable phosphorus. However, the resource recovery may come at the cost of unintended environmental impacts. One promising recovery system, referred to as TRENS, consists of an enhanced biological phosphorus removal and recovery system (EBP2R) connected to a photobioreactor. Based on a simulation of a full-scale nutrient and water recovery system in its potential operating environment, we assess the potential environmental impacts of such a system using the EASETECH model. In the simulation, recovered water and nutrients are used in scenarios of agricultural irrigation-fertilization and aquifer recharge. In these scenarios, TRENS reduces global warming up to 15% and marine eutrophication impacts up to 9% compared to conventional treatment. This is due to the recovery and reuse of nutrient resources, primarily nitrogen.

The key environmental concerns obtained through the LCA are linked to increased human toxicity impacts from the chosen end use of wastewater recovery products. The toxicity impacts are from both heavy metals release associated with land application of recovered nutrients and production of AlCl3, which is required for advanced wastewater treatment prior to aquifer recharge. Perturbation analysis of the LCA pinpointed nutrient substitution and heavy metals content of algae biofertilizer as critical areas for further research if the performance of nutrient recovery systems such as TRENS is to be better characterized. Our study provides valuable feedback to the TRENS developers and identifies the importance of system expansion to include impacts outside the immediate nutrient recovery system itself. The study also show for the first time the successful evaluation of urban-to-agricultural water systems in EASETECH.
Life cycle assessment modelling considering impurities in recyclable materials

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Faraca, G. (Intern), Damgaard, A. (Intern), Boldrin, A. (Intern), Astrup, T. F. (Intern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Electronic versions:
AbstractGFAR.pdf
Source: PublicationPreSubmission
Source-ID: 128105429
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Life cycle assessment of capital goods in waste management systems
The environmental importance of capital goods (trucks, buildings, equipment, etc.) was quantified by LCA modelling 1 tonne of waste treated in five different waste management scenarios. The scenarios involved a 240L collection bin, a 16m3 collection truck, a composting plant, an anaerobic digestion plant, an incinerator and a landfill site. The contribution of capital goods to the overall environmental aspects of managing the waste was significant but varied greatly depending on the technology and the impact category: Global Warming: 1-17%, Stratospheric Ozone Depletion: 2-90%, Ionising Radiation, Human Health: 2-91%, Photochemical Ozone Formation: 2-56%, Freshwater Eutrophication: 0.05-99%, Marine Eutrophication: 0.03-6%, Terrestrial Acidification: 2-13%, Terrestrial Eutrophication: 1-8%, Particulate Matter: 11-26%, Human Toxicity, Cancer Effect: 10-92%, Human Toxicity, non-Cancer Effect: 1-71%, Freshwater Ecotoxicity: 3-58%. Depletion of Abiotic Resources - Fossil: 1-31% and Depletion of Abiotic Resources - Elements (Reserve base): 74-99%. The single most important contribution by capital goods was made by the high use of steel. Environmental impacts from capital goods are more significant for treatment facilities than for the collection and transportation of waste and for the landfilling of waste. It is concluded that the environmental impacts of capital goods should always be included in the LCA modelling of waste management, unless the only impact category considered is Global Warming.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Brogaard, L. K. (Intern), Christensen, T. H. (Intern)
Pages: 561-574
Publication date: 2016
Main Research Area: Technical/natural sciences
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Journal: Waste Management
Volume: 56
ISSN (Print): 0956-053X
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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Web of Science (2016): Indexed yes
Scopus rating (2016): CiteScore 4 SJR 1.354 SNIP 2.044
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.739 SNIP 2.256 CiteScore 4.33
Web of Science (2015): Indexed yes
Life Cycle Assessment of Cloudburst Management Plans in Adaptation to Climate Change in Copenhagen, Denmark

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Brudler, S. (Intern), Arnbjerg-Nielsen, K. (Intern), Rygaard, M. (Intern)
Number of pages: 1
Publication date: 2016
Event: Poster session presented at IWA World Water Congress & Exhibition, Brisbane, Australia.
Main Research Area: Technical/natural sciences
Life cycle assessment of stormwater management in the context of climate change adaptation

Expected increases in pluvial flooding, due to climatic changes, require large investments in the retrofitting of cities to keep damage at an acceptable level. Many cities have investigated the possibility of implementing stormwater management (SWM) systems which are multi-functional and consist of different elements interacting to achieve desired safety levels. Typically, an economic assessment is carried out in the planning phase, while environmental sustainability is given little or no attention. In this paper, life cycle assessment is used to quantify environmental impacts of climate change adaptation strategies. The approach is tested using a climate change adaptation strategy for a catchment in Copenhagen, Denmark. A stormwater management system, using green infrastructure and local retention measures in combination with planned routing of stormwater on the surfaces to manage runoff, is compared to a traditional, sub-surface approach. Flood safety levels based on the Three Points Approach are defined as the functional unit to ensure comparability between systems. The adaptation plan has significantly lower impacts (3-18 person equivalents/year) than the traditional alternative (14-103 person equivalents/year) in all analysed impact categories. The main impacts are caused by managing rain events with return periods between 0.2 and 10 years. The impacts of handling smaller events with a return period of up to 0.2 years and extreme events with a return period of up to 100 years are lower in both alternatives. The uncertainty analysis shows the advantages of conducting an environmental assessment in the early stages of the planning process, when the design can still be optimised, but it also highlights the importance of detailed and site-specific data.
Life cycle assessment of stormwater management systems for Nørrebro, Copenhagen

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Department of Management Engineering, Quantitative Sustainability Assessment
Authors: Brudler, S. (Intern), Arnbjerg-Nielsen, K. (Intern), Hauschild, M. Z. (Intern), Rygaard, M. (Intern)
Number of pages: 1
Publication date: 2016
Event: Poster session presented at 22nd SETAC Europe LCA Case Study Symposium, Montpellier, France.
Main Research Area: Technical/natural sciences
Electronic versions: 160916_SETAC_sabr.pdf

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Poster
Source: PublicationPreSubmission
Source-ID: 2347567982
Publication: Research - peer-review › Journal article – Annual report year: 2016
Life-Cycle Costing of Food Waste Management in Denmark: Importance of Indirect Effects

Prevention has been suggested as the preferred food waste management solution compared to alternatives such as conversion to animal fodder or to energy. In this study we used societal life-cycle costing, as a welfare economic assessment, and environmental life-cycle costing, as a financial assessment combined with life-cycle assessment, to evaluate food waste management. Both life-cycle costing assessments included direct and indirect effects. The latter are related to income effects, accounting for the marginal consumption induced when alternative scenarios lead to different household expenses, and the land-use-changes effect, associated with food production. The results highlighted that prevention, while providing the highest welfare gains as more services/goods could be consumed with the same income, could also incur the highest environmental impacts if the monetary savings from unpurchased food commodities were spent on goods/services with a more environmentally damaging production than that of the (prevented) food. This was not the case when savings were used, e.g., for health care, education, and insurances. This study demonstrates that income effects, although uncertain, should be included whenever alternative scenarios incur different financial costs. Furthermore, it highlights that food prevention measures should not only demote the purchase of unconsumed food but also promote a low-impact use of the savings generated.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Aarhus University
Authors: Martínez Sanchez, V. (Intern), Tonini, D. (Intern), Møller, F. (Ekstern), Astrup, T. F. (Intern)
Number of pages: 11
Pages: 4513-4523
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Main Research Area: Technical/natural sciences

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ISSN (Print): 0013-936X
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.26 SJR 2.538 SNIP 1.889
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.584 SNIP 1.828 CiteScore 5.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.103 CiteScore 5.52
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.146 SNIP 2.056 CiteScore 5.17
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.178 SNIP 1.953 CiteScore 5.16
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.964 SNIP 1.729
Limited recovery of soil microbial activity after transient exposure to gasoline vapors

During gasoline spills complex mixtures of toxic volatile organic compounds (VOCs) are released to terrestrial environments. Gasoline VOCs exert baseline toxicity (narcosis) and may thus broadly affect soil biota. We assessed the functional resilience (i.e. resistance and recovery of microbial functions) in soil microbial communities transiently exposed to gasoline vapors by passive dosing via headspace for 40 days followed by a recovery phase of 84 days. Chemical exposure was characterized with GC-MS, whereas microbial activity was monitored as soil respiration (CO2 release) and soil bacterial growth ([3]H]leucine incorporation). Microbial activity was strongly stimulated and inhibited at low and high exposure levels, respectively. Microbial growth efficiency decreased with increasing exposure, but rebounded during the recovery phase for low-dose treatments. Although benzene, toluene, ethylbenzene and xylene (BTEX) concentrations decreased by 83-97% during the recovery phase, microbial activity in high-dose treatments did not recover and numbers of viable bacteria were 3-4 orders of magnitude lower than in control soil. Re-inoculation with active soil microorganisms failed to restore microbial activity indicating residual soil toxicity, which could not be attributed to BTEX, but rather to mixture toxicity of more persistent gasoline constituents or degradation products. Our results indicate a limited potential for functional recovery of soil microbial communities after transient exposure to high, but environmentally relevant, levels of gasoline VOCs which therefore may compromise ecosystem services provided by microorganisms even after extensive soil VOC dissipation.
Community resilience, Ecotoxicology, GC-MS fingerprinting analysis, Petroleum-derived compounds, Soil microbiology
Linking algal growth inhibition to chemical activity: A tool for identifying excess toxicity

**General information**
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Technical University of Denmark, University of Toronto, ARC Arnot Research & Consulting Inc.
Authors: Nørgaard Schmidt, S. (Intern), Armitage, J. M. (Ekstern), Anot, J. (Ekstern), Kusk, K. (Ekstern), Mayer, P. (Intern)
Pages: 285-285
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Electronic versions:
SETAC_Europe_Abstractbook_Nantes.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016

Linking climate change mitigation and coastal eutrophication management through biogas technology: Evidence from a new Danish bioenergy concept

The interest in sustainable bioenergy solutions has gained great importance in Europe due to the need to reduce GHG emissions and to meet environmental policy targets, not least for the protection of groundwater and surface water quality. In the Municipality of Solrød in Denmark, a novel bioenergy concept for anaerobic co-digestion of food industry residues, manure and beach-cast seaweed has been developed and tested in order to quantify the potential for synergies between climate change mitigation and coastal eutrophication management in the Køge Bay catchment. The biogas plant, currently under construction, was designed to handle an annual input of up to 200,000t of biomass based on four main fractions: pectin wastes, carrageenan wastes, manure and beach-cast seaweed. This paper describes how this bioenergy concept can contribute to strengthening the linkages between climate change mitigation strategies and Water Framework Directive (WFD) action planning. Our assessments of the projected biogas plant indicate an annual reduction of GHG emissions of approx. 40,000t CO2 equivalents, corresponding to approx. 1/3 of current total GHG emissions in the Municipality of Solrød. In addition, nitrogen and phosphorous loads to Køge Bay are estimated to be reduced by approx. 63tyr.-1 and 9tyr.-1, respectively, contributing to the achievement of more than 70% of the nutrient reduction target set for Køge Bay in the first WFD river basin management plan. This study shows that anaerobic co-digestion of the specific food industry residues, pig manure and beach-cast seaweed is feasible and that there is a very significant, cost-effective GHG and nutrient loading mitigation potential for this bioenergy concept. Our research demonstrates how an integrated planning process where considerations about the total environment are integrated into the design and decision processes can support the development of this kind of holistic bioenergy solutions.

**General information**
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Roskilde University, Aarhus University, DHI Denmark
Authors: Kaspersen, B. S. (Ekstern), Christensen, T. B. (Ekstern), Fredenslund, A. M. (Intern), Møller, H. B. (Ekstern), Buttsb, M. B. (Ekstern), Jensen, N. H. (Ekstern), Kjaer, T. (Ekstern)
Pages: 1124-1131
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: Science of the Total Environment
Volume: 541
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
Linking nitrifiers diversity to the flux of their key resources

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Urban Water Systems
Authors: Diwan, V. (Intern), Smets, B. F. (Intern), Albrechtsen, H. (Intern), Dechesne, A. (Intern)
Pages: 204-205
Publication date: 2016

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Publisher: IWA
Main Research Area: Technical/natural sciences
Conference: MEWE and biofilms IWA specialist conference, Copenhagen, Denmark, 04/09/2016 - 04/09/2016
Electronic versions:
MEWE2016_Diwan.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Livscyklusscreening af affaldsforebyggelse: Emballageaffald og bygge- og anlægsaffald

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Brogaard, L. K. (Intern), Damgaard, A. (Intern), Astrup, T. F. (Intern)
Number of pages: 42
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http://www2.mst.dk/Udgiv/publikationer/2016/04/978-87-93435-63-6.pdf
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Lokal afledning af regnvand - byens hverdagsregn

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Lerer, S. M. (Intern), Sørup, H. J. D. (Intern)
Number of pages: 2
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Publisher: Dansk Byplan
Original language: Danish
Main Research Area: Technical/natural sciences
Long-Term Emission Factors for Land Application of Treated Organic Municipal Waste

The agro-ecosystem model Daisy was used to explore the long-term fate of nitrogen (N) after land application of compost and digestate (based on source separated organic municipal solid waste (MSW)). The cumulative crop N yield response and emissions for mineral fertilizer (MF), anaerobically digested organic waste (MSW-D), and composted organic waste (MSW-C) were derived by fitting a linear mixed model to the outcomes of the simulations. The non-linearity of crop N yield responses and emission responses to increasing N fertilizer application was addressed by dividing these responses into high and low crop response conditions. The crop N yield response and five emission pathways (NO$_3^-$ leaching to groundwater, NO$_3^-$ and NH$_4^+$ loss to surface water, and NH$_3$ and N$_2$O emissions into the atmosphere) were quantified as environmental inventory factors, which were calculated for both high and low response conditions. The crop N yield response cumulated over time from the application of N fertilizer almost levelled out for MF within 3 to 5 years after application, while it increased over a time period of 100 years for MSW-C. In addition, MSW-D showed features of both MF and MSW-C, a steep rise in crop N yield response due to high inorganic N content and a gradual increase thereafter, due to the slow mineralization of organic N. Overall, 52–69 % of N applied as MF was up-taken by plant biomass, while plant uptakes of 15–28 % by MSW-D and 19–29 % by MSW-C were measured under high response conditions. When the N fertilizer application rate exceeded the rate of plant uptake, the rate of N utilization dropped by 80–90 % for MF, albeit to lesser degree for MSW-D and MSW-C. The simulations showed that emissions to the environment from organic fertilizers took place over a longer time and omission of the long-term effects could result in underestimation of potential impacts to the environment. As well as the time scope of assessment, local conditions were determining the N emissions. For the N$_2$O emission, there were very small differences between high and low response conditions for organic fertilizer. The N$_2$O emission factors varied for 1.8–3.0 % for MSW-D and 1.7–5.1 % for MSW-C. For NO$_3^-$ leaching to groundwater, there were large differences between high and low response conditions. For high response conditions, the emission factors varied from 6 to 39, 17 to 68, and 9 to 59 of input N from the application of MF, MSW-D, and MSW-C, respectively. Under low response conditions, much higher leaching emission factors were estimated ranging from 21 to 61 % for MF, 20 to 73 % for MSW-D, and 11 to 66 % for MSW-C.

General information

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Copenhagen
Authors: Yoshida, H. (Intern), Nielsen, M. P. (Ekstern), Scheutz, C. (Intern), Jensen, L. S. (Ekstern), Bruun, S. (Ekstern), Christensen, T. H. (Intern)
Pages: 111-124
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Main Research Area: Technical/natural sciences

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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
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Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 0.515 SNIP 0.874 CiteScore 1.2
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.511 SNIP 0.829 CiteScore 1.16
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.535 SNIP 1.065 CiteScore 1.27
LOTUS—Preparing Sentinel-3 SAR Altimetry Processing for Ocean and Land

The Sentinel-3 satellite mission with its SRAL instrumentation contains new features compared to the conventional radar altimeter mission that form the basis for new innovative scientific analyses of both ocean and inland water levels. To utilize the full potential of the new data source, new methods and processing chains need to be developed. Subsequently, new potential Copernicus products should be developed that utilize the improved along-track resolution over both the oceans and over land. The main objective of the LOTUS project is to prepare the scientific and operational use of data from Sentinels 3. Then new operational processing, validation and delivery mechanisms need to be developed and implemented for generating the new dynamic products. Finally, the take-up of the new Copernicus products by the value-adding sectors needs to be stimulated and demonstrated to ensure that they will be used for commercial activities. LOTUS will develop processing scheme for extracting high-resolution sea surface heights, wave heights and wind speeds from SAR mode data. Over land, the LOTUS will develop processing scheme for extracting high-resolution river and lake heights, soil moisture, and snow water equivalents. This presentation shows results based on analyses using CRYOSAT data and available S-3 data. Furthermore, new DEMO data sets are presented and examples of scientific impact demonstrated.

General information
State: Published
Organisations: National Space Institute, Geodesy, Department of Environmental Engineering, Water Resources Engineering, STARLAB, Newcastle University, DHI Denmark, STARKAB, CLS
Authors: Knudsen, P. (Intern), Andersen, O. B. (Intern), Nielsen, K. (Intern), Stenseng, L. (Intern), Villadsen, H. (Intern), Pelloquin, C. (Ekstern), Moreno, L. (Ekstern), Berry, P. (Ekstern), Thibaut, P. (Ekstern), Moreau, T. (Ekstern), Bauer-Gottwein, P. (Intern), Madsen, H. (Ekstern), Petersen, O. (Ekstern)
Number of pages: 1
Publication date: 2016
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Main Research Area: Technical/natural sciences
Electronic versions:
LOTUS – Preparing Sentinel-3 SAR Altimetry Processing for Ocean and Land

The Sentinel-3 satellite mission with its SRAL instrumentation contains new features compared to the conventional radar altimeter mission that form the basis for new innovative scientific analyses of both ocean and inland water levels. To utilize the full potential of the new data source, new methods and processing chains need to be developed. Subsequently, new potential Copernicus products should be developed that utilize the improved alongtrack resolution over both the oceans and over land. The main objective of the LOTUS project is to prepare the scientific and operational use of data from Sentinel 3. Then new operational processing, validation and delivery mechanisms need to be developed and implemented for generating the new dynamic products. Finally, the take-up of the new Copernicus products by the value-adding sectors needs to be stimulated and demonstrated to ensure that they will be used for commercial activities. LOTUS will develop processing scheme for extracting high-resolution sea surface heights, wave heights and wind speeds from SAR mode data. Over land, the LOTUS will develop processing scheme for extracting high-resolution river and lake heights, soil moisture, and snow water equivalents. This presentation shows results based on analyses using CRYOSAT data and available S-3 data. Furthermore, new DEMO data sets are presented and examples of scientific impact demonstrated.

Low-sludge age EBPR process for resource recovery – microbial and biochemical process characterization

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Residual Resource Engineering, Technical University of Denmark
Authors: Valverde Pérez, B. (Intern), Wágner, D. S. (Intern), Lóránt, B. (Ekstern), Gülay, A. (Intern), Radovici, M. (Ekstern), Angelidaki, I. (Intern), Smets, B. F. (Intern), Plósz, B. G. (Intern)
Number of pages: 1
Low-sludge age EBPR process for resource recovery – microbial and biochemical process characterization

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Technical University of Denmark
Authors: Valverde Pérez, B. (Intern), Wágner, D. S. (Intern), Lóránt, B. (Ekstern), Gülay, A. (Intern), Smets, B. F. (Intern), Plósz, B. G. (Intern)
Pages: 398-399
Publication date: 2016

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Place of publication: Copenhagen, Denmark
Publisher: IWA
Main Research Area: Technical/natural sciences
Conference: MEWE and biofilms IWA specialist conference, Copenhagen, Denmark, 04/09/2016 - 04/09/2016
Electronic versions:
MEWE2016_AbstractBookperez.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Management of source-separated organic household waste intended for anaerobic digestion
Driven by the Waste Management Directive and the Renewable Energy Directive, the biological treatment of organic household waste, such as food waste from kitchens, now needs to be undertaken by European Union member countries. Anaerobic digestion (AD), which allows for the utilisation of both energy (biogas production) and nutrients (through the agricultural use of digestion residue) is commonly suggested as the best way forward in this regard. The common practice of acquiring organic waste from other waste involves introducing sorting guidelines to citizens, with the corresponding material fractions included in these procedures, followed by the separate collection of source-separated organic household waste (SSOHW).
A main topic related to the implementation of this scheme on a large scale is feedstock characterisation. This is important for system optimisation regarding both technical performance, e.g. by predicting methane production and the amount of residue, and also the environmental profile, e.g. by assessing the environmental value of impact contributions when substituting fossil energy and mineral fertilisers. SSOHW is known as a highly heterogeneous waste stream, and thus its characterisation is not an easy task.

SSOHW is also accompanied by non-biodegradable impurities in the collected waste fractions. This issue is usually addressed through the physical pre-treatment of SSOHW, at which stage it is desirable to reject the maximum amount of non-biodegradable impurities while minimising biodegradable matter loss. Several well-established technologies, each with its own advantages and disadvantages, are known, and these sit alongside newly emerging solutions.

To ensure the environmental sustainability of the waste management sector when implementing the AD of SSOHW, it is important that the process has a better environmental profile than the alternative treatment being displaced, in this case incineration. When comparing AD to incineration, climate change effects indicated by global warming potential (GWP) from a life cycle assessment (LCA) perspective can be used as criteria.

The overall aim of this PhD study is to provide background data for the environmental assessment of a wide range of AD of SSOHW implementations in Europe. To achieve this aim, three specific objectives were formulated regarding waste characterisation, physical pre-treatment and European framework conditions:

- Characterise individual material fractions present in Danish SSOHW pertinent to their biochemical methane potential and other parameters of importance for AD treatment.
- Describe the technologies currently available for the physical pre-treatment of SSOHW prior to AD in Scandinavian countries, and provide the necessary data required to include them in LCA SSOHW management models.
- Determine the framework conditions that will ensure the best AD of SSOHW performance when considering climate change.

Waste characterisations for all EU member states, as well as descriptions of all available pre-treatment technologies, were not possible to detail within the scope of the present PhD thesis. Therefore, waste characterisation was limited to Denmark, and only Scandinavian pre-treatment technologies were included, but it is assumed that the data, to some extent, can be used to describe more general European conditions if country-specific data are unavailable.

Regarding the first objective, hand-sorting of SSOHW in a Danish municipality (where the source separation of organic household waste has been implemented) was performed, desirable material fractions sampled and a range of laboratory investigations performed. The material fractions covered were: animal food waste (AFW), vegetable food waste (VF), kitchen tissue (KT), vegetation waste (VW), moulded fibres (MF), animal straw (AS), dirty paper (DP) and dirty cardboard (DC).

For the second objective, a thorough assessment of a new pre-treatment technology in Denmark was followed by making a comparison to alternative pre-treatment technologies in Scandinavian countries. For the technology assessment, the material flow analysis principle was used, in that the technology process was described and LCA inventory data were generated. Amongst existing pre-treatment technologies, the screw press-, disc screen- and dispersion-based processes were represented by data from the literature.

The last objective was addressed through two LCA studies. The first assessed climate change effects associated with the AD of SSOHW compared to incineration, by concentrating on individual material fractions, and the second assessed the climate change effects of optimising the AD of SSOHW at the pre-treatment stage of the life cycle.

Based on this work, the following results were achieved:
- Using the GWP criterion only one material fraction – VFW – was always better for AD compared to incineration. For AFW, KT, VW and DP, performance with AD was better unless it was compared to a highly efficient incinerator. Material fractions such as MF and DC were attractive for AD, albeit only when AD with CHP and incineration with mainly heat production were compared. AS was always better to incinerate.
- In Denmark, food waste (both animal- and vegetable-derived) and kitchen tissue were the main material fractions allowing GWP mitigation with AD when it was compared to incineration, while the inclusion of other material fractions with SSOHW sorting guidelines was of less importance.
- The new pre-treatment technology introduced in the present thesis is a promising solution for pre-treating SSOHW prior to AD, and it had advantages over the screw press-, disc screen- and dispersion-based pre-treatment technologies.
- Any change in pre-treatment efficiency, such as ± 10% material recovered from the biomass, does not affect the net GWP of the AD of SSOHW significantly, meaning that other aspects, e.g. economy, practicality or other environmental aspects of relevance, might be used as guidance when selecting the technology for practical use.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Naroznova, I. (Intern), Scheutz, C. (Intern), Møller, J. (Intern)
Number of pages: 39
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Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark, DTU Environment
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:

This study provides a systematic approach for assessment of contaminants in materials for recycling. Paper recycling is used as an illustrative example. Three selected chemicals, bisphenol A (BPA), diethylhexyl phthalate (DEHP) and mineral oil hydrocarbons (MOHs), are evaluated within the paper cycle. The approach combines static material flow analysis (MFA) with dynamic material and substance flow modeling. The results indicate that phasing out of chemicals is the most effective measure for reducing chemical contamination. However, this scenario was also associated with a considerable lag phase (between approximately one and three decades) before the presence of chemicals in paper products could be considered insignificant. While improved decontamination may appear to be an effective way of minimizing chemicals in products, this may also result in lower production yields. Optimized waste material source-segregation and collection was the least effective strategy for reducing chemical contamination, if the overall recycling rates should be maintained at the current level (approximately 70% for Europe). The study provides a consistent approach for evaluating contaminant levels in material cycles. The results clearly indicate that mass-based recycling targets are not sufficient to ensure high quality material recycling.
Measuring community-wide conjugative plasmid permissiveness

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, University of Copenhagen
Authors: Smets, B. F. (Intern), Klümper, U. (Intern), Dechesne, A. (Intern), Riber, L. (Ekstern), Brandt, K. K. (Ekstern), Gülay, A. (Intern), Sørensen, S. J. (Ekstern)
Number of pages: 1
Pages: 62-62
Publication date: 2016

Host publication information
Title of host publication: International Society for Plasmid Biology Plasmid Biology 2016
Place of publication: Cambridge, UK
Main Research Area: Technical/natural sciences
Electronic versions:
Measuring_community_wide_conjugative_plasmid_permissiveness.pdf
Source: PublicationPreSubmission
Source-ID: 2342515516
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016
Meeting the Needs for Released Nanomaterials Required for Further Testing—The SUN Approach

The analysis of the potential risks of engineered nanomaterials (ENM) has so far been almost exclusively focused on the pristine, as-produced particles. However, when considering a life-cycle perspective, it is clear that ENM released from genuine products during manufacturing, use, and disposal is far more relevant. Research on the release of materials from nanoproducts is growing and the next necessary step is to investigate the behavior and effects of these released materials in the environment and on humans. Therefore, sufficient amounts of released materials need to be available for further testing. In addition, ENM-free reference materials are needed since many processes not only release ENM but also nanosized fragments from the ENM-containing matrix that may interfere with further tests. The SUN consortium (Project on “Sustainable Nanotechnologies”, EU seventh Framework funding) uses methods to characterize and quantify nanomaterials released from composite samples that are exposed to environmental stressors. Here we describe an approach to provide materials in hundreds of gram quantities mimicking actual released materials from coatings and polymer nanocomposites by producing what is called “fragmented products” (FP). These FP can further be exposed to environmental conditions (e.g., humidity, light) to produce “weathered fragmented products” (WFP) or can be subjected to a further size fractionation to isolate “sieved fragmented products” (SFP) that are representative for inhalation studies. In this perspective we describe the approach, and the used methods to obtain released materials in amounts large enough to be suitable for further fate and (eco)toxicity testing. We present a case study (nanoparticulate organic pigment in polypropylene) to show exemplarily the procedures used to produce the FP. We present some characterization data of the FP and discuss critically the further potential and the usefulness of the approach we developed.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Environmental Chemistry, Swiss Federal Laboratories for Materials Science and Technology (Empa), ETSS, RWTH Aachen University, University of Vienna, BASF, Wageningen University & Research, Aix-Marseille University, Ca’Foscari University of Venice
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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.26 SJR 2.538 SNIP 1.889
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.584 SNIP 1.828 CiteScore 5.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.103 CiteScore 5.52
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.146 SNIP 2.056 CiteScore 5.17
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.178 SNIP 1.953 CiteScore 5.16
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.964 SNIP 1.729
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.835 SNIP 1.803
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.943 SNIP 1.942
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.8 SNIP 1.927
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.541 SNIP 1.901
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.604 SNIP 2.014
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.863 SNIP 2.046
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.545 SNIP 2.071
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.353 SNIP 1.953
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.419 SNIP 1.977
Mesophilic and thermophilic alkaline fermentation of waste activated sludge for hydrogen production: Focusing on homoacetogenesis

The present study compared the mesophilic and thermophilic alkaline fermentation of waste activated sludge (WAS) for hydrogen production with focus on homoacetogenesis, which mediated the consumption of H2 and CO2 for acetate production. Batch experiments showed that hydrogen yield of WAS increased from 19.2 mL H2/gVSS at 37 °C and pH 10–80.1 mL H2/gVSS at 55 °C and pH 10. However, the production of volatile fatty acids (mainly acetate) was higher at 37 °C and pH 10 by comparison with 55 °C and pH 10. Hydrogen consumption due to homoacetogenesis was observed at 37 °C and pH 10 but not 55 °C and pH 10. Higher expression levels of genes relating with homoacetogenesis and lower expression levels of genes relating with hydrogen production were found at 37 °C and pH 10 compared to 55 °C and pH 10. The continuous experiment demonstrated the steady-state hydrogen yield of WAS was comparable to that obtained from batch experiments at 55 °C and pH 10, and homoacetogenesis was still inhibited. However, the steady-state hydrogen yield of WAS (6.5 mL H2/gVSS) was much lower than that (19.2 mL H2/gVSS) obtained from batch experiments at 37 °C and pH 10 due to the gradual enrichment of homoacetogens as demonstrated by qPCR analysis. The high-throughput sequencing analysis of 16S rRNA genes showed that the abundance of genus Clostridium, containing several homoacetogens, was 5 times higher at 37 °C and pH 10 than 55 °C and pH 10.

General information

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Fudan University
Authors: Wan, J. (Ekstern), Jing, Y. (Ekstern), Zhang, S. (Ekstern), Angelidaki, I. (Intern), Luo, G. (Ekstern)
Number of pages: 9
Pages: 524-532
Publication date: 2016
Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.49 SJR 2.629 SNIP 2.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.689 SNIP 2.507 CiteScore 6.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.957 SNIP 2.727 CiteScore 6.13
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.693 CiteScore 6.02
ISI indexed (2013): ISI indexed yes
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Biogas production is an economically attractive technology that has gained momentum worldwide over the past years. Biogas is produced by a biologically mediated process, widely known as “anaerobic digestion.” This process is performed by a specialized and complex microbial community, in which different members have distinct roles in the establishment of a collective organization. Deciphering the complex microbial community engaged in this process is interesting both for unraveling the network of bacterial interactions and for applicability potential to the derived knowledge. In this study, we dissect the bioma involved in anaerobic digestion by means of high throughput Illumina sequencing (~51 gigabases of sequence data), disclosing nearly one million genes and extracting 106 microbial genomes by a novel strategy combining two binning processes. Microbial phylogeny and putative taxonomy performed using >400 proteins revealed that the biogas community is a trove of new species. A new approach based on functional properties as per network representation was developed to assign roles to the microbial species. The organization of the anaerobic digestion microbiome is resembled by a funnel concept, in which the microbial consortium presents a progressive functional
specialization while reaching the final step of the process (i.e., methanogenesis). Key microbial genomes encoding enzymes involved in specific metabolic pathways, such as carbohydrates utilization, fatty acids degradation, amino acids fermentation, and syntrophic acetate oxidation, were identified. Additionally, the analysis identified a new uncultured archaeon that was putatively related to Methanomassiliicoccales but surprisingly having a methylotrophic methanogenic pathway. This study is a pioneer research on the phylogenetic and functional characterization of the microbial community populating biogas reactors. By applying for the first time high-throughput sequencing and a novel binning strategy, the identified genes were anchored to single genomes providing a clear understanding of their metabolic pathways and highlighting their involvement in anaerobic digestion. The overall research established a reference catalog of biogas microbial genomes that will greatly simplify future genomic studies.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Padua
Authors: Campanaro, S. (Ekstern), Treu, L. (Intern), Kougias, P. (Intern), De Francisci, D. (Intern), Valle, G. (Ekstern), Angelidaki, I. (Intern)
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Scopus rating (2016): CiteScore 5.89 SJR 1.969 SNIP 1.65
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BFI (2015): BFI-level 2
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Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.414 SNIP 1.722 CiteScore 5.86
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.17 SNIP 1.815 CiteScore 6.21
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Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.15 SNIP 1.849 CiteScore 5.7
ISI indexed (2012): ISI indexed yes
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BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.249 SNIP 2.168 CiteScore 6.1
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.774 SNIP 1.745
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Anaerobic digestion, Archaea, Bacteria, Binning, Biogas, Metagenomics, Methanogens, Microbial community structure, Next-generation sequencing
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Metagenomic analysis of rapid gravity sand filter microbial communities suggests novel physiology of Nitrospira spp

Rapid gravity sand filtration is a drinking water production technology widely used around the world. Microbially catalyzed processes dominate the oxidative transformation of ammonia, reduced manganese and iron, methane and hydrogen sulfide, which may all be present at millimolar concentrations when groundwater is the source water. In this study, six metagenomes from various locations within a groundwater-fed rapid sand filter (RSF) were analyzed. The community gene catalog contained most genes of the nitrogen cycle, with particular abundance in genes of the nitrification pathway. Genes involved in different carbon fixation pathways were also abundant, with the reverse tricarboxylic acid cycle pathway most abundant, consistent with an observed Nitrospira dominance. From the metagenomic data set, 14 near-complete genomes were reconstructed and functionally characterized. On the basis of their genetic content, a metabolic and geochemical model was proposed. The organisms represented by draft genomes had the capability to oxidize ammonium, nitrite, hydrogen sulfide, methane, potentially iron and manganese as well as to assimilate organic compounds. A composite Nitrospira genome was recovered, and amo-containing Nitrospira genome contigs were identified. This finding, together with the high Nitrospira abundance, and the abundance of atypical amo and hao genes, suggests the potential for complete ammonium oxidation by Nitrospira, and a major role of Nitrospira in the investigated RSFs and potentially other nitrifying environments.
Metagenomics and single-cell genomics reveal high abundance of comammox Nitrospira in a rapid gravity sand filter treating groundwater

The recent discovery of complete ammonia oxidizing (comammox) Nitrospira has revealed that the metabolic division of labor in nitrification is not obligate as was assumed during the last century. Despite the detection and enrichment of comammox Nitrospira from different nitrifying environments, the ecological relevance of comammox remains unknown. In this study, we analyzed the microbial communities from various locations within a groundwater-fed rapid sand filter (RSF), where Nitrospira were at very high relative abundances. Through metagenomics, a highly abundant composite multi-genome of Nitrospira genus was recovered harboring metabolic capacity for complete ammonia oxidation. We developed a cell extraction strategy that enables the disruption of Nitrospira cell clusters attached to the mineral coating of the sand. Individual cells were identified via fluorescent in situ hybridization (FISH) with Nitrospira-specific 16S rRNA probes and sorted via fluorescence-activated cell sorting (FACS). Sorted cells were screened and selected Nitrospira spp. were subject to whole-genome sequencing. The single cell genomes confirmed the genomic presence of a complete ammonia oxidation pathway and revealed clear taxonomic differences with the recently described comammox Nitrospira genomes. The high abundance of comammox Nitrospira spp. together with the low abundance of canonical ammonia oxidizing prokaryotes in the investigated RSF system suggests the essential role of this novel comammox Nitrospira in the RSFs and potentially other nitrifying environments.

General information

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Organisations: Department of Environmental Engineering, Water Technologies, Department of Systems Biology, Center for Biological Sequence Analysis, Metagenomics, Department of Bio and Health Informatics, Aarhus University
Authors: Palomo, A. (Intern), Fowler, J. (Intern), Gülay, A. (Intern), Rasmussen, S. (Intern), Schramm, A. (Ekstern), Sicheritz-Pontén, T. (Intern), Smets, B. F. (Intern)
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Methane Production and Kinetic Modeling for Co-digestion of Manure with Lignocellulosic Residues

Anaerobic digestion (AD) of animal manure and lignocellulosic residues is gaining increased interest as a result of their wide availability, optimum physicochemical characteristics, high methane potential, and absence of conflict with the human food chain compared to energy crops. The aim of this study was to assess the biogas production process of two lignocellulosic substrates, wheat straw (WS) and meadow grass (MG), with cattle manure (CM) under thermophilic (53°C) conditions, focusing on nutrient availability in the reaction mixtures, along with C/N ratios. Results showed that, with the use of 50% WS on an organic matter basis in the feedstock and substitution of the rest of the volatile solids (VS)
component share between CM and MG (25:75, 50:50, and 75:25), the methane yield can be increased by 20-24% compared to WS mono-digestion, with a methane production rate of 27, 23, and 22 N mL of CH4 g-1 of VS day-1, respectively. Moreover, the positive effects of coupled biological reactions in the reaction mixture of co-digestion were explained using the synergistic effect value (η). The η value was calculated using estimated and experimental methane yields. Furthermore, in MG co-digestion, where 75% VS originated from MG and the rest was distributed as a 25:75 mixture of CM and WS, a 14% enhancement in the methane yield was shown in comparison to MG mono-digestion, with the maximum methane production rate of 25 N mL of CH4 g-1 of VS day-1 in batch experiments. Finally, the best co-digestion results with the highest methane yield (up to 25%) and lowest lag phase (6-7 days) were achieved when 75% organic matter originated from CM. The combination presenting the above-mentioned increase in the methane yield also showed a methane production rate of 22 N mL of CH4 g-1 of VS day-1. It was concluded that increasing the MG share in co-digestion improves the feedstock digestibility and also gives the higher methane production rate. In contrast, a high WS share increases the lag phase and is a detriment to the biodegradability. Finally, through co-digestion of two lignocellulosic substrates of different physicochemical characteristics with CM, the overall biodegradability compared to single-substrate digestion is improved and the methane yield is enhanced.
Methane production from formate, acetate and H$_2$/CO$_2$; focusing on kinetics and microbial characterization

For evaluating the methanogenesis from typical methanogenic precursors (formate, acetate and H$_2$/CO$_2$), CH$_4$ production kinetics were investigated at 37 $\pm$ 1 degrees C in batch anaerobic digestion tests and stimulated by modified Gompertz model. The results showed that maximum methanation rate from formate, acetate and H$_2$/CO$_2$ were 19.58 $\pm$ 0.49, 42.65 $\pm$ 1.17 and 314.64 $\pm$ 3.58 N mL/gVS/d in digested manure system and 6.53 $\pm$ 0.31, 132.04 $\pm$ 3.96 and 640.16 $\pm$ 19.92 N mL/gVS/d in sewage sludge system during second generation incubation. Meanwhile the model could not fit well in granular sludge system, while the rate of formate methanation was faster than from H$_2$/CO$_2$ and acetate. Considering both the kinetic results and microbial assay we could conclude that H$_2$/CO$_2$ methanation was the fastest methanogenic step in digested manure and sewage sludge system with Methanomicrobiales as dominant methanogens, while granular sludge with Methanobacteriales as dominant methanogens contributed to the fastest formate methanation. 

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Methodological considerations for using umu assay to assess photo-genotoxicity of engineered nanoparticles

In this study we investigated the feasibility of high-throughput (96-well plate) umu assay to test the genotoxic effect of TiO2 engineered nanoparticles (ENPs) under UV light (full spectrum) and visible light (455nm). Exposure of TiO2 ENPs to up to 60min of UV light induced a photocatalytic production of ROS. However, UV light itself caused cytotoxic damage to Salmonella typhimurium at exposures >15min and a genotoxic effect at exposures >0.5min; and use of UV filters did not lower this effect. No genotoxicity of TiO2 ENPs was observed under visible light conditions at concentrations up to 100μgmL(-1); or under dark conditions at concentrations up to 667μgmL(-1), though cytotoxicity was seen at the higher concentrations. Additionally, the growth factor calculation was influenced by a shading effect due to ENPs, and was corrected by considering the pre-incubation OD readings of Plate B. Recommendations provided in this paper, as well as
investigation of the effect of the light sources should be considered when using the umu assay to quantify the photo-
genotoxicity of engineered nanomaterials.

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Authors: Cupi, D. (Intern), Baun, A. (Intern)
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Web of Science (2017): Indexed Yes
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BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.91 SNIP 1.048 CiteScore 2.64
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ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.991 SNIP 1.19 CiteScore 2.85
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.043 SNIP 1.221
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.816 SNIP 1.139
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.85 SNIP 1.168
Scopus rating (2007): SJR 0.807 SNIP 1.077
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.859 SNIP 1.219
Scopus rating (2005): SJR 0.692 SNIP 1.089
Scopus rating (2004): SJR 0.713 SNIP 1.046
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.631 SNIP 0.934
Scopus rating (2002): SJR 0.596 SNIP 0.971
Methodologies for managing the Energy-Water-Food nexus at different scales

General information
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Publisher: Technical University of Denmark (DTU)
Editors: Sønderberg Petersen, L., Hvidtfeldt Larsen, H.
Chapter: 9
Main Research Area: Technical/natural sciences

Microbes in biological processes for municipal landfill leachate treatment: Community, function and interaction
Landfill leachate (LFL) contains high strength of ammonium and complex organic substances including biodegradable volatile fatty acids (VFAs), refractory aquatic humic substances (AHS) and micro-scale xenobiotic organic chemicals (XOCs), which promotes the diverse microbial community in LFL treatment bioreactors. These microbes cooperate to remove nitrogen, biodegrade organic matters, eliminate the toxicity of XOCs and produce energy. In these diverse microbes, some show dominant in the bioreactor and are prevalent in many kinds of LFL treatment bio-processes, such as Brocadia from the phylum of Planctomycetes, Nitrosomonas sp., the phylum of Proteobacteria, Bacteroidetes and Firmicutes. The bioreactor's operational parameters influence the microbial community, inversely affect the bioreactor's performance. It is practical to accumulate desirable microbes by managing the bioreactor's running condition. High ammonium loading, low DO (<2 mg l−1) and optimal pH value are the practical way to accumulate the desirable AOB and realize the partial nitrification. Nitrite and organic matters inhibit the anaerobic ammonium oxidation bacteria (AnAOB). In anaerobic LFL treatment bioreactors, Methanosaeta and Methanosarcina can outcompete sulfur reducing bacteria and homoacetogens to be the dominant Archaea. Nitrite oxidizing bacteria (NOB), heterotrophic denitrifying bacteria and AnAOB compete nitrite and influenced each other. How to manage NOB, heterotrophic denitrifying bacteria and AnAOB in good cooperation condition is still an issue and need further study.
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Scopus rating (2016): CiteScore 3.38 SJR 1.033 SNIP 1.555
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.899 SNIP 1.326 CiteScore 2.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.881 SNIP 1.389 CiteScore 2.53
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.873 SNIP 1.449 CiteScore 2.51
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.056 SNIP 1.289 CiteScore 2.31
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.919 SNIP 1.38 CiteScore 2.34
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.004 SNIP 1.27
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.114 SNIP 1.382
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.652 SNIP 1.118
Scopus rating (2007): SJR 0.657 SNIP 1.033
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.021 SNIP 1.431
Scopus rating (2005): SJR 0.56 SNIP 1.15
Scopus rating (2004): SJR 0.353 SNIP 0.752
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.408 SNIP 0.804
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.57 SNIP 0.661
Scopus rating (2001): SJR 0.557 SNIP 1.018
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Web of Science (2000): Indexed yes
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Microbial and biochemical process characterization of a low-sludge age EBPR process for resource recovery

General information
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Organisations: Department of Environmental Engineering, Water Technologies, Residual Resource Engineering, Technical University of Denmark
Authors: Valverde Pérez, B. (Intern), Wagner, D. S. (Intern), Lóránt, B. (Ekstern), Gulyay, A. (Intern), Radovici, M. (Ekstern), Angelidaki, I. (Intern), Smets, B. F. (Intern), Plósz, B. G. (Intern)
Number of pages: 1
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Microbial biodiversity enhances micropollutants biotransformation in Moving Bed Biofilm Reactors (MBBR) with controlled biofilm thickness

General information
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Organisations: Department of Environmental Engineering, Water Technologies, Environmental Chemistry, AnoxKaldnes AB
Authors: Torresi, E. (Intern), Fowler, J. (Intern), Polesel, F. (Intern), Smets, B. F. (Intern), Andersen, H. R. (Intern), Christensson, M. (Ekstern), Plósz, B. G. (Intern)
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Main Research Area: Technical/natural sciences
Electronic versions:
Abstract_Z_carriers_Elena_Torresi.pdf

Microbial challenges – contamination and aftergrowth

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Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Albrechtsen, H. (Intern)
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Microbial electrochemical monitoring of volatile fatty acids during anaerobic digestion

Volatile fatty acid (VFA) concentration is known as an important indicator to control and optimize anaerobic digestion (AD) process. In this study, an innovative VFA biosensor was developed based on the principle of a microbial desalination cell. The correlation between current densities and VFA concentrations was firstly evaluated with synthetic digestate. Two linear relationships were observed between current densities and VFA levels from 1 to 30 mM (0.04 to 8.50 mA/m², R²=0.97) and then from 30 to 200 mM (8.50 to 10.80 mA/m², R²=0.95). The detection range was much broader than that of other existing VFA biosensors. The biosensor had no response to protein and lipid which are frequently found along with VFAs in organic waste streams from AD, suggesting the selective detection of VFAs. The current displayed different responses to VFA levels when different ionic strengths and external resistances were applied, though linear relationships were always observed. Finally, the biosensor was further explored with real AD effluents and the results did not show significance differences with those measured by GC. The simple and efficient biosensor showed promising potential for online, inexpensive and reliable measurement of VFA levels during AD and other anaerobic processes.

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Authors: Jin, X. (Intern), Angelidaki, I. (Intern), Zhang, Y. (Intern)
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Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 2.956 SNIP 2.103 CiteScore 5.52
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Web of Science (2013): Indexed yes
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Scopus rating (2012): SJR 3.146 SNIP 2.056 CiteScore 5.17
ISI indexed (2012): ISI indexed yes
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Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.964 SNIP 1.729
Web of Science (2010): Indexed yes
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Scopus rating (2009): SJR 2.835 SNIP 1.803
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Microbial Electrochemical Systems and Technologies: It Is Time To Report the Capital Costs

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Authors: Zhang, Y. (Intern), Angelidaki, I. (Intern)
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Scopus rating (2016): CiteScore 6.26 SJR 2.538 SNIP 1.889
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
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Microbial electrosynthesis of hydrogen peroxide in microbial reverse-electrodialysis electrolysis cell

Microbial reverse-electrodialysis electrolysis cell (MREC) as a novel type of microbial electrochemical technologies has been proposed to produce H₂ and CH₄. In this study, we developed MREC to produce the strong oxidant H₂O₂. In the MREC, electrical potential generated by the exoelectrogens and the salinity-gradient between sea water and river water were utilized to drive the high-rate H₂O₂ production without external power supply. Operational parameters such as air flow rate, pH, cathodic potential, flow rate of high and low concentration solution were investigated. The optimal H₂O₂ production were observed at high and low concentration solution flow rate of 0.5 mL/min, air flow rate of 8-20 mL/min, cathode potential of -0.485 ± 0.025 V (vs Ag/AgCl). Under the optimal conditions, the maximum H₂O₂ yield of 778 ± 11
mg/L could be obtained. Cathode potential was found as the key factor for H2O2 production, which can be controlled through adjusting the air flow rate without power supply and potentiostat. This study shows for the first time high yield synthesis of H2O2 from oxygen reduction in a microbial electrochemical system without external power supply.

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**Microbial granulation for lactic acid production**
This work investigated the formation of microbial granules to boost the productivity of lactic acid (LA). The flocculated form of LA-producing microbial consortium, dominated by Lactobacillus sp. (91.5% of total sequence), was initially obtained in a continuous stirred-tank reactor (CSTR), which was fed with 2% glucose and operated at a hydraulic retention time (HRT) of 12h and pH 5.0±0.1 under a thermophilic condition (50°C). The mixed liquor in the CSTR was then transferred to an up-flow anaerobic sludge blanket reactor (UASB). The fermentation performance and granulation process were monitored with a gradual decrease of HRT from 8.0 to 0.17 h, corresponding to an increase in the substrate loading from 60 to 2,880 g glucose L−1d−1. As the operation continued, the accumulation of biomass in the UASB was clearly observed, which changed from flocculent to granular form with decrease in HRT. Up to the HRT decrease to 0.5 h, the LA concentration was maintained at 19-20 g L−1 with over 90% of substrate removal efficiency. However, further decrease of HRT resulted in a decrease of LA concentration with increase in residual glucose. Nevertheless, the volumetric LA productivity continuously increased, reaching 67 g L-fermenter−1h−1 at HRT 0.17 h. The size of LA-producing granules and hydrophobicity gradually increased with decrease in HRT, reaching 6.0 mm and 60%, respectively. These biogranules were also found to have high settling velocities and low porosities, ranging 2.69-4.73 cm s−1 and 0.39-0.92, respectively.

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Authors: Kim, D. (Ekstern), Lee, M. (Ekstern), Hwang, Y. (Intern), Im, W. (Ekstern), Yun, Y. (Ekstern), Park, C. (Ekstern), Kim, M. (Ekstern)
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Web of Science (2010): Indexed yes
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Web of Science (2007): Indexed yes
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Web of Science (2005): Indexed yes
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Microbial granulation management: Simple changes in reactor operation enable control of granular properties and the engineering of microbial communities in wastewater applications

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State: Published
Organisations: Department of Environmental Engineering, Water Technologies
Authors: Blum, J. (Intern)
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Micronidal turnover of PAH: analysis of degradation and dissolution kinetics and simulation of remediation options

General information
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Organisations: Department of Environmental Engineering, Environmental Chemistry, Technical University of Munich, Helmholtz Centre for Environmental Research
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Microscale In Vitro Assays for the Investigation of Neutral Red Retention and Ethoxyresorufin-O-Deethylase of Biofuels and Fossil Fuels

Only few information on the potential toxic effectiveness of biofuels are available. Due to increasing worldwide demand for energy and fuels during the past decades, biofuels are considered as a promising alternative for fossil fuels in the transport sector. Hence, more information on their hazard potentials are required to understand the toxicological impact of biofuels on the environment. In the German Cluster of Excellence “Tailor-made Fuels from Biomass” design processes for economical, sustainable and environmentally friendly biofuels are investigated. In an unique and interdisciplinary approach, ecotoxicological methods are applied to gain information on potential adverse environmental effects of biofuels at an early phase of their development. In the present study, three potential biofuels, ethyl levulinate, 2-methyltetrahydrofuran and 2-methylfurain were tested. Furthermore, we investigated a fossil gasoline fuel, a fossil diesel fuel and an established biodiesel. Two in vitro bioassays, one for assessing cytotoxicity and one for aryl hydrocarbon receptor agonism, so called dioxin-like activity, as measured by Ethoxyresorufin-O-Deethylase, were applied using the permanent fish liver cell line RTL-W1 (Oncorhynchus mykiss). The special properties of these fuel samples required modifications of the test design. Points that had to be addressed were high substance volatility, material compatibility and low solubility. For testing of gasoline, diesel and biodiesel, water accommodated fractions and a passive dosing approach were tested to address the high hydrophobicity and low solubility of these complex mixtures. Further work has to focus on an improvement of the chemical analyses of the fuel samples to allow a better comparison of any effects of fossil fuels and biofuels.

General information
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Organisations: Department of Environmental Engineering, Environmental Chemistry, RWTH Aachen University
Authors: Heger, S. (Ekstern), Bluhm, K. (Ekstern), Brendt, J. (Ekstern), Mayer, P. (Intern), Anders, N. (Ekstern), Schäffer, A. (Ekstern), Seiler, T. (Ekstern), Hollert, H. (Ekstern)
Mikrobiologisk risikovurdering af øgede temperaturer i grundvandet ved ATES (Aquifer Thermal Energy Storage)

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Authors: Tønder, M. M. (Intern), Christensen, S. C. B. (Intern), Larsen, S. L. (Intern), Albrechtsen, H. (Intern), Boe-Hansen, R. (Ekstern), Niemi Sørensen, S. (Ekstern)
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DTU_GEUS_DCE_2016_Videnskabelig_udredning_af_international_viden_om_skifergas_relateret_til_en_dansk_kontekst. pdf
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Model-based integration of enantiomer and stable isotope fractionation for chiral pesticides degradation

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Authors: Jin, B. (Intern), Rolle, M. (Intern)
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Modeling contaminant plumes in fractured limestone aquifers
Determining the fate and transport of contaminant plumes from contaminated sites in limestone aquifers is important because they are a major drinking water resource. This is challenging because they are often heavily fractured and contain chert layers and nodules, resulting in a complex transport behavior. Improved conceptual models are needed for this type of site. Here conceptual models are developed by combining numerical models with field data. Several types of fracture flow and transport models are available for the modeling of contaminant transport in fractured media. These include the established approaches of the equivalent porous medium, discrete fracture and dual continuum models. However, these modeling concepts are not well tested for contaminant plume migration in limestone geologies. Our goal was to develop and evaluate approaches for modeling the transport of dissolved contaminant plumes in fractured limestone aquifers in 3D and to test methods for determining the required flow and transport parameters.

The models were compared for a contaminated site in Denmark, where a plume of dissolved PCE has migrated through a fractured limestone aquifer. Numerical modeling was used in the planning of field tests and to update the conceptual model in an iterative process. Field data includes information on spill history, distribution of the contaminant (multilevel sampling), geology and hydrogeology. To describe the geology and fracture system, data from borehole logs, packer tests, optical televiewers and cores was combined with an analysis of local heterogeneities and data from analogous sites. A combined pump and tracer test was performed at the site with simultaneous contaminant sampling to determine flow and transport parameters of the fractures and matrix, and to quantify the contaminant distribution in the aquifer. Different models were used for the planning and interpretation of the pump and tracer test. The models were evaluated by examining their ability to describe collected field data. The comparison with data showed that the models have substantially different representations of the contaminant behavior, with different consequences for evaluation of contaminant risk and potential remediation strategies. For instance, the fractured aquifer means that tracer tests result in fast breakthroughs, while larger scale plume transport is much slower. On the plume scale, the equivalent porous medium model and the dual-porosity model can reproduce the main features of the plume at a given time. However, small-scale fracture-matrix interactions such as diffusion of contaminant into the matrix result in non-linear plume speeds, and these cannot be represented with an equivalent-porous medium model. The paper concludes with recommendations on how to identify and employ suitable models to advance the conceptual understanding and as decision support tools for risk assessment and the planning of remedial actions.

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Modeling contaminant transport in limestone aquifers

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Modeling contaminant transport in limestone aquifers

General information
Modeling contaminant transport in limestone aquifers

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Modeling multicomponent ionic transport in groundwater with IPhreeqc coupling: Electrostatic interactions and geochemical reactions in homogeneous and heterogeneous domains

The key role of small-scale processes like molecular diffusion and electrochemical migration has been increasingly recognized in multicomponent reactive transport in saturated porous media. In this study, we propose a two-dimensional multicomponent reactive transport model taking into account the electrostatic interactions during transport of charged ions in physically and chemically heterogeneous porous media. The modeling approach is based on the local charge balance and on the description of compound-specific and spatially variable diffusive/dispersive fluxes. The multicomponent ionic transport code is coupled with the geochemical code PHREEQC-3 by utilizing the IPhreeqc module, thus enabling to perform the geochemical calculations included in the PHREEQC’s reaction package. The multicomponent reactive transport code is benchmarked with different 1-D and 2-D transport problems. Successively, conservative and reactive transport examples are presented to demonstrate the capability of the proposed model to simulate transport of charged species both at the laboratory and at the field scale.

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Modeling position-specific isotope fractionation of organic micropollutants degradation via different reaction pathways

Organic compounds are produced in vast quantities for industrial and agricultural use, as well as for human and animal healthcare [1]. These chemicals and their metabolites are frequently detected at trace levels in fresh water environments, such as groundwater systems, and are referred to as organic micropollutants. Degradation of various organic micropollutants occurs via different reaction pathways. Compound specific stable isotope analysis (CSIA) is a valuable tool to characterize different degradation pathways of these contaminants in different aquatic systems and under different environmental conditions. Recent advances in analytical techniques have promoted the fast development and implementation of multi-element CSIA. However, quantitative frameworks to evaluate multi-element stable isotope data and incorporating mechanistic information on the transformation of different organic contaminants [2,3] are still lacking. In this study we propose an integrated modeling approach to simultaneously predict concentration as well as bulk and position-specific multi-element isotope evolution during the transformation of organic micropollutants [4]. The model simulates position-specific isotopologues explicitly incorporating the atoms that experience isotope effects. Thus, it provides a mechanistic description of isotope fractionation occurring at specific molecular positions. We apply the proposed approach to interpret the data available for three selected organic micropollutants: dichlorobenzamide (BAM), isoproturon (IPU) and diclofenac (DCF). The model successfully reproduces the multi-element isotope data, and precisely captures the dual element isotope trends, characterizing the different degradation pathways. Besides illustrating the model capability of mechanistic evaluation of experimental observations, we also show its potential as a predictive and design tool to explore transformation pathways in micropollutants degradation scenarios for which position-specific isotope data are not (yet) available.

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Modelling and control of nitrogen and phosphorus removing systems

General information
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Organisations: Department of Environmental Engineering, Water Technologies, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS, Krüger A/S, University of Santiago de Compostela
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Modelling free surface aquifers to analyze the interaction between groundwater and sinuous streams

Several mathematical methods for modelling free surface aquifers are available. Aquifer-stream interaction is an important application of these models, and are challenging to simulate because stream interaction is described by a highly variable head boundary, which can cause numerical instabilities and errors. In addition, when streams are sinuous, groundwater flow is truly 3-dimensional, with strong vertical flows and sharp changes in horizontal direction. Here 3 different approaches to simulating free surface aquifers are compared for simulating groundwater-stream interaction. The aim of the models was to investigate the effect of meander bends on the spatial and temporal variability of aquifer-stream
interaction, and to develop a new 3D conceptual model of groundwater-stream interaction. Three mathematical methods were tested, representing the three main methods available for modeling 3D unconfined aquifers: a saturated-unsaturated flow model, moving mesh, and a new coordinate transformation. The saturated/unsaturated model couples the saturated groundwater flow equation with a solution of Richards equation. The moving mesh solves the saturated groundwater equation with a free surface and deformable numerical finite element mesh. Finally, the new coordinate transform method employs a coordinate transform so that the saturated groundwater flow equation is solved on a fixed finite element mesh with a stationary free surface.

This paper describes in detail the new coordinate transform method. It employs a transformation of the vertical coordinate, so that the top surface remains stationary. The transformation introduces non-linearities into the saturated groundwater flow equation, with the hydraulic conductivity becoming a function of the head at the top boundary. Mathematical analysis is then applied to show well posedness, and provide stability and linear convergence results. Numerical results confirm the mathematical analysis. The three methods were compared for a simplified 2-dimensional test case with highly variable stream flow boundaries. Results showed that all methods can properly simulate the groundwater head under steady-state and transient conditions. The coordinate transformation method was the least computationally demanding method, requiring 6 times less simulation time than the saturated-unsaturated and moving mesh flow models. The methods were then compared for a more challenging 3-dimensional problem. Results showed that the coordinate transformation method required 41 times less computational effort than the moving mesh.

The coordinate transformation method was then applied to simulate a field site located at Grindsted stream, Denmark. In order to investigate the importance of stream geometry for the problem, two scenarios were implemented: straight stream and a meandering stream. The model was compared to field data to verify results. The model was shown to properly simulate groundwater head variability measured at piezometers and discharge to the stream as measured by heat flux, point velocity probes and flux meters. The results from the straight stream scenario and the meandering stream scenario showed that meander bends strongly affect groundwater-discharge to the stream: the discharge is focused at the outward pointing side of the meander bends. Similarly, the groundwater flow paths toward the stream are affected by the stream meanders. Shallow groundwater enters the meander from the outward-pointing side of the bend, while deep groundwater flows beneath the stream and enters the stream from the opposite side. On the basis of these results, a new three-dimensional conceptual model of groundwater-stream interaction is proposed. The new conceptual model demonstrates that conventional two-dimensional symmetric groundwater streamflow conceptual models do not apply for real meandering streams.

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Modelling Illicit Drug Fate in Sewers for Wastewater-Based Epidemiology
With increasing consumption of illicit drugs, in particular cocaine and cannabis, in recent decades, the negative social and public health impact has also propagated. Following drug consumption and human metabolism, fractions of unchanged parent drugs and metabolites are excreted into toilets. After transport in sewers, these chemicals enter wastewater treatment plants (WWTPs). Monitoring campaigns are normally performed at WWTP influent to collect representative samples. Following quantitative chemical analysis, measured drug loads are used to estimate population-normalized parent drug consumption based on a candidate biomarker (the parent drug itself or one of the human metabolites). This approach has gained increasing attention in the past decade and is termed wastewater-based epidemiology. It has been shown that this emerging approach can improve and complement survey-based methods.

Sewer systems can be considered as biological reactors, in which the concentration of organic chemicals present in wastewater can be impacted by in-sewer processes during hydraulic residence time. Illicit drug biomarkers, as trace organic chemicals in the range of nanograms to micrograms per liter, are subject to physical, chemical or biological processes in sewers (fate processes). The occurrence of these processes may lead to significant change of drug loads at WWTP influent compared to source release points. Therefore, not accounting for these variations may negatively affect drug use estimates. However, due to a lack of sufficient evidence on potential in-sewer sorption and transformation of drug biomarkers, these processes are often neglected by wastewater-based epidemiologists. The motivation of this thesis was to overcome this substantial knowledge gap by: (i) providing new evidence on sorption and transformation of drug biomarkers in raw wastewater and sewer biofilms; and (ii) developing modelling tools – by combining and extending
To predict the fate of drug biomarkers in raw wastewater, simultaneous evaluation and modelling of substrate utilization and microbial growth processes was performed. It was hypothesized that active biomass dynamics during batch experiments (due to high substrate availability and significant microbial growth) can significantly impact the prediction of biotransformation rates. For this purpose, the Wastewater Aerobic/anaerobic Transformations in Sewers (WATS) model was combined with the Activated Sludge Model for Xenobiotics (ASM-X) to predict the fate of drug biomarkers together with the primary metabolic processes. Two new processes were considered, namely sorption-desorption to reactor wall and abiotic transformation. As for sewer biofilms, the extended ASM-X model was further modified by accounting for diffusive mass transfer limitation of biomarkers from the bulk phase into the biofilm and within the biofilm matrix.

Selected model parameters were estimated with the Bayesian optimization method DREAM(ZS). A calibration methodology was developed with focus on uncertainty propagation among model parameters, e.g. from abiotic transformation rates to biotransformation rates. Subsequently, uncertainty analysis was performed to assess the impact of variability of model parameters on model output. Moreover, different transformation pathways were tested for the selected biomarkers and new pathways were identified based on mass balance, uncertainty analysis, and feasibility of transformations (according to an existing pathway database). Results from the experimental and modelling assessment indicated that by ignoring primary metabolic processes in raw wastewater would impose significant overestimation (up to 385%) of transformation rates under aerobic conditions, whereas no difference was found under anaerobic conditions. Abiotic transformation processes were the dominant removal mechanism for many of the selected chemicals (e.g., cocaine: 80-100%, batch experiments with raw wastewater) under both aerobic and anaerobic conditions. Several biomarkers underwent substantial biotransformation e.g., almost complete removal of heroin and morphine-3-glucuronide after 12 h in batch experiments with raw wastewater. It was further observed that several biofilms can enhance biotransformation of a number of selected chemicals, such as benzoylecgonine and 6-monoacetylmorphine. Overall, redox conditions were found to have an influence on biotransformation rates (especially for methadone) and, to a lesser extent, on abiotic transformation rates. Only a few chemicals, such as 11-hydroxy-THC, were found to sorb onto suspended solids and sewer biofilms. Validation of calibrated models with an independent dataset was successful for most compounds, the main exception being methadone under aerobic conditions.

To demonstrate the impact of in-sewer processes on estimation of daily drug use at catchment level, a generic scenario analysis was performed to assess the uncertainties associated with in-sewer processes and sampling. It was found that ignoring in-sewer processes for cocaine and its metabolite benzoylecgonine can add up to 11% (median value for a large catchment) error in daily cocaine consumption estimates. This error was 43% and 11% for estimates of daily heroin use with 6-monoacetylmorphine and morphine as candidate biomarkers, respectively. In contrary, sampling error (flow-proportional sampling mode) was the highest in the smallest catchment – up to 17% for cocaine. Subsequently, measured cocaine and benzoylecgonine loads from a 2-week monitoring campaign at the Lynetten WWTP influent (Copenhagen, Denmark) were used to estimate cocaine consumption in two upstream catchments by accounting for in-sewer fate processes. Significant differences in consumption trends were observed between weekdays, weekends, holidays and a street music festival. On average, twice as high cocaine consumption was found during festival period as compared to normal weekdays. Wastewater-based epidemiology is a truly interdisciplinary approach in which engineering tools, including models developed and tested in this thesis, can be beneficial for the accurate estimation of drug consumption in urban areas.

**General information**

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Authors: Ramin, P. (Intern), Plósz, B. G. (Intern), Mikkelsen, P. S. (Intern)

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Modelling the Fate of Xenobiotic Trace Chemicals via Wastewater Treatment and Agricultural Resource Reuse

As a result of widespread human activities, pharmaceuticals and biocides are ubiquitously present at trace levels in the environment. Large amounts of these substances, also identified as xenobiotic trace chemicals (XTCs), are released daily from: (i) households and healthcare facilities, following human consumption and disposal; (ii) husbandry and other analogous facilities, following veterinary consumption; and (iii) industrial facilities. A significant fraction of these emissions reaches municipal wastewater treatment plants (WWTPs), where XTCs undergo incomplete removal partly due to WWTP design limitations. These chemicals are thus eventually released to the environment, e.g. in freshwater bodies receiving WWTP effluents, representing a threat to living organisms.

WWTPs have been generally identified as a major point source of XTC emissions to the environment. Nevertheless, due to the high number of marketed and consumed chemicals, and to the uncertainties associated to sampling and analytical methodologies, quantifying the elimination of XTCs during wastewater treatment still remains a challenge. Developing robust modelling tools to predict the fate of XTCs in WWTPs can help overcoming this challenge. However, in-depth understanding of mechanisms and processes, determining XTCs removal during wastewater treatment, is still required. This PhD thesis aimed at filling knowledge gaps in the field of XTC fate modelling during and beyond wastewater treatment. We aimed at improving the comprehension of XTC fate, and thus the predictive capabilities of fate models: (i) at process scale, with a focus on sorption and biological transformation of XTCs in biological treatment systems; (ii) in full-scale WWTPs, assessing the impact of retransformation and WWTP operation on XTC elimination; and (iii) in integrated WWTP-agricultural systems. Different modelling tools, suitting the specific purposes of our investigations, were developed, extended and/or innovatively applied. Fate models used as reference in this thesis include: the Activated Sludge Modelling Framework for Xenobiotics (ASM-X); the generic WWTP model SimpleTreat Activity; and the dynamic soil-plant model for fate prediction in agricultural systems.

Experimental and model-based observations were combined to assess sorption of ionizable XTCs onto activated sludge and XTC biotransformation in moving bed biofilm reactors (MBBRs). Most XTCs are in fact multispecies chemicals, being present in neutral and/or ionized form in wastewater. We demonstrated that pH conditions and, to a lesser extent, iron salt dosing for chemical phosphorus removal can significantly affect solid-liquid partitioning of the zwitterionic antibiotic ciprofloxacin onto activated sludge. Electrostatic interactions and complexation are thus dominating sorption mechanisms. Under a range of pH, redox and iron salt dosing conditions, non-linear sorption (n=0.62–1.33) was observed. Extensions to traditional partitioning models were accordingly proposed for ciprofloxacin and other zwitterionic XTCs, accounting for: (i) high non-linearity of XTC sorption; or (ii) ionization with changing pH and different sorption potential of ionized species. Furthermore, XTCs are typically present in ng L⁻¹ to µg L⁻¹ concentrations in wastewater, being referred to as non-growth substrates, and their biological degradation can be associated with microbial growth processes. In this PhD thesis, we assessed the influence of primary metabolic processes on XTC biotransformation in MBBR biofilm. Our investigation was performed by comparing biotransformation kinetics in pre-denitrifying MBBRs operated in single-stage and three-stage configurations. The latter configuration produced a prolonged biofilm exposure to organic electron donor (COD) loading and complexity tiered by segregated and integrated biofilm reactors, which significantly influenced kinetics of heterotrophic denitrification and XTC biotransformation. Biotransformation rate constants for a number of non-recalcitrant XTCs were found correlated to the denitrification potential of MBBR biofilm, suggesting that XTC degradation occurred via microbial co-metabolism. In addition, enhanced biotransformation kinetics was shown for a number of XTCs (sulfamethoxazole, erythromycin, atenolol) as compared to previous findings for conventional activated sludge.

A number of factors have been described to influence the elimination of XTCs in full-scale WWTPs. Specifically, relevant
Modelling the Impact of Water Sensitive Urban Design technologies on the urban water cycle

Alternative stormwater management approaches for urban developments, also called Water Sensitive Urban Design (WSUD), are increasingly being adopted with the aims of providing flood control, flow management, water quality improvements and opportunities to harvest stormwater for non-potable uses. WSUD structures (WSUDs) are typically small, decentralized systems for managing stormwater runoff near the source. These systems interact with the urban hydrological cycle, modifying the evapotranspiration, runoff and groundwater recharge fluxes. It is challenging to quantify these hydrological changes because of the cost and complexity of modelling multiple WSUD systems in larger scale urban catchments. For this reason, new modelling tools are needed. These tools must be simple enough to be computationally efficient, while still describing the observed hydrological responses of urban catchments. The models must be able to simulate both the response of single WSUDs and many coupled WSUDs in an urban catchment.

This thesis aims to develop new models of two WSUD technologies: green roofs and infiltration trenches/soakaways. In particular the thesis has the following objectives:

1. To identify and develop new models of green roofs and infiltration devices relevant for urban drainage applications, and integrate them into urban hydrological models.
2. To quantify the long term hydrological performance of green roofs and infiltration devices using a statistical analysis of WSUD performance.
3. To model the interaction of infiltration based WSUDs with groundwater.
4. To assess a new combination of different WSUD techniques for improved stormwater management.
5. To model the impact of a widespread implementation of multiple soakaway systems at the catchment scale.
6. To test the models by simulating observed data describing the performance of single WSUD units, and the performance of multiple systems at a catchment scale.

To address these aims, new models of green roofs and soakaways are developed and tested using observations from several urban catchments. The models are used to quantify the hydrological performance of single devices relevant for
Urban drainage applications. Moreover, the coupling of soakaway and detention storages is also modeled to analyze the benefits of combining different local stormwater management systems.

These models are then integrated into urban drainage network models and groundwater models in order to analyze the impact of stormwater infiltration and local detention on drainage networks and groundwater flows.

Results show that soakaways/infiltration trenches and green roofs significantly reduce annual stormwater runoff. Annual runoff from green roofs is 43-68% of the incoming rainfall and 0-62% for soakaways. Peak flow and volume reductions during single events are also quantified as a function of the return period.

Using a part of a soakaway as detention storage significantly improves its ability to reduce single event peak runoff without significant changes to its annual performance. Peak flow and annual runoff reductions are quantified for different soakaway and detention volume combinations. These systems also avoid problems of sewer network surcharge in a small catchment during a 10 year return period event.

The thesis quantifies the hydrological performance of infiltration devices interacting with groundwater. A threshold distance between infiltration devices and groundwater is estimated in order to classify whether infiltration devices are affected by groundwater or not. The threshold distance is determined as function of the soil hydraulic conductivity and the storage volume of the infiltration device. For instance, it is shown that in clay soils, infiltration trenches must be more than 11-12m above the water table if they are to be fully effective.

Widespread stormwater infiltration leads to increased groundwater recharge and the risk of groundwater flooding in areas with shallow groundwater. The increased occurrence of groundwater seepage above terrain is quantified in a case study by a catchment hydrological model that is calibrated to observations. Moreover, the performance of existing stormwater infiltration systems is affected by landuse changes in other parts of their catchment. These changes were quantified for the case study by a model and observations over a 20 year period. It was shown that urbanization with widespread stormwater infiltration increased the risk of groundwater flooding.

WSUDs are useful technologies for controlling urban stormwater runoff and the models presented in this thesis can help by simulating their hydrological impact. Careful engineering design is required to ensure that optimal results are achieved and to avoid unexpected outcomes such as increased groundwater flooding.

**General Information**

State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Water Resources Engineering, DHI Denmark
Authors: Locatelli, L. (Intern), Binning, P. J. (Intern), Mark, O. (Ekstern), Mikkelsen, P. S. (Intern), Arnbjerg-Nielsen, K. (Intern)
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**Modificering af regnserier så de reflekterer et ændret klima**

**General Information**

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Organisations: Department of Environmental Engineering, Urban Water Systems, Rambøll Danmark A/S
Authors: Sørup, H. J. D. (Intern), Gregersen, I. B. (Ekstern), Arnbjerg-Nielsen, K. (Intern)
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**Relations**
Activities:
Modificering af regnserier så de reflekterer et ændret klima
Monitoring of volatile fatty acids during anaerobic digestion using a microbial electrochemical sensor

Volatile fatty acid (VFA) concentration is known as an important indicator to control and optimize anaerobic digestion (AD) process. In this study, an innovative VFA biosensor was developed based on the principle of a microbial desalination cell. The bulk substrate was dosed into the middle chamber innovatively which was separated from the anode chamber by an anion exchange membrane. The detection range can be broadened as only part of the ionized VFAs can transport through the membrane and the biofilm can be protected from inhibitors and toxicants.

The correlation between current densities and VFA concentrations was firstly evaluated with synthetic digestate. Two linear relationships were observed between current densities and VFA levels from 1 to 30 mM (0.04±0.01 to 8.50±0.32 mA/m^2, R^2=0.97) and then from 30 to 200 mM (8.50±0.32 to 10.80±1.26 mA/m^2, R^2=0.95). The detection range was much broader than that of other existing VFA biosensors. The biosensor had no response to protein and lipid which are frequently found along with VFAs in organic waste streams from AD, suggesting the selective detection of VFAs. The current displayed different responses to VFA levels when different ionic strengths and external resistances were applied, though linear relationships were always observed. Finally, the biosensor was further explored with real AD effluents and the results did not show significant differences with those measured by GC. The simple and efficient biosensor showed promising potential for online, inexpensive and reliable measurement of VFA levels during AD and other anaerobic processes. The outcomes will expand the application of bio-electrochemical system application.
Multi-angular observations of vegetation indices from UAV cameras

Unmanned aerial vehicles (UAVs) are found as an alternative to the classical manned aerial photogrammetry, which can be used to obtain environmental data or as a complementary solution to other methods (Nex and Remondino, 2014). Although UAVs have coverage limitations, they have better resolution compared to satellites and aircrafts, they are cheaper and easy to handle, providing data in a short period of time (Matese et al., 2015; Uysal, Toprak and Polat, 2015). Furthermore, they can be equipped with different types of payloads carrying various sensors such as a thermal and multispectral cameras (Bermi et al., 2009), hyper spectral camera (Burkart et al., 2015) and photometric elevation mapping sensor (Shahbazi et al., 2015) among others. Therefore, UAVs can be used in many fields such as agriculture, forestry, archeology, architecture, environment and traffic monitoring (Nex and Remondino, 2014). In this study, the UAV used is a hexacopter s900 equipped with a Global Positioning System (GPS) and two cameras; a digital RGB photo camera and a multispectral camera (MCA), with a resolution of 5472 x 3648 pixels and 1280 x 1024 pixels, respectively. In terms of applications, traditional methods using vegetation indices from reflectance often assume Lambertian models (de Moura et al., 2015), where the light is reflected equally in all the directions (Mobley, 2014) and, therefore, multi-angular reflectance is not considered. However, differences in directional scattering (anisotropy) can provide important data about biophysical behavior in vegetation such as leaf area index (LAI), leaf angular distribution (LAD), vegetation water content, nitrogen and chlorophyll content (Tagesson et al., 2015), canopy roughness and others (de Moura et al., 2015). The Bidirectional Reflectance Distribution Function (BRDF) describes the surface reflectance changes depending on viewing geometry, usually used to analyze remote sensing data from satellite, airborne and surface platforms. (Singh et al., 2016). BRDF observations can also be obtained with the MCA camera located in the UAV. Thus, the aim of this study is to capture multi-angular observations in different forest locations (Sørø and Risø) in Denmark by flying the UAV over the area of interest. Since the payload has a fix position, the viewing angles obtained due to the Field of view (FOV) of the MCA camera can be exploited and the flight pattern simulates some goniometer positions. This approach allows to measure different azimuth and zenith angles according to the sun position and to acquire different characteristics of vegetation depending on a specific time and amount of light.
Multicomponent ionic transport and pH fronts propagation

General information
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Organisations: Department of Environmental Engineering, Water Resources Engineering, University of Tubingen
Authors: Rolle, M. (Intern), Muniruzzaman, M. (Ekstern)
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Multiple coating thicknesses for sampling of organic pollutants – linear regressions confirm equilibrium even in challenging environmental media

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Authors: Mayer, P. (Intern), Nørgaard Schmidt, S. (Intern), Knudsmark Sjøholm, K. (Ekstern), Christensen, J. H. (Ekstern), Gidley, P. (Ekstern), Vorkamp, K. (Ekstern), Witt, G. (Ekstern), Jahnke, A. (Ekstern)
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Nanoproducts – what is actually available to European consumers?
It remains unclear which kinds of nanoproducts are available on the European market, although this information is a prerequisite for any kind of exposure and risk assessment. In order to address this lack of information, we have established The Nanodatabase (http://www.nanodb.dk), which is an online inventory of products claimed by manufacturers to contain nanomaterials (NMs) or be based on nanotechnology. The database currently entails 2231 products. The database is unique and includes basic information about the product (name, NM used, location of NM, product category, etc.) as well as a safety evaluation of each individual product according to the NanoRiskCat-framework. Our analysis of products that are currently present in the database shows that most products fall into “personal care” and “clothing” categories (≥300), followed by “sporting goods” and “cleaning” (>200). Silver and titanium dioxide are the most used NMs, but it is not possible to identify the NMs used for almost 60% of the products in the database. The data analysis shows that for most product categories the dominant route of exposure is dermal, and that the exposure potential as well as
human and environmental hazard potential of most products is either “high” or “unknown”. In order to address the current lack of reporting by manufacturers when it comes to nanoproducts, we recommend that it is made mandatory to disclose and report any nanomaterials used in a consumer product and it becomes illegal to advertise and market products as “nano” when they have no content of nanomaterials.

**General information**

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Organisations: Department of Environmental Engineering, Environmental Chemistry, Residual Resource Engineering
Authors: Hansen, S. F. (Intern), Heggelund, L. R. (Intern), Revilla Besora, P. (Intern), Mackevica, A. (Intern), Boldrin, A. (Intern), Baun, A. (Intern)
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**Nanoscale zero-valent iron impregnation of covalent organic polymer grafted activated carbon for water treatment**

The use of nanoscale zero valent iron (nZVI) has quickly become a leading research material for the treatment of typically hard to degrade contaminants found in groundwater. These contaminants include antibiotics, pesticides, halogenated organics, heavy metals, among others. However, the effectiveness of nZVI has its limitations, due to its high reactivity and subsequent loss of degradative ability. Therefore, nZVI must be stabilized in a matrix allowing for the maintaining of reactivity, as well as the protection from the effects of the surrounding environment.

By employing a nanoporous polymeric network already previously proven to stabilize nZVI and a long-standing water treatment material,1 activated carbon; we have developed an advanced material that allows for the not only the stabilization of nZVI, but also the improved degradation of various water contaminants. This was done by performing a series of surface modification techniques to the surface of the activated carbon, then physically grafting the covalent organic polymer to the carbon in a shell-like manner, and ultimately synthesizing nZVI in situ within the pores of both the activated carbon and the polymeric network. Not only does this enhanced version of activated carbon utilize the outstanding adsorptive properties of both activated carbon and the polymeric network, but it also employs the degradation capability of nZVI. In this way, a new breed of materials is being developed, working in a synergistic manner for the purpose of the remediation of contaminants found in the groundwater.

We confirmed the existence of the polymeric shell with a variety of chemical characterization techniques; including Fourier transform infrared spectroscopy (FTIR), elemental analysis, X-ray photoelectron spectroscopy (XPS), transmission electron microscopy (TEM), and scanning electron microscopy (SEM). We also monitored the degradation and/or adsorption of various contaminants (e.g. chlorinated organics like trichloroethylene and trichloroethane, and heavy metals
like cadmium and nickel) to produce the kinetics of the interactions.

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Organisations: Department of Environmental Engineering, Water Technologies, Department of Micro- and Nanotechnology, Surface Engineering, Department of Applied Mathematics and Computer Science, Korea Advanced Institute of Science & Technology, Seoul National University


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**New treatment technology to remove worms in biological rapid sand filters**

**General information**

State: Published

Organisations: Department of Environmental Engineering, Urban Water Systems

Authors: Christensen, S. C. B. (Intern), Larsen, S. L. (Intern), Asmussen, O. W. (Ekstern), Boe-Hansen, R. (Ekstern), Albrechtsen, H. (Intern)

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**New treatment technology to remove worms in biological sand filter**

**General information**

State: Published

Organisations: Department of Environmental Engineering, Urban Water Systems

Authors: Christensen, S. C. B. (Intern), Larsen, S. L. (Intern), Asmussen, O. (Ekstern), Boe-Hansen, R. (Ekstern), Albrechtsen, H. (Intern)

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**Objective Classification of Rainfall in Northern Europe for Online Operation of Urban Water Systems Based on Clustering Techniques**

This study evaluated methods for automated classification of rain events into groups of "high" and "low" spatial and temporal variability in offline and online situations. The applied classification techniques are fast and based on rainfall data only, and can thus be applied by, e.g., water system operators to change modes of control of their facilities. A k-means clustering technique was applied to group events retrospectively and was able to distinguish events with clearly different temporal and spatial correlation properties. For online applications, techniques based on k-means clustering and quadratic discriminant analysis both provided a fast and reliable identification of rain events of "high" variability, while the k-means provided the smallest number of rain events falsely identified as being of "high" variability (false hits). A simple classification method based on a threshold for the observed rainfall intensity yielded a large number of false hits and was thus outperformed by the other two methods.
Occupational Exposure Assessment of Nanomaterials using Control Banding Tools

Nanotechnology can be termed as the “new industrial revolution”. A broad range of potential benefits in various applications for the environment and everyday life of humans can be related to the use of nanotechnology. Nanomaterials are used in a large variety of products already in the market, and because of their novel physical and chemical characteristics, the application of nanomaterials is projected to increase further. This will inevitably increase the production of nanomaterials with potential increase of exposure for the workers which are the first in line expected to become exposed to potentially hazardous nanomaterials.

Exposure assessment of nanomaterials is more difficult to define and conduct than that of traditional chemicals. This thesis provides an analysis of the field of occupational exposure assessment and a number of challenges are identified. The analysis showed that there are in general two approaches to assess the exposure of nanomaterials at the workplace: they can be measured or they can be estimated by modelling. It was pointed out that measurements are the standard approach used for the assessment of workplace exposure. However, as highlighted throughout the analysis, the assessment of conventional chemicals is well established with clear definition of which metric to use (generally mass concentration). For nanoparticles the assessment procedures are not defined yet and there is debate on which metric...
should be used (e.g., mass, surface, size-number distribution). Similarly to measurements, it was found that models in general can be used successfully and effectively in assessing the exposure to conventional chemicals. Several models are suggested also by the European Chemicals Agency (ECHA) in the technical guidance document R.14 for the assessment of occupational exposure and some of them are under a validation process. However, difficulties arise when the existing models for chemicals are applied to nanoparticles, because of the rapid changes of the nanoparticles in aerosols, which is mainly due to different processes of transformation (agglomeration and aggregation, deposition, chemical reactions, and potential mixing and interaction between the nanomaterial and the background aerosol). Moreover, there are no extensive historical data for comparison and model calibration.

Nevertheless, as it is illustrated throughout this thesis, application of modelling for occupational exposure assessment to nanomaterials is still a promising route. A few years ago a new conceptual model for the assessment of inhalation exposure to nanomaterials was developed. As illustrated in this thesis, this new model includes considerations on nanoparticles behaviour and physical and chemical properties. In addition, several Control Banding (CB) tools for estimating the exposure to nanomaterials have been developed. An evaluation of current CB tools showed that they are all meant for a qualitative or semi-quantitative exposure assessment of nanomaterials. Two of these tools, NanoSafer and Stoffenmanager Nano, are relatively advanced, and they are good foundations for an advanced exposure assessment. Considering the tiered approach for workplace assessment proposed by the OECD, these two tools could be situated, between Tier 1 (Information gathering) and Tier 2 (Basic exposure assessment).

Moreover, the thesis and the included scientific papers provide an in-depth analysis and a case study of CB tools. A set of parameters were identified which should always be taken into account for occupational assessment of inhalation exposure to nanoparticles. Harmonization considering a set of parameters was encouraged in order to pursue the development of an advanced CB tool for occupational exposure assessment to nanomaterials. Such as model could be a suitable strategic component for a first exposure assessment and may also improve the risk communication between stakeholders involved in risk assessment of nanomaterials at the workplace.

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Organisations: Department of Environmental Engineering, Environmental Chemistry, National Research Center for Working Environment
Authors: Liguori, B. (Intern), Baun, A. (Intern), Hansen, S. F. (Intern), Jensen, K. A. (Ekstern)
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Publication: Research › Ph.D. thesis – Annual report year: 2016

On the need for integrating LCA into decision making
The need for sustainable solutions has gained attention both in academia and industry research due to increasing demands of human beings, which are incompatible with limitations in resources availability. Several methods, such as Life Cycle Assessment (LCA), were developed in the past decades to assess the environmental profile of products and services. However, when decision makers have several alternatives at hand to solve a problem, environmental performance is not the only criterion for choosing the best alternative. Other criteria such as risks and economical costs and benefits that are associated with the alternatives will also influence the final choice. Sometimes the most environmentally sustainable alternative may not be the safest or cheapest one. How to make a balanced decision considering environmental performance together with other criteria is not straight forward.

Decision analysis is broadly used to help decision makers identify the best solution among alternatives. The decision is based on expected utility generation, which incorporates consequences (or impacts) associated with each alternative. Depending on the research field and goal of the study, the included consequences can be e.g. environmental impacts, property damages from natural hazards and/or human health impacts. We examined the current decision analysis practice as it is applied in different research fields. The review shows that generally environmental impacts are considered less often than the other consequences. Meanwhile, LCA has been applied in many research fields to assess a wide range of environmental impacts associated with products or services. There is a huge potential for integrating LCA into other decisions analysis tools to include assessments of the environmental profile of alternatives. This will provide the possibility of systematical inclusion of environmental considerations in the decision making process, thus facilitating a more holistic
decision. However, due to different scopes and purposes of LCA and other decision analysis tools, the integration is not straightforward. The lack of consistency in e.g. system boundaries and handling of uncertainty needs to be carefully managed.

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Organisations: Department of Management Engineering, Quantitative Sustainability Assessment, Department of Civil Engineering, Section for Structural Engineering, Transport DTU, Transport Modelling, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Department of Environmental Engineering, Urban Water Systems, National Food Institute, Research Group for Genomic Epidemiology
Authors: Dong, Y. (Intern), Miraglia, S. (Intern), Manzo, S. (Intern), Georgiadis, S. (Intern), Sørup, H. J. D. (Intern), Boriani, E. (Intern), Thøns, S. (Intern), Hauschild, M. Z. (Intern)
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Open-source CFD model for optimization of forward osmosis and reverse osmosis membrane modules
Osmotic membrane separation processes are based on using semi-permeable membranes to remove solutes from a given feed solution. This can happen either as Reverse Osmosis (RO) where a hydraulic pressure is applied to drive separation across the membrane, or as Forward Osmosis (FO) where osmotic pressure difference between a feed solution and a draw solution is used to drive the separation process. In both systems, concentration polarization in the vicinity of membrane surfaces are one of the major concerns in terms of separation efficiency, as this phenomenon effectively reduces the driving forces for the separation processes. In this work we present an optimized computational fluid dynamics (CFD) model capable of efficiently running steady-state and transient simulations of both RO and FO at low computational cost. Use of the model is demonstrated for FO by showing how it can provide theoretical insight into the flow phenomena present in the commonly used lab-scale membrane module CF042. We demonstrate how the model can be used to investigate the way in which various flow and geometry parameters influence module performance. Our results indicate that varying the inlet angles, or the number of inlets, have very little influence on the total mass transfer across the membrane. The model can also be used for investigating mass-transfer for various spacer types, densities and configurations and this is demonstrated in an "analysis of how spacer geometry affects "dead volumes" with low flow in the module. The open source CFD code is provided free-of-charge, so that it might be readily used by the membrane community in prototyping their own custom-designed membrane chambers/modules, or characterize existing chambers/modules. With the optimized solver code presented here simulations in geometries containing millions of cells will converge within 24 h using just a single CPU. (C) 2015 Elsevier B.V. All rights reserved.

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Organisations: Department of Environmental Engineering, Water Technologies, Technical University of Denmark
Authors: Gruber, M. F. (Intern), Aslak, U. (Ekstern), Hélix-Nielsen, C. (Intern)
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Operational strategy, economic and environmental performance of sludge treatment reed bed systems - based on 28 years of experience

Sludge treatment reed bed (STRB) systems have been used for dewatering and mineralisation of sludge in Europe since 1988. STRB systems provide substantial environmental, economic, and operational benefits compared to mechanical sludge dewatering solutions such as belt presses and centrifuges. They require less energy, no chemicals, reduce the sludge volume and produce bio solids with dry solid contents up to 20-40% under Danish climate conditions, depending on the sludge quality. Experience has shown that sludge treated in STRBs represents a high quality product with a low content of pathogens and hazardous organic compounds, qualities that make it suitable for recycling on agricultural land.

The upfront capital cost for STRBs are often higher compared to mechanical dewatering devices. However, the operational expenses (OPEX) (including energy, chemicals, bio solid handling) are significantly lower compared to
conventional mechanical dewatering devices, delivering an economic break-even of about 3-5 years. This paper provides an overview of the operation and maintenance costs and environmental benefits of a typical STRB based on the experiences gained from the operation of a large number of STRBs with yearly treatment capacities between 100 and 3,000 tonnes of dry solid up to approximately 250,000 PE in Denmark and Europe.

**General information**

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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Orbicon
Authors: Nielsen, S. (Ekstern), Larsen, J. D. (Intern)
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BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.466 SNIP 0.599 CiteScore 1.19
Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 0.587 SNIP 0.685 CiteScore 1.14
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 0.568 SNIP 0.7 CiteScore 1.3
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.601 SNIP 0.669 CiteScore 1.13
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Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.591 SNIP 0.626 CiteScore 1.25
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Scopus rating (2010): SJR 0.522 SNIP 0.602
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.589 SNIP 0.686
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.579 SNIP 0.697
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.749 SNIP 0.781
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.693 SNIP 0.796
Optical Biosensors to Explore Biological Systems
The study of live biological systems requires the use of advanced techniques that provide high structural and chemical information and at the same time, avoid damage in the system and modification of the structural/chemical features. Techniques based on interaction with light have shown their capability to work in biosensor devices. For example, Raman spectroscopy can be non-invasive and can provide 1 μm of spatial resolution in 1 second of collection time, well suited for sensing. Moreover, it may give information at the single cell and even approaching the single molecule scale. Here we present the capability of different light based techniques for biosensing.

As the first example, surface enhanced Raman spectroscopy (SERS) is performed in onion using silver plasmonic nanostructures. Our studies detect different molecular compounds present in the plant based on their SERS signals. SERS imaging allows us to monitor the location of nanoparticles and to image chemical compounds within the target. Moreover, a pH-sensitive reporter molecule, pMBA attached to the silver nanoparticles, is used to infer pH values in the extracellular space of an onion layer.

As a second example, we explore how a membrane protein may be used as an efficient sensor in an organic environment via a biomimetic membrane model. The combination of both biomimetic membranes and protein membranes as a signal transduction medium has interesting applications in biology and medicine. It is crucial that the matrix where a protein is embedded is optimal in order to maintain the concentration gradient. Moreover, curvature and mechanical forces in the membrane may also affect the protein function. In this work, by inducing chemical and mechanical changes of the matrix we optimize the system via measuring variations of the gradient through the membrane.
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Scopus rating (2015): SJR 2.145 SNIP 1.173 CiteScore 3.3
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.203 SNIP 1.166 CiteScore 3.33
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Scopus rating (2013): SJR 2.229 SNIP 1.165 CiteScore 3.64
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BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.322 SNIP 1.204 CiteScore 3.75
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.646 SNIP 1.303
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.953 SNIP 1.361
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 3.222 SNIP 1.416
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Scopus rating (2005): SJR 2.659 SNIP 1.403
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Scopus rating (2003): SJR 2.617 SNIP 1.428
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.508 SNIP 1.45
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.428 SNIP 1.386
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Optimal algal cultivation for used water resource recovery

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Organisations: Department of Environmental Engineering, Water Technologies, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS, Technical University of Denmark
Authors: Valverde Pérez, B. (Intern), Wagner, D. S. (Intern), Fuentes-Martínez, J. M. (Ekstern), Steidl, M. (Ekstern), Dechesne, A. (Intern), Flores Alsina, X. (Intern), Gernaey, K. (Intern), Huusom, J. K. (Intern), Plósz, B. G. (Intern)
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Optimised biogas production from the co-digestion of sugar beet with pig slurry: Integrating energy, GHG and economic accounting

Several countries have established a number of increased targets for energy production from renewable sources. Biogas production, which will play a key role in future energy systems largely based on renewable sources, is expected to grow significantly in the next few decades. To achieve these ambitious targets, the biogas production chain has to be optimised to obtain economic viability and environmental sustainability while making use of a diversified range of feedstock materials, including agricultural residues, agro-industrial residues and, to some extent, dedicated energy crops. In this study, we integrated energetic, GHG and economic analysis to optimise biogas production from the co-digestion of pig slurry (PS) and sugar beet pulp silage (SB). We found that utilising SB as a co-substrate improves the energy and GHG balances, mostly because of increased energy production. However, utilising SB negatively affects the profitability of biogas production, because of the increased costs involved in feedstock supply. The scale of the processing plant is neutral in terms of profitability when SB is added. The results indicate that medium-to large-sized biogas plants, using low shares of SB co-substrate, may be the preferred solution.

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Optimising the anaerobic co-digestion of urban organic waste using dynamic bioconversion mathematical modelling

Mathematical anaerobic bioconversion models are often used as a convenient way to simulate the conversion of organic materials to biogas. The aim of the study was to apply a mathematical model for simulating the anaerobic co-digestion of various types of urban organic waste, in order to develop strategies for controlling and optimising the co-digestion process. The model parameters were maintained in the same way as the original dynamic bioconversion model, albeit with minor adjustments, to simulate the co-digestion of food and garden waste with mixed sludge from a wastewater treatment plant in a continuously stirred tank reactor. The model's outputs were validated with experimental results obtained in thermophilic conditions, with mixed sludge as a single substrate and urban organic waste as a co-substrate at hydraulic retention times of 30, 20, 15 and 10 days. The predicted performance parameter (methane productivity and yield) and operational parameter (concentration of ammonia and volatile fatty acid) values were reasonable and displayed good correlation and accuracy. The model was later applied to identify optimal scenarios for an urban organic waste co-digestion process. The simulation scenario analysis demonstrated that increasing the amount of mixed sludge in the co-substrate had a marginal effect on the reactor performance. In contrast, increasing the amount of food waste and garden waste resulted in improved performance.

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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Blueprinter
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Scopus rating (2016): CiteScore 7.49 SJR 2.629 SNIP 2.558
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BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.957 SNIP 2.727 CiteScore 6.13
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BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.693 CiteScore 6.02
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.966 SNIP 2.456 CiteScore 5.15
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.867 SNIP 2.374 CiteScore 5.43
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Web of Science (2011): Indexed yes
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Scopus rating (2010): SJR 2.582 SNIP 2.196
Optimization of biomethanation focusing on high ammonia loaded processes

The toxicity effect of high ammonia is one of the most common problems, which cause imbalance and low biogas production rate in biogas plants. When protein-rich substrates (e.g. pig manure and mink manure, food waste, etc.) are used in biogas plants, lead to suboptimal utilization of the biogas potential and unstable biogas process. However, up to now, the solutions for alleviating ammonia toxicity effect have been proven either too expensive or time consuming for the full-scale biogas plants. Thus, sustainable and practical solutions to overcome the problem of ammonia inhibition efficiently are urgently required. In order to alleviate the toxicity effect of high ammonia levels, some new ideas-hypotheses were presented and evaluated in this thesis.

Firstly, preliminary modelling results from a previous study, have demonstrated that the increase of lipids' concentration in ammonia-rich substrates, could theoretically mitigate the ammonia inhibition problem (Angelidaki et al., 1999). Therefore, the effect of co-digestion of cattle manure with lipids (i.e. glycerol trioleate (GTO)) under high ammonia levels (5 g NH4+-N·L-1) in anaerobic continuous stirred tank (CSTR) reactors (RGTO) was assessed. Additionally, for comparison purposes, a soluble carbohydrate (i.e. glucose) was also used as a co-substrate in an identical CSTR reactor (RGLU). At 5 g NH4+-N·L-1, relative methane production of RGTO and RGLU, was 10.5% and 41% compared to the expected uninhibited production, respectively. At the same time control reactor (RCTL), only fed with manure, reached 32.7% compared to the uninhibited basis production. Therefore, the hypothesis that the co-digestion of manure with lipids could alleviate the ammonia inhibition was not supported by the results. However, an “ammonia-LCFA synergetic inhibitory effect” was observed, which caused a deterioration of the inhibition effect in anaerobic digestion process. On contrary, the reactor where glucose was co-digested demonstrated higher tolerance to ammonia toxicity compared with the reactor where GTO was used.

Secondly, the problem of ammonia inhibition during biomethanation process could also be solved by microbiological methods. It is possible to promote the syntrophic acetate oxidation pathway during biomethanation process for counteracting ammonia inhibition. Therefore, the effects of different ammonia levels on pure strains of syntrophic acetate oxidation bacteria (SAOB) and hydrogenotrophic methanogens were evaluated. Furthermore, the effect of different ammonia levels on the syntrophic cultivation of SAOB and hydrogenotrophic methanogens was also assessed. The results showed that some hydrogenotrophic methanogens (79.1% of the theoretical methane production) were equally, or more resistant to ammonia toxicity compared to SAOB (11.1% of the theoretical methane production). In addition, the thermophilic hydrogenotrophic methanogens tested in the current study were more robust to high ammonia concentrations.
compared to the mesophilic hydrogenotrophic methanogens, which was contradictory to the results of some previous studies. Moreover, for SAOB, the resistance to ammonia toxicity could be improved by syntrophic cultivation with hydrogenotrophic methanogens, which indicated that at high ammonia levels, hydrogenotrophic methanogens seem to be the key players in the SAO pathway.

Thirdly, based on the same idea (promoting the syntrophic acetate oxidation pathway to alleviate ammonia inhibition), the hypothesis of bioaugmentation with high ammonia tolerant methanogenic archaea could be a new practical solution for fast recovery from ammonia inhibition. The results derived from this study clearly demonstrated a 31.3% increase in methane production yield in the CSTR reactor, at steady-state, after bioaugmentation. It indicated that this new solution to counteract ammonia inhibition was more practical and effective compared with other methods applied today in continuous reactors. Furthermore, bioaugmentation with an ammonia tolerant methanogen to alleviate ammonia toxicity could be applied for improving the efficiency of biomethanation process in full-scale continuous reactors.

Finally, an innovative method, where hydrogen is injected in the anaerobic reactor and subsequently been converted together with carbon dioxide to methane by hydrogenotrophic methanogens, could potentially be more tolerant to ammonia toxicity. Therefore, the effect of different ammonia levels on this hydrogen assisted biogas upgrading process under different hydrogen partial pressure (0, 0.25, 0.5 and 1 atm) in anaerobic reactors at both mesophilic and thermophilic temperature was evaluated. When the initial hydrogen partial pressure was 0.5 atm, the methane yield at high ammonia load (7 g NH4+-N L-1) was 41.0% and 22.3% lower than at low ammonia load (1 g NH4+-N L-1) in mesophilic and thermophilic condition, respectively. For the reactors without adding hydrogen, the methane yield decreased 65.0% (mesophilic) and 44.2% (thermophilic) when ammonia level increased to 7 g NH4+-N L-1. The results demonstrated that the hydrogen assisted biogas production and upgrading processes were inhibited by high ammonia levels. Nevertheless, the hydrogen assisted biogas upgrading process was still more robust to the increasing ammonia concentrations compared to the conventional anaerobic digestion processes. Under all the different ammonia concentrations tested in the current study, the optimal hydrogen partial pressure in batch reactors was 0.5 atm. Furthermore, at 0.5 atm of hydrogen partial pressure, the thermophilic methanogens seemed to be more robust to high ammonia concentrations (5 and 7 g NH4+-N L-1) compared with mesophilic methanogens.
Optimizing nitrification in biological rapid sand filters: Diagnosing and supplementing micronutrients needed for proper filter performance

Nitrification is an important biological process commonly used in biological drinking water filters to remove ammonium from drinking water. Recent research has shown that a lack of micronutrients could be limiting the performance of these filters. Because nitrification is a biological process, carbon, nitrogen, phosphorus and other micronutrients, such as copper, are required to ensure growth and activity. In nitrification, copper is a micronutrient that is needed in the amoA enzyme used by ammonia-oxidizers to oxidize ammonium to nitrite. Increasing nitrification performance is needed in many filters that are unable to meet ammonium guideline values for drinking water, and can also be used to optimize filter performance by increasing water treatment capacity. Although copper supplementation can increase nitrification in some filters with nitrification problems, it does not always work. Therefore, in order to avoid the time, expense, and regulatory hurdles of supplementing a filter with copper, there is a need to accurately diagnose copper limitations in these filters. To determine if copper addition could increase nitrification in filters with nitrification problems, a bench scale batch essay was developed and tested. Initial batch experiments showed that proper mixing was needed to avoid concentration gradients, and that caution should be taken when mixing to avoid damaging the filter coating. Initial experiments were used to determine the proper mixing regime, which was then applied to all further batch tests. A collaboration between DTU Environment, industrial partners, and different water works was established to test the batch essays at two different water works. Both water works had trouble meeting the Danish guideline value for ammonium (0.05 mg NH4/L). At the start of the batch essays, ammonium removal was determined at 3 different ammonium concentrations, both with and without copper addition (for a total of 6 different batch essays). This was done at both water works to determine the initial removal rates. After initial dosing, the ammonium to each batch set up was increased to 10 mg NH4/L to allow for a period of incubation. After a week, the batches were re-spiked to the 3 different ammonium concentrations examined initially. Copper supplementation did not show any observable difference in ammonium removal at the start of the batch essays. After the cultivation period, one of the water works showed increased ammonium removal with copper addition at all examined ammonium concentrations. This was also observed in the corresponding full scale waterworks. The addition of copper yielded no observed difference in ammonium removal at the second water works, which was also observed in the corresponding full scale filter. These findings are important as they show that the batch essays can be used as a diagnostic tool to determine if copper supplementation can increase nitrification performance. The developed batch essays have important practical implications in optimizing nitrification performance. They can not only be used to diagnose and improve nitrification in existing filters, but can also be used to determine if the nitrification capacity of a filter can be increased, which could optimize filter operation. The batch essays have the potential to be an important diagnostic tool that could decrease regulatory hurdles, and save time and money.

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Optimizing nitrification in biological rapid sand filters for drinking water production
Addition of phosphate or trace metals or better management e.g. in terms of ammonium load can improve the nitrification rate and efficiency in biological rapid sand filters.

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Authors: Albrechtsen, H. (Intern), Smets, B. F. (Intern), Lee, C. O. (Intern), Tatari, K. (Intern), Nielsen, P. B. (Ekstern), Binning, P. J. (Intern), Boe-Hansen, R. (Ekstern), Wagner, F. B. (Intern)
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Optimizing Wellfield Operation in a Variable Power Price Regime

Wellfield management is a multiobjective optimization problem. One important objective has been energy efficiency in terms of minimizing the energy footprint (EFP) of delivered water (MWh/m³). However, power systems in most countries are moving in the direction of deregulated markets and price variability is increasing in many markets because of increased penetration of intermittent renewable power sources. In this context the relevant management objective becomes minimizing the cost of electric energy used for pumping and distribution of groundwater from wells rather than minimizing energy use itself. We estimated EFP of pumped water as a function of wellfield pumping rate (EFP-Q relationship) for a wellfield in Denmark using a coupled well and pipe network model. This EFP-Q relationship was subsequently used in a Stochastic Dynamic Programming (SDP) framework to minimize total cost of operating the combined wellfield-storage-demand system over the course of a 2-year planning period based on a time series of observed price on the Danish power market and a deterministic, time-varying hourly water demand. In the SDP setup, hourly pumping rates are the decision variables. Constraints include storage capacity and hourly water demand fulfilment. The SDP was solved for a baseline situation and for five scenario runs representing different EFP-Q relationships and different maximum wellfield pumping rates. Savings were quantified as differences in total cost between the scenario and a constant-rate pumping benchmark. Minor savings up to 10% were found in the baseline scenario, while the scenario with constant EFP and unlimited pumping rate resulted in savings up to 40%. Key factors determining potential cost savings obtained by flexible wellfield operation under a variable power price regime are the shape of the EFP-Q relationship, the maximum feasible pumping rate and the capacity of available storage facilities.
Ormebekæmpelse i vandværksfiltre: Forekomst og bekæmpelsesteknologi

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Osmotic stress tolerance in semi-terrestrial tardigrades

Little is known about ionic and osmotic stress tolerance in tardigrades. Here, we examine salt stress tolerance in Ramazzottius oberhaeuseri and Echiniscus testudo from Nivå (Denmark) and address whether limno-terrestrial tardigrades can enter a state of quiescence (osmobiosis) in the face of high external osmolyte concentrations. Direct transfers into NaCl solutions showed an upper tolerance level of around 600 mOsm kg⁻¹ in R. oberhaeuseri and 200 mOsm kg⁻¹ in E. testudo. During salt exposures, R. oberhaeuseri contracted into a ‘tun’, whereas E. testudo remained active leaving it more susceptible to acute effects of the ions. Further experiments focused on the more resilient R. oberhaeuseri, which entered a tun and readily regained activity when directly exposed to polyethylene glycol and sucrose of up to 872 ± 0 and 813 ± 3 mOsm kg⁻¹, respectively, revealing a higher tolerance towards non-ionic osmolytes.
as compared to NaCl. Ramazzottius oberhaeuseri furthermore readily regained activity following gradual increases in non-ionic osmolytes and NaCl of up to 2434 ± 28 and 1905 ± 3 mOsm kg⁻¹, respectively, showing that short-term acclimation promoted salt stress tolerance. Our results suggest that the limno-terrestrial R. oberhaeuseri enters a state of quiescence in the face of high external osmotic pressure and that it, in this state, is highly tolerant of ionic and osmotic stress.

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Organisations: Department of Environmental Engineering, Water Technologies, University of Copenhagen
Authors: Heidemann, N. W. T. (Ekstern), Smith, D. K. (Ekstern), Hygum, T. L. (Ekstern), Stapanie, L. (Ekstern), Clausen, L. K. B. (Ekstern), Jørgensen, A. (Ekstern), Helix-Nielsen, C. (Intern), Møbjerg, N. (Ekstern)
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Scopus rating (2014): SJR 1.529 SNIP 1.61 CiteScore 2.77
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Scopus rating (2013): SJR 1.33 SNIP 1.635 CiteScore 2.8
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.278 SNIP 1.606 CiteScore 2.55
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.111 SNIP 1.475 CiteScore 2.26
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.376 SNIP 1.611
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.289 SNIP 1.632
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Scopus rating (2008): SJR 1.246 SNIP 2.064
Scopus rating (2007): SJR 1.393 SNIP 2.004
Scopus rating (2006): SJR 1.31 SNIP 1.527
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Scopus rating (2000): SJR 1.593 SNIP 2.137
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Overestimation of soil CO₂ fluxes from closed chamber measurements at low atmospheric turbulence biases the diurnal pattern and the annual soil respiration budget

Abstract

Precise quantification of the diurnal and seasonal variation of soil respiration (Rs) is crucial to correctly estimate annual soil carbon fluxes as well as to correctly interpret the response of Rs to biotic and abiotic factors on different time scale. In this study we found a systematic effect of low atmospheric turbulence on continuous hourly Rs measurements with closed chambers throughout one year in a temperate Danish beech forest. Using friction velocity (u*) measured at the site above the canopy, we filtered out chamber flux data measured at low atmospheric turbulence. The non-filtered data showed a clear diurnal pattern of Rs across all seasons with highest fluxes during night time suggesting an implausible negative temperature sensitivity of Rs. When filtering out data at low turbulence, the annually averaged diurnal pattern changed, such that the highest Rs fluxes were seen during day time, i.e. following the course of soil temperatures. This effect on the diurnal pattern was due to low turbulence primarily occurring during night time. We calculated different annual Rs budgets by filtering out fluxes for different levels of u*. The highest annual Rs budget was found when including all data and it decreased with an increasing u* filter threshold. Our results show that Rs was overestimated at low atmospheric turbulence throughout the year and that this overestimation considerably biased the diurnal pattern of Rs and led to an overestimation of the annual Rs budget. Thus we recommend that that any analysis of the diurnal pattern of Rs must consider overestimation of Rs at low atmospheric turbulence, to yield unbiased diurnal patterns. This is crucial when investigating temperature responses and potential links between CO₂ production and Rs on a short time scale, but also for correct estimation of annual Rs budgets. Acknowledgements: This study was funded by the free Danish Ministry for Research, Innovation and higher Education, the free Danish Research Council (DFF - 1323-00182).
Overordnet beskrivelse af skifergas og skifergasproduktion

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Authors: Hansen, S. F. (Intern)
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Oversigt over forurenende stofgruppers skæbne i miljøet

**General information**
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Organisations: Department of Environmental Engineering, Water Resources Engineering
Authors: Bjerg, P. L. (Intern)
Pages: 73-74
Ozonation for source treatment of pharmaceuticals in hospital wastewater - ozone lifetime and required ozone dose

Ozonation aimed at removing pharmaceuticals was studied in an effluent from an experimental pilot system using staged moving bed biofilm reactor (MBBR) tanks for the optimal biological treatment of wastewater from a medical care unit of Aarhus University Hospital. Dissolved organic carbon (DOC) and pH in samples varied considerably, and the effect of these two parameters on ozone lifetime and the efficiency of ozone in removing pharmaceuticals were determined. The pH in the effluent varied from 5.0 to 9.0 resulting in approximately a doubling of the required ozone dose at the highest pH for each pharmaceutical. DOC varied from 6 to 20 mg-DOC/L. The ozone required for removing each pharmaceutical, varied linearly with DOC and thus, ozone doses normalized to DOC (specific ozone dose) agreed between water samples (typically within 15%). At neutral pH the specific ozone dose required to remove the easiest degradable pharmaceutical, sulfadiazine, was 0.50 ± 0.04 mg-O3/mg-DOC and the most recalcitrant, diatrizoic acid, required 4.7 ± 0.6 mg-O3/mg-DOC. The lifetime of ozone increased drastically in the higher end of the indicated dosage. At the lowest observed pH of 5.0, its lifetime was quadrupled to 20 min which influences the design of the reaction tank. The addition of 0.1 mg-H2O2 per 1 mg-O3 mitigated the prolonged lifetime without a corresponding influence in the pharmaceutical removal efficiency of ozone.

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Authors: Hansen, K. M. S. (Intern), Spiliotopoulou, A. (Intern), Chhetri, R. K. (Intern), Casas, M. E. (Ekstern), Bester, K. (Ekstern), Andersen, H. R. (Intern)
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Scopus rating (2015): CiteScore 5.68
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Passive Sampling in Regulatory Chemical Monitoring of Nonpolar Organic Compounds in the Aquatic Environment

We reviewed compliance monitoring requirements in the European Union, the United States, and the Oslo-Paris Convention for the protection of the marine environment of the North-East Atlantic, and evaluated if these are met by passive sampling methods for nonpolar compounds. The strengths and shortcomings of passive sampling are assessed for water, sediments, and biota. Passive water sampling is a suitable technique for measuring concentrations of freely dissolved compounds. This method yields results that are incompatible with the EU's quality standard definition in terms of total concentrations in water, but this definition has little scientific basis. Insufficient quality control is a present weakness of passive sampling in water. Laboratory performance studies and the development of standardized methods are needed to improve data quality and to encourage the use of passive sampling by commercial laboratories and monitoring agencies. Successful prediction of bioaccumulation based on passive sampling is well documented for organisms at the lower trophic levels, but requires more research for higher levels. Despite the existence of several knowledge gaps, passive sampling presently is the best available technology for chemical monitoring of nonpolar organic compounds. Key issues to be addressed by scientists and environmental managers are outlined.

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Physico-chemical characterisation of material fractions in household waste: Overview of data in literature
State-of-the-art environmental assessment of waste management systems rely on data for the physico-chemical composition of individual material fractions comprising the waste in question. To derive the necessary inventory data for different scopes and systems, literature data from different sources and backgrounds are consulted and combined. This study provides an overview of physico-chemical waste characterisation data for individual waste material fractions available in literature and thereby aims to support the selection of data fitting to a specific scope and the selection of uncertainty ranges related to the data selection from literature. Overall, 97 publications were reviewed with respect to employed characterisation method, regional origin of the waste, number of investigated parameters and material fractions and other qualitative aspects. Descriptive statistical analysis of the reported physico-chemical waste composition data was performed to derive value ranges and data distributions for element concentrations (e.g. Cd content) and physical parameters (e.g. heating value). Based on 11,886 individual data entries, median values and percentiles for 47 parameters in 11 individual waste fractions are presented. Exceptional values and publications are identified and discussed. Detailed datasets are attached to this study, allowing further analysis and new applications of the data.
Physico-chemical characterisation of material fractions in residual and source-segregated household waste in Denmark

Physico-chemical waste composition data are paramount for the assessment and planning of waste management systems. However, the applicability of data is limited by the regional, temporal and technical scope of waste characterisation studies. As Danish and European legislation aims for higher recycling rates evaluation of source-segregation and recycling chains gain importance. This paper provides a consistent up-to-date dataset for 74 physico-chemical parameters in 49 material fractions from residual and 24 material fractions from source-segregated Danish household waste. Significant differences in the physico-chemical properties of residual and source-segregated waste fractions were found for many parameters related to organic matter, but also for elements of environmental concern. Considerable differences in potentially toxic metal concentrations between the individual recyclable fractions within one material type were observed. This indicates that careful planning and performance evaluation of recycling schemes are important to ensure a high quality of collected recyclables. Rare earth elements (REE) were quantified in all waste fractions analysed, with the highest concentrations of REE found in fractions with high content of mineral raw materials, soil materials and dust. The observed REE concentrations represent the background concentration level in non-hazardous waste materials that may serve as a reference point for future investigations related to hazardous waste management. The detailed dataset provided here can be used for assessments of waste management solutions in Denmark and for the evaluation of the quality of recyclable materials in waste.

General information
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Publication information
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Polishing of pharmaceuticals in conventionally treated wastewater with intermittently fed Moving Bed Biofilm Reactors (MBBR)

General information
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Organisations: Department of Environmental Engineering, Water Technologies
Authors: Tang, K. (Intern)
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Polymers as reference partitioning phase: polymer calibration for an analytically operational approach to quantify multimedia phase partitioning
Polymers are increasingly applied for the enrichment of hydrophobic organic chemicals (HOCs) from various types of samples and media in many analytical partitioning-based measuring techniques. We propose using polymers as a reference partitioning phase and introduce polymer-polymer partitioning as the basis for a deeper insight into partitioning differences of HOCs between polymers, calibrating analytical methods, and consistency checking of existing and calculation of new partition coefficients. Polymer-polymer partition coefficients were determined for polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and organochlorine pesticides (OCPs) by equilibrating 13 silicones, including polydimethylsiloxane (PDMS) and low-density polyethylene (LDPE) in methanol-water solutions. Methanol as cosolvent ensured that all polymers reached equilibrium while its effect on the polymers' properties did not significantly affect silicone-silicone partition coefficients. However, we noticed minor cosolvent effects on determined polymer-polymer partition coefficients. Polymer-polymer partition coefficients near unity confirmed identical absorption capacities of several PDMS materials, whereas larger deviations from unity were indicated within the group of silicones and between silicones and LDPE. Uncertainty in polymer volume due to imprecise coating thickness or the presence of fillers was identified as the source of error for partition coefficients. New polymer-based (LDPE-lipid, PDMS-air) and multimedia partition coefficients (lipid-water, air-water) were calculated by applying the new concept of a polymer as reference partitioning phase and by using polymer-polymer partition coefficients as conversion factors. The present study encourages the use of polymer-polymer partition coefficients, recognizing that polymers can serve as a linking third phase for a quantitative understanding of equilibrium partitioning of HOCs between any two phases.

General information
State: Published
Organisations: National Food Institute, Research Group for Molecular Toxicology, Department of Environmental Engineering, Environmental Chemistry, Hamburg University of Applied Sciences, Masaryk University
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Pages: 5818–5826
Publication date: 2016
Main Research Area: Technical/natural sciences
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Position-specific isotope modeling of organic micropollutants transformations through different reaction pathways

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering
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Position-specific isotope modeling of organic micropollutants transformation through different reaction pathways

The degradation of organic micropollutants occurs via different reaction pathways. Compound specific isotope analysis is a valuable tool to identify such degradation pathways in different environmental systems. We propose a mechanism-based modeling approach that provides a quantitative framework to simultaneously evaluate concentration as well as bulk and position-specific multi-element isotope evolution during the transformation of organic micropollutants. The model explicitly simulates position-specific isotopologues for those atoms that experience isotope effects and, thereby, provides a mechanistic description of isotope fractionation occurring at different molecular positions. To demonstrate specific features of the modeling approach, we simulated the degradation of three selected organic micropollutants: dichlorobenzamide (BAM), isoproturon (IPU) and diclofenac (DCF). The model accurately reproduces the multi-element isotope data observed in previous experimental studies. Furthermore, it precisely captures the dual element isotope trends characteristic of different reaction pathways as well as their range of variation consistent with observed bulk isotope fractionation. It was also possible to directly validate the model capability to predict the evolution of position-specific isotope ratios with available experimental data. Therefore, the approach is useful both for a mechanism-based evaluation of experimental results and as a tool to explore transformation pathways in scenarios for which position-specific isotope data are not yet available.
Soil microbial diversity is huge and a few grams of soil contain more bacterial taxa than there are bird species on Earth. This high diversity often makes predicting the responses of soil bacteria to environmental change intractable and restricts our capacity to predict the responses of soil functions to global change. Here, using a long-term field experiment in a California grassland, we studied the main and interactive effects of three global change factors (increased atmospheric CO2 concentration, precipitation and nitrogen addition, and all their factorial combinations, based on global change scenarios for central California) on the potential activity, abundance and dominant taxa of soil nitrite-oxidizing bacteria (NOB). Using a trait-based model, we then tested whether categorizing NOB into a few functional groups unified by physiological traits enables understanding and predicting how soil NOB respond to global environmental change. Contrasted responses to global change treatments were observed between three main NOB functional types. In particular, putatively mixotrophic Nitrobacter, rare under most treatments, became dominant under the 'High CO2+Nitrogen+Precipitation' treatment. The mechanistic trait-based model, which simulated ecological niches of NOB types consistent with previous ecophysiological reports, helped predicting the observed effects of global change on NOB and elucidating the underlying biotic and abiotic controls. Our results are a starting point for representing the
overwhelming diversity of soil bacteria by a few functional types that can be incorporated into models of terrestrial ecosystems and biogeochemical processes.

**Prediction of bacterial growth on xenobiotics**

The utilisation of a given substrate leads to bacterial growth and the associated yield is normally determined experimentally. Different yield estimation methods exist based on knowledge of the Gibbs energy of reaction and the energy needed for synthesis of new biomass [1-4]. Estimating yield from thermodynamic considerations of
stoichiometrically balanced reactions is typically done in biotechnology and wastewater treatment [5], an approach recently adopted by Helbling et al. [6]. More recent methods specifically incorporate detailed knowledge of the degradation pathway and bacterial metabolism to attain predictions closer to the experimentally observed yields [3]. However, this knowledge is seldom known for xenobiotics in the environment but is needed to assess the turnover leading to biomass production, i.e. for sludge production or biogenic residues. The objectives of the present study were thus to (i) formulate and use a simple quantitative structure-activity relationship to estimate a minimum growth yield under aerobic conditions and (ii) compare the estimations with experimental results from literature. We based our estimation method on the approach suggested by Diekert [2], requiring as input just the Gibbs energy of formation of the reactants and products and a limited amount of structural data (e.g., the number of carbon atoms in the substrate). To estimate the yield, the Gibbs energy of reaction was quantified from balanced mineralisation reactions as the difference between the Gibbs energy of formation of the products and reactants. The Gibbs energy of the mineralisation reaction can be regarded as the maximum energy released and partly captured by the biomass. The carbon present in the substrate is used for synthesis and oxidised to CO2 to yield energy for anabolism. We accounted for this by specifying how much of the energy can be used as a function of the chemical structure based on general rules of microbial turnover. Thus, we obtain a minimum yield from use of the substrate as a sole source of energy and carbon. In order to test the applicability of our estimation method, we evaluated it with both simple substrates (e.g. acetate, methanol, and glyoxylate) and xenobiotics (e.g. 2,4-D, linuron, carbofuran, carbon tetrachloride, and toluene). Experimental data for the simple substrates were taken from [4], for xenobiotics from [6] and own experimental data. For simple substrates, our approach predicts yields close to experimental values and also for xenobiotics the yield predictions for most of the compounds are close to the experimentally obtained values. Overall, with our method we were able to obtain yield predictions close to experimental values with a minimum of input information. Mor
Probabilistic modelling of sea surges in coastal urban areas

General information
State: Published
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Probabilistic runoff volume forecasting in risk-based optimization for RTC of urban drainage systems
This article demonstrates the incorporation of stochastic grey-box models for urban runoff forecasting into a full-scale, system-wide control setup where setpoints are dynamically optimized considering forecast uncertainty and sensitivity of overflow locations in order to reduce combined sewer overflow risk. The stochastic control framework and the performance of the runoff forecasting models are tested in a case study in Copenhagen (76 km² with 6 sub-catchments and 7 control points) using 2-h radar rainfall forecasts and inlet flows to control points computed from a variety of noisy/oscillating in-sewer measurements. Radar rainfall forecasts as model inputs yield considerably lower runoff forecast skills than “perfect” gauge-based rainfall observations (ex-post hindcasting). Nevertheless, the stochastic grey-box models clearly outperform benchmark forecast models based on exponential smoothing. Simulations demonstrate notable improvements of the control efficiency when considering forecast information and additionally when considering forecast uncertainty, compared with optimization based on current basin fillings only.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Urban Water Systems, Department of Environmental Engineering, Dynamical Systems, Krüger A/S
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Protocol for settling velocity model calibration using an innovative batch settling test-- focus on identifiability analysis of the hindered-transient-compression model

General information
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Organisations: Department of Environmental Engineering, Water Technologies, Technical University of Denmark
Quantification of chemical contaminants in the paper and board fractions of municipal solid waste

Chemicals are used in materials as additives in order to improve the performance of the material or the production process itself. The presence of these chemicals in recyclable waste materials may potentially affect the recyclability of the materials. The addition of chemicals may vary depending on the production technology or the potential end-use of the material. Paper has been previously shown to potentially contain a large variety of chemicals. Quantitative data on the presence of chemicals in paper are necessary for appropriate waste paper management, including the recycling and re-processing of paper. However, a lack of quantitative data on the presence of chemicals in paper is evident in the literature.

The aim of the present work is to quantify the presence of selected chemicals in waste paper derived from households. Samples of paper and board were collected from Danish households, including both residual and source-segregated materials, which were disposed of (e.g., through incineration) and recycled, respectively. The concentration of selected chemicals was quantified for all of the samples. The quantified chemicals included mineral oil hydrocarbons, phthalates, phenols, polychlorinated biphenyls, and selected toxic metals (Cd, Co, Cr, Cu, Ni, and Pb). The results suggest large variations in the concentration of chemicals depending on the waste paper fraction analysed. Research on the fate of chemicals in waste recycling and potential problem mitigation measures should be focused on in further studies.

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State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Environmental Chemistry
Authors: Pivnenko, K. (Intern), Olsson, M. E. (Intern), Götzte, R. (Intern), Eriksson, E. (Intern), Astrup, T. F. (Intern)
Quantification of dermal exposure to nanoparticles from solid nanocomposites by using single particle ICP-MS

Engineered nanoparticles are used in various applications due to their unique properties, which has led to their widespread use in consumer products. Silver, titanium and copper-based nanoparticles are few of the most commonly used nanomaterials in consumer products, mainly due to their biocidal, optical or photocatalytical properties. There is a lot of research focusing on effects exerted by nanoparticles, but the knowledge concerning release and subsequent exposure to nanoparticles is very limited, and information regarding potential dermal exposure from nanomaterial containing solid articles in particular is currently lacking. Challenges with regard to qualitative and quantitative characterization of nanoparticle exposure have been increasingly addressed in the literature in the last decade, and single particle ICP-MS has shown to be one of the most promising techniques for nanoparticle detection and characterization. In this study, we have investigated the potential dermal exposure to three different types of nano-enabled consumer products: Ag-containing keyboard covers, TiO₂ coated ceramic tiles, and wood painted with CuO containing paint. The potential for dermal transfer from the aforementioned surfaces was tested by surface wiping followed by analysis using single particle ICP-MS. The nanoparticles were extracted from the wipes by ultrasonication in deionized water, and this technique was tested to be around 60-100% effective for extracting the particles adsorbed to the wipes. The method was optimized by spiking the wipes with known amounts of nanoparticles and treating them the same way as the experimental samples. Our preliminary results show that single particle ICP-MS has the potential for quantitatively measuring potential dermal exposure to nanoparticles, and when used in combination with other characterization techniques, such as conventional ICP-MS (for analysis of total metal content) and electron microscopy (particle shape) it can provide necessary particle characterization that can aid consumer exposure assessment to nanoparticles.
Quantification of methane emissions from two Danish landfills

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Fathi Aghdam, E. (Intern), Fredenslund, A. M. (Intern), Kjeldsen, P. (Intern), Scheutz, C. (Intern)
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Range of technology choices in life cycle assessment of environmental treatment technologies: An example of a solid waste landfill model

Limited data availability and local differences of environmental treatment technologies lead to the use of sub-optimal data and choices of single datasets, where multiple data choices may be representative. The use of data not representing the entire coverage of an LCA study can cause a bias in the result interpretation and limit the robustness of the results. The objective of this study is to demonstrate the relationship between the number of discrete data options and the goal and scope of the study. The importance of the spread in LCA results and how this spread influences the LCA result interpretation is assessed. The objective is obtained by performing a landfill model case study and presenting and discussing results relative to the specificity of the coverage of the study (see conceptual approach in Figure 1).

The outcomes shows a trend of decreasing LCA result ranges with increasing level of specification of the technological and geographical coverage of the study. For example, for global warming potential, the global maximum value is 2.6 times larger than the global minimum value and, for human toxicity, carcinogenic, the global maximum value is 45 times larger than the global minimum value. These ranges have the potential to significantly influence the LCA results, and are interpreted as potential magnitudes of errors introduced by the data choices. The results highlighted the pitfalls of choosing specific data to represent a generic process, and vice-versa. The former will lead to precise, but inaccurate results, whereas in the latter the obtained data represent a lower level of knowledge than the initial goal and scope.

To conclude, a detailed description of the coverage of the study and understanding of the technologies are necessary for representative life cycle inventory modelling. This conclusions was described in a step-wise approach for representative data choices and modelling. The outcomes shed light on the potential spread caused by discrete data choices in the modelling of environmental treatment technologies.
Recent developments on biofuels production from microalgae and macroalgae

Biofuels from algae are considered as promising alternatives of conventional fossil fuels, as they can eliminate most of the environmental problems. The present study focuses on all the possible avenues of biofuels production through biochemical and thermochemical conversion methods in one place, bringing together both microalgae and macroalgae on the same platform. It provides a brief overview on the mechanism of different biofuel production from algae. Factors affecting the biofuel process and the associated challenges have been highlighted along with analysis of techno-economic study available in literature. Undoubtedly, biodiesel is the center of attraction among other biofuels. However, their routes and process need to be optimized in order to bring the minimum fuel selling price (MFSP) of biodiesel competitive. Technological challenges have not been overcome to make biofuel production process energetically and commercially viable. Macroalgae are low in lipid content. Therefore, the use of macroalgae is restricted for gaseous fuels or fermentative methods of liquid biofuels production. Anaerobic digestion of algal biomass is easy and seems promising as the process is simple in terms of engineering and infrastructure requirement. Hydrogen production by microalgae through biophotolysis seems interesting as it directly converts the solar energy into hydrogen. However, the process has not been scaled-up till today. Hydrothermal liquefaction (HTL) is more promising due to handling of wet biomass at moderate temperature and pressure and conversion of whole biomass into high-quality oil. However, HTL process is energy intensive.
Plastics recycling has the potential to substitute virgin plastics partially as a source of raw materials in plastic product manufacturing. Plastic as a material may contain a variety of chemicals, some potentially hazardous. Phthalates, for instance, are a group of chemicals produced in large volumes and are commonly used as plasticisers in plastics manufacturing. Potential impacts on human health require restricted use in selected applications and a need for the closer monitoring of potential sources of human exposure. Although the presence of phthalates in a variety of plastics has been recognised, the influence of plastic recycling on phthalate content has been hypothesised but not well documented. In the present work we analysed selected phthalates (DMP, DEP, DPP, DiBP, DBP, BBzP, DEHP, DCHP and DnOP) in samples of waste plastics as well as recycled and virgin plastics. DBP, DiBP and DEHP had the highest frequency of detection in the samples analysed, with 360 μg/g, 460 μg/g and 2700 μg/g as the maximum measured concentrations, respectively. Among other, statistical analysis of the analytical results suggested that phthalates were potentially added in the later stages of plastic product manufacturing (labelling, gluing, etc.) and were not removed following recycling of household waste plastics. Furthermore, DEHP was identified as a potential indicator for phthalate contamination of plastics. Close monitoring of plastics intended for phthalates-sensitive applications is recommended if recycled plastics are to be used as raw material in production.
Reductive dechlorination of trichloroethylene (TCE) in competition with Fe and Mn oxides – observed dynamics in H2-dependent terminal electron accepting processes

The determination of hydrogen (H2) concentration together with the products of microbial reduction reactions in a trichloroethylene dechlorinating system is conducted to delineate the ongoing predominant terminal electron accepting processes (TEAP). Formate was used as electron donor and synthetic Fe minerals or environmental samples were used as the substrata. Iron(III) and Mn(IV) reduction limited microbial dechlorination by the mixed anaerobic culture by decreasing the level of H2 in the system. The H2 measurements indicated that the H2 concentration at which different TEAPs occur can overlap and thus these TEAPs can therefore occur concurrently rather than exclusively. Difference in Fe(III) bioavailability and hence, Fe(III) reduction partially explain this wide range. The distinction between dechlorination and other microbial reduction processes based on H2 threshold values is not feasible under such conditions, though there appears to be a relation between the rates of H2 consuming process and the observed H2 level.

General information
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BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.84 SNIP 0.82 CiteScore 1.93
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Reduktion af forureningsrisiko fra atmosfærisk luft: Guideline for danske vandværker – Beluftning og trykudligning med atmosfærisk luft i produktion af drikkevand

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Regulatory ecotoxicity testing of nanomaterials – proposed modifications of OECD test guidelines based on laboratory experience with silver and titanium dioxide nanoparticles
Regulatory ecotoxicity testing of chemicals is of societal importance and a large effort is undertaken at the OECD to ensure that OECD test guidelines (TGs) for nanomaterials (NMs) are available. Significant progress to support the adaptation of selected TGs to NMs was achieved in the context of the project MARINA (http://www.marina-fp7.eu/) funded within the 7th European Framework Program. Eight OECD TGs were adapted based on the testing of at least one ion-releasing NM (Ag) and two inert NMs (TiO2). With the materials applied, two main variants of NMs (ion releasing vs. inert NMs) were addressed. As the modifications of the test guidelines refer to general test topics (e.g. test duration or measuring principle), we assume that the described approaches and modifications will be suitable for the testing of further NMs with other chemical compositions. Firm proposals for modification of protocols with scientific justification(s) are presented for the following tests: growth inhibition using the green algae Raphidocelis subcapitata (formerly:
Pseudokirchneriella subcapitata; TG 201), acute toxicity with the crustacean Daphnia magna (TG 202), development toxicity with the fish Danio rerio (TG 210), reproduction of the sediment-living worm Lumbriculus variegatus (TG 225), activity of soil microflora (TGs 216, 217), and reproduction of the invertebrates (Enchytraeus crypticus, Eisenia fetida, TGs 220, 222). Additionally, test descriptions for two further test systems (root elongation of plants in hydroponic culture; test on fish cells) are presented. Ecotoxicological data obtained with the modified test guidelines for TiO2 NMs and Ag NM and detailed method descriptions are available.

**General information**

**State:** Published

**Organisations:** Department of Environmental Engineering, Environmental Chemistry, Heriot-Watt University, University of Plymouth, INIA, Leiden University, Fraunhofer Institute for Molecular Biology and Applied Ecology IME, Aarhus University

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- Web of Science (2013): Indexed yes
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Release of nanomaterials from consumer products and implications for consumer exposure assessment

During the past decade the number of consumer products that contain nanomaterials (NMs) has been rapidly increasing. Materials manufactured at the nanoscale exhibit unique physicochemical properties and have greater reactivity in comparison to the bulk material. Because of this, NMs are being utilized in a wide variety of products, ranging from food and personal care products to electronics and large appliances.

Over the course of the last four years, the number of products claiming to contain NMs has increased from 1 200 in 2012 to more than 2 300 in 2016. The increasing use of nanoproducts and the uncertainties associated with the risks they may pose is raising concerns about consumer safety. During the use of nano-enabled products there is a potential for NM release, which can consequently lead to consumer and/or environmental exposure. Consumer exposure testing has only recently started to receive some attention, and the data currently available in the literature is scarce. Most studies are addressing only a narrow range of product categories and a few NM types, having experimental setups that are rarely comparable from study to study. Moreover, the analytical techniques applied for release testing are rarely suitable for reporting NM release with particle number concentration, size distribution or surface area concentration, which are known to be of toxicological importance.

The work presented in this thesis addresses the lack of data on consumer exposure to NMs from various consumer products. First, data from literature and online databases was used to obtain an overview of what nanoproducts are available on the EU market, and which nanoproducts have been experimentally tested for their potential NM release. Specific focus was placed on evaluating suitable analytical methods for NM quantification and characterization. The findings showed that single particle inductively coupled plasma mass spectrometry (spICP-MS) in combination with other methods is a well suited analytical technique that can provide extensive NM characterization, such as mass and number concentration, and size distribution of NMs. Then, several nano-enabled products were selected for experimental testing of NM release, namely four types of food contact materials (Ag) and two types of toothbrushes (Ag) for potential oral exposure, as well as five types of textiles (TiO2) and five different surface coatings (Ag and CuO) for potential dermal exposure. The NM release was characterized by using spICP-MS and transmission electron microscopy (TEM), together providing data for NM mass and number concentration, size distribution, and morphology. In most cases, it was found that NM release from the consumer products was in the ng/g (or ng/cm2 where applicable) range. Ag release from food contact materials and toothbrushes was tested in food simulants (deinized (DI) water, ethanol, acetic acid) and tap water, respectively. The results showed that there is a potential for Ag exposure both in dissolved and nano-particulate form (up to around 6 µg/L and 40 000 particles/mL), but the amounts were magnitudes below the permitted Ag exposure limits set by European Food Safety Authority (EFSA) and World Health Organization (WHO). The TiO2 release was tested for five types of textiles that did not openly disclose TiO2 content. The fabrics were immersed in DI water, and the resulting amounts of potential Ti exposure were found to be up to around 8 000 particles/cm2 corresponding to around 24 ng/cm2. These amounts may be considered negligible compared to the reported Ti amounts in a wide range of products available on the market that claim to contain nano-TiO2 as an additive, especially when it comes to food products. Dermal exposure testing for Ag and CuO surface coatings was done by wiping tests and revealed particle release very close to background levels, unless the surface was subjected to abrasion before executing the wiping tests. In general, all the products that were tested released very low amounts of the initial NM content present in the product, indicating that throughout long-term use of the products there might be continuous NM release, or most of the NMs would end up in solid waste. The NM release data obtained both from the literature and from the experimental studies presented in this thesis were subsequently used for consumer exposure estimation. Several consumer exposure assessment tools were identified and their applicability for NM exposure assessment is discussed in this thesis. It was concluded that current consumer exposure assessment models have not been designed for estimating NM-relevant exposures, as they are mainly dealing with mass as a dose metric, without taking NM properties into consideration. This highlights the need of developing tools that are specifically designed for NM exposure assessment, taking into account not only potential exposure in terms of total NM mass, but also number concentration and size distribution. All in all, the work presented in this thesis underline various important issues that need to be considered and addressed when completing nanoproduct release testing, NM quantification and characterization, data reporting, and consumer exposure assessment. Firstly, there is an urgent need to apply a combination of characterization methods to gain a better understanding about the potential NM exposure. Secondly, standardization of NM release testing and data reporting is of key relevance, to ensure that the data generated is comparable among studies and can be extrapolated to other nanoproducts with similar properties. Finally, standardized data reporting and exposure assessment is of utmost importance to move towards harmonization of NM exposure and hazard characterization that could further aid NM-relevant risk assessment.

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Mackeiva, A. (Intern), Hansen, S. F. (Intern), Olsson, M. E. (Intern)
Number of pages: 74
Publication date: 2016
The European chemical legislation requires manufacturers and importers of chemicals to do consumer exposure assessment when the chemical has certain hazards associated to it (e.g. explosive, carcinogenicity, and hazardous to the aquatic environment), but the question is how this obligation can be met in light of the scientific uncertainty and technical challenges related to exposure assessment of nanomaterials. In this paper, we investigate to what extent the information and data in the literature can be used to perform consumer exposure assessment according to the REACH requirements and we identify and discuss the key data needs and provide recommendations for consumer exposure assessment of nanomaterials. In total, we identified 76 studies of relevance. Most studies have analyzed the release of Ag and TiO2 from textiles and paints, and CNT and SiO2 from nanocomposites. Less than half of the studies report their findings in a format that can be used for exposure assessment under REACH, and most do not include characterization of the released particles. Although inhalation, dermal, and oral exposures can be derived using the guidelines on how to complete consumer exposure assessments under REACH, it is clear that the equations are not developed to take the unique properties of nanomaterials into consideration. Future research is therefore needed on developing more generalized methods for representing nanomaterial release from different product groups at relevant environmental conditions. This includes improving the analytical methods for determining nanomaterial alteration and transformation, as well as quantification, which could subsequently lead to more nano-specific consumer exposure assessment models.
Remediation of PCB contaminated sediments using activated carbon: Assessing efficiency and robustness using equilibrium sampling

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Nørgaard Schmidt, S. (Intern), Bridges, T. S. (Ekstern), Gidley, P. (Ekstern), Lotufo, G. (Ekstern), Ruiz, C. (Ekstern), Kennedy, A. (Ekstern), Rogers, N. (Ekstern), Ghosh, U. (Ekstern), Burgess, R. (Ekstern), Fernandez, L. (Ekstern), Mayer, P. (Intern)
Pages: 258-258
Publication date: 2016

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Place of publication: Nantes, France
Publisher: SETAC Europe
Main Research Area: Technical/natural sciences
Conference: SETAC Europe 26th Annual Meeting, France, 22/05/2016 - 22/05/2016
Electronic versions:
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Remediation of PCB contaminated sediments using activated carbon: Thermodynamic exposure assessment

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Nørgaard Schmidt, S. (Intern), Bridges, T. S. (Ekstern), Gidley, P. (Ekstern), Lotufo, G. (Ekstern), Ruiz, C. (Ekstern), Kennedy, A. (Ekstern), Rogers, N. (Ekstern), Ghosh, U. (Ekstern), Burgess, R. (Ekstern), Fernandez, L. (Ekstern), Mayer, P. (Intern)
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Host publication information
Title of host publication: SETAC Orlando - abstract book
Place of publication: Orlando, Florida
Publisher: Society of Environmental Toxicology and Chemistry
Article number: 563
Main Research Area: Technical/natural sciences
Electronic versions:
Removal of Antibiotics in Biological Wastewater Treatment Systems—A Critical Assessment Using the Activated Sludge Modeling Framework for Xenobiotics (ASM-X)

Many scientific studies present removal efficiencies for pharmaceuticals in laboratory-, pilot-, and full-scale wastewater treatment plants, based on observations that may be impacted by theoretical and methodological approaches used. In this Critical Review, we evaluated factors influencing observed removal efficiencies of three antibiotics (sulfamethoxazole, ciprofloxacin, tetracycline) in pilot- and full-scale biological treatment systems. Factors assessed include (i) retransformation to parent pharmaceuticals from e.g., conjugated metabolites and analogues, (ii) solid retention time (SRT), (iii) fractions sorbed onto solids, and (iv) dynamics in influent and effluent loading. A recently developed methodology was used, relying on the comparison of removal efficiency predictions (obtained with the Activated Sludge Model for Xenobiotics (ASM-X)) with representative measured data from literature. By applying this methodology, we demonstrated that (a) the elimination of sulfamethoxazole may be significantly underestimated when not considering retransformation from conjugated metabolites, depending on the type (urban or hospital) and size of upstream catchments; (b) operation at extended SRT may enhance antibiotic removal, as shown for sulfamethoxazole; (c) not accounting for fractions sorbed in influent and effluent solids may cause slight underestimation of ciprofloxacin removal efficiency. Using tetracycline as example substance, we ultimately evaluated implications of effluent dynamics and retransformation on environmental exposure and risk prediction.
Removal of primary and secondary trace organic substrates in aerobic and anaerobic sewer biofilm

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Environmental Chemistry
Authors: Ramin, P. (Intern), Polesel, F. (Intern), Brock, A. L. (Intern), Torresi, E. (Intern), Plósz, B. G. (Intern)
Number of pages: 2
Publication date: 2016
Event: Abstract from MEWE and biofilms IWA specialist conference, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Sewer biofilm, Drug biomarkers, Wastewater based epidemiology
Electronic versions:
Ramin_et_al._Mewe_2016_FINAL.pdf
Source: PublicationPreSubmission
Source-ID: 125882664
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Rent ubehandlet grundvand - kan vi bevare drømmen?

General information
State: Published
Organisations: Department of Environmental Engineering
Authors: Arvin, E. (Intern)
Response to Comment on "Application of the Activity Framework for Assessing Aquatic Ecotoxicology Data for Organic Chemicals"

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, CEHTRA/KREATiS, Trent University, ARC Arnot Research & Consulting Inc., European Centre for Ecotoxicology and Toxicology of Chemicals
Authors: Thomas, P. (Ekstern), Mackay, D. (Ekstern), Mayer, P. (Intern), Arnot, J. (Ekstern), Burgos, M. G. (Ekstern)
Pages: 4141-4142
Publication date: 2016
Main Research Area: Technical/natural sciences

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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.26 SJR 2.538 SNIP 1.889
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.584 SNIP 1.828 CiteScore 5.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.103 CiteScore 5.52
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.146 SNIP 2.056 CiteScore 5.17
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.178 SNIP 1.953 CiteScore 5.16
ISI indexed (2011): ISI indexed yes
Re-thinking stressor interactions: The role of groundwater contamination impacting stream ecosystems

Streams are significantly impacted by a large number of micropolutants and their transformation products (e.g. pharmaceuticals, chlorinated solvents, pesticides/biocides, nutrients, heavy metals), leading to a severe degradation of essential ecological functions and services. The large diversity of compounds and their sources makes the quantification of their occurrence and toxicity a challenging task. Conventionally, chemical impacts to ecosystems are assessed one compound/group of compounds or one source type at a time. We presume this will give us a good indication of the impact of a particular stressor. Our hypothesis, however, is that this will underestimate the combined impact caused by chemical cocktail effects, and interactions between stressors (e.g. contaminant-effected change in redox conditions releasing heavy metals). Moreover, a stream system impacted by multiple stressors has a high chronic stress level, so even small perturbations on top of changes in water flow or additional chemical stressors may be detrimental to the stream health.

To address this issue, we identified contaminant sources and chemical stressors along a 16-km groundwater-fedstream stretch (Grindsted, Denmark) to quantify the contaminant discharges, and potentially link the chemical impact and stream water quality. Potential pollution sources include two contaminated sites (Grindsted factory/landfill), aquaculture, waste water discharges, and diffuse sources from agriculture and urban areas. Data for xenobiotic organic groundwater contaminants, pesticides, heavy metals, general water chemistry, physical conditions and stream flow from three campaigns in 2012 and 2014 were assessed. The measured chemical concentrations were converted to toxic units (TU) based on 48-h acute toxicity tests with Daphnia magna. Ecological status was determined by monitoring meiofaunal (i.e. nematodes) and macrobenthic invertebrate communities.

The results show a substantial impact on Grindsted stream from multiple sources of many origins. The groundwater plume from the Grindsted factory site caused elevated concentrations of chlorinated ethenes, benzene and site-specific pharmaceuticals in both the hyporheic zone and the stream water for several km downstream of the discharge area. Heavy metal concentrations were found around or above the threshold values for barium, copper, lead, nickel and zinc in the stream water, hyporheic zone and streambed sediment. The calculated TU was generally similar along the stream, but for arsenic and nickel higher values were observed where the groundwater plume discharges into the stream. Also, log sum TUD.magna values for organic contaminants were elevated in both the hyporheic zone and stream. Thus, the overall...
chemical stress in the main discharge area is much higher than upstream, while it gradually decreases downstream. The ecological results indicate a change in community composition for both meio- and macrobenthic fauna, pointing towards the presence of a local impact resulting from the discharging contaminated groundwater. Ecological impacts could be related to xenobiotic compounds coming from groundwater, as well as the presence of trace metals of diffuse and/or biogenic origin in the same area, but linkage to one specific factor was not possible. This work highlights the importance of a holistic assessment of stream water quality to identify and quantify the main contaminant sources and resulting chemical stream stressors leading to potential ecological impacts.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Aarhus University, Bielefeld University
Number of pages: 1
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Event: Abstract from Groundwater Quality Conference (GQ16), Shenzhen Kylin Villa, China.
Main Research Area: Technical/natural sciences
Electronic versions: McKnight_GQ16_abstract.pdf
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

**Revisiting the paper *“Using radiometric surface temperature for surface energy flux estimation in Mediterranean drylands from a two-source perspective”***

The recent paper by Morillas et al. [Morillas, L. et al. Using radiometric surface temperature for surface energy flux estimation in Mediterranean drylands from a two-source perspective, Remote Sens. Environ. 136, 234–246, 2013] evaluates the two-source model (TSM) of Norman et al. (1995) with revisions by Kustas and Norman (1999) over a semiarid tussock grassland site in southeastern Spain. The TSM - in its current incarnation, the two-source energy balance model (TSEB) - was applied to this landscape using ground-based infrared radiometer sensors to estimate both the composite surface radiometric temperature and component soil and canopy temperatures. Morillas et al. (2013) found the TSEB model substantially underestimated the sensible H (and overestimated the latent heat LE) fluxes. Using the same data set from Morillas et al. (2013), we were able to confirm their results. We also found energy transport and exchange behavior derived from primarily the observations themselves to differ significantly from a number of prior studies using land surface temperature for estimating heat fluxes with one-source modeling approaches in semi-arid landscapes. However, revisions to key vegetation inputs to TSEB and the soil resistance formulation resulted in a significant reduction in the bias and root mean square error (RMSE) between model output of H and LE and the measurements compared to the prior results from Morillas et al. (2013). These included more representative ground-based vegetation greenness and local leaf area index values as well as modifications to the coefficients of the soil resistance formulation to account for the very rough (rocky) soil surface conditions with a clumped canopy. This indicates that both limitations in remote estimates of biophysical indicators of the canopy at the site and the lack of adjustment in soil resistance formulation to account for site specific characteristics, contributed to the earlier findings of Morillas et al. (2013). This suggests further studies need to be conducted to reduce the uncertainties in the vegetation and land surface temperature input data in order to more accurately assess the effects of the transport exchange processes of this Mediterranean landscape on TSEB formulations.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, USDA-ARS Hydrology and Remote Sensing Lab, Spanish Research Council Institute for Sustainable Agriculture, University of British Columbia, Utah State University, Universidad Pablo de Olavide, Consejo Superior de Investigaciones Científicas
Authors: Kustas, W. P. (Ekstern), Nieto, H. (Ekstern), Morillas, L. (Ekstern), Anderson, M. C. (Ekstern), Alferi, J. G. (Ekstern), Hipps, L. E. (Ekstern), Villagarcía, L. (Ekstern), Domingo, F. (Ekstern), García, M. (Intern)
Number of pages: 9
Pages: 645-653
Publication date: 2016
Main Research Area: Technical/natural sciences

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Volume: 184
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BFI (2017): BFI-level 2
Samarbejde mellem forskning og forsyning giver bonus

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Tang, C. (Intern)
Pages: 48-49
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Main Research Area: Technical/natural sciences

Publication information
Journal: DanskVand
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Issue number: 6
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ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Electronic versions:
2016_12_06_danskVAND_2016_6_Vand_i_tal.pdf
Publication: Research › Journal article – Annual report year: 2016

Sammenhæng mellem aktivitet af metanoksiderende bakterier, opformeret fra sandfiltre på danske vandværker, og nedbrydningen af pesticidet bentazon

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Water Technologies
Authors: Hedegaard, M. J. (Intern), Delinere, H. (Ekstern), Prasse, C. (Ekstern), Dechesne, A. (Intern), Smets, B. F. (Intern), Albrechtsen, H. (Intern)
Number of pages: 13
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Main Research Area: Technical/natural sciences
Electronic versions:
Hedegaard_Mathilde_Dansk_Vand_til_dansk_vand.pdf
Publication: Research › Sound/Visual production (digital) – Annual report year: 2016

Sammenligning af niveauspecificke prøvetagningsmetoder for vurdering af koncentrationsfordeling i kalkmagasin: Akacievej, Hedehusene

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering
Authors: Broholm, M. M. (Intern), Fjordbøge, A. S. (Intern), Mosthaf, K. (Intern), Brauns, B. (Intern), Bjerg, P. L. (Intern), Binning, P. J. (Intern)
Number of pages: 39
Publication date: 2016

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark, DTU Environment
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Main Research Area: Technical/natural sciences
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2016_Broholm_RegionHProvetagning_2016.pdf
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Source-ID: 127837174
Sammensætning af boremudder

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Aarhus University
Authors: Hansen, S. F. (Intern), Sanderson, H. (Ekstern)
Pages: 67-68
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Title of host publication: Videnskabelig udredning af international viden om skifergas relateret til en dansk kontekst : DTU, GEUS, DCE
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Chapter: 4.2.1
Main Research Area: Technical/natural sciences
Electronic versions:
DTU_GEUS_DCE_2016_Videnskabelig_udredning_af_international_viden_om_skifergas_relateret_til_en_dansk_kontekst.pdf

Secondary settling sensor setup development – testing prototypes and compression models via practical model parameter identifiability assessment

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Technical University of Denmark
Authors: Valverde Pérez, B. (Intern), Penkarski-Rodon, E. (Ekstern), Wagner, D. S. (Intern), Plósz, B. G. (Intern)
Number of pages: 1
Publication date: 2016
Event: Abstract from Particle Separation - 2016, Oslo, Norway.
Main Research Area: Technical/natural sciences
Hindered, Transient, Compression settling velocity, Settling sensor, Practical identifiability
Source: PublicationPreSubmission
Source-ID: 125775525

Selective heavy metal capture from contaminated water

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Department of Micro- and Nanotechnology, Surface Engineering, Korea Advanced Institute of Science & Technology, Seoul National University
Authors: Ko, D. (Intern), Lee, J. (Ekstern), Jakobsen, M. H. (Intern), Hwang, Y. (Ekstern), Yavuz, C. T. (Ekstern), Andersen, H. R. (Intern)
Number of pages: 1
Publication date: 2016
Event: Poster session presented at 9th Europe-Korea Conference on Science and Technology (EKC2016), Berlin, Germany.
Main Research Area: Technical/natural sciences
Electronic versions:
EKC_presentation.pdf
Source: PublicationPreSubmission
Source-ID: 126887185

Semi-quantitative analysis of solid waste flows from nano-enabled consumer products in Europe, Denmark and the United Kingdom - Abundance, distribution and management
Many nano-enabled consumer products are known to be in the global market. At the same, little is known about the quantity, type, location etc. of the engineered nanomaterials (ENMs) inside the products. This limits the scientific investigations of potential environmental effects of these materials, and especially the knowledge of ENM behaviour and potential effects at the end-of-life stage of the products is scarce. To gain a better understanding of the end-of-life waste
treatment of nano-enabled consumer product, we provide an overview of the ENMs flowing into and throughout waste systems in Europe, Denmark and the United Kingdom. Using a nanoproduct inventory (nanodb.dk), we performed a four-step analysis to estimate the most abundant ENMs and in which waste fractions they are present. We found that in terms of number of products: (i) nano silver is the most used ENM in consumer products, and (ii) plastic from used product containers is the largest waste fraction also comprising a large variety of ENMs, though possibly in very small masses. Also, we showed that the local waste management system can influence the distribution of ENMs. It is recommended that future research focus on recycling and landfilling of nano-enabled products since these compartments represent hot spots for end-of-life nanoproducucts.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Environmental Chemistry
Authors: Heggelund, L. R. (Intern), Hansen, S. F. (Intern), Astrup, T. F. (Intern), Boldrin, A. (Intern)
Number of pages: 9
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Main Research Area: Technical/natural sciences

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BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.354 SNIP 2.044
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.739 SNIP 2.256 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.777 SNIP 2.482 CiteScore 3.43
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.822 SNIP 2.435 CiteScore 3.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.611 SNIP 2.184 CiteScore 2.91
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.698 SNIP 2.085 CiteScore 2.99
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.555 SNIP 1.78
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.502 SNIP 1.899
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.378 SNIP 2.13
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.035 SNIP 1.767
Sensors for microbial drinking water quality

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Tatari, K. (Intern), Corfitzen, C. B. (Intern), Albrechtsen, H. (Intern), Christensen, S. C. B. (Intern)
Number of pages: 43
Publication date: 2016

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark, DTU Environment
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Sensors_for_microbial_drinking_water_quality_2016_w_logo.pdf

Bibliographical note
Karolina Tatari m. fl.
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Separation of Peptides and Interaction with Forward Osmosis Biomimetic Membranes: A Solution Diffusion Model

General information
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Organisations: Department of Environmental Engineering, Water Technologies, Aalborg University, University of Copenhagen
Authors: Bajraktari, N. (Intern), Madsen, H. T. (Ekstern), Gruber, M. F. (Intern), Jensen, H. (Ekstern), Hélix-Nielsen, C. (Intern)
Number of pages: 1
Pages: 505A
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Biophysical Journal
Volume: 110
Issue number: 3, Suppl. 1
Separation of Peptides with Forward Osmosis Biomimetic Membranes

Forward osmosis (FO) membranes have gained interest in several disciplines for the rejection and concentration of various molecules. One application area for FO membranes that is becoming increasingly popular is the use of the membranes to concentrate or dilute high value compound solutions such as pharmaceuticals. It is crucial in such settings to control the transport over the membrane to avoid losses of valuable compounds, but little is known about the rejection and transport mechanisms of larger biomolecules with often flexible conformations. In this study, transport of two chemically similar peptides with molecular weight (Mw) of 375 and 692 Da across a thin film composite Aquaporin Inside™ Membrane (AIM) FO membrane was investigated. Despite the relative large size, both peptides were able to permeate the dense active layer of the AIM membrane and the transport mechanism was determined to be diffusion-based. Interestingly, the membrane permeability increased 3.65 times for the 692 Da peptide ($1.39 \times 10^{-12}$ m²·s⁻¹) compared to the 375 Da peptide ($0.38 \times 10^{-12}$ m²·s⁻¹). This increase thus occurs for an 85% increase in Mw but only for a 34% increase in peptide radius of gyration ($R_g$) as determined from molecular dynamics (MD) simulations. This suggests that $R_g$ is a strong influencing factor for membrane permeability. Thus, an increased $R_g$ reflects the larger peptide chains ability to sample a larger conformational space when interacting with the nanostructured active layer increasing the likelihood for permeation.

General information

State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Aalborg University, University of Copenhagen
Number of pages: 12
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Publication information

Journal: Membranes
Volume: 6
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Web of Science (2018): Indexed yes
Scopus rating (2016): SJR 0.533 SNIP 0.832 CiteScore 2.19
Web of Science (2016): Indexed yes
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Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 0.702 SNIP 0.918 CiteScore 2.42
Scopus rating (2013): SJR 0.562 SNIP 0.829 CiteScore 1.84
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.273 SNIP 0.791 CiteScore 0.79
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.107 CiteScore 0
ISI indexed (2011): ISI indexed no
Original language: English
biomimetic, forward osmosis, peptides, rejection, Science (General), Q1-390, Science, Q
Electronic versions:
membranes_06_00046.pdf
DOIs:
10.3390/membranes6040046
Links:
http://www.mdpi.com/2077-0375/6/4/46
The new paradigm for used water treatment suggests the use of short solid retention times (SRT) to minimize organic substrate mineralization and to maximize resource recovery. However, little is known about the microbes and the underlying biogeochemical mechanisms driving these short-SRT systems. In this paper, we report the start-up and operation of a short-SRT enhanced biological phosphorus removal (EBPR) system operated as a sequencing batch reactor (SBR) fed with preclarified municipal wastewater, which is supplemented with propionate. The microbial community was analysed via 16S rRNA amplicon sequencing. During start-up (SRT = 8 d), the EBPR was removing up to 99% of the influent phosphate and completely oxidized the incoming ammonia. Furthermore, the sludge showed excellent settling properties. However, once the SRT was shifted to 3.5 days nitrification was inhibited and bacteria of the Thiothrix taxon proliferated in the reactor, thereby leading to filamentous bulking (sludge volume index up to SVI = 1100 mL/g). Phosphorus removal deteriorated during this period, likely due to the out-competition of polyphosphate accumulating organisms (PAO) by sulphate reducing bacteria (SRB). Subsequently, SRB activity was suppressed by reducing the anaerobic SRT from 1.2 day to 0.68 day, with a consequent rapid SVI decrease to ~200 mL/g. The short-SRT EBPR effectively removed phosphate and nitrification was mitigated at SRT = 3 days and oxygen levels ranging from 2 to 3 mg/L.
Silver nanoparticles (AgNPs) are currently being used in many different kinds of consumer products in order to take advantage of their antimicrobial properties. However, the potential migration of silver nanoparticles into food and subsequent consumer exposure has hardly been addressed. In the current study, we investigated four brands of commercially available plastic food storage containers and measured the total amount of silver, particle size and number concentration, and the migration rates into three different food simulants (Milli-Q grade water, 10 % ethanol, and 3 % acetic acid) for 10 days at 40 °C. The experimental setup was made according to the European Commission Directive (EU 10/2011) for articles intended to be in contact with food. The total amount of silver in plastic containers and migration solutions was quantified by ICP-MS analysis, and the size of the migrated particles was investigated by single particle ICP-MS and TEM-EDS. The total mass and median size of released particulate Ag were generally highest in 3 % acetic acid for three out of four food container brands. The total content of silver in the containers varied from 13 to 42 µg/g. The highest migration was observed in the 3 % acetic acid food simulant for all four brands of containers, with total silver release up to 3.1 ng/cm² after 10 days. In conclusion, the experimental results show that silver has the potential of migrating into food, especially when in contact with more acidic substances.

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Mackevica, A. (Intern), Olsson, M. E. (Intern), Hansen, S. F. (Intern)
Number of pages: 11
Publication date: 2016
Main Research Area: Technical/natural sciences
Simulation and prediction of biomass turnover and soil organic matter formation

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Helmholtz Centre for Environmental Research
Authors: Trapp, S. (Intern), Brock, A. L. (Intern), Kästner, M. (Ekstern)
Pages: 39-39
Publication date: 2016

Host publication information
Title of host publication: SOMmic - Microbial Contribution and Impact on Soil Organic Matter, Structure and Genesis - program and abstracts
Place of publication: Leipzig, Germany
Publisher: Helmholtz Centre for Environmental Research - UFZ
Main Research Area: Technical/natural sciences
Electronic versions:
Proceedings_SOMmic_Workshop_2016_11.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Simultaneous removal of As, Cd, Cr, Cu, Ni and Zn from stormwater using high-efficiency industrial sorbents: Effect of pH, contact time and humic acid
The effect of contact time, solution pH, and the presence of humic acid (HA) on the combined removal of As, Cd, Cr, Cu, Ni and Zn is investigated in batch tests using alumina, granulated activated carbon (GAC), and bauxsol coated sand (BCS) as sorbents. It is found that the equilibrium time for Cd, Cu, Ni and Zn is about 4 h, while no clear equilibrium is observed for As and Cr. It is also found that increasing the pH until pH ~ 8 enhanced Cd, Cu, Ni and Zn removal, but increasing the pH above this point had no major effect. In the cases of As and Cr, higher pH values (i.e. > 7) decreased their removal. The presence of both 20 and 100 mg/L HA suppressed the heavy metal removal except for Cr, and the suppression was higher at the higher HA concentration. Geochemical simulations suggest that this is due to the formation of dissolved HA-metal complexes preventing effective metal sorption. In the case of Cr, the presence of HA increased the removal when using alumina or BCS, while hindering the removal when using GAC. The findings show that the pH-value of the stormwater to be treated must be in the range of 6-7 in order to achieve removal of the full spectrum of metals. The results also show that natural organic matter may severely influence the removal efficiency, such that, for most metals the removal was reduced to the half, while for Cr it was increased to the double for alumina and BCS. Consequently, a properly working filter set up may not work properly anymore when receiving high loads of natural organic acids during the pollen season in spring or during defoliation in autumn and early winter, and during mixing of runoff with snowmelt having a low pH.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems
Authors: Genc-Fuhrman, H. (Intern), Mikkelsen, P. S. (Intern), Ledin, A. (Intern)
Number of pages: 10
Pages: 76-85
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Science of the Total Environment
Volume: 566-567
ISSN (Print): 0048-9697
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.09 SJR 1.621 SNIP 1.849

DOIs:
10.1016/j.scitotenv.2016.04.210

Source: FindIt
Source-ID: 2304611766
Publication: Research - peer-review › Journal article – Annual report year: 2016
Size-dependent uptake of micro- and nanoplastics in Daphnia magna

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Technical University of Denmark
Authors: Rist, S. (Intern), Møberg, A. S. (Ekstern), Baun, A. (Intern), Hartmann, N. B. (Intern)
Number of pages: 1
Publication date: 2016
Event: Poster session presented at European Conference on Plastics in Freshwater Environments, Berlin, Germany.
Main Research Area: Technical/natural sciences
Electronic versions: poster_sinja_rist.pdf
Source: PublicationPreSubmission
Source-ID: 127825854
Publication: Research - peer-review › Poster – Annual report year: 2016

Size fractionation of waste-to-energy boiler ash enables separation of a coarse fraction with low dioxin concentrations
Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/F) formed in modern Waste-to-Energy plants are primarily found in the generated ashes and air pollution control residues, which are usually disposed of as hazardous waste. The objective of this study was to explore the occurrence of PCDD/F in different grain size fractions in the boiler ash, i.e. ash originating from the convection pass of the boiler. If a correlation between particle size and dioxin concentrations could be found, size fractionation of the ashes could reduce the total amount of hazardous waste. Boiler ash samples from ten sections of a boiler's convective part were collected over three sampling days, sieved into three different size fractions - 0.355 mm - and analysed for PCDD/F. The coarse fraction (>0.355 mm) in the first sections of the horizontal convection pass appeared to be of low toxicity with respect to dioxin content. While the total mass of the coarse fraction in this boiler was relatively small, sieving could reduce the amount of ash containing toxic PCDD/F by around 0.5 kg per tonne input waste or around 15% of the collected boiler ash from the convection pass. The mid-size fraction in this study covered a wide size range (0.09-0.355 mm) and possibly a low toxicity fraction could be identified by splitting this fraction into more narrow size ranges. The ashes exhibited uniform PCDD/F homologue patterns which suggests a stable and continuous generation of PCDD/F.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Umea University, Rambøll Danmark A/S
Authors: Weidemann, E. (Ekstern), Allegrini, E. (Intern), Astrup, T. F. (Intern), Hulgaard, T. (Ekstern), Riber, C. (Ekstern), Jansson, S. (Ekstern)
Pages: 110-113
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Waste Management
Volume: 49
ISSN (Print): 0956-053X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.354 SNIP 2.044
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.739 SNIP 2.256 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.777 SNIP 2.482 CiteScore 3.43
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Soil and Plant Contamination – Modelling and Simulation of Processes

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Trapp, S. (Intern)
Pages: 47-47
Publication date: 2016

Host publication information
Title of host publication: International Symposium on Persistent Toxic Substances ISPTS 2016 - Book of abstract
Place of publication: Leipzig, Germany
Soil pH effects on the interactions between dissolved zinc, non-nano- and nano-ZnO with soil bacterial communities

Zinc oxide nanoparticles (ZnO NPs) are used in an array of products and processes, ranging from personal care products to antifouling paints, textiles, food additives, antibacterial agents and environmental remediation processes. Soils are an environment likely to be exposed to manmade nanoparticles due to the practice of applying sewage sludge as a fertiliser or as an organic soil improver. However, understanding on the interactions between soil properties, nanoparticles and the organisms that live within soil is lacking, especially with regards to soil bacterial communities. We studied the effects of nanoparticulate, non-nanoparticulate and ionic zinc (in the form of zinc chloride) on the composition of bacterial communities in soil with a modified pH range (from pH 4.5 to pH 7.2). We observed strong pH-dependent effects on the interaction between bacterial communities and all forms of zinc, with the largest changes in bacterial community composition occurring in soils with low and medium pH levels (pH 4.8 and 5.9). The high pH soil (pH 7.2) was less susceptible to the effects of zinc exposure. At the highest doses of zinc (2500 mg/kg dw soil), both nano and non-nano particulate zinc applications elicited a similar response in the soil bacterial community, and this differed significantly to the ionic zinc salt treatment. The results highlight the importance of considering soil pH in nanotoxicology studies, although further work is needed to determine the exact mechanisms controlling the toxicity and fate and interactions of nanoparticles with soil microbial communities.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, NERC Centre for Ecology & Hydrology
Authors: Read, D. S. (Ekstern), Matzke, M. (Ekstern), Gweon, H. S. (Ekstern), Newbold, L. K. (Ekstern), Heggelund, L. R. (Intern), Ortiz, M. D. (Ekstern), Lahive, E. (Ekstern), Spurgeon, D. (Ekstern), Svendsen, C. (Ekstern)
Number of pages: 9
Pages: 4120-4128
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmental Science and Pollution Research
Volume: 23
Issue number: 5
ISSN (Print): 0944-1344
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.66 SJR 0.813 SNIP 1.048
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.879 SNIP 1.02 CiteScore 2.5
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.949 SNIP 1.178 CiteScore 2.57
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.879 SNIP 1.163 CiteScore 2.34
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.017 SNIP 1.232 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.13 SNIP 1.1 CiteScore 2.3
Solar UV Irradiation-Induced Production of Greenhouse Gases from Plant Surfaces: From Leaf to Earth

During the past few decades it has been documented that the ultra-violet (UV) component of natural sunlight alone or in combination with visible light can instantaneously stimulate aerobic plant production of a range of important trace gases: CH$_4$, CO$_2$, CO, short-chain hydrocarbons/ non-methane volatile organic compounds (NMVOC), NOx and N$_2$O. This gas production, near or at the plant surface, is a new discovery and is normally not included in emission budgets (e.g. by the Intergovernmental Panel on Climate Change, IPCC) due to a lack of information with respect to validation and upscaling. For CH$_4$ it is known that the light dose controls emission under ambient and artificial light conditions, but the atmospheric gas composition and other environmental factors can influence gas production as well. Several plant components, including pectin and leaf wax, have been suggested as a precursor for CH$_4$ production, but underlying mechanisms are not fully known. For other gases such generating processes have not been established yet and mechanisms remain hypothetical. Field measurements of UV-induced emissions of the gases under natural light conditions are scarce. Therefore, realistic upscaling to the ecosystem level is uncertain for all gases. Nevertheless, based on empirical response curves, we propose the first global upscaling of UV-induced N$_2$O and CO to illustrate emission ranges from a global perspective and as a contribution to an ongoing quantification process. When scaled to the global level, the UV-induced emission of CO by vegetation surfaces amounts to up to 22 Tg yr$^{-1}$, which equals 11–44% of all the natural terrestrial plant sources accounted for so far. The total light-driven N$_2$O emissions amount to 0.65–0.78 Tg yr$^{-1}$, which equals 7–24% of the natural terrestrial source strength accounted for (range 3.3–9 Tg N yr$^{-1}$). In this review, we summarize current knowledge, based on experimental work with sunlight and artificial light, and estimate potential emission ranges and uncertainties, placing the available data into perspective. We discuss the state of the art in proposed mechanisms, precursors and environmental relationships, we consider the relevance of measured emission rates, and we also suggest a range of future research topics. Furthermore we propose and describe methods and techniques that can be used for future research.

General information
State: Published
Organisations: Department of Environmental Engineering, Atmospheric Environment, University of Copenhagen, Aalborg University
Solar UV irradiation-induced production of N2O from plant surfaces - low emissions rates but all over the world

Nitrous oxide (N2O) is an important long-lived greenhouse gas and precursor of stratospheric ozone depleting mono-nitrogen oxides. The atmospheric concentration of N2O is persistently increasing; however, large uncertainties are associated with the distinct source strengths. Here we investigate for the first time N2O emission from terrestrial vegetation in response to natural solar ultra violet radiation. We conducted field site measurements to investigate N2O atmosphere exchange from grass vegetation exposed to solar irradiance with and without UV-screening. Further laboratory tests were conducted with a range of species to study the controls and possible loci of UV-induced N2O emission from plants. Plants released N2O in response to natural sunlight at rates of c. 20-50 nmol m⁻² h⁻¹, mostly due to the UV component. The emission rate is temperature dependent with a rather high activation energy indicative for an abiotic process. The prevailing zone for the N2O formation appears to be at the very surface of leaves. However, only c. 26% of the UV-induced N2O appears to originate from plant-N. Further, the process is dependent on atmospheric oxygen concentration. Our work demonstrates that ecosystem emission of the important greenhouse gas, N2O, may be up to c. 30% higher than hitherto assumed.

Sources and propagation of uncertainty in N2O model predictions

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS
Authors: Domingo Felez, C. (Intern), Valverde Pérez, B. (Intern), Plósz, B. G. (Intern), Sin, G. (Intern), Smets, B. F. (Intern)
Number of pages: 1
Publication date: 2016
Event: Poster session presented at 5th IWA/WEF Wastewater Treatment Modelling Seminar 2016, Annecy, France.
Main Research Area: Technical/natural sciences
Modelling, N2O, Uncertainty, Production pathway, Experimental design
Electronic versions:
Spatial distribution of microbial community and N₂O depth profiles in counter- and co-diffusion biofilms functioning simultaneous nitrification and denitrification

**General information**

*State:* Published  
*Organisations:* Department of Environmental Engineering, Water Technologies, Tokyo University of Agriculture and Technology, National Institute of Advanced Industrial Science and Technology  
*Authors:* Terada, A. (Ekstern), Kinh, C. T. (Ekstern), Suenaga, T. (Ekstern), Hori, T. (Ekstern), Riya, S. (Ekstern), Smets, B. F. (Intern), Hosomi, M. (Ekstern)  
*Pages:* 76-77  
*Publication date:* 2016

**Host publication information**

*Title of host publication:* Microbial ecology and water engineering & biofilms specialist groups (MEWE2016)  
*Place of publication:* Copenhagen, Denmark  
*Publisher:* IWA  
*Main Research Area:* Technical/natural sciences  
*Conference:* MEWE and biofilms IWA specialist conference, Copenhagen, Denmark, 04/09/2016 - 04/09/2016  
*Electronic versions:* MEWE2016_AbstractBookTerada.pdf

**Sporgasdispersionsmetoden - erfaringer, usikkerheder og status**

**General information**

*State:* Published  
*Organisations:* Department of Environmental Engineering, Residual Resource Engineering  
*Authors:* Mønster, J. (Intern), Scheutz, C. (Intern)  
*Number of pages:* 15  
*Publication date:* 2016

**Publication information**

*Media of output:* Powerpoint  
*Original language:* Danish  
*Place of publication:* Kgs. Lyngby  
*Publisher:* Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet  
*Main Research Area:* Technical/natural sciences  
*Conference:* ATV - Jord og Grundvand 2016 : Abstractsamling  
*Publication:* Research - peer-review > Conference abstract in proceedings – Annual report year: 2016

**Sporgasmetoden - erfaringer og usikkerheder**

**General information**

*State:* Published  
*Organisations:* Department of Environmental Engineering, Residual Resource Engineering  
*Authors:* Mønster, J. (Intern), Scheutz, C. (Intern)  
*Number of pages:* 2  
*Publication date:* 2016

**Host publication information**

*Title of host publication:* ATV - Jord og Grundvand 2016 : Abstractsamling  
*Place of publication:* Kgs. Lyngby  
*Publisher:* ATV Jord og Grundvand  
*Main Research Area:* Technical/natural sciences  
*Conference:* 07/03/2016 - 07/03/2016  
*Electronic versions:* Sporgasmetoden_erfaringer_og_usikkerheder.pdf

*Publication:* Research - peer-review > Conference abstract in proceedings – Annual report year: 2016
Stable isotope probing and dynamic loading experiments provide insight into the ecophysiology of novel ammonia oxidizers in rapid gravity sand filters

Nitrification is often the dominant microbial process in rapid gravity sand filters (RSF), used to treat aerated groundwater to produce drinking water. RSFs harbor diverse microbial communities including a range of ammonia oxidizing clades; Betaproteobacteria (Nitrosomonas, Nitrosospira), Archaea, diverse potentially ammonia oxidizing heterotrophs and abundant Nitrospira spp., recently shown to comprise both canonical nitrite oxidizing as well as complete ammonium oxidizing (comammox) types. We examined the contributions of the different ammonia oxidizers to in situ ammonia oxidation, and aimed to elucidate the differences in ecophysiology between the ammonia oxidizing clades that enable them to co-exist in this unique environment. Experiments were conducted using sand columns designed and operated to mimic the conditions in the full-scale parent RSF. RNA and DNA stable isotope probing based on 13C-bicarbonate incorporation during continuous feeding with either ammonium or nitrite as sole energy source implicated Nitrospira spp. and certain ‘heterotrophic’ bacteria in addition to Nitrosomonas spp. in autotrophy during ammonium oxidation in RSFs. Further experimentation aimed to elucidate the ecophysiology of each ammonia oxidizing clade in RSFs, in particular comammox Nitrospira for which little is currently known. Columns were fed with RSF effluent spiked with various concentrations of ammonium ranging from 0.1- 5.0 mg/L delivered at different loading rates to examine the effects of both ammonium loading and oxygen limitation on ammonia oxidizers. Our observations indicate that the native conditions in the RSF used in this study foster the enrichment of comammox Nitrospira, which provides a preliminary step in the description of their ecophysiology.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Urban Water Systems, University of Copenhagen, University of Southern Denmark
Authors: Fowler, J. (Intern), Palomo, A. (Intern), Gülay, A. (Intern), Tatari, K. (Intern), Thamdrup, B. (Ekstern), Albrechtsen, H. (Intern), Sørensen, S. (Ekstern), Smets, B. F. (Intern)
Number of pages: 1
Publication date: 2016
Event: Abstract from 16th International Symposium on Microbial Ecology, Montreal, Canada.
Main Research Area: Technical/natural sciences
Electronic versions:
PS03_Nitrogen_assimilation.pdf
Source: PublicationPreSubmission
Source-ID: 12636804
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

State-of-the-Art Solid Waste Management Life-Cycle Modeling Workshop
There are many alternatives for the management of solid waste including recycling, biological treatment, thermal treatment and landfill disposal. In many cases, solid waste management systems include the use of several of these processes. Solid waste life-cycle assessment models are often used to evaluate the environmental consequences of various waste management strategies. The foundation of every life-cycle model is the development and use of process models to estimate the emissions from solid waste unit processes. The objective of this workshop is to describe life-cycle modeling of the solid waste processes and systems. The workshop will begin with an introduction to solid waste life-cycle modeling and available models, which will be followed by sessions on life-cycle process modeling for individual processes (e.g., landfills, biological treatment, and thermal treatment). The first part of each session will be used to explain the state-of-the-art for a given solid waste process model and the remainder of the time will be devoted to input and discussion.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Damgaard, A. (Intern), Levis, J. W. (Ekstern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Electronic versions:
ISWALCAWorkshopv2.pdf
Source: PublicationPreSubmission
Source-ID: 128105174
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Strategies for Transferring Mixtures of Organic Contaminants from Aquatic Environments into Bioassays
Mixtures of organic contaminants are ubiquitous in the environment. Depending on their persistence and physicochemical properties, individual chemicals that make up the mixture partition and distribute within the environment and might then jointly elicit toxicological effects. For the assessment and monitoring of such mixtures, a variety of cell-based in vitro and low-complexity in vivo bioassays based on algae, daphnids or fish embryos are available. A very important and sometimes
unrecognized challenge is how to combine sampling, extraction and dosing to transfer the mixtures from the environment into bioassays, while conserving (or re-establishing) their chemical composition at adjustable levels for concentration-effect assessment. This article outlines various strategies for quantifiable transfer from environmental samples including water, sediment, and biota into bioassays using total extraction or polymer-based passive sampling combined with either solvent spiking or passive dosing.

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Helmholtz Centre for Environmental Research, German Federal Institute of Hydrology, Hamburg University of Applied Sciences, Eberhard-Karls-Universität Tübingen
Authors: Jahnke, A. (Ekstern), Mayer, P. (Intern), Schäfer, S. (Ekstern), Witt, G. (Ekstern), Haase, N. (Ekstern), Escher, B. I. (Ekstern)
Pages: 5424–5431
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmental Science and Technology
Volume: 50
Issue number: 11
ISSN (Print): 0013-936X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.26 SJR 2.538 SNIP 1.889
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.584 SNIP 1.828 CiteScore 5.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.103 CiteScore 5.52
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.146 SNIP 2.056 CiteScore 5.17
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.178 SNIP 1.953 CiteScore 5.16
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.964 SNIP 1.729
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.835 SNIP 1.803
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.943 SNIP 1.942
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.8 SNIP 1.927
Strategies for transferring mixtures of organic contaminants from multimedia environments into bioassays

**General information**
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, Helmholtz Centre for Environmental Research
Authors: Jahnke, A. (Ekstern), Mayer, P. (Intern), Schaefer, S. (Ekstern), Witt, G. (Ekstern), Haase, N. (Ekstern), Escher, B. (Ekstern)
Pages: 159-159
Publication date: 2016

**Host publication information**
Title of host publication: SETAC Orlando - abstract book
Place of publication: Orlando, Florida
Publisher: Society of Environmental Toxicology and Chemistry
Article number: 579
Main Research Area: Technical/natural sciences
Electronic versions:
Publication: Research - peer-review » Conference abstract in proceedings – Annual report year: 2017

Structural and functional robustness of an environmental bacterial community degrading diesel fuel

**General information**
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Poznan University of Technology
Authors: Sydow, M. (Ekstern), Owsianiak, M. (Intern), Smets, B. F. (Intern), Chrzanowski, L. (Ekstern)
Pages: S128-S128
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**
Journal: New Biotechnology
Volume: 33
ISSN (Print): 1871-6784
Submerged Pond Sand Filter-A Novel Approach to Rural Water Supply

This study describes the new design and function of a modified version of a traditional slow sand filter. The Submerged Pond Sand Filter is built inside a pond and has a vertical as well as a horizontal flow of water through a sloped filter opening. The filter provides treated drinking water to a rural Indian village. The filter has functioned with minimal maintenance for five years without being subject to the typical scraping off and changing of sand as needed in traditional slow sand filters every few months. This five-year study showed bacterial removal efficiency of 97% on average with a level of faecal coliforms of 2 +/- 2 colony forming units (CFU)/100 mL measured in the treated water. Turbidity was visibly removed during treatment. When water was retrieved from the filter through a manual pump for long consistent time intervals (60 min), faecal coliform counts increased from four to 10 CFU/100 mL on average compared to shorter pumping
intervals (5 min). Though the treated water did not comply with the World Health Organization standards of 0 CFU/100 mL, the filter significantly improved water quality and provided one of the best sources of drinkable water in a water-depleted area, where only surface water was available. Furthermore, it is a sustainable treatment method due to low maintenance requirements.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Technical University of Denmark, University of Copenhagen
Authors: Øhlenschlæger, M. (Ekstern), Christensen, S. C. B. (Intern), Bregnhøj, H. (Ekstern), Albrechtsen, H. (Intern)
Number of pages: 14
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Water
Volume: 8
Issue number: 6
Article number: 250
ISSN (Print): 2073-4441
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.05 SJR 0.548 SNIP 1.079
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.522 SNIP 1.043 CiteScore 1.96
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.466 SNIP 0.862 CiteScore 1.45
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.283 SNIP 0.553 CiteScore 1
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.239 SNIP 0.562
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
drinking water, sand filtration, bacteria, faecal coliforms, India, maintenance, surface water
Electronic versions:
water_08_00250.pdf
DOIs:
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Source: FindIt
Source-ID: 2305652967
Publication: Research - peer-review › Journal article – Annual report year: 2016

Support for 3rd regulatory review on nanomaterials – environmental legislation: Project Report
Ricardo Energy & Environment, in partnership with subcontractors Milieu Consulting and the Technical University of Denmark (DTU), was commissioned by the European Commission to carry out a project entitled “The preparation of the third regulatory review on nanomaterials - environmental legislation”, specific contract number 070201/ENV/2015/SI2.716613/ENV.A3, Commission reference ENV.C.3/ETU/2015/0030. The study objective was to compile and develop information on nanomaterials and advanced materials in the environment and explore further the regulatory implementation challenges. The study had three main components: - A preliminary evaluation of releases of nanomaterials to different media (air, water, land, recycling and waste disposal). - A review of progress on the application of environmental and other key legislation to nanomaterials. - A prospective view on future developments in advanced materials, and challenges for environmental legislation. Consultation with stakeholders was carried out by email and
telephone, and a stakeholder workshop was held on 21 June 2016. At the workshop, the interim findings were presented, and stakeholder feedback and views were discussed. Following the workshop, stakeholders provided feedback in writing. This feedback has been taken into account for the finalisation of the report

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Broomfield, M. (Ekstern), Hansen, S. F. (Intern), Pelsy, F. (Ekstern)
Number of pages: 190
Publication date: 2016

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Publisher: European Commission
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Broomfield_et_al_.2016.pdf
DOIs: 10.2779/49879
Publication: Commissioned › Report – Annual report year: 2017

Suppression of nitrite-oxidizing bacteria in intermittently aerated biofilm reactors: a model-based explanation

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies
Authors: Ma, Y. (Intern), Domingo Felez, C. (Intern), Plósz, B. G. (Intern), Smets, B. F. (Intern)
Pages: 158-159
Publication date: 2016

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Title of host publication: Microbial ecology and water engineering & biofilms specialist groups (MEWE2016)
Place of publication: Copenhagen, Denmark
Publisher: IWA
Main Research Area: Technical/natural sciences
Conference: MEWE and biofilms IWA specialist conference, Copenhagen, Denmark, 04/09/2016 - 04/09/2016
Electronic versions:
MEWE2016_AbstractBookyuma.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Suppression of nitrite-oxidizing bacteria in intermittently aerated biofilms: a model-based explanation

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies
Authors: Ma, Y. (Intern), Domingo Felez, C. (Intern), Plósz, B. G. (Intern), Smets, B. F. (Intern)
Number of pages: 1
Publication date: 2016
Event: Poster session presented at MEWE and biofilms IWA specialist conference, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
MEWE_poster_YUMA.pdf
Source: PublicationPreSubmission
Source-ID: 127665194
Publication: Research - peer-review › Poster – Annual report year: 2016

Surface-atmosphere exchange of ammonia over peatland using QCL-based eddy-covariance measurements and inferential modeling

Recent advances in laser spectrometry offer new opportunities to investigate ecosystem-atmosphere exchange of environmentally relevant trace gases. In this study, we demonstrate the applicability of a quantum cascade laser (QCL) absorption spectrometer to continuously measure ammonia concentrations at high time resolution and thus to quantify the
net exchange between a seminatural peatland ecosystem and the atmosphere based on the eddy-covariance approach. Changing diurnal patterns of both ammonia concentration and fluxes were found during different periods of the campaign. We observed a clear tipping point in early spring with decreasing ammonia deposition velocities and increasingly bidirectional fluxes that occurred after the switch from dormant vegetation to CO2 uptake but was triggered by a significant weather change. While several biophysical parameters such as temperature, radiation, and surface wetness were identified to partially regulate ammonia exchange at the site, the seasonal concentration pattern was clearly dominated by agricultural practices in the surrounding area. Comparing the results of a compensation point model with our measurement-based flux estimates showed considerable differences in some periods of the campaign due to overestimation of non-stomatal resistances caused by low acid ratios. The total cumulative campaign exchange of ammonia after 9 weeks, however, differed only in a 6% deviation with 911 and 857 gNH3-N ha-1 deposition being found by measurements and modeling, respectively. Extrapolating our findings to an entire year, ammonia deposition was lower than reported by Hurkuck et al. (2014) for the same site in previous years using denuder systems. This was likely due to a better representation of the emission component in the net signal of eddy-covariance fluxes as well as better adapted site-specific parameters in the model. Our study not only stresses the importance of high-quality measurements for studying and assessing land surface-atmosphere interactions but also demonstrates the potential of QCL spectrometers for continuous observation of reactive nitrogen species as important additional instruments within long-term monitoring research infrastructures such as ICOS or NEON at sites with strong nearby ammonia sources leading to relatively high mean background concentrations and fluxes.

General information
State: Published
Organisations: Department of Environmental Engineering, Atmospheric Environment, Thünen Institute of Climate-Smart Agriculture, Swiss Federal Research Station Agroscope ART, Aerodyne Research, Inc, INRA Institut National de La Recherche Agronomique, University of Helsinki
Number of pages: 17
Pages: 11283-11299
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Atmospheric Chemistry and Physics
Volume: 16
Issue number: 17
ISSN (Print): 1680-7316
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 3.264 SNIP 1.756 CiteScore 5.72
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.308 SNIP 1.531 CiteScore 5.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.482 SNIP 1.698 CiteScore 5.17
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.784 SNIP 1.854 CiteScore 5.34
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.882 SNIP 1.583 CiteScore 4.91
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.279 SNIP 1.489 CiteScore 5.2
Surprisingly low frequency attenuation effects in long tubes when measuring turbulent fluxes at tall towers

The eddy covariance technique relies on the fast and accurate measurement of gas concentration fluctuations. While for some gasses robust and compact sensors are available, measurement of, e.g., non CO2 greenhouse gas fluxes is often performed with sensitive equipment that cannot be run on a tower without massively disturbing the wind field. To measure CO and N2O fluxes, we installed an eddy covariance system at a 125 m mast, where the gas analyser was kept in a laboratory close to the tower and the sampling was performed using a 150 m long tube with a gas intake at 96 m height. We investigated the frequency attenuation and the time lag of the N2O and CO concentration measurements with a concentration step experiment. The results showed surprisingly high cut-off frequencies (close to 2 Hz) and small low-pass filter induced time lags (< 0.3 s), which were similar for CO and N2O. The results indicate that the concentration signal was hardly biased during the ca 10 s travel through the tube. Due to the larger turbulence time scales at large measurement heights the low-pass correction was for the majority of the measurements < 5%. For water vapour the tube attenuation was massive, which had, however, a positive effect by reducing both the water vapour dilution correction and the cross sensitivity effects on the N2O and CO flux measurements. Here we present the set-up of the concentration step change experiment and its results and compare them with recently developed theories for the behaviour of gases in turbulent tube flows.
Sustainable flood risk management – What is sustainable?
Sustainable flood risk management has to be achieved since flood protection is a fundamental societal service that we must deliver. Based on the discourse within the fields of risk management and sustainable urban water management, we discuss the necessity of assessing the sustainability of flood risk management, and propose an evaluation framework for doing so. We argue that it is necessary to include quantitative sustainability measures in flood risk management in order to exclude unsustainable solutions. Furthermore, we use the concept of absolute sustainability to discuss the prospects of maintaining current service levels without compromising future generation’s entitlement of services. Discussions on the sustainability of different overall flood risk schemes must take place. Fundamental changes in the approaches will require fundamental changes in the mind-sets of practitioners as well as lawmakers, politicians and the general public, which inevitably will take some time. Right now, the importance lies in setting an agenda where sustainability is important and needs to be quantified and assessed when managing flood risk.

Sustainable management of C&D waste - reducing the source to ozone depletion and global warming
Large quantities of construction and demolition waste (C&D waste) are produced. Buildings in many countries are thermally insulated by insulation foam containing large amounts of fluorocarbons (chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) or hydrofluoro-carbons (HCFCs), which are strong ozone depleting substances and/or greenhouse gases. The fluorocarbons are released extremely slowly during use. Therefore, the insulation material will still contain large quantities of fluorocarbons when the buildings reach the end-of-life and are demolished. A protocol for managing insulation foam waste in Denmark developed by DAKOFA (The Waste and Resource Network Denmark) gives
recommendations on sustainable management of insulation foam waste including mapping of insulation foam waste in buildings, and further management during demolishing and recycling of the C&D waste in order to reduce the release of the harmful substances.

Systematic design of an optimal control system for the SHARON-Anammox process
A systematic design of an optimal control structure for the SHARON-Anammox nitrogen removal process is studied. The methodology incorporates two novel features to assess the controllability of the design variables candidate for the regulatory control layer: (i) H_2 control method, which formulates the control problem as a mathematical optimization problem, and (ii) close-loop disturbance gain (CLDG) plots. It is shown that the methodology is especially appropriate for bioreactors. The solution of the mixed sensitivity stacked H_2 control problem ranked the combinations of controlled variables (CVs). The best candidates to CVs were paired with the manipulated variables using the relative gain array. The proposed control structure was further analyzed and verified for disturbance rejection using the CLDG plots. The optimal pairing of CVs with the actuators (kLa and acid/base addition) is found to be dissolved oxygen (DO) and pH in the SHARON reactor. Furthermore, to relate the controller actions to process operation objective, nitrogen removal efficiency, two cascade control systems are designed. The first cascade loop controls TNN/TAN ratio in the influent to the Anammox reactor by adjusting the set point for DO in the regulatory layer, while the second cascade loop controls the nitrogen removal efficiency (i.e. effluent TNN and TAN) by adjusting the TNN/TAN ratio at the effluent of the SHARON reactor. The control system is evaluated and benchmarked using a set of realistic dynamic scenario simulations, demonstrating that the different control strategies successfully maintain stable and high nitrogen removal efficiency. The nested cascade control structure shows the best performance, removing up to 95% of the influent ammonia. Both the control design methodology and the resulting optimal control structures are expected to contribute to stable operation and control of these emerging nitrogen removal technologies.
Systematic design of optimal control systems for WWTPs: case study of the SHARON-Anammox process

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS
Authors: Valverde Perez, B. (Intern), Mauricio Iglesias, M. (Intern), Sin, G. (Intern)
Number of pages: 1
Publication date: 2016
Event: Poster session presented at 5th IWA/WEF Wastewater Treatment Modelling Seminar 2016, Annecy, France.
Main Research Area: Technical/natural sciences

Control design, H-infinity, Anammox, Autotrophic nitrogen removal, Disturbance analysis, Process modelling

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Source: FindIt
Source-ID: 2290399878
Publication: Research - peer-review › Journal article – Annual report year: 2016
Taxonomy and functional roles of biogas microbiota binned from multiple metagenomes of anaerobic digestion systems

Anaerobic digestion, a biologically mediated process, is a worldwide spread technology for biogas production. This work represents the first comprehensive catalogue of microbial genomes populating mesophilic and thermophilic biogas reactors treating manure, agro-industrial organic residues. High throughput Illumina sequencing was performed on samples collected from 22 biogas reactors (laboratory and full scale) operating under different conditions. Using a binning strategy, 575 high quality microbial genome bins were extracted and abundance-weighted community composition was determined. Average nucleotide identity grouped the genomes in 373 different species. Phylogeny and taxonomy assignment at species/genus level was possible only for 12% of the community members demonstrating a high degree of novelty in this microbiome. Moreover, 21 highly abundant genomes were found to be present in all digesters and constitute the community core group. Interestingly, 42% of them were classified as belonging to the Syntrophomonadaceae family. A correlation between the community composition resilience and the microbial functional specialization was also established. The core functional properties were found to cover all the steps of the anaerobic digestion process, from hydrolysis to methanogenesis. On contrary, 4 groups of genomes were identified only in specific bioreactors and therefore were found to be dependent on the operational parameters. Despite specific, some of these genomes are crucial for a properly functioning microbiome since they operate in peculiar conditions, determined by lipids and polysaccharides overload or in the presence of ammonia inhibition. Remarkably, by combining community composition and functional properties we provided a clear understanding of the anaerobic digestion process.
Testing the applicability of BIOME-BGC to simulate beech gross primary production in Europe using a new continental weather dataset

A daily 1-km Pan-European weather dataset can drive the BIOME-BGC model for the estimation of current and future beech gross primary production (GPP). Annual beech GPP is affected primarily by spring temperature and more irregularly by summer water stress. The spread of beech forests in Europe enhances the importance of modelling and monitoring their growth in view of ongoing climate changes. The current paper assesses the capability of a biogeochemical model to simulate beech gross primary production (GPP) using a Pan-European 1-km weather dataset. The model BIOME-BGC is applied in four European forest ecosystems having different climatic conditions where the eddy covariance technique is used to measure water and carbon fluxes. The experiment is in three main steps. First, the accuracy of BIOME-BGC GPP simulations is assessed through comparison with flux observations. Second, the influence of two major meteorological drivers (spring minimum temperature and growing season dryness) on observed and simulated inter-annual GPP variations is analysed. Lastly, the impacts of two climate change scenarios on beech GPP are evaluated through statistical analyses of the ground data and model simulations. The weather dataset can drive BIOME-BGC to simulate most of the beech GPP evolution in all four test areas. Both observed and simulated inter-annual GPP variations are mainly dependent on minimum temperature around the beginning of the growing season, while spring/summer dryness exerts a secondary role. BIOME-BGC can also reasonably predict the impacts of the examined climate change scenarios. The proposed modelling approach is capable of approximately reproducing spatial and temporal beech GPP variations and impacts of expected climate changes in the examined European sites.
The challenge of chemicals in material lifecycles

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Pivnenko, K. (Intern), Astrup, T. F. (Intern)
Number of pages: 2
Pages: 1-2
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Waste Management
Volume: 56
ISSN (Print): 0956-053X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.354 SNIP 2.044
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.739 SNIP 2.256 CiteScore 4.33
Web of Science (2015): Indexed yes
The chemistry and isotopic composition of waters in the low-enthalpy geothermal system of Cimino-Vico Volcanic District, Italy

Geothermal energy exploration is based in part on interpretation of the chemistry, temperature, and discharge rate of thermal springs. Here we present the major element chemistry and the δD, δ18O, 87Sr/86Sr and δ11B isotopic ratio of groundwater from the low-enthalpy geothermal system near the city of Viterbo in the Cimino-Vico volcanic district of west-Central Italy. The geothermal system hosts many thermal springs and gas vents, but the resource is still unexploited. Water chemistry is controlled by mixing between low salinity, HCO3-rich fresh waters (< 24.2 °C) flowing in shallow volcanic rocks and SO4-rich thermal waters (25.3 °C to 62.2 °C) ascending from deep, high permeability Mesozoic limestones. The (equivalent) SO4/Cl (0.01–0.02), Na/Cl (2.82–5.83) and B/Cl ratios (0.02–0.38) of thermal waters differs from the ratios in other geothermal systems from Central Italy, probably implying a lack of hydraulic continuity across the region. The δ18O (− 6.6‰ to − 5.9‰) and δD (− 40.60‰ to − 36.30‰) isotopic composition of spring water suggest that the recharge area for the geothermal system is the summit region of Mount Cimino. The strontium isotope ratios
(87Sr/86Sr) of thermal waters (0.70797–0.70805) are consistent with dissolution of the Mesozoic evaporite-carbonate units that constitute the reservoir, and the ratios of cold fresh waters mainly reflect shallow circulation through the volcanic cover and some minor admixture (< 10%) of thermal water as well. The boron isotopic composition (δ11B) of fresh waters (~ 5.00 and 6.12‰) is similar to that of the volcanic cover, but the δ11B of thermal waters (~ 8.37‰ to ~ 4.12‰) is a mismatch for the Mesozoic reservoir rocks and instead reflects dissolution of secondary boron minerals during fluid ascent through flysch units that overlie the reservoir. A slow and tortuous ascent enhances extraction of boron but also promotes conductive cooling, partially masking the heat present in the reservoir. Overall data from this study is consistent with previous studies that concluded that the geothermal system has a large energy potential.

General information
State: Published
Organisations: Department of Environmental Engineering, U.S. Geological Survey, La Sapienza - Università di Roma
Authors: Battistel, M. (Intern), Hurwitz, S. (Ekstern), Evans, W. C. (Ekstern), Barbieri, M. (Ekstern)
Number of pages: 8
Pages: 222-229
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Volcanology and Geothermal Research
Volume: 328
ISSN (Print): 0377-0273
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.73 SJR 1.801 SNIP 1.259
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.684 SNIP 1.107 CiteScore 2.72
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.723 SNIP 1.221 CiteScore 2.53
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.603 SNIP 1.327 CiteScore 2.58
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.111 SNIP 1.217 CiteScore 2.39
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.852 SNIP 1.054 CiteScore 2.05
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.679 SNIP 1.119
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.59 SNIP 1.096
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.387 SNIP 1.551
Scopus rating (2007): SJR 1.796 SNIP 1.14
Scopus rating (2006): SJR 1.619 SNIP 1.341
Scopus rating (2005): SJR 1.319 SNIP 1.206
Scopus rating (2004): SJR 1.517 SNIP 1.196
Scopus rating (2003): SJR 1.586 SNIP 1.184
Scopus rating (2002): SJR 1.075 SNIP 0.946
Scopus rating (2001): SJR 1.133 SNIP 0.949
Scopus rating (2000): SJR 1.101 SNIP 0.932
Scopus rating (1999): SJR 1.334 SNIP 0.953
Original language: English
Low-enthalpy geothermal system, Fluid geochemistry, Boron isotopes, Strontium isotopes, Central Italy
DOIs:
The consequences of the diurnal variation of soil respiration for soil budgets from up-scaled day-time measurements

General information
State: Published
Organisations: Department of Environmental Engineering, Atmospheric Environment
Authors: Brændholt, A. (Intern), Larsen, K. S. (Intern), Pilegaard, K. (Intern), Ibrom, A. (Intern)
Number of pages: 1
Publication date: 2016
Event: Poster session presented at Potsdam GHG Flux Workshop, Potsdam, Germany.
Main Research Area: Technical/natural sciences

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Source: PublicationPreSubmission
Source-ID: 127669581
Publication: Research - peer-review › Poster – Annual report year: 2016

The cost of ending groundwater overdraft on the North China Plain
Overexploitation of groundwater reserves is a major environmental problem around the world. In many river basins, groundwater and surface water are used conjunctively and joint optimization strategies are required. A hydroeconomic modeling approach is used to find cost-optimal sustainable surface water and groundwater allocation strategies for a river basin, given an arbitrary initial groundwater level in the aquifer. A simplified management problem with conjunctive use of scarce surface water and groundwater under inflow and recharge uncertainty is presented. Because of head-dependent groundwater pumping costs the optimization problem is nonlinear and non-convex, and a genetic algorithm is used to solve the one-step-ahead subproblems with the objective of minimizing the sum of immediate and expected future costs. A real-world application in the water scarce Ziya River basin in northern China is used to demonstrate the model capabilities. Persistent overdraft from the groundwater aquifers on the North China Plain has caused declining groundwater levels. The model maps the marginal cost of water in different scenarios, and the minimum cost of ending groundwater overdraft in the basin is estimated to be CNY 5.58 billion yr$^{-1}$. The study shows that it is cost-effective to slowly recover the groundwater aquifer to a level close to the surface, while gradually lowering the groundwater value to the equilibrium at CNY 2.15 m$^{-3}$. The model can be used to guide decision-makers to economic efficient long-term sustainable management of groundwater and surface water resources.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Chinese Academy of Sciences
Authors: Davidsen, C. (Intern), Liu, S. (Ekstern), Mo, X. (Ekstern), Rosbjerg, D. (Intern), Bauer-Gottwein, P. (Intern)
Number of pages: 15
Pages: 771-785
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: Hydrology and Earth System Sciences
Volume: 20
Issue number: 2
ISSN (Print): 1027-5606
Ratings:
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.22 SJR 2.216 SNIP 1.624
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.225 SNIP 1.497 CiteScore 3.74
The Effect of Data Structure and Model Choices on MFA Results: A Comparison of Phosphorus Balances for Denmark and Austria

Material Flow Analysis (MFA) studies for a particular substance often exist for several different countries or regions, but share a similar goal and scope. In direct comparisons of such regional resource budgets, the importance of the choices made in establishing an MFA system tends to be disregarded.

We identify and quantify the effects of choices made in system layout, data material and uncertainty assessment on the
outcome of regional MFAs using two recent country-scale MFAs (of Denmark and Austria) of phosphorus as a case study.

We highlight the differences in system boundaries and definition of flows and processes. We quantify types and choice of data sources; analyse the consistency of the data used by looking at the extent of data reconciliation, as a measure of model quality; quantify the effect of different approaches to uncertainty assessment; and show the influence of aggregating/disaggregating flows.

We show that differences in system layout are mostly attributable to varying goals and scope definitions. Direct comparison of uncertainties across studies is problematic: both studies draw on similar types of data sources, yet they show very different uncertainty assessments; the uncertainty assessment in MFA is always subjective to a certain extent. We demonstrate that reconciliation of conflicting data provides a useful measure to assess data consistency and model quality: data are more consistent (5% average change in reconciled data) in the Austrian than in the Danish (9%) case. We suggest an iterative approach to uncertainty assessment. Likewise, we demonstrate the effect of the aggregation of flows on model uncertainty.

These findings quantify and emphasise the importance of examining MFA studies’ metadata and suggest an approach to be followed when drawing on such studies as a source of information.

**General information**

- **State:** Published
- **Organisations:** Department of Environmental Engineering, Residual Resource Engineering, Vienna University of Technology
- **Authors:** Klinglmair, M. (Intern), Zoboli, O. (Ekstern), Laner, D. (Ekstern), Rechberger, H. (Ekstern), Astrup, T. F. (Intern), Scheutz, C. (Intern)
- **Pages:** 166-175
- **Publication date:** 2016
- **Main Research Area:** Technical/natural sciences

**Publication information**

- **Journal:** Resources, Conservation and Recycling
- **Volume:** 109
- **ISSN (Print):** 0921-3449
- **Ratings:**
  - BFI (2018): BFI-level 1
  - Web of Science (2018): Indexed yes
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  - Web of Science (2017): Indexed yes
  - BFI (2016): BFI-level 1
  - Scopus rating (2016): CiteScore 3.73 SJR 1.16 SNIP 1.709
  - Web of Science (2016): Indexed yes
  - BFI (2015): BFI-level 1
  - Scopus rating (2015): SJR 1.275 SNIP 1.915 CiteScore 3.98
  - Web of Science (2015): Indexed yes
  - BFI (2014): BFI-level 1
  - Scopus rating (2014): SJR 1.339 SNIP 2.089 CiteScore 3.7
  - Web of Science (2014): Indexed yes
  - BFI (2013): BFI-level 1
  - Scopus rating (2013): SJR 1.432 SNIP 2.184 CiteScore 3.34
  - ISI indexed (2013): ISI indexed yes
  - Web of Science (2013): Indexed yes
  - BFI (2012): BFI-level 1
  - Scopus rating (2012): SJR 1.262 SNIP 1.811 CiteScore 2.91
  - ISI indexed (2012): ISI indexed yes
  - Web of Science (2012): Indexed yes
  - BFI (2011): BFI-level 1
  - Scopus rating (2011): SJR 1.119 SNIP 1.848 CiteScore 2.62
  - ISI indexed (2011): ISI indexed yes
  - Web of Science (2011): Indexed yes
  - BFI (2010): BFI-level 1
  - Scopus rating (2010): SJR 1.163 SNIP 1.82
The effects of physicochemical wastewater treatment operations on forward osmosis
Raw municipal wastewater from a full-scale wastewater treatment plant was physicochemically pretreated in a large pilot-scale system comprising coagulation, flocculation, microsieve and microfiltration operated in various configurations. The produced microsieve filtrates and microfiltration permeates were then concentrated using forward osmosis (FO). Aquaporin Inside(TM) FO membranes were used for both the microsieve filtrate and microfiltration permeates, and Hydration Technologies Inc.-thin-film composite membranes for the microfiltration permeate using only NaCl as the draw solution. The FO performance was evaluated in terms of the water flux, water flux decline and solute rejections of biochemical oxygen demand, and total and soluble phosphorus. The obtained results were compared with the results of FO after only mechanical pretreatment. The FO permeates satisfied the Swedish discharge demands for small and medium-sized wastewater treatment plants. The study demonstrates that physicochemical pretreatment can improve the FO water flux by up to 20%. In contrast, the solute rejection decreases significantly compared to the FO-treated wastewater with mechanical pretreatment.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Lund University, Aquaporin A/S
Authors: Hey, T. (Ekstern), Bajraktari, N. (Intern), Vogel, J. (Ekstern), Hélix-Nielsen, C. (Intern), La Cour Jansen, J. (Ekstern), Jönsson, K. (Ekstern)
Pages: 2130-2142
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmental Technology
Volume: 38
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ISSN (Print): 0959-3330
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.6 SJR 0.528 SNIP 0.747
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.633 SNIP 0.772 CiteScore 1.63
The Efficiency of Informality: Quantifying Greenhouse Gas Reductions from Informal Recycling in Bogotá, Colombia

The dual challenges of increasing urbanization and consumption are centered in cities in the Global South, where growing waste production threatens public and environmental health. Reuse and recycling are widely recognized to provide broad environmental benefits. Although most industrialized cities replaced their informal recycling sectors with municipally run recycling schemes and have had to build their recycling rates anew, most industrializing cities in the Global South remain centers of recycling and reuse through the work of informal workers. Bogotá, Colombia, is emblematic of many cities in the Global South seeking to modernize their city, in part by formalizing their recycling system. This article asks: What are the greenhouse gas (GHG) emission implications of this modernization? Using interviews and observation in combination with life cycle assessment, we compare GHG emissions resulting from the baseline case (1,200 tonnes per day [t/d] recycled...
through informal channels; 5,700 t/d landfilled) to three alternative scenarios that formalize the recycling sector: the prohibition of informal recycling; a reduction in informal recycling coupled with a scale-up of formalized recycling; and the replacement of informal recycling with formal recycling. We find that the baseline recycling scenario, dependent on the informal sector only, emits far fewer GHGs than do all formalization scenarios. Three processes drive the results, in order of magnitude: informal textile reuse (largest GHG savings); landfilling (largest emitter of GHGs); and metal recycling (GHG savings). A hybrid model could combine the incentives and efficiency of the informal system with the better working conditions of the municipal one.

**General information**

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Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of California
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- Scopus rating (2005): SJR 0.614 SNIP 1.503
The formation dynamics of microbial aggregates

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, University of Birmingham
Authors: Cockx, B. (Intern), Clegg, R. J. (Ekstern), Kreft, J. (Ekstern), Smets, B. F. (Intern)
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The fundament of food, crop protein production, is threatened by climate change

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Organisations: Department of Chemical and Biochemical Engineering, Department of Environmental Engineering, Atmospheric Environment, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Aarhus University
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The impact of backwashing on nitrification in biological rapid sand filters under different ammonium loading conditions

General information
The influence of reactor staging on microbial structure and functions in pre-denitrifying MBBRs

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Organisations: Department of Environmental Engineering, Environmental Chemistry, Water Technologies, Aarhus University, AnoxKaldnes AB
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The link between data choices and reality in life cycle assessment modelling of waste management technologies

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Henriksen, T. (Intern), Astrup, T. F. (Intern), Damgaard, A. (Intern)
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The microbiome of biogas reactors treating lignocellulosic substrates revealed different mechanisms for carbohydrates utilization

The present study dissected the microbiome of biogas reactors treating lignocellulosic substrate and swine manure by means of high throughput Illumina sequencing. A comparative metagenomic analysis allowed to identify the microbial species firmly attached to the digested lignocellulosic particles and to distinguish them from the planktonic microbes floating in the liquid medium. Proteobacteria and Firmicutes were the most abundant phyla identified respectively in the liquid samples and firmly attached to the grass, and accounted approximately 17 and 22% of the total microbial counts.
Additionally, Actinobacteria were also presented in both samples but in lower relative abundance. Assembly of the shotgun reads followed by a binning process led to the extraction of 151 genome bins, out of which 80 microbial species were completely new and not previously deposited in any database. Moreover, it was shown that 25 microbial genomes were more enriched (>2 fold) in the firmly attached grass samples compared to the liquid phase. A bioinformatic approach based on multiple databases for functional annotation (KEGG, COG, SEED and dbCAN) demonstrated that these microbial species encode enzymes related to carbohydrate utilisation and present numerous carbohydrate binding modules. Finally, it was found that apart from the cellulosome multi-enzyme complex, specific microbes, such as Bacteroidetes, present different mechanisms for binding and degrading the lignocellulose due to the presence of multiple CBM6 modules in beta-xylosidase and endoglucanase proteins or SLH modules in unknown proteins.
Tidlige variationer i vandføring, forureningssluft og koncentrationer af klorerede opløsningsmidler i Grindsted

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Organisations: Department of Environmental Engineering, Water Resources Engineering
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TiO₂ assisted photo-oxidative pretreatment of wheat straw for biogas production

Photo-catalytic oxidation is an advanced oxidation process in which a catalyst is used to absorb light energy and oxidize the target substrates such as organic polymers. A number of metal oxides and metal ions can efficiently increase substrate's depolymerisation during the process of photo-catalytic oxidation. Titanium oxide (TiO₂) is a photo-catalyst that in its rutile and anatase forms presents the property to enhance the photo-oxidation of lignin-containing substrates. Due to lignin is one of the major obstacles in methane production from lignocellulosic biomass, its destruction is a necessary step to enhance biomass biodegradability in anaerobic digestion (AD) process. Thus, the present study elucidated the photo-catalytic oxidation of highly lignified wheat straw using TiO₂at the presence of UV light in the region of 300-360nm. Specifically, the combinations of four different concentrations of TiO₂ (i.e. 0.5, 1, 1.5 and 2 wt%) with four different exposure time periods (i.e. 0, 60, 120 and 180 min) were investigated under 700W medium pressure UV lamp radiations. Subsequently, biochemical methane potentials (BMPs) assays were conducted under thermophilic conditions for the different pretreated samples, based on the guidelines of the BMP protocol. The results showed that the methane yield was increased by 27% (p < 0.05) when compared to untreated wheat straw, due to the action of pretreatment with 1.5 wt% TiO₂ at 180min of exposure time. The findings were in accordance with the scanning electron microscopy (SEM) images of the pretreated wheat straw that showed augmented damaged areas and development of pits after the pretreatment. In addition, the products of oxidation were also measured, as it was expected the lignin to be oxidized into phenolic acids. For instance, vanillic acid was found to be markedly higher in the pretreated samples that were exposed for 180min with 1.5 wt% and 2 wt% of TiO₂ compared to the untreated wheat straw. Moreover, it was concluded that the products of lignin oxidation and also, the presence of TiO₂ did not inhibit the AD process. Finally, UV treatment or TiO₂ alone did not enhance the decomposition of wheat straw and the methane production from these samples did not differ significantly compared to untreated biomass (p > 0.05).
Towards a consensus-based biokinetic model for green microalgae – The ASM-A

Cultivation of microalgae in open ponds and closed photobioreactors (PBRs) using wastewater resources offers an opportunity for biochemical nutrient recovery. Effective reactor system design and process control of PBRs requires process models. Several models with different complexities have been developed to predict microalgal growth. However, none of these models can effectively describe all the relevant processes when microalgal growth is coupled with nutrient removal and recovery from wastewaters. Here, we present a mathematical model developed to simulate green microalgal growth (ASM-A) using the systematic approach of the activated sludge modelling (ASM) framework. The process model – identified based on a literature review and using new experimental data – accounts for factors influencing photoautotrophic and heterotrophic microalgal growth, nutrient uptake and storage (i.e. Droop model) and decay of microalgae. Model parameters were estimated using laboratory-scale batch and sequenced batch experiments using the novel Latin Hypercube Sampling based Simplex (LHSS) method. The model was evaluated using independent data obtained in a 24-L PBR operated in sequenced batch mode. Identifiability of the model was assessed. The model can effectively describe microalgal biomass growth, ammonia and phosphate concentrations as well as the phosphorus storage using a set of average parameter values estimated with the experimental data. A statistical analysis of simulation and measured data suggests that culture history and substrate availability can introduce significant variability on parameter values for predicting the reaction rates for bulk nitrate and the intracellularly stored nitrogen state-variables, thereby requiring scenario specific model calibration. ASM-A was identified using standard cultivation medium and it can provide a platform for extensions accounting for factors influencing algal growth and nutrient storage using wastewater resources.

General information
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Towards an optimal experimental design for N2O model calibration during biological nitrogen removal

Process models describing nitrous oxide (N2O) production during biological nitrogen removal allow for the development of mitigation strategies of this potent greenhouse gas. N2O is an intermediate of nitrogen removal, hence its prediction is negatively affected by the uncertainty associated to its substrates. Improving experimental designs for model calibration reduces prediction uncertainties. Moreover, the individual analysis of autotrophic and heterotrophic contribution to the total NO and N2O pool was assessed for already proposed model structures under different experimental scenarios. The results show the need for information-rich experimental designs to assess the predicting capabilities of N2O models. This work represents a step further in understanding the N2O production and emissions associated to conventional wastewater treatment. Moreover, it will facilitate the development of strategies to minimize the carbon footprint of wastewater treatment plants.

General information
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Organisations: Department of Environmental Engineering, Water Technologies, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS
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Number of pages: 3
Publication date: 2016
Towards a standardization of biomethane potential tests

Production of biogas from different organic materials is a most interesting source of renewable energy. The biomethane potential (BMP) of these materials has to be determined to get insight in design parameters for anaerobic digesters. Although several norms and guidelines for BMP tests exist, interlaboratory tests regularly still show high variability of BMPs for the same substrate. A workshop was held in June 2015, in Leysin, Switzerland, with over 40 attendees from 30 laboratories around the world, to agree on common solutions to the conundrum of inconsistent BMP test results. This paper presents the consensus of the intense roundtable discussions and cross-comparison of methodologies used in respective laboratories. Compulsory elements for the validation of BMP results were defined. They include the minimal number of replicates, the request to carry out blank and positive control assays, a criterion for the test duration, details on BMP calculation, and last but not least criteria for rejection of the BMP tests. Finally, recommendations on items that strongly influence the outcome of BMP tests such as inoculum characteristics, substrate preparation, test setup, and data analysis are presented to increase the probability of obtaining validated and reproducible results.
Towards the development of an automated ATP measuring platform to monitor microbial quality of drinking water

This work aimed to develop an automated and nearly on-line method to monitor ATP levels in drinking water as an indicator of microbial contamination. The system consists of a microfluidic cartridge installed in a light tight box, where the sample is mixed with the reagents and the emitted light is detected by a photomultiplier. Temperature in the assay box is controlled and set to 25°C. Calibration of the system using ATP standard solutions was successful, both for free and for total ATP. Chemical release of ATP by reagent addition however resulted in the formation of particles that ultimately clogged the microfluidic channels. An alternative thermal lysis step was implemented, by adding a flow-through heating/cooling step to the system. Thermal lysis showed efficient release of ATP from an E. coli dilution, but the releasing efficiency varied according to the type of water. Overall, the developed prototype system proves the concept of a lab-on-a-chip ATP analyzer.
Toxicity of Engineered Nanoparticles to Aquatic Invertebrates

This chapter provides a targeted description of some of the most important processes that influence toxicity and uptake of nanoparticles in aquatic invertebrates. It discusses silver nanoparticles (Ag NPs), on how aspects of dissolution and chemical species obtained from this process can influence ecotoxicity of aquatic invertebrates. The chapter focuses on how fullerenes affect the toxicity of other pollutants, but also reflect on the fate and behavior of C60 in the aquatic environment, as well as ecotoxicity to aquatic invertebrates. It presents the case of titanium dioxide nanoparticles (TiO2 NPs), and considers the acute and chronic ecotoxicity. The chapter examines in more detail the processes that influence this toxicity, for example, agglomeration and aggregation, and photocatalytic activity upon exposure to UV light. It covers the longer-term effects of various nanomaterials by reviewing literature on bioaccumulation focusing on the effect of nanoparticle coating, uptake, and depuration in aquatic invertebrates.

Toxicity testing with the willow tree transpiration test - 15 years of results

General information
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Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Trapp, S. (Intern), Clausen, L. P. W. (Intern)
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Transferring in vivo exposure into in vitro assays using silicone to assess the endocrine activity of POPs accumulated in human breast implants

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Organisations: Department of Environmental Engineering, Environmental Chemistry, National Food Institute, Research Group for Analytical Food Chemistry, Copenhagen Center for Health Technology
Authors: Gilbert, D. (Ekstern), Mayer, P. (Intern), Pedersen, M. (Intern), Vinggaard, A. M. (Intern)
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Transformation and sorption of illicit drug biomarkers in sewer systems: understanding the role of suspended solids in raw wastewater

Sewer pipelines, although primarily designed for sewage transport, can also be considered as bioreactors. In-sewer processes may lead to significant variations of chemical loadings from source release points to the treatment plant influent. In this study, we assessed in-sewer utilization of growth substrates (primary metabolic processes) and transformation of illicit drug biomarkers (secondary metabolic processes) by suspended biomass. Sixteen drug biomarkers were targeted, including mephedrone, methadone, cocaine, heroin, codeine and tetrahydrocannabinol (THC) and their major human metabolites. Batch experiments were performed under aerobic and anaerobic conditions using raw wastewater, and abiotic biomarker transformation and partitioning to suspended solids and reactor wall were separately investigated under both redox conditions. A process model was identified by combining and extending Wastewater Aerobic/anaerobic Transformations in Sewers model (WATS) and Activated Sludge Model for Xenobiotics (ASM-X). Kinetic and stoichiometric model parameters were estimated using experimental data via the Bayesian optimization method DREAM(ZS). Results suggest that biomarker transformation significantly differs from aerobic to anaerobic conditions, and abiotic conversion is the dominant mechanism for many of the selected substances. Notably, explicit description of biomass growth during batch experiments was crucial to avoid significant overestimation (up to 385%) of aerobic biotransformation rate constants. Predictions of in-sewer transformation provided here can reduce the uncertainty in the estimation of drug consumption as part of wastewater-based epidemiological studies.

General information
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Treatment of Swimming Pool Water with UV Followed by Ozone

General information
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Organisations: Department of Environmental Engineering, Water Technologies
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Udledning af metan og andre klimagasser fra skifergasindvinding

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Authors: Scheutz, C. (Intern)
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Udvikling og anvendelse af screeningsmetode til bestemmelse af 91 deponiers egnethed i forhold til etablering af biocover

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Fredenslund, A. M. (Intern), Mønster, J. (Intern), Kjeldsen, P. (Intern), Scheutz, C. (Intern)
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Underestimation of ammonia-oxidizing bacteria abundance by amplification bias in amoA-targeted qPCR
Molecular methods to investigate functional groups in microbial communities rely on the specificity and selectivity of the primer set towards the target. Here, using rapid sand filters for drinking water production as model environment, we investigated the consistency of two commonly used quantitative PCR methods to enumerate ammonia-oxidizing bacteria (AOB): one targeting the phylogenetic gene 16S rRNA and the other, the functional gene amoA. Cloning-sequencing with
both primer sets on DNA from two waterworks revealed contrasting images of AOB diversity. The amoA-based approach preferentially recovered sequences belonging to Nitrosomonas Cluster 7 over Cluster 6A ones, while the 16S rRNA one yielded more diverse sequences belonging to three AOB clusters, but also a few non-AOB sequences, suggesting broader, but partly unspecific, primer coverage. This was confirmed by an in silico coverage analysis against sequences of AOB (both isolates and high-quality environmental sequences). The difference in primer coverage significantly impacted the estimation of AOB abundance at the waterworks with high Cluster 6A prevalence, with estimates up to 50-fold smaller for amoA than for 16S rRNA. In contrast, both approaches performed very similarly at waterworks with high Cluster 7 prevalence. Our results highlight that caution is warranted when comparing AOB abundances obtained using different qPCR primer sets.
Untangling the Effect of Fatty Acid Addition at Species Level Revealed Different Transcriptional Responses of the Biogas Microbial Community Members

In the present study, RNA-sequencing was used to elucidate the change of anaerobic digestion metatranscriptome after long chain fatty acids (oleate) exposure. To explore the general transcriptional behavior of the microbiome, the analysis was first performed on shotgun reads without considering a reference metagenome. As a second step, RNA reads were aligned on the genes encoded by the microbial community, revealing the expression of more than 51,000 different transcripts. The present study is the first research which was able to dissect the transcriptional behavior at a single species level by considering the 106 microbial genomes previously identified. The exploration of the metabolic pathways confirmed the importance of Syntrophomonas species in fatty acids degradation, and also highlighted the presence of protective mechanisms toward the long chain fatty acid effects in bacteria belonging to Clostridiales, Rykenellaceae, and in species of the genera Halothermothrix and Anaerobaculum. Additionally, an interesting transcriptional activation of the chemotaxis genes was evidenced in seven species belonging to Clostridia, Halothermothrix, and Tepidanaerobacter. Surprisingly, methanogens revealed a very versatile behavior different from each other, even among similar species of the Methanoculleus genus, while a strong increase of the expression level in Methanosarcina sp. was evidenced after oleate addition.
Urban drainage research and planning. Quo vadis?

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Organisations: Department of Environmental Engineering, Urban Water Systems
Used water resource recovery using green microalgae

A paradigm shift is promoted in wastewater treatment whereby wastewater is considered as a source of nutrients, water and energy, rather than waste and it is referred to as used water. Microalgae cultivation on used water resources offers the potential to recover nitrogen, phosphorus, water and energy. When coupling with used water treatment, microalgae is mostly considered to produce energy, phosphorus, nitrogen, water and energy. A novel used water resource recovery approach was presented earlier, referred to as TRENS – a fully biochemical process for the removal, recovery and reuse of used water resources promoting sustainable urban water management. The system consists of a low solids retention time (SRT) enhanced biological phosphorus removal and recovery (EBP2R) system that can provide optimal cultivation medium – in terms of nutrients and water – for downstream microalgal cultivation. The microalgal suspension cultivated in the photobioreactor (PBR) can be then used for e.g., “fertigation” on agricultural land whereby the water and the nutrients are recovered. Alternatively, the algal biomass can be harvested and can be used for co-digestion in existing anaerobic digesters, whereas the water content can be used for aquifer recharge.

Design and optimization of bacterial-microalgal systems requires process models that can be readily combined with consensus used water treatment models, e.g. the activated sludge models (ASM). Previous microalgal process models cannot be used for such purposes as a result of their deficiencies. Some lack e.g., accounting for the storage of nitrogen and phosphorus, and for the potential for microalgae to grow heterotrophic on organic carbon that are relevant processes for used water resource recovery systems.

Therefore, the first objective of this thesis is to develop a consensus-based microalgal process model (ASM-A) accounting for photoautotrophic and heterotrophic microalgal growth, the uptake and storage of nitrogen and phosphorus and decay. The model was developed in the ASM framework as an extension to ASM-2d, thus it can be readily connected to bacterial unit processes. The process rates of the microalgal model were identified based on extensive literature review. Laboratory experiments in differently scaled batch PBRs were conducted in order to provide proper measurement data for model identification, comprising the selection of process rate equations as well as the estimation of the stoichiometric and kinetic model parameter distribution. The model identifiability analysis was conducted using the Latin Hypercube Sampling based Simplex (LHSS) method, adapted from the literature. The process model identified can effectively describe microalgal biomass concentration, soluble ammonium and phosphate concentrations as well as the phosphorus storage. The nitrogen storage is found to be affected by substrate availability, whilst the soluble nitrate concentration depends on the culture history, thereby requiring scenario specific model calibration. One of the most important factors affecting microalgal growth is the available light. Thus, for predicting the light distribution, the effect of using different simulation model structures on the model accuracy and uncertainty was assessed. Moreover, the effects of light scattering, biomass concentration and pigmentation on light attenuation in PBRs were investigated, using laboratory-scale experimental data. The light attenuation coefficient was estimated using the Lambert-Beer equation. Results suggest that light attenuation depends primarily on the pigmentation of the microalgae and also on the biomass concentration. Moreover, using a discretized layer-model to describe the light distribution in PBRs can result in more accurate prediction of the microalgal growth as well as the reduction of the uncertainty of the model predictions.

Furthermore, the effect of the variation of influent N-to-P ratio on the reactor performance was assessed in a mixed consortium of Chlorella and Scenedesmus sp. as well as in a monoculture of Chlorella sp. (both commonly used in used water treatment systems) in continuous cultivation using the treated used water from the upstream EBP2R system. When the N-to-P ratio in the influent was lowered to a sub-optimal level diatoms proliferated in the PBR cultivating the mixed green microalgal consortium. Once the ratio was increased again, the diatoms could be washed out of the system. Model predictive accuracy deteriorated as a result of the changes in culture composition due to the possible change in microalgal kinetics. The variation of the N-to-P ratio did not have an effect on the composition of the monoculture of Chlorella sp., no contamination was encountered during the 85 days of cultivation on used water. The upstream bacterial unit process in the second case was operated at a higher SRT (16 d), suggesting that longer SRT might be able to mitigate the potential of contamination by other microalgal species.

Lastly, an innovative method was developed to harvest microalgal biomass grown in suspended cultures in the TRENS system. A two-step flocculation was applied, whereby in the first step cationic polymer was added to the microalgae to
destabilize the cells, then in the second step the aggregation of flocs was enhanced by the addition of bacterial biomass wasted in the upstream short-SRT EBPR process. Effective recovery was obtained (97%), by the significant (40%) reduction in the amount of cationic polymer required compared to the case when only cationic polymer was used for the flocculation without the addition of bacteria, thus further reducing harvesting costs. The biomethane potential of the harvested microalgal-bacterial biomass was estimated at mesophilic conditions, obtaining synergistic effect when co-digesting the two substrates and resulting in a maximum methane yield of 560±24 mlCH4/gVS.

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Use of life-cycle assessment for including the environmental dimension in the decision making process in the water utility

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Organisations: Department of Environmental Engineering, Urban Water Systems, HOFOR A/S
Authors: Godskesen, B. (Ekstern), Jørgensen, A. (Ekstern), Rygaard, M. (Intern)
Pages: 18-18
Publication date: 2016

**Host publication information**
Title of host publication: 10th annual meeting of DWF16 : Abstracts
Publisher: Danish Water Forum
Main Research Area: Technical/natural sciences
Conference: 10th annual meeting of Danish Water Forum (DWF), Frederiksberg, Denmark, 28/01/2016 - 28/01/2016
Electronic versions: DWF_Use_of_Life_cycle_assessment_for_including_the_environmental_dimension_in_the_decision_making_process_in_the_water_utility.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016

Using a combination of binning strategies and taxonomic approaches to unravel the anaerobic digestion microbiome

Metagenomic sequencing is a fundamental tool to identify the functional potential of the prokaryotic species present in microbial communities, particularly for the unculturable microbes. Recent advances in software dedicated to metagenomic assembly allow nowadays to generate collections of scaffolds comprehensive of thousands genome sequences, but the binning of these scaffolds into OTUs representative of microbial genomes is still challenging. In the attempt to obtain a deep characterization of the anaerobic digestion microbiome, different metagenomic binning approaches were integrated into a new tool. To facilitate the binning process, this tool integrates two strategies; the taxonomic assignment of scaffolds and the clustering based on coverage values. By applying this procedure, 373 high quality genomes involved in the anaerobic digestion process have been extracted and annotated using COG, KEGG, SEED and Pfam. These high throughput approaches pose nowadays other basic challenges related to the computational effort needed for the taxonomic assignment of hundreds new microbial genomes. It is also mandatory to verify if other DNA sequences deriving from the same species are already present in public databases. Metagenomics raise new fundamental questions regarding the definition of what a microbial species is and how it can be defined solely considering its genome. In order to address these issues we have developed a collection of scripts to check the presence of the same genome sequence not only in different assemblies, but also in public databases and, finally, to simplify its functional annotation.

**General information**
State: Published
Using mechanisms of hydrolysis and sorption to reduce siloxanes occurrence in biogas of anaerobic sludge digesters

Hydrolysis of hexamethylcyclotrisiloxane (D3), octamethylcyclotetrasiloxane (D4), decamethylcyclopentasiloxane (D5), dodecamethylcyclohexasiloxane (D6) and dodecamethylcyclohexasilane (D6_silane) and their sorption to digested sludge was studied in batch experiments. Hydrolysis was affected by the type of the compound and the applied temperature, while the relevant half-life values ranged between $0.07 \pm 0.01$ d (D3, 55 °C) and $48.4 \pm 17.1$ d (D6_silane, 4 °C). D5 showed the greatest affinity for sorption to digested sludge (logKd: 3.84 ± 3.42), the lowest LogKd value was found for D3 (1.46 ± 0.95). Prediction of investigated compounds’ fate in a single-stage anaerobic digestion system indicated that volatilization seems to be the major fate in both mesophilic and thermophilic conditions. The addition of a pre-digester with 3 d retention time would significantly decrease the expected concentrations of all siloxanes in biogas, enhancing their removal through hydrolysis and sorption to sludge.
Utilizing the partitioning properties of silicone for the passive sampling of polychlorinated biphenyls (PCBs) in indoor air

The former use of polychlorinated biphenyls (PCBs) in construction materials can lead to elevated indoor air concentrations. We studied the partitioning of PCB congeners between indoor air and silicone with a view to establish passive sampling of PCBs. The release of PCB congeners from silicone followed first order kinetics and confirmed air-side rate-limited mass transfer. Logarithmic elimination rate constants decreased linearly with the logKOA values of the PCB congeners, but varied in a non-linear way with air velocity. Linear uptake of PCBs was found for silicone disks (0.5 mm thickness) in a petri dish, while PCBs reached equilibrium in silicone-coated paper sheets (0.001 mm silicone on each side) exposed to indoor air for 1–2 weeks. The ratios of equilibrium concentrations in silicone and conventionally measured air concentrations were roughly comparable with silicone-air partition coefficients, but further research is required for the determination of silicone-air partition coefficients. Avoiding performance reference compounds (PRCs) because of the indoor setting, the two formats were calibrated against conventional active measurements. Comparisons of air concentrations derived from active and kinetic passive sampling showed a divergence by factors of 2.4 and 2.0 (median values) for the petri dishes and the silicone-coated paper, respectively. With promising results for sensitivity and precision, the calibration of kinetic passive samplers remains the main challenge and will need suitable, non-hazardous PRCs. Equilibrium sampling indicated promising alternatives.
Valorization of macroalga Saccharina latissima as novel feedstock for fermentation-based succinic acid production in a biorefinery approach and economic aspects

This study aimed to evaluate the potential of the macroalga Saccharina latissima as feedstock for fermentation-based succinic acid production in a biorefinery approach. Seasonal variations in the content of carbohydrates, and fermentable sugars, had a significant impact on the succinic acid yield and titer. A maximum succinic acid yield of 91.9% (g g⁻¹ of total sugars) corresponding to 70.5% of the theoretical maximum yield was achieved when a blend of macroalgal biomass cultivated over two growing seasons and harvested in July and August was used as feedstock. A succinic acid titer of 36.8 g L⁻¹ with a maximum productivity of 3.9 g L⁻¹ h⁻¹ was achieved. The high content of total phenolic compounds (TPCs) in the macroalgal biomass (July-August: 5-1% DM), and high concentration of macro- (Ca, K, Na, Mg, P, N and Fe) and micronutrients in the solid residue recovered after enzymatic hydrolysis (PHSR), makes co-production of antioxidants (i.e. phenolics) and fertilizer very attractive. Finally, a simplified economic assessment showed that for the analyzed scenarios the main product's selling price (succinic acid) can be lowered significantly by coproducing added value products (fertilizers) and high added value-lower volume products (antioxidants).

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark
Authors: Silva Marinho, G. (Intern), Alvarado-Morales, M. (Intern), Angelidaki, I. (Intern)
Number of pages: 8
Pages: 102-109
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Algal Research
Volume: 16
ISSN (Print): 2211-9264
Ratings:
  BFI (2018): BFI-level 1
  Web of Science (2018): Indexed yes
  BFI (2017): BFI-level 1
  Web of Science (2017): Indexed Yes
  BFI (2016): BFI-level 1
  Scopus rating (2016): CiteScore 4.45 SJR 1.442 SNIP 1.12
  Web of Science (2016): Indexed yes
  BFI (2015): BFI-level 1
  Scopus rating (2015): SJR 1.939 SNIP 1.596 CiteScore 5.53
  Scopus rating (2014): SJR 1.945 SNIP 1.603 CiteScore 4.96
  Scopus rating (2013): SJR 1.437 SNIP 1.129 CiteScore 4.17
  ISI indexed (2013): ISI indexed no
Original language: English
Agronomy and Crop Science, Actinobacillus succinogenes, Bioenergy, Building block, Fermentation, Polyphenols, Seaweed
DOIs:
10.1016/j.algal.2016.02.023
Variation in biochemical composition of Saccharina latissima and Laminaria digitata along an estuarine salinity gradient in inner Danish waters

In European kelp cultivation, knowledge on the spatial variation in biomass productivity and quality needs to be established. The present study provides a detailed overview of the biochemical composition and biomass production potential of Saccharina latissima and Laminaria digitata along a salinity gradient (16–31 PSU) in inner Danish waters. We discuss the results in a cultivation perspective, and evaluate the potential use of Laminariales as an energy feedstock, a feed additive and a bioremediation tool for mitigating eutrophication. We found the highest biomass production potential, the highest protein content (7.5% of dry matter), and the highest capacity for bio-remediation of nitrogen (1.88% N of dry matter) at high salinities, as opposed to the highest concentrations of fermentable sugars (90% of dry matter) and pigments at low salinities. Thus, areas suitable for high biomass production are not necessarily optimal for producing a specific biomass quality such as high carbohydrate concentration for bioenergy conversion, and this challenges the cultivation practice. Furthermore, concentrations of arsenic in the biomass were generally higher (up to 88 ppm) than allowed for animal diet (40 ppm) and could therefore impose challenges for utilizing S. latissima and L. digitata as animal feed additives.
Waste material recycling: Assessment of contaminants limiting recycling

Materials and articles are constantly increasing in their complexity, promoted by demand for functionality, appearance and cost of consumer and industrial products. To satisfy these demands, a variety of chemicals and combinations of materials are used in products. On the other hand, material recycling has been recognised as a backbone of circular economy, with constant measures and initiatives being proposed in order to increase the recycling rates of materials being consumed. Material cycles are complex and dynamic systems where chemicals are added and removed in production, manufacturing, consumption and waste management stages within a product's lifecycle (Figure 1). Hence, waste materials contain potentially hazardous chemicals that are unwanted in the new products made of the recycled raw materials. So far, the presence of such chemicals in materials for recycling has not been systematically investigated. This PhD project provided detailed quantitative data following a consistent approach to assess potential limitations for the presence of chemicals in relation to material recycling. Paper and plastics were used as illustrative examples of materials with well-established recycling schemes and great potential for increase in recycling, respectively.

The approach followed in the present work was developed and performed in four distinct steps. As step one, fractional composition of waste paper (30 fractions) and plastics (9 fractions) from households in Åbenrå municipality (Southern Denmark) was provided. In step two, a literature review concerning presence of chemicals in paper was performed. It was shown that approx. 10,000 individual chemicals may be present in paper products. Among the chemicals identified, approx. 150 were considered hazardous and approx. 50 were identified as particularly relevant with respect to paper recycling. Potential sources for chemicals in paper were evaluated. Printing and conversion were identified as the most important steps in relation to paper cycle, but chemicals added non-intentionally (NIAS) in a variety of steps (Figure 1) may also play a role.

Figure 1 Schematic representation of generic material and chemical cycles for a defined geographical boundary (e.g., Europe). Chemical loss implies evaporation, degradation, migration, etc., as well as removal through material (re) processing. NIAS: Non-Intentionally Added Substances [1].

Following, chemical analyses for quantification of a range of potential contaminants in paper (mineral oils, phenols, phthalates, polychlorinated biphenyls and toxic metals) and plastics (phthalates and brominated flame retardants) were done. The results indicated large variations in presence of chemical contaminants (from μg/kg to g/kg), depending on the contaminant in focus or the sub-fraction (e.g., books) of the material fraction being analysed (e.g., paper). Certain material fractions showed higher content of chemicals (e.g., bisphenols in thermal paper and flame retardants in polystyrene plastics), potentially detrimental to their recycling. Finally, a material flow analysis (MFA) approach revealed the potential for accumulation and spreading of contaminants in material recycling, on the example of the European paper cycle.

Assessment of potential mitigation measures indicated that prevention of chemical use, removal of chemicals in recycling and constrain chemicals to specific product flows were in decreasing order of effectiveness. The assessment also pointed out the potential trade-offs between material quantity (i.e. recycling rates) and quality (i.e. presence of contaminants) when mitigation measures are applied.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Environmental Chemistry
Authors: Pivnenko, K. (Intern), Astrup, T. F. (Intern), Eriksson, E. (Intern)
Number of pages: 47
Publication date: 2016

Publication information
Place of publication: Kgs. Lyngby
Publisher: Department of Environmental Engineering, Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Publication: Research › Ph.D. thesis – Annual report year: 2016

Wastewater treatment in Kangerlussuaq, Greenland by chemical coagulation and UV disinfection

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Department of Civil Engineering, ARTEK, Section for Arctic Engineering and Sustainable Solutions, Technical University of Denmark
Authors: Chhetri, R. K. (Intern), Klupsch, E. (Ekstern), Andersen, H. R. (Intern), Jensen, P. E. (Intern)
Number of pages: 2
Wastewater Treatment Potentials in Kangerlussuaq: Characterization of Flow and Chemical Loadings

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Technical University of Denmark
Authors: Konring, A. (Ekstern), Tang, C. (Intern)
Number of pages: 2
Pages: 49-50
Publication date: 2016

Host publication information
Title of host publication: ARTEK Event 2016 – International Conference Sanitation in Cold Climate Regions
Publisher: Arctic Technology Centre, DTU Technical University of Denmark
ISBN (Print): 9788778774316
Main Research Area: Technical/natural sciences
Electronic versions:
Book_of_Abstracts_Artek_Event_2016.pdf

Bibliographical note
Byg Report R-340
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016

Water level observations from Unmanned Aerial Vehicles (UAVs) for improving probabilistic estimations of interaction between rivers and groundwater

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, DHI Denmark, DHI
Authors: Bandini, F. (Intern), Butts, M. (Ekstern), Vammen Jacobsen, T. (Ekstern), Bauer-Gottwein, P. (Intern)
Number of pages: 1
Publication date: 2016
Conference: European Geosciences Union General Assembly 2016, Vienna, Austria, 17/04/2016 - 17/04/2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Geophysical Research Abstracts
Volume: 18
Article number: EGU2016-3144
ISSN (Print): 1607-7962
Ratings:
Web of Science (2014): Indexed yes
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
ISI indexed (2012): ISI indexed no
What does it take to practice sustainable flood risk management?

**General information**
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Department of Civil Engineering, Section for Structural Engineering, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis
Authors: Sørup, H. J. D. (Intern), Brudler, S. (Intern), Lerer, S. M. (Intern), Miraglia, S. (Intern), Georgiadis, S. (Intern), Arnbjerg-Nielsen, K. (Intern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Links:
http://www.sustain.dtu.dk/

**Bibliographical note**
Sustain Abstract W-1

**Relations**
Activities:

What does it take to practice sustainable flood risk management?
Publication: Research - peer-review › Conference abstract in journal – Annual report year: 2016

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**Metanemission fra Hedeland deponi**

**General information**
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Mønster, J. (Intern), Scheutz, C. (Intern)
Number of pages: 11
Publication date: Dec 2015

**Publication information**
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish
Main Research Area: Technical/natural sciences
Electronic versions:
Hedeland_notat_Aug_2014_final.pdf
Source: PublicationPreSubmission
Source-ID: 118542531
Publication: Commissioned - peer-review › Report – Annual report year: 2015

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**Miljøvurdering (LCA) af fremtidige behandlingsmuligheder for organisk affald fra husholdninger i den dansk-tyske grænseregion**

**General information**
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Jensen, M. B. (Intern), Møller, J. (Intern), Scheutz, C. (Intern)
Recovery of ammonia and sulfate from waste streams and bioenergy production via bipolar bioelectrodialysis

Ammonia and sulfate, which are prevalent pollutants in agricultural and industrial wastewaters, can cause serious inhibition in several biological treatment processes, such as anaerobic digestion. In this study, a novel bioelectrochemical approach termed bipolar bioelectrodialysis was developed to recover ammonia and sulfate from waste streams and thereby counteracting their toxicity during anaerobic digestion. Furthermore, hydrogen production and wastewater treatment were also accomplished. At an applied voltage of 1.2 V, nitrogen and sulfate fluxes of 5.1 g View the MathML sourceNH4+-N/m²/d and 18.9 g View the MathML sourceSO4²−/m²/d were obtained, resulting in a Coulombic and current efficiencies of 23.6% and 77.4%, respectively. Meanwhile, H2 production of 0.29 L/L/d was achieved. Gas recirculation at the cathode increased the nitrogen and sulfate fluxes by 2.3 times. The applied voltage, initial (NH4)2SO4 concentrations and coexistence of other ions were affecting the system performance. The energy balance revealed that
net energy (≥16.8 kWh/kg-N recovered or ≥4.8 kWh/kg-H2SO4 recovered) was produced at all the applied voltages (0.8-1.4 V). Furthermore, the applicability of bipolar bioelectrodialysis was successfully demonstrated with cattle manure. The results provide new possibilities for development of cost-effective technologies, capable of waste resources recovery and renewable energy production.
A 10-days heatwave around flowering superimposed on climate change conditions significantly affects production of 22 barley accessions

Extreme climate events as heatwaves, floods and storms cause acute changes in season variability influencing primary production and are very likely to increase in magnitude and/or frequency (IPCC, AR5, WGI).

In the present study 22 primarily Nordic barley accessions were grown in four basic climate treatments of 1) 19/12°C (day/night) and 400 ppm carbon dioxide concentration [CO₂] mimicking ambient South Scandinavian summer conditions, 2) elevated temperature (+5°C day/night), 3) elevated [CO₂] at 700 ppm and 4) the combination of elevated temperature and [CO₂]. Temperature and [CO₂] were at levels representing a worst case scenario (~RCP8.5, IPCC) at the end of the 21st century. A 10 day-heatwave of 33/22°C (day/night) was superimposed around the time of flowering on the basic climate treatments.

The superimposed heatwave decreased overall grain yield in all combinations, however, vast variation in response was identified among accessions. In the two-factor treatment the decrease in grain yield varied from 2-80%. The heatwave caused the strongest overall effect in the treatment of elevated [CO₂] decreasing grain yield by 48% and the least effect (35%) was observed under elevated temperature suggesting elevated temperature to have a priming effect. In all heatwave treatments allocation of biomass was changed, increasing aboveground vegetative biomass and decreasing grain yield as previously reported.

The treatment with the combination of elevated temperature, [CO₂] and the superimposed heatwave may best represent a future climate scenario since more than one climate factor most likely will change at a time. From the basic ambient treatment to the two-factor treatment including heatwave, grain yield decreased 52%.

Our study emphasizes the need for assessing the effects of extreme events under climate change conditions on numerous accessions in order to select appropriate genotypes for breeding future cultivars that can secure the primary production.

General information
State: Published
Organisations: Department of Chemical and Biochemical Engineering, Department of Environmental Engineering, University of Copenhagen, MTT Agrifood Research
Authors: Ingvardsen, C. H. (Intern), Lyngkjær, M. F. (Ekstern), Peltonen-Sainio, P. (Ekstern), Mikkelsen, T. N. (Intern), Bagger Jørgensen, R. (Intern)
Pages: 160-161
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Procedia Environmental Sciences
Volume: 29
ISSN (Print): 1878-0296
Ratings:
Web of Science (2018): Indexed yes
ISI indexed (2013): ISI indexed no
Abiotic and biofilm-mediated transformation of heroin biomarkers in wastewater under aerobic and anaerobic conditions

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Engineering, KWR Watercycle Research Institute
Authors: Ramin, P. (Intern), Causanilles, A. (Ekstern), Polesel, F. (Intern), Emke, E. (Ekstern), de Voogt, P. (Ekstern), Plósz, B. G. (Intern)
Number of pages: 2
Publication date: 2015
Event: Abstract from 2nd International Conference on "Wastewater-based drug epidemiology", Ascona, Switzerland.
Main Research Area: Technical/natural sciences
Electronic versions:
RAMIN_Abstract_TestingTheWaters.pdf
Source: PublicationPreSubmission
Source-ID: 117805564
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2015

A bi-weekly actual evapotranspiration dataset derived from NOAA-AVHRR images across the Iberian Peninsula and the Balearic islands, 1981-2015

Using the complete set of diurnal NOAA-AVHRR images from 1981 to 2015, in this study we developed a bi-weekly high-spatial resolution (1.1-km) actual evapotranspiration (ETa) dataset covering the Iberian Peninsula and the Balearic islands. Daily ETa was estimated by applying the algorithm developed by Sobrino et al. (2007), which is based on the S-SEBI model. The 35-year NOAA-AVHRR images were geometrically and radiometrically corrected, including a topographic correction of visible and near-infrared spectral channels. Satellite changes and orbit drifts were also corrected using post-launch calibration coefficients, and surface temperature (Ts) estimated using a split-window algorithm by optimized coefficients according to the corresponding sensor effective wavelength (Lahraoua et al., 2013). Relative normalization for solar-zenith and sensor-view angles was applied to the Ts daily time-series. For an accurate quantification of daily ETa, cloud cover was removed applying the algorithm developed by Azorin-Molina et al. (2013), and the evaporative fraction estimated by means of the “triangle method”, using the spatial relationship between Ts and albedo for each daily image. The daily time series were transformed to a bi-weekly temporal resolution and biweekly images were smoothed using a temporal filtering approach to reduce the observed noise. For validation purposes, annual series of ETa were compared with water balances in hydrological basins with different vegetation, water use and management conditions. Finally, the resulting bi-weekly ETa time-series were compared with reference evapotranspiration series for Spain to detect periods and regions affected by an evapotranspiration deficit. The created dataset can be useful to identify drought extent and to characterize land cover changes characterized by abrupt and progressive modifications in the evaporation conditions.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Spanish National Research Council, Instituto Nacional de Tecnica Aeroespacial Esteban Terradas, King Abdullah University of Science and Technology
Number of pages: 1
Publication date: 2015
Event: Abstract from Earth Observation for Water Cycle Science 2015, Italy.
Main Research Area: Technical/natural sciences
Electronic versions:
abstract_Vicente_serrano.pdf
Source: PublicationPreSubmission
Source-ID: 118777889
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2015
A certain shade of green: New insights into shading effects of nanoparticles on algal growth

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry
Authors: Hjorth, R. (Intern), Sørensen, S. N. (Intern), Olsson, M. E. (Intern), Baun, A. (Intern), Hartmann, N. I. B. (Intern)
Number of pages: 1
Publication date: 2015
Main Research Area: Technical/natural sciences
Electronic versions:
SETAC_Poster_Hjorth_et_al_2015_Algeshading.pdf
Source: PublicationPreSubmission
Source-ID: 108585351
Publication: Research - peer-review › Poster – Annual report year: 2015

A comprehensive 454 survey provides insights into microbial diversity and community structure in rapid sand filters

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Urban Water Systems
Authors: Gülay, A. (Intern), Musovic, S. (Intern), Albrechtsen, H. (Intern), Smets, B. F. (Intern)
Pages: 79-83
Publication date: 2015
Host publication information
Title of host publication: IWA Specialized Conference biofilms in drinking water systems from treatment to tap
Place of publication: Arosa, Switzerland
Publisher: IWA Publishing
Main Research Area: Technical/natural sciences
Rapid sand filters, Pyrosequencing, Core taxa, Drinking water, Groundwater
Source: PublicationPreSubmission
Source-ID: 116644585
Publication: Research - peer-review › Article in proceedings – Annual report year: 2015

Projects:

Lake remediation by microbial fuel cells
Department of Environmental Engineering
Period: 01/02/2018 → 31/01/2021
Number of participants: 4
Phd Student:
Haxthausen, Karl Rasmus August (Intern)
Supervisor:
Gosewinkel, Ulrich Bay (Ekstern)
Zhang, Yifeng (Intern)
Main Supervisor:
Trapp, Stefan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Contaminant mass discharge of chlorinated solvents in clay tills: Concepts, quantification and risk assessment
Department of Environmental Engineering
Monitoring rivers and streams with unmanned aerial systems for determination of ecological status

Department of Environmental Engineering
Period: 01/01/2018 → 31/12/2020
Number of participants: 4
PhD Student:
Köppl, Christian Josef (Intern)
Supervisor:
Garcia, Monica (Intern)
McKnight, Ursula S. (Intern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Biological production of n-Hexanol

Department of Environmental Engineering
Period: 01/12/2017 → 30/11/2020
Number of participants: 3
PhD Student:
Yang, Xiaoyong (Intern)
Supervisor:
Kougias, Panagiotis (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet
Project: PhD

Diffuse radiation and temperature effects on crop water use efficiency

Department of Environmental Engineering
Period: 01/12/2017 → 30/11/2020
Number of participants: 5
PhD Student:
Sobejano Paz, Veronica (Intern)
Supervisor:
Garcia, Monica (Intern)
Liu, Suxia (Ekstern)
Mo, Xingguo (Ekstern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Ecology of intibiotic resistance genes and mobile genetic elements in microal communities of the urban water system

Department of Environmental Engineering
Period: 01/12/2017 → 30/11/2020
Number of participants: 3
Phd Student:
Parchen, Camiel (Ekstern)
Supervisor:
Dechesne, Arnaud (Intern)
Main Supervisor:
Smets, Barth F. (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Hydraulic Modelling and data assimilation for deep urban tunnel systems

Department of Environmental Engineering
Period: 01/12/2017 → 30/11/2020
Number of participants: 4
Phd Student:
Palmitessa, Rocco (Intern)
Supervisor:
Borup, Morten (Intern)
Law, Adrian Wing Keung (Ekstern)
Main Supervisor:
Mikkelsen, Peter Steen (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Microbial electrochemistry meet UV: For effektive degradation of organic matter

Department of Environmental Engineering
Period: 01/12/2017 → 30/11/2020
Number of participants: 3
Phd Student:
Zou, Rusen (Intern)
Supervisor:
Zhang, Yifeng (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet
Project: PhD

Planning Tools for Stormwater Pollution Management
Department of Environmental Engineering
Period: 01/12/2017 → 30/11/2020
Number of participants: 4
Phd Student:
Jensen, Ditte Marie Reinholdt (Intern)
Supervisor:
Vezzaro, Luca (Intern)
Vezzaro, Luca (Intern)
Main Supervisor:
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Sustainability Assessment of Residual Biomass Resource Management
Department of Environmental Engineering
Period: 01/12/2017 → 30/11/2020
Number of participants: 3
Phd Student:
Albizzati, Paola Federica (Intern)
Supervisor:
Tonini, Davide (Intern)
Main Supervisor:
Astrup, Thomas Fruergaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Leak detection in water supply pipes using drone-borne sensor technology
Identification of water leaks in distribution pipes with UAVs via microwave and thermal monitoring
Department of Environmental Engineering
Water Resources Engineering
National Space Institute
Geodesy
Department of Applied Mathematics and Computer Science
Image Analysis & Computer Graphics
DroneInspektion ApS
Drone Systems ApS
Aarhus Water
Solrød Vandværk
HOFOR A/S

VandCenter Syd
Period: 16/11/2017 → 30/06/2018
Number of participants: 4
Project participant:
Bandini, Filippo (Intern)
Jakobsen, Jakob (Intern)
Bauer-Gottwein, Peter (Intern)
Frisvad, Jeppe Revall (Intern)

Project

Bioinorganic artificial photosynthesis of single cell protein from carbon dioxide.

Department of Environmental Engineering
Period: 01/11/2017 → 31/10/2020
Number of participants: 3
Phd Student:
Xu, Mingyi (Intern)
Supervisor:
Zhang, Yifeng (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

Ex-situ biogas upgrading through biologically mediated CO2 hydrogenation

Department of Environmental Engineering
Period: 01/11/2017 → 31/10/2020
Number of participants: 3
Phd Student:
Peprah, Maria (Intern)
Supervisor:
Kougias, Panagiotis (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Powdered bioaugmentation inocula to alleviate ammonia toxicity in anaerobic digesters

Department of Environmental Engineering
Period: 01/11/2017 → 31/10/2020
Number of participants: 3
Phd Student:
Yan, Miao (Intern)
Supervisor:
Fotidis, Ioannis (Intern)
Supporting water infrastructure investment planning with hydro-economic models

Department of Environmental Engineering
Period: 01/09/2017 → 31/08/2020
Number of participants: 5
Phd Student:
Payet-burin, Raphaël (Intern)
Supervisor:
Cardenal, Silvio Javier Pereira (Intern)
Kromann, Mikkel Aabenhus (Ekstern)
Strzepek, Kenneth Marc (Ekstern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

An in vitro method for toxicity testing of inhaled particles

Department of Environmental Engineering
Period: 15/08/2017 → 14/08/2020
Number of participants: 4
Phd Student:
Da Silva, Emilie (Intern)
Supervisor:
Hougaard, Karin Sørig (Ekstern)
Sørli, Jorid Birkeland (Intern)
Main Supervisor:
Baun, Anders (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Decision support tools for managing water resources in mixed land use catchments

Department of Environmental Engineering
Period: 15/08/2017 → 14/08/2020
Number of participants: 3
Phd Student:
Lemaire, Grégory Guillaume (Intern)
Supervisor:
McKnight, Ursula S. (Intern)
Main Supervisor:
Bjerg, Poul Løgstrup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD
Documentation and quantification of natural and enhanced degradation of chlorinated contaminants in the subsurface

Department of Environmental Engineering
Period: 15/08/2017 → 14/08/2020
Number of participants: 3
Phd Student: Ottosen, Cecilie Bang (Intern)
Supervisor: Bjerg, Poul Logstrup (Intern)
Main Supervisor: Broholm, Mette Martina (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Operational monitoring and Forecasting system for Resilience of agriculture and forestry under intensification of the Water cycle: a Big Data approach

Department of Environmental Engineering
Water Resources Engineering
TSK
Period: 01/07/2017 → 01/09/2019
Number of participants: 1
Acronym: FORWARD
Project participant: Garcia, Monica (Intern)

Karakterisering og kvantificering af producerede nanobobler i vand

Department of Environmental Engineering
Urban Water Systems
Water Technologies
CM Aqua Technologies ApS
Water ApS
Brancheorganisationen AquaCirkle
Period: 01/07/2017 → 30/04/2018
Number of participants: 4
Acronym: NanoBobler
Project participant: Nielsen, Katrine (Intern)
Andersen, Henrik Rasmus (Intern)
Kaarsholm, Kamilla Marie Speht (Intern)
Droumpali, Ariadni (Intern)

Development op the next generation op Aquaporin Inside TM biomimetic membranes

Department of Environmental Engineering
Period: 01/07/2017 → 30/06/2020
Number of participants: 4
Phd Student: Górecki, Radoslaw Pawel (Intern)
Supervisor:
Balancing Costs and Benefits of New Urban Water Management Objectives for Both Real Time Applications and Urban Planning

Department of Environmental Engineering
Period: 01/06/2017 → 31/05/2020
Number of participants: 4
PhD Student:
Skrydstrup, Julie (Intern)
Supervisor:
Gregersen, Ida Bülow (Intern)
Löwe, Roland (Intern)
Main Supervisor:
Ambjerg-Nielsen, Karsten (Intern)

Krav til rensning af regnbetinget udledning i Danmark og EU

Department of Environmental Engineering
Urban Water Systems
Teknologisk Institut
Københavns Universitet
Period: 01/05/2017 → 30/06/2018
Number of participants: 2
Acronym: VandKval
Project Manager, organisational:
Mikkelsen, Peter Steen (Intern)
Project Manager, academic:
Nielsen, Katrine (Intern)

Agricultural Water Innovations in the Tropics

Department of Environmental Engineering
Water Resources Engineering
Period: 01/04/2017 → 01/05/2020
Number of participants: 1
Acronym: AgWIT
Project participant:
Garcia, Monica (Intern)

Wastewater Treatment Textbook revision
Revision of 3rd edition
Department of Environmental Engineering
Monitoring of the Yucatan Peninsula with UAVs
Deployment of Unmanned Aerial Vehicles (UAVs) to observe water level, bathymetry and temperature in the worldwide unique water bodies of the Yucatan peninsula (Mexico).

Department of Environmental Engineering

Water Resources Engineering
Period: 10/02/2017 → 05/04/2017
Number of participants: 4
cenote, lagoon, Yucatan, bathymetry, water level, temperature, UAVs
Project participant:
Bandini, Filippo (Intern)
Lopez, Alejandro (Ekstern)
Project Manager, organisational:
Merediz-Alonso, Gonzalo (Ekstern)
Project Manager, academic:
Bauer-Gottwein, Peter (Intern)
Documents:
Research contract

Airborne and satellite remote sensing for hydrologic modelling applications

Department of Environmental Engineering
Period: 01/02/2017 → 31/01/2020
Number of participants: 4
Phd Student:
Kittel, Cecile Marie Margaretha (Intern)
Supervisor:
Garcia, Monica (Intern)
Tøttrup, Christian (Ekstern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Circular Economy: Integrated sustainability assessment of resource recovery and cycling

Department of Environmental Engineering
Period: 01/12/2016 → 10/04/2020
Number of participants: 3
Phd Student:
Andreasi Bassi, Susanna (Intern)
Supervisor:
Boldrin, Alessio (Intern)
Main Supervisor:
Astrup, Thomas Fruergaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD
Circular Economy: Life cycle assessment of chemicals in material cycles

Department of Environmental Engineering
Period: 01/12/2016 → 14/08/2020
Number of participants: 3
Phd Student:
Xanthopoulou, Larisa (Intern)
Supervisor:
Baun, Anders (Intern)
Main Supervisor:
Astrup, Thomas Fruergaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Life cycle assessment modelling of advanced (bio)energy technologies

Department of Environmental Engineering
Period: 01/12/2016 → 30/11/2019
Number of participants: 3
Phd Student:
Lodato, Concetta (Intern)
Supervisor:
Tonini, Davide (Intern)
Main Supervisor:
Astrup, Thomas Fruergaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Optimal and holistic implementation of central drinking water softening

Department of Environmental Engineering
Period: 01/12/2016 → 28/01/2020
Number of participants: 4
Phd Student:
Tang, Camilla (Intern)
Supervisor:
Rygaard, Martin (Intern)
Wormslev, Erik C. (Ekstern)
Main Supervisor:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Fuldautomatisk decentral rensning af partikler i regnbetingede udledninger

Department of Environmental Engineering
Urban Water Systems
Water Technologies
Teknologisk Institut
HydroSystems  
Period: 01/11/2016 → 31/10/2018  
Number of participants: 6  
Acronym: FUPARU  
Project participant:
Nielsen, Katrine (Intern)  
Mikkelsen, Peter Steen (Intern)  
Andersen, Henrik Rasmus (Intern)  
Vezzaro, Luca (Intern)  
Borup, Morten (Intern)  
Chhetri, Ravi Kumar (Intern)

Plant Uptake of Environmental Chemicals  
Department of Environmental Engineering  
Period: 01/11/2016 → 24/10/2020  
Number of participants: 4  
Phd Student:
Jensen, Christian Kjær (Intern)  
Supervisor:
Mikkelsen, Teis Nørgaard (Intern)  
Rein, Arno (Ekstern)  
Main Supervisor:
Trapp, Stefan (Intern)

Financing sources  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU)

Quantification of trace gas emissions from waste management facilities  
Department of Environmental Engineering  
Period: 01/11/2016 → 31/10/2019  
Number of participants: 3  
Phd Student:
Duan, Zhenhan (Intern)  
Supervisor:
Scheutz, Charlotte (Intern)  
Main Supervisor:
Kjeldsen, Peter (Intern)

Financing sources  
Source: Internal funding (public)  
Name of research programme: Stipendie fra udlandet

Models for real time warning and control strategies in urban drainage and wastewater systems  
Department of Environmental Engineering  
Period: 01/10/2016 → 30/09/2019  
Number of participants: 4  
Phd Student:
Pedersen, Jonas Wied (Intern)  
Supervisor:
Madsen, Henrik (Intern)  
Vezzaro, Luca (Intern)  
Main Supervisor:
Mikkelsen, Peter Steen (Intern)
**Computational modelling and simulation of anaerobic biomass conversion to biogas, focusing on the effects of substrate characterisation, solid-liquid-gas phase interactions and microbial growth dynamics**

Department of Environmental Engineering  
Period: 15/09/2016 → 14/01/2020  
Number of participants: 3  
Phd Student:  
Kovalovszki, Adam (Intern)  
Supervisor:  
Alvarado-Morales, Merlin (Intern)  
Main Supervisor:  
Angelidaki, Irini (Intern)

**Digital tools for landscape architects: A case study of digital tools used for analyzing and screening climate adaptation challenges in the early design phase**

Danish Title: Undersøgelse af digitale værktøjer hos arkitekttegnestuer til beregning og screening af regnvand i den tidlige designfase  
DTU Environment/European Regional Development Fund.

Department of Civil Engineering  
Section for Building Design  
Department of Environmental Engineering  
Urban Water Systems  
Period: 01/09/2016 → 31/12/2016  
Number of participants: 3  
Project participant:  
Ambjerg-Nielsen, Karsten (Intern)  
Mikkelsen, Peter Steen (Intern)  
Project Manager, academic:  
Jensen, Lotte Bjerregaard (Intern)

**Optimized water distribution using high-resolution data sources and novel data analysis methods**

Department of Environmental Engineering  
Period: 01/09/2016 → 14/10/2019  
Number of participants: 4  
Phd Student:  
Kirstein, Jonas Kjeld (Intern)  
Supervisor:  
Borup, Morten (Intern)  
Høgh, Klavs (Ekstern)  
Main Supervisor:  
Rygaard, Martin (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD
SMAP Soil Moisture Data To Improve Remotely Sensed Global Estimates of Evapotranspiration

Evapotranspiration is a key variable in the hydrological cycle, however it cannot be measured directly using remote sensing data. This project aims to integrate SMAP NASA soil moisture products directly into global remote sensing evapotranspiration algorithms to improve modeling and assess regional droughts.

Department of Environmental Engineering

Water Resources Engineering
Period: 01/08/2016 → 01/08/2018
Number of participants: 2
Project participant:
Garcia, Monica (Intern)
Fisher, Josh (Ekstern)

Development of sectorial drought indices in the Iberian Peninsula: improving monitoring and early warning of droughts in Spain (in Spanish)

Department of Environmental Engineering

Water Resources Engineering
Period: 01/07/2016 → 01/07/2018
Number of participants: 2
Project participant:
Garcia, Monica (Intern)
Vicente-Serrano, Sergio (Ekstern)

Optimized real-time management of interacting water systems for a smarter city

Department of Environmental Engineering

Period: 01/07/2016 → 28/07/2019
Number of participants: 5
Phd Student:
Lund, Nadia Schou Vormdran (Intern)
Supervisor:
Borup, Morten (Intern)
Helwigh, Ole Mark (Ekstern)
Madsen, Henrik (Intern)
Main Supervisor:
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Prediction Methods for the Environmental Fate of Organic Chemicals

Department of Environmental Engineering

Period: 01/07/2016 → 31/12/2018
Number of participants: 4
Phd Student:
Brock, Andreas Libonati (Intern)
Supervisor:
Kästner, Matthias (Ekstern)
Rein, Arno (Ekstern)
Main Supervisor:
Trapp, Stefan (Intern)

Financing sources
Mixture Effects in Biodegradation Testing of Aromatic and Aliphatic Hydrocarbons

Department of Environmental Engineering
Period: 15/06/2016 → 13/12/2019
Number of participants: 4
Phd Student:
Hammershøj, Rikke Høst (Intern)
Supervisor:
Andersen, Henrik Rasmus (Intern)
Birch, Heidi (Intern)
Main Supervisor:
Mayer, Philipp (Intern)

Computational Fluid Dynamics Simulations of electroosmotic phenomena

Department of Environmental Engineering
Period: 01/02/2016 → 31/01/2019
Number of participants: 3
Phd Student:
Aschmoneit, Fynn Jerome (Intern)
Supervisor:
Yde, Lars (Ekstern)
Main Supervisor:
Hélix-Nielsen, Claus (Intern)

Bicover systems for greenhours gas mitigation at landfills

Department of Environmental Engineering
Period: 01/01/2016 → 31/12/2018
Number of participants: 3
Phd Student:
Olesen, Andreas Ole Urup (Intern)
Supervisor:
Scheutz, Charlotte (Intern)
Main Supervisor:
Kjeldsen, Peter (Intern)

Ozonation of semi-closed aquatic systems - Online control

Department of Environmental Engineering
Period: 01/01/2016 → 31/12/2018
Number of participants: 6
Phd Student:
The effect of sorption and dosing on the degradation of poorly water soluble substances in different environmental matrices using standard OECD guidelines

Department of Environmental Engineering
Period: 01/01/2016 → 31/12/2018
Number of participants: 4
Phd Student:
Shrestha, Prasit (Intern)
Supervisor:
Birch, Heidi (Intern)
Hennecke, Dieter (Ekstern)
Main Supervisor:
Mayer, Philipp (Intern)

Rist, Sinja (Intern)
Supervisor:
Hartmann, Nanna B. (Intern)
Meibom, Peter (Intern)
Main Supervisor:
Baun, Anders (Intern)

Biological Sample Preparation for Electron Microscopy
Special Topic Course
Center for Electron Nanoscopy
DTU Danchip
Department of Environmental Engineering
Urban Water Engineering
Support for 3rd regulatory review of nanomaterials – environmental legislation

Ricardo Energy & Environment, in partnership with subcontractors Milieu Consulting and the Technical University of Denmark (DTU), was commissioned by the European Commission to carry out a project entitled “The preparation of the third regulatory review on nanomaterials - environmental legislation”, specific contract number 070201/ENV/2015/SI2.716613/ENV.A3, Commission reference ENV.C.3/ETU/2015/0030. The study objective was to compile and develop information on nanomaterials and advanced materials in the environment and explore further the regulatory implementation challenges. The study had three main components: - A preliminary evaluation of releases of nanomaterials to different media (air, water, land, recycling and waste disposal). - A review of progress on the application of environmental and other key legislation to nanomaterials. - A prospective view on future developments in advanced materials, and challenges for environmental legislation. Consultation with stakeholders was carried out by email and telephone, and a stakeholder workshop was held on 21 June 2016. At the workshop, the interim findings were presented, and stakeholder feedback and views were discussed. Following the workshop, stakeholders provided feedback in writing. This feedback has been taken into account for the finalisation of the report.

Addressing China's water challenges with hydroeconomic optimization

Department of Environmental Engineering

Period: 01/11/2015 → 31/10/2018
Number of participants: 2
Phd Student:
Martinsen, Grith (Intern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)

Financing sources
Mechanisms of release and transport of arsenic in groundwater of semi-arid basins in China

Department of Environmental Engineering
Period: 01/11/2015 → 31/10/2018
Number of participants: 3
PhD Student:
Stolze, Lucien (Intern)
Supervisor:
Bauer-Gottwein, Peter (Intern)
Main Supervisor:
Rolle, Massimo (Intern)

Characterization and recycling of waste fractions from recycling centers

Department of Environmental Engineering
Period: 15/10/2015 → 14/10/2018
Number of participants: 4
PhD Student:
Faraca, Giorgia (Intern)
Supervisor:
Boldrin, Alessio (Intern)
Damgaard, Anders (Intern)
Main Supervisor:
Astrup, Thomas Fruergaard (Intern)

Pilotprojekt til et frivilligt måleprogram for metanudledning fra biogas - og opgraderings anlæg.

Department of Environmental Engineering
Residual Resource Engineering
Energistyrelsen
AgroTech A/S
SP Sveriges Provnings- och Forskningsinstitut
Period: 09/10/2015 → 20/11/2015
Number of participants: 2
Project participant:
Fredenslund, Anders Michael (Intern)
Scheutz, Charlotte (Intern)

Hyperspatial mapping of water, energy and carbon fluxes with Unmanned Aerial Vehicles

Department of Environmental Engineering
Period: 01/10/2015 → 02/03/2019
Number of participants: 4
PhD Student:
Innovative bioaugmentation strategies to tackle ammonia inhibition in anaerobic digestion process

Department of Environmental Engineering
Period: 01/10/2015 → 30/09/2018
Number of participants: 3
PhD Student:
Tian, Hailin (Intern)
Supervisor:
Fotidis, Ioannis (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet
Project: PhD

Innovative-bio-electrochemical-anaerobic-digestion coupled system for ammonia recovery and energy production from food-waste residues

Department of Environmental Engineering
Period: 01/10/2015 → 28/02/2019
Number of participants: 3
PhD Student:
Zhao, Nannan (Intern)
Supervisor:
Zhang, Yifeng (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet
Project: PhD

Large-scale operational hydrologic modeling using remote sensing data

Department of Environmental Engineering
Period: 01/10/2015 → 30/09/2018
Number of participants: 2
PhD Student:
Jiang, Liguang (Intern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet
Project: PhD
Mechanisms and regulation of nitrous oxide (N2O) production during biological wastewater treatment

Department of Environmental Engineering

Period: 01/10/2015 → 30/09/2018
Number of participants: 4
Phd Student:
Su, Qingxian (Intern)
Supervisor:
Jensen, Marlene Mark (Intern)
Thamdrup, Bo (Ekstern)
Main Supervisor:
Smets, Barth F. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet
Project: PhD

Biomimetic Membranes for Water Treatment and Energy Production

Department of Environmental Engineering

Period: 15/09/2015 → 14/09/2018
Number of participants: 3
Phd Student:
Schneider, Carina (Intern)
Supervisor:
Fotidis, Ioannis (Intern)
Main Supervisor:
Hélix-Nielsen, Claus (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Development of Global biodiversity Indicators

GEO BON (the Group on Earth Observations Biodiversity Observation Network) consortium involving researchers and organizations around the world has developed a novel set of global indicators to address important gaps in our understanding of biodiversity change across scales, from national to global. These indicators are embedded in open online analysis platforms following GEO data sharing principles and have the long-term commitment of established research institutions.

Department of Environmental Engineering

Water Resources Engineering

Group on Earth Observations Biodiversity Observation Network

Period: 09/09/2015 → 07/10/2017
Number of participants: 1
biodiversity, remote sensing , evaporative fraction
Project participant:
Garcia, Monica (Intern)
Documents:
GBCI_Version1.2_low_Biodiversity_Index

Characterization of recyclable materials in household waste

Department of Environmental Engineering
**Linking the exposure and effects of organic chemical mixtures to their equilibrium partitioning concentrations in lipids**

Department of Environmental Engineering  
Period: 01/09/2015 → 15/03/2019  
Number of participants: 3  
Phd Student: Trac, Ngoc Lam (Intern)  
Supervisor: Nørgaard Schmidt, Stine (Intern)  
Main Supervisor: Mayer, Philipp (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU)  
Project: PhD

**Microbial community evolution models for describing the degradation of chlorinated solvents**

Department of Environmental Engineering  
Period: 01/09/2015 → 31/08/2018  
Number of participants: 4  
Phd Student: Murray, Alexandra Marie (Intern)  
Supervisor: Broholm, Mette Martina (Intern)  
Role, Massimo (Intern)  
Main Supervisor: Broholm, Mette Martina (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU)  
Project: PhD

**Surrogate modeling of inundation for both real time control and planning applications**

Department of Environmental Engineering  
Period: 01/09/2015 → 30/05/2019  
Number of participants: 3  
Phd Student: Thrysøe, Cecilie (Intern)  
Supervisor: Borup, Morten (Intern)  
Main Supervisor: Armbjerg-Nielsen, Karsten (Intern)
Shaie gas in a Danish context

Department of Environmental Engineering

Environmental Chemistry
Period: 31/08/2015 → 29/01/2016
Number of participants: 1
Shaie gas, Risk screening
Project participant:
Hansen, Steffen Foss (Intern)

Relations
Press / Media items:
Forskere står med mange ubesvarede skifergasspørgsmål: Der er stadig mange ubesvarede spørgsmål om skifergassboringernes konsekvenser for miljøet og grundvandet.
36 risici ved at bore efter skifergas
Rapport: Sådan gør vi skifergas miljøvenlig
Debat: Nej, skifergas er da alt andet end forsvarligt
Hård kritik af Total og kommune

Life-cycle assessment of climate adaption technologies for stormwater management

Department of Environmental Engineering
Period: 15/08/2015 → 07/02/2019
Number of participants: 5
Phd Student:
Brudler, Sarah (Intern)
Supervisor:
Arnbjerg-Nielsen, Karsten (Intern)
Hauschild, Michael Zwicky (Intern)
Lauesen, Linne Marie (Ekstern)
Main Supervisor:
Rygaard, Martin (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Water in Urban Areas (Vand i Byer)
Innovation Network funded by Danish Agenc for Science and Higher education. A partnership for climate change adaptation and innovation

Department of Environmental Engineering
Urban Water Systems
Period: 01/08/2015 → 31/07/2018
Number of participants: 1
Acronym: ViB
Project participant:
Godskesen, Berit (Intern)

Innovative bioaugmentation strategies to tackle ammonia inhibition in an-aerobic digestion process

Department of Environmental Engineering
Residual Resource Engineering
Lemvig Biogasanlæg A.m.b.A.
Period: 01/08/2015 → 31/07/2018
Number of participants: 3
Acronym: MicrobStopNH3
Number of related Ph.D. students: 1
Project participant:
Fotidis, Ioannis (Intern)
De Francisci, Davide (Intern)
Project Manager, academic:
Angelidaki, Irini (Intern)

Biomimetic Phopshate Recovery
Department of Environmental Engineering
Period: 01/08/2015 → 31/07/2018
Number of participants: 3
Phd Student:
Truelsen, Sigurd Friis (Intern)
Supervisor:
Pedersen, Per Amstrup (Ekstern)
Main Supervisor:
Hélix-Nielsen, Claus (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Micropollutants removal for hospital wastewater
Department of Environmental Engineering
Period: 15/05/2015 → 14/05/2018
Number of participants: 3
Phd Student:
Ooi, Gordon Tze Hoong (Intern)
Supervisor:
Bester, Kai (Ekstern)
Main Supervisor:
Andersen, Henrik Rasmus (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Vand Innovation SMVer
Department of Environmental Engineering
Urban Water Systems
Office for Innovation & Sector Services
Period: 01/05/2015 → 31/07/2018
Number of participants: 6
Acronym: ViS
Project participant:
Godskesen, Berit (Intern)
Mikkelsen, Peter Steen (Intern)
Kærn, Veggo Aaberg (Intern)
Nielsen, Katrine (Intern)
Neergaard, Birgitte (Intern)
Philipsen, Lærke (Intern)

**Project**

Data quality in LCA of waste management: importance for result interpretation and result decision making

Department of Environmental Engineering  
Period: 01/04/2015 → 31/07/2018  
Number of participants: 3  
Phd Student:  
Henriksen, Trine (Intern)  
Supervisor:  
Astrup, Thomas Fruergaard (Intern)  
Main Supervisor:  
Damgaard, Anders (Intern)

**Financing sources**
Source: Internal funding (public)  
Name of research programme: Samfinansierede - Virksomhed  
Project: PhD

Engineering microbial communities in granular autotrophic nitrogen removal systems by steering metabolic networks

Department of Environmental Engineering  
Period: 01/03/2015 → 28/05/2018  
Number of participants: 4  
Phd Student:  
Blum, Jan-Michael (Intern)  
Supervisor:  
Jensen, Marlene Mark (Intern)  
Thamdrup, Bo (Ekstern)  
Main Supervisor:  
Smets, Barth F. (Intern)

**Financing sources**
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD

Miljøvurdering af indsamling, genanvendelse og bortskaffelse af tøj, og tekstilaffald

Department of Environmental Engineering  
Period: 15/01/2015 → 17/02/2019  
Number of participants: 4  
Phd Student:  
Nørup, Nynne (Intern)  
Supervisor:  
Damgaard, Anders (Intern)  
Pihl, Kaj A. (Ekstern)  
Main Supervisor:  
Scheutz, Charlotte (Intern)

**Financing sources**
Source: Internal funding (public)  
Name of research programme: Industrial PhD  
Project: PhD

Improving phosphorus recovery by supplementing existing Danish wastewater treatment using electrodialysis.  
MUDP-project.
Department of Civil Engineering
Arctic Technology Centre, ARTEK
Department of Environmental Engineering
Urban Water Engineering

Naturstyrelsen
Period: 01/01/2015 → 31/07/2015
Number of participants: 4
biological, wastewater treatment, electrodialysis, phosphorus
Project ID: 26452
Project participant:
Andersen, Henrik Rasmus (Intern)
Supervisor:
Jensen, Pernille Erland (Intern)
Main Supervisor:
Ottosen, Lisbeth M. (Intern)
Project Coordinator:
Ebbers, Benjamin (Intern)

Microplastics Occurrence, effects and sources of releases to the environment in Denmark
Microplastics Occurrence, effects and sources of releases to the environment in Denmark Environmental project No. 1793, 2015. Ministry of Environment and Food The Danish Environmental Protection Agency.

Department of Environmental Engineering
Environmental Chemistry
COWI AS
Period: 01/01/2015 → 12/11/2015
Number of participants: 1
Microplastics
Project participant:
Hansen, Steffen Foss (Intern)
Documents:
Lassen et al. 2015

Micropollutants removal for hospital wastewater
Department of Environmental Engineering
Period: 01/01/2015 → 31/12/2017
Number of participants: 5
Phd Student:
Tang, Kai (Intern)
Main Supervisor:
Andersen, Henrik Rasmus (Intern)
Examiner:
Mayer, Philipp (Intern)
McArdell, Christa S. (Ekstern)
Stasinakis, Athanasios (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

Optimization of greenhouse gas mitigation of landfills
Department of Environmental Engineering
Drivers and Barriers to the Innovation and Implementation of Alternative Solutions to Climate Adoption

Department of Environmental Engineering
Period: 15/12/2014 → 11/10/2018
Number of participants: 4
Phd Student:
Madsen, Herle Mo (Intern)
Supervisor:
Andersen, Maj Munch (Intern)
Rygaard, Martin (Intern)
Main Supervisor:
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Functional nanostructured materials to real water treatment applications

Department of Environmental Engineering
Period: 15/12/2014 → 14/12/2017
Number of participants: 8
Phd Student:
Ko, Dongah (Intern)
Supervisor:
Hwang, Yuhoon (Intern)
Jakobsen, Mogens Havsteen (Intern)
Yavuz, Cafer T. (Ekstern)
Main Supervisor:
Andersen, Henrik Rasmus (Intern)
Examiner:
Baun, Anders (Intern)
Dossi, Eleftheria (Ekstern)
Holm, Peter Engelund (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)

Relations
Publications:
Functional nanostructured materials for stormwater runoff treatment
Project: PhD

Innovative microbial electrolysis cell-anaerobic digestion coupled system for ammonia recovery and energy production from ammonia-rich residues
Department of Environmental Engineering
Period: 15/12/2014 → 14/12/2017
Number of participants: 3
Phd Student:
Li, Xiaohu (Intern)
Supervisor:
Zhang, Yifeng (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet
Project: PhD

Water Supplies' Water Footprint
Department of Environmental Engineering
Period: 15/12/2014 → 30/11/2018
Number of participants: 6
Phd Student:
Gejl, Ryle Nørskov (Intern)
Supervisor:
Bjerg, Poul Legstrup (Intern)
Hauschild, Michael Zwicky (Intern)
Henriksen, Hans Jørgen (Ekstern)
Rasmussen, Jens (Ekstern)
Main Supervisor:
Rygaard, Martin (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Investigating the fate of nanomaterials in waste water treatment plants; removal, release and subsequent impacts
Department of Environmental Engineering
Environmental Chemistry
Norwegian Research Council
Period: 01/12/2014 → 30/05/2018
Number of participants: 2
Nanoparticles, Wastewater treatment
Acronym: NanoWASTE
Project participant:
Hansen, Steffen Foss (Intern)
Polesel, Fabio (Intern)

Project

Contrasting the Water Innovation Systems In Europe and China
Department of Environmental Engineering
Period: 01/12/2014 → 02/03/2018
Number of participants: 4
Phd Student:
Moro, Mariù Abritta (Intern)
Supervisor:
Andersen, Maj Munch (Intern)
McKnight, Ursula S. (Intern)
Main Supervisor:
Smets, Barth F. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Deciphering the microbial ecology in biogas reactors for optimizing the anaerobic digestion process
Department of Environmental Engineering
Period: 01/12/2014 → 30/11/2017
Number of participants: 7
Phd Student:
Zhu, Xinyu (Intern)
Supervisor:
Kougias, Panagiotis (Intern)
Treu, Laura (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Zhang, Yifeng (Intern)
Nielsen, Jeppe Lund (Ekstern)
de Sousa, Diana Zita Machado (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)

Relations
Publications:
Deciphering the microbial ecology in bio-gas reactors for optimizing the anaerobic digestion process
Project: PhD

Microbial aggregates: A computational approach to investigate mechanisms & implications
Department of Environmental Engineering
Period: 01/12/2014 → 15/06/2018
Number of participants: 4
Phd Student:
Cockx, Bastiaan (Intern)
Supervisor:
Kreft, Jan Ulrich (Ekstern)
Plósz, Benedek G. (Intern)
Main Supervisor:
Smets, Barth F. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Bioelectrochemical-anaerobic digestion-coupled system for simultaneous recovery and bioenergy production
Department of Environmental Engineering
Period: 15/10/2014 → 20/12/2017
Number of participants: 6
Phd Student:
Jin, Xiangdan (Intern)
Supervisor:
Zhang, Yifeng (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Kougias, Panagiotis (Intern)
He, Zhen Jason (Eksterm)
Norddahl, Birgir (Eksterm)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet

Relations
Publications:
Bioelectrochemical systems serve anaerobic digestion process for process monitoring and biogas upgrading
Project: PhD

Swimming pool disinfection by-products
Department of Environmental Engineering
Period: 15/10/2014 → 30/08/2017
Number of participants: 6
Phd Student:
Cheema, Waqas Akram (Intern)
Supervisor:
Kaarsholm, Kamilla Marie Speht (Intern)
Main Supervisor:
Andersen, Henrik Rasmus (Intern)
Examiner:
Albrechtsen, Hans-Jørgen (Intern)
Chowdhury, Shakhawat (Eksterm)
Uhl, Wolfgang (Eksterm)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist

Relations
Activities:
7th International Conference
7th International Conference
Destruction of DBPs and their precursors in swimming pool water by combined UV-treatment and ozonation
Effect of UV treatment on DBPs formation in chlorinated seawater swimming pools - a laboratory study
IOA-PAG International Conference
2016 IUVA World Congress
2017 IUVA Americas Conference
Project: PhD

Chemical disinfection of combined sewer overflow (CSO) water
Department of Environmental Engineering
Period: 01/10/2014 → 20/12/2017
Number of participants: 6
Phd Student:
Chhetri, Ravi Kumar (Intern)
Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Main Supervisor:
Andersen, Henrik Rasmus (Intern)
Examiner:
Mikkelsen, Peter Steen (Intern)
Dalsgaard, Anders (Ekstern)
Stasinakis, Athanasios (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)

**Relations**
Publications:
Chemical disinfection of combined sewer overflows
Project: PhD

**Development of innovative landfill gas management technologies**
Department of Environmental Engineering
Period: 01/10/2014 → 22/10/2018
Number of participants: 4
Phd Student:
Fjelsted, Lotte (Intern)
Supervisor:
Christensen, Anders Georg (Intern)
Scheutz, Charlotte (Intern)
Main Supervisor:
Kjeldsen, Peter (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

**Realizing autotrophic nitrogen removal in membrane-aerated biofilms**
Department of Environmental Engineering
Period: 01/10/2014 → 31/01/2018
Number of participants: 6
Phd Student:
Ma, Yunjie (Intern)
Supervisor:
Plösö, Benedek G. (Intern)
Main Supervisor:
Smets, Barth F. (Intern)
Examiner:
Andersen, Henrik Rasmus (Intern)
Nerenberg, Robert (Ekstern)
Lackner, Susanne (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet

**Relations**
Publications:
Monitoring and modeling of nitrogen conversions in membrane-aerated biofilm reactors: Effects of intermittent aeration
Project: PhD

**Modelling tools for integrating geological, geophysical and contamination data for characterization of groundwater plumes**
Department of Environmental Engineering
Period: 01/09/2014 → 05/12/2017
Number of participants: 7
Phd Student:
Modelling tools for integrating geological, geophysical and contamination data for characterization of groundwater plumes

Project: PhD

Department of Environmental Engineering
Period: 15/08/2014 → 15/07/2018
Number of participants: 3
Phd Student:
Rønde, Vinni Kampman (Intern)
Supervisor:
McKnight, Ursula S. (Intern)
Main Supervisor:
Bjerg, Poul Løgstrup (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Interdisciplinary tools for identification and quantification of groundwater contamination arising from point sources

Department of Environmental Engineering
Period: 01/07/2014 → 30/04/2017
Number of participants: 1
Acronym: OPTIMISE
Working partner:
Garcia, Monica (Intern)

Important European and international initiatives (SPECNET, BIOSPEC and COST Action ES0903) explored the use of proximal optical sensing of ecosystem where carbon and water vapor flux is estimated by eddy covariance techniques. Such optical observations provide data at the high spectral, temporal and spatial resolutions necessary to more fully comprehend the links between light use, plant physiology and ecosystem functioning and provide key validation datasets for satellite remote sensing, such as the Sentinel missions, and the flux communities.

The recent advances in UAV platforms and optical sensors provide unprecedented opportunities for high spatial, spectral and multi-angular near-ground Earth observations. This will enable scientists to answer ecological and physiological questions at multiple scales through integrated empirical and modeling methods. Important progress is also being made in remote sensing of steady-state fluorescence, the most direct proxy for photosynthesis. The FLuorescence EXplorer (FLEX) mission, selected for further studies, will also benefit as this Action will support FLEX validation and calibrations campaigns. Furthermore, scientists have recognized the need to develop a ‘smart’ on-line platform to process and analyses optical data along with biophysical and water/carbon flux measurements and share these with other scientific communities and stakeholders which will also be addressed in this Action.

Department of Environmental Engineering
Water Resources Engineering
Period: 01/07/2014 → 30/04/2017
Number of participants: 1
Acronym: OPTIMISE
Working partner:
Garcia, Monica (Intern)
Optimise Workshop

**Ressourceeffektivisering af anlæg til opvarmning og/eller køling af bygninger mv. med brug af grundvand**

Department of Environmental Engineering

Urban Water Engineering

Enopsol

Krüger A/S
Period: 01/06/2014 → 30/06/2015
Number of participants: 3
Acronym: ATES
Project participant:
Christensen, Sarah Christine Boesgaard (Intern)
Tønder, Marta Munk (Intern)
Albrechtsen, Hans-Jørgen (Intern)

**Biofilm architecture vs composition attenuates pathogen invasion**

Department of Environmental Engineering
Period: 01/06/2014 → 05/12/2017
Number of participants: 7
Phd Student:
Kinnunen, Marta (Intern)
Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Dechesne, Arnaud (Intern)
Main Supervisor:
Smets, Barth F. (Intern)
Examiner:
Trapp, Stefan (Intern)
Burmølle, Mette (Ekstern)
Curtis, Thomas P. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)

**Relations**
Publications:
Invasion in microbial communities: Role of community composition and assembly processes
Project: PhD

**PhD in Environmental Monitoring with Unmanned Airborne Vehicles**
The PhD project is based on remote sensing from Unmanned Airborne Vehicles (UAVs), environmental modeling and data assimilation. Data are acquired using a water laser ranger, a multi-spectral camera and a thermal camera mounted on lightweight unmanned airborne vehicles. Implementation of the payload on the UAVs, processing of the data and informing of hydrological models are the the main study areas. The main objective is to study water and energy fluxes from land and water surfaces, including evapotranspiration, with a spatial accuracy that has no parallel in other remote sensing technologies.

Water Resources Engineering

National Space Institute

**Sky Watch**
Period: 01/05/2014 → 30/04/2017
Number of participants: 1
UAVs drones remote sensing hydrology water
Project participant:
Environmental Monitoring with Unmanned Airborne Vehicles

Department of Environmental Engineering
Period: 01/05/2014 → 20/12/2017
Number of participants: 6
Phd Student: Bandini, Filippo (Intern)
Supervisor: Garcia, Monica (Intern)
Main Supervisor: Bauer-Gottwein, Peter (Intern)
Examiner: Bjerg, Poul Løgstrup (Intern)
Carbonneau, Patrice Eric (Ekstern)
Madsen, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Hydraulics and drones: observations of water level, bathymetry and water surface velocity from Unmanned Aerial Vehicles
Project: PhD

Updating large-scale hydrodynamic models with radar altimetry data from CryoSat

Department of Environmental Engineering
Period: 01/04/2014 → 30/09/2017
Number of participants: 6
Phd Student: Schneider, Raphael (Intern)
Supervisor: Madsen, Henrik (Intern)
Main Supervisor: Bauer-Gottwein, Peter (Intern)
Examiner: Mikkelsen, Peter Steen (Intern)
Bates, Paul David (Ekstern)
Refsgaard, Jens Christian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed

Relations
Publications:
CryoSat-2 satellite radar altimetry for river analysis and modelling
Project: PhD

Using long weather forecast to improve integrated wastewater management

Department of Environmental Engineering
Period: 01/04/2014 → 05/12/2017
Number of participants: 6
Phd Student: Courdent, Vianney Augustin Thomas (Intern)
Supervisor:
Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD

Relations
Publications:
Numerical Weather Prediction and Relative Economic Value framework to improve Integrated Urban Drainage-Wastewater management
Project: PhD

Risikovurdering og kildeidentificering af stoffer i digestat fra REnescience
Department of Environmental Engineering
Residual Resource Engineering
Environmental Chemistry
DONG Energy A/S
Period: 01/03/2014 → 31/12/2014
Number of participants: 3
Acronym: REnescience
Project participant:
Eriksson, Eva (Intern)
Pivnenko, Kostyantyn (Intern)
Project Coordinator:
Astrup, Thomas Fruergaard (Intern)
Project

Partitioning between heterotrophic and autotrophic forest respiration by means of stable isotopes
Department of Environmental Engineering
Period: 01/03/2014 → 30/09/2017
Number of participants: 7
PhD Student:
Brændholt, Andreas (Intern)
Supervisor:
Ibrom, Andreas (Intern)
Larsen, Klaus Steenberg (Intern)
Main Supervisor:
Pilegaard, Kim (Intern)
Examiner:
Scheutz, Charlotte (Intern)
Friborg, Thomas (Ekstern)
Rütting, Tobias (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering

Relations
Publications:
Estimation of ecosystem respiration and its components by means of stable isotopes and improved closed-chamber methods
Characterization and Management of Nanowaste
Department of Environmental Engineering
Period: 15/01/2014 → 30/09/2017
Number of participants: 7
Phd Student:
Heggelund, Laura Roverskov (Intern)
Supervisor:
Astrup, Thomas Fruergaard (Intern)
Hansen, Steffen Foss (Intern)
Main Supervisor:
Boldrin, Alessio (Intern)
Examiner:
Kjeldsen, Peter (Intern)
Ingerslev, Flemming (Intern)
Mitrano, Denise M. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Characterization of waste from nanoenabled products
Project: PhD

Effect of niche dimensionality on nitrifier community diversity
Department of Environmental Engineering
Period: 15/01/2014 → 19/04/2017
Number of participants: 4
Phd Student:
Diwan, Vaibhav (Intern)
Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Smets, Barth F. (Intern)
Main Supervisor:
Dechesne, Arnaud (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

Functionality increase in MBBRs due to metabolic expansion vs community expansion
Department of Environmental Engineering
Period: 15/01/2014 → 26/04/2017
Number of participants: 8
Phd Student:
Torresi, Elena (Intern)
Supervisor:
Andersen, Henrik Rasmus (Intern)
Andersen, Henrik Rasmus (Intern)
Plósz, Benedek G. (Intern)
Main Supervisor:
Smets, Barth F. (Intern)
Examiner:
Rolle, Massimo (Intern)
Patureau, Dominique (Ekstern)
Wilén, Britt-Marie (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet

Relations
Publications:
Removal of micropollutants in Moving Bed Biofilm reactors (MBBRs)
Project: PhD

N2O dynamics in conventional and innovative mainstream and side-stream nitrogen removal technologies
Department of Environmental Engineering
Period: 15/01/2014 → 22/12/2017
Number of participants: 3
Phd Student:
Ekström, Sara Elisabet Margareta (Intern)
Supervisor:
Plósz, Benedek G. (Intern)
Main Supervisor:
Smets, Barth F. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Treatment of worm infested biological rapid sand filters
Department of Environmental Engineering
Urban Water Engineering
Krüger A/S
Two anonymous water utilities
Period: 01/01/2014 → 23/06/2015
Number of participants: 1
Project participant:
Christensen, Sarah Christine Boesgaard (Intern)

Relations
Activities:
Treatment of worm infested rapid sand filters
Publications:
Treatment of worm infested biological rapid sand filters
Ormebekæmpelse i vandværksfiltre
Project

Colloidal fractions of persistent organic pollutants in road runoff: sources, generation and innovative treatment techniques
Department of Environmental Engineering
Environmental Chemistry
Chalmers University of Technology
Period: 01/01/2014 → 31/12/2016
Number of participants: 1
Acronym: ColloidPOP
Number of related Ph.D. students: 1
Project participant:
Unified testing procedures for wind turbines through inflow characterisation using nacelle lidars

*UniTTe* addresses the question of how best to characterise the wind when measuring the power and loads on modern wind turbines.

Current international standards require us to measure the wind from a mast, far in-front of the rotor and at the rotor centre height (hub-height). *UniTTe* proposes a radical change so that in the future we will measure with a lidar (laser anemometer) mounted on the nacelle, measure quite close to the rotor and measure over a range of heights. The advantages will be significant: avoiding erecting high masts (hugely expensive offshore), getting better correlation between the wind and the power and loads and achieving universal procedures that work equally well both offshore and in mountains.

*UniTTe* - Unified Turbine Testing

**Department of Wind Energy**

**Test and Measurements**

**Department of Electrical Engineering**

**Aeroelastic Design**

**Residual Resource Engineering**

**Wind Turbines**

**Period:** 01/01/2014 → 31/12/2017

**Number of participants:** 11

nacelle lidars, power performance, loads assessment, inflow, induction

**Acronym:** *UniTTe*

**Number of related Ph.D. students:** 2

**Project participant:**

Friis Pedersen, Troels (Intern)

Troldborg, Niels (Intern)

Meyer Forsting, Alexander Raul (Intern)

Bechmann, Andreas (Intern)

Courtney, Michael (Intern)

Borraccino, Antoine (Intern)

Vignaroli, Andrea (Intern)

Natarajan, Anand (Intern)

Sathe, Ameya (Intern)

Dimitrov, Nikolay Krasimirov (Intern)

**Project Manager, academic:**

Wagner, Rozenn (Intern)

**Related projects:**

Modeling of Wind Turbine Inflow

**Activities:**

EWEA Technology Workshop

Wind Europe Summit 2016

Perdigao NEWA meeting

11th EAWE PhD seminar on Wind Energy in Europe

Power curve measurement using $V_\infty$ estimates from nacelle lidars and its uncertainty

ISARS2016

12th German Wind Energy Conference DEWEK 2015

ECCOMAS Congress 2016

Predicting free-stream wind speed in complex terrain with lidar measurements

Power curve measurement using $V_\infty$ estimates from nacelle lidars and its uncertainty

**Publications:**

Calibration report for Avent 5-beam Demonstrator lidar
Calibration report for ZephIR Dual Mode lidar (unit 351)
Generic methodology for calibrating profiling nacelle lidars

Project

Forward osmosis biomimetic membranes for sensor and separation applications

Department of Environmental Engineering
Period: 01/01/2014 → 15/03/2017
Number of participants: 5
PhD Student:
Bajraktari, Niada (Intern)
Main Supervisor:
Hélix-Nielsen, Claus (Intern)
Examiner:
Pinelo, Manuel (Intern)
Christensen, Morten Lykkegaard (Ekstern)
Jönsson, Ann-Sofi (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Sustainable Production of Third Generation (3G) Bioenergy Carriers and High Value Aquatic Fish Feed from Macroalgae

Department of Environmental Engineering
Period: 01/01/2014 → 30/08/2017
Number of participants: 6
PhD Student:
D'Este, Martina (Intern)
Supervisor:
Alvarado-Morales, Merlin (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Fotidis, Ioannis (Intern)
Thomsen, Anne Belinda (Intern)
Nakashimada, Yutaka (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Algal Biomass for Bioenergy and Bioproducts Production in Biorefinery Concepts
Project: PhD

The structure and functional role of microbial communities in rapid sand filters

Department of Environmental Engineering
Period: 01/01/2014 → 30/09/2017
Number of participants: 7
PhD Student:
Palomo, Alejandro (Intern)
Supervisor:
Rasmussen, Simon (Intern)
Smets, Barth F. (Intern)
Main Supervisor:
Sicheritz-Pontén, Thomas (Intern)
Examiner:
Petersen, Thomas Nordahl (Intern)
Daims, Holger (Ekstern)
Thamdrup, Bo (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)

Relations
Publications:
Discovery and description of complete ammonium oxidizers in groundwater-fed rapid sand filters
Project: PhD

Biogas enhancement and upgrading
Department of Environmental Engineering
Period: 15/12/2013 → 06/06/2017
Number of participants: 6
Phd Student:
Bassani, Ilaria (Intern)
Supervisor:
Kougias, Panagiotis (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Jensen, Marlene Mark (Intern)
Guwy, Alan (Ekstern)
Norddahl, Birgir (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Hydrogen assisted biological biogas upgrading
Project: PhD

Establishment and calibration of consensus process models of N2O dynamics
Department of Environmental Engineering
Period: 15/12/2013 → 30/08/2017
Number of participants: 7
Phd Student:
Domingo-Felez, Carlos (Intern)
Supervisor:
Plósz, Benedek G. (Intern)
Sin, Gürkan (Intern)
Main Supervisor:
Smets, Barth F. (Intern)
Examiner:
Gernaey, Krist V. (Intern)
Plaza, Elzbieta (Ekstern)
Sperandio, Mathieu (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:

Establishment and calibration of consensus process model for nitrous oxide dynamics in water quality engineering
Project: PhD

Full-scale quantification of greenhouse gas emissions from wastewater treatment plants
Department of Environmental Engineering
Period: 15/12/2013 → 16/11/2017
Number of participants: 6
Phd Student: Delre, Antonio (Intern)
Supervisor: Mønster, Jacob (Intern)
Main Supervisor: Scheutz, Charlotte (Intern)
Examiner: Ibrom, Andreas (Intern)
Allen, Grant (Ekstern)
Thomsen, Marianne (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Greenhouse gas emissions from wastewater treatment plants: measurements and carbon footprint assessment
Project: PhD

Assessment of the drinking water quality sensor prototype "Zebra"
Department of Environmental Engineering
Urban Water Engineering
Grundfos A/S
Period: 01/12/2013 → 31/07/2014
Number of participants: 3
Project participant: Christensen, Sarah Christine Boesgaard (Intern)
Vang, Óluva Karin (Intern)
Albrechtsen, Hans-Jørgen (Intern)

New technology for an efficient utilization of meadow grass in biogas reactor
Department of Environmental Engineering
Period: 01/12/2013 → 15/03/2017
Number of participants: 6
Phd Student: Tsapekos, Panagiotis (Intern)
Supervisor: Kougias, Panagiotis (Intern)
Main Supervisor: Angelidaki, Irini (Intern)
Examiner: Dechesne, Arnaud (Intern)
Malpei, Francesca (Ekstern)
Norddahl, Birgir (Ekstern)

Financing sources
**Relations**

**Publications:**

**Enhancing biogas production from recalcitrant lignocellulosic residue**

**Project:** PhD

**Controlling factors for nitrification in biological rapid sand filters for drinking water treatment**

**Department of Environmental Engineering**

**Period:** 15/11/2013 → 25/10/2017

**Number of participants:** 6

**Phd Student:** Wagner, Florian Benedikt (Intern)

**Supervisor:** Boe-Hansen, Rasmus (Intern)

**Main Supervisor:** Albrechtsen, Hans-Jørgen (Intern)

**Examiner:** Jensen, Marlene Mark (Intern)

**Roslev, Peter (Ekstern)**

**van der Wielen, Paul W. J. J. (Ekstern)**

**Financing sources**

Source: Internal funding (public)

Name of research programme: Samfinansieret - Andet

**Relations**

**Publications:**

**Importance of copper for nitrification in biological rapid sand filters for drinking water production**

**Project:** PhD

**Ecotoxicity and groundwater remediation potential of engineered nanoparticles**

**Department of Environmental Engineering**

**Period:** 15/11/2013 → 08/02/2017

**Number of participants:** 7

**Phd Student:** Hjorth, Rune (Intern)

**Supervisor:** Broholm, Mette Martina (Intern)

**Hansen, Steffen Foss (Intern)**

**Main Supervisor:** Baun, Anders (Intern)

**Examiner:** Rygaard, Martin (Intern)

**Malloy, Timothy F. (Ekstern)**

**Syberg, Kristian (Ekstern)**

**Financing sources**

Source: Internal funding (public)

Name of research programme: Samfinansieret - Andet

**Relations**

**Publications:**

**Environmental risk assessment and management of engineered nanomaterials - The role of ecotoxicity testing**

**Project:** PhD

**Systematic quantification of biogas potential in urban organic waste**
Department of Environmental Engineering
Period: 15/11/2013 → 26/04/2017
Number of participants: 7
Phd Student:
Fitamo, Temesgen Mathewos (Intern)
Supervisor:
Boldrin, Alessio (Intern)
Main Supervisor:
Scheutz, Charlotte (Intern)
Examiner:
De Francisci, Davide (Intern)
La Cour Jansen, Jes (Intern)
La Cour Jansen, Jes (Intern)
Ward, Alastair James (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Systematic Quantification of Biogas Potential in Urban Organic Waste
Project: PhD

Risk assessment of stream water: linking mass discharge from contaminated sites, in-stream fate and water health
Department of Environmental Engineering
Period: 01/11/2013 → 26/06/2017
Number of participants: 6
Phd Student:
Sonne, Anne Thobo (Intern)
Supervisor:
McKnight, Ursula S. (Intern)
Main Supervisor:
Bjerg, Poul Løgstrup (Intern)
Examiner:
Broholm, Mette Martina (Intern)
Kronvang, Brian (Ekstern)
Roy, James W. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Integrated assessment of chemical stressors and ecological impact in mixed land use stream systems
Project: PhD

Innovative bioelectrochemical-anaerobic-digestion coupled system for ammonia recovery and energy production from ammonia-rich residues
Inhibition of anaerobic digestion process by high levels of ammonia (NH4+/NH3) is the most serious problem existing in Danish biogas plants. No viable/applicable method to overcome this problem has been found up to now. This project proposes an innovative process which integrates bioelectrochemical system (BES) with anaerobic digestion to recover ammonia, and thereby enhance biomethanation of ammonia-rich residues. In this process, ammonia recovery and electricity production will be realized in a novel BES submersed in an anaerobic reactor. Moreover, removal of ammonia from anaerobic reactor will alleviate or counteract ammonia inhibition and enhance the conversion of ammonia-rich wastes to biogas, giving synergistic advantages for both ammonia recycling and increase of biogas production. The system performance and potential limitations will be addressed and technical solutions will be developed.

Department of Environmental Engineering
Residual Resource Engineering
Period: 01/10/2013 → 30/09/2017
Number of participants: 3
Bioelectrochemistry, Anaerobic digestion, Ammonia recovery, Bioenergy, Biocatalysis, Wastewater handling, Open land, Sustainability
Acronym: ElectroAD
Number of related Ph.D. students: 1
Project participant:
Zhang, Yifeng (Intern)
Fotidis, Ioannis (Intern)
Project Coordinator:
Angelidaki, Irini (Intern)
Project

Release of nanoparticles from consumer products
Department of Environmental Engineering
Period: 01/10/2013 → 01/12/2016
Number of participants: 6
Phd Student:
Mackevica, Aiga (Intern)
Supervisor:
Olsson, Mikael Emil (Intern)
Main Supervisor:
Hansen, Steffen Foss (Intern)
Examiner:
Löschner, Katrin (Intern)
Cornelis, Geert (Ekstern)
Jensen, Keld Alstrup (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Relations
Publications:
Release of nanomaterials from consumer products and implications for consumer exposure assessment
Project: PhD

Rensning af drikkevand
Department of Environmental Engineering
Urban Water Engineering
Period: 15/09/2013 → 30/04/2014
Number of participants: 4
Project participant:
Christensen, Sarah Christine Boesgaard (Intern)
Andersen, Henrik Rasmus (Intern)
Refstrup, Mona (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Project

Characterization of Biomass Combustion Ashes
Department of Environmental Engineering
Period: 01/09/2013 → 05/12/2017
Number of participants: 5
Phd Student:
Maresca, Alberto (Intern)
Main Supervisor:
Astrup, Thomas Fruergaard (Intern)
Examiner:
Kjeldsen, Peter (Intern)
Polettini, Alessandra (Ekstern)
Steenari, Britt-Marie (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Characterisation of wood combustion ashes
Project: PhD

Quantitative spatio-temporal flood risk modelling in an urban context
Department of Environmental Engineering
Period: 01/09/2013 → 30/09/2014
Number of participants: 3
Phd Student:
Sto. Domingo, Niña Donna Farpale (Intern)
Supervisor:
Helwigh, Ole Mark (Ekstern)
Main Supervisor:
Arnbjerg-Nielsen, Karsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Wastewater resource recovery using green micro-algae
Department of Environmental Engineering
Period: 01/09/2013 → 08/02/2017
Number of participants: 6
Phd Student:
Wágner, Dorottya Sarolta (Intern)
Supervisor:
Smets, Barth F. (Intern)
Main Supervisor:
Płósz, Benedek G. (Intern)
Examiner:
Hartmann, Nanna B. (Intern)
Ellegaard, Marianne (Ekstern)
Steyer, Jean-Philippe (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Environmental Assessment of Sewage Sludge Management - Focusing on Sludge Treatment Reed Beds
Department of Environmental Engineering
Period: 01/08/2013 → 30/09/2017
Number of participants: 6
Phd Student:
Larsen, Julie Dam (Intern)
Improving Weather Risk Management in West Africa: Evaluation of Remote Sensing for Index Insurance

The Weather Risk Management Facility (WRMF) is a joint initiative between two United Nations agencies, the International Fund for Agricultural Development (IFAD) and the World Food Programme (WFP). It has been working to address the challenges weather risk (particularly drought) poses for smallholders producing crops in rural areas. One way the WRMF does this is by developing and supporting innovative weather and climate risk management tools – including index insurance – that improve rural livelihoods and reduce hunger. Launched in 2008 with the support of the Bill and Melinda Gates Foundation, the WRMF draws on IFAD’s experience in rural finance and on WFP’s expertise in disaster-risk reduction and management.

Building on lessons learned from carrying out pilots and research, the WRMF identified key constraints and success factors in the uptake, sustainability and scalability of index insurance. Index insurance offers structural opportunities where, as part of a larger package of risk management strategies and services, it can be delivered through risk aggregators, such as agricultural finance providers, input suppliers and contract farming organizations. Indexation can also form a basis for risk financing and insurance for governments, relief agencies, at a more aggregated level.

This latest project, ‘Improving Weather Risk Management in West Africa: Evaluation of Remote Sensing for Index Insurance’, is designed to test the feasibility of index implementation for poor rural smallholders using innovative remote sensing technology. The project will address implementation needs, and research and evaluate methodologies, focusing on selected test locations in West Africa (e.g. Senegal). The rationale for this project is that conventional weather index insurance (using weather stations) and area yield index insurance (using crop yield data), suffer from significant constraints, such as lack of appropriate weather station coverage and adequate yield information. In many cases these constraints represent a severe limitation to the introduction and scaling up of insurance products – both traditional crop and indexed insurance. By removing some of the obstacles encountered by such approaches, and despite a different set of technical, organizational and financial challenges, remote sensing may offer new opportunities for development of new insurance instruments for indexation. The specific goal of this project is to research and develop sustainable index insurance products for smallholder farmers who are producing crops in drought-prone areas of developing countries. Any successfully piloted methodologies could then feed into existing IFAD and WFP programmes such as R43 and other ongoing operations.

This briefing note is primarily written for organizations, research centres, and firms which are involved in remote sensing and agricultural productivity monitoring, to explain about the project and the way in which the WRMF hopes to engage with them during phase 2 and potentially beyond.

Consultancy project. Member of the Evaluation Committee.

Department of Environmental Engineering

Water Resources Engineering

International Fund for Agricultural Development
Period: 31/07/2013 → 30/04/2014
Number of participants: 1
Project participant:
Garcia, Monica (Intern)

Relations
Activities:
Workshop Evaluation Meeting Committee
Project
Integration of biomass and wind power for biogas enhancement and upgrading via hydrogen assisted anaerobic digestion

Department of Environmental Engineering
Residual Resource Engineering
Period: 01/07/2013 → …
Number of participants: 3
upgrade, biogas, enhancement
Acronym: SYMBIO
Project participant:
Kougias, Panagiotis (Intern)
Luo, Gang (Intern)
Project Coordinator:
Angelidaki, Irini (Intern)

Future Scenario Analysis in Solid Waste Management

Department of Environmental Engineering
Period: 01/07/2013 → 05/12/2017
Number of participants: 6
Phd Student:
Bisinella, Valentina (Intern)
Supervisor:
Christensen, Thomas Højlund (Intern)
Main Supervisor:
Astrup, Thomas Fruergaard (Intern)
Examiner:
Boldrin, Alessio (Intern)
Brandão, Miguel M. R. (Ekstern)
Guyonnet, Dominique (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Future scenario development within life cycle assessment of waste management systems
Project: PhD

Microbial degradation of pesticides in rapid sandfilters in water supply - Process understanding

Department of Environmental Engineering
Period: 01/05/2013 → 19/11/2017
Number of participants: 5
Phd Student:
Hedegaard, Mathilde Jørgensen (Intern)
Main Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Examiner:
Bjerg, Poul Løgstrup (Intern)
Boon, Nico (Ekstern)
Nybroe, Ole (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Microbial degradation of pesticides in rapid sand filters used for drinking water treatment
Project: PhD

**A novel method to recover ammonia from biogas plants**
In this project, we will develop an innovative technology to recover inhibitors from anaerobic digestion

Department of Environmental Engineering
Residual Resource Engineering
Period: 01/04/2013 → 31/10/2013
Number of participants: 2
Biocatalysis, Biogas, Biohydrogen, Bioelectrochemistry, Monitoring, Control, Bioenergy
Acronym: ElectroAD1
Project ID: 30992
Project participant:
Zhang, Yifeng (Intern)
Angelidaki, Irini (Intern)

**Feasibility of phytoremediation for common soil and groundwater pollutants**
Department of Environmental Engineering
Period: 01/04/2013 → 20/12/2017
Number of participants: 6
Phd Student:
Clausen, Lauge Peter Westergaard (Intern)
Supervisor:
Broholm, Mette Martina (Intern)
Main Supervisor:
Trapp, Stefan (Intern)
Examiner:
Kjeldsen, Peter (Intern)
Eggen, Trine (Ekstern)
Magid, Jakob (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

**Relations**
Publications:
Feasibility of phytoremediation for common soil and groundwater pollutants
Project: PhD

**Aquavalens: Protecting the health of Europeans by improving methods for the detection of pathogens in drinking water and water used in food preparation**
New research approaches are needed to enable rapid determination of the pathogen load of European drinking water sources and supply systems used for food processing and preparation, human consumption and drinking. The new approaches should be based on molecular methods and complement the current time-consuming microbiological techniques, which are based on the cultivation of indicator bacteria. Highly standardised methods are essential, validated with certified molecular reference material. The approaches will need to address the issue of inhibition of molecular methods and assess the significance of any positive detection. The combination of molecular techniques with electronic sensors will also be investigated. The new techniques will result in detailed insight into the pathogen load, the hygienic quality and the specific microbial strains (viruses, bacteria, protozoa) responsible for outbreaks of waterborne infections. They will lead to better understanding of the sources, infectivity and virulence of these strains. The efficacy of the new techniques has to be demonstrated. AQUAVALENS is centred on the concept of developing suitable platforms that harness the advances in new molecular techniques to permit the routine detection of waterborne pathogens and improve the provision of hygienically safe water for drinking and food production that is appropriate for large and small systems throughout Europe. Whilst in recent years there has been considerable developments, especially in molecular technology, very few systems are available that meet the needs of water providers. Consequently, and unless it proves essential, rather than necessarily develop new technologies, the key focus will be to adopt and, where appropriate, adapt existing technologies to develop these detection systems.
Project participant:

- Bang-Berthelsen, Iben (Intern)
- Idrizi, Resadije (Intern)
- Bang, Dang Duong (Intern)
- Albrechtsen, Hans-Jørgen (Intern)

Project Manager, academic:

- Schultz, Anna Charlotte (Intern)

Microbial water quality in clean water tanks following inspection and cleaning

Department of Environmental Engineering

VandCenter Syd

Period: 01/03/2013 → 30/09/2013

Number of participants: 2

Project participant:

- Christensen, Sarah Christine Boesgaard (Intern)
- Albrechtsen, Hans-Jørgen (Intern)

Relations

Activities:

- Microbial growth in clean water tanks
Publications:
Microbial water quality in clean water tanks following inspection and cleaning

Project

Modelling of in-sewer transformation of biomarkers
Department of Environmental Engineering
Period: 15/02/2013 → 08/02/2017
Number of participants: 6
Phd Student:
Ramin, Pedram (Intern)
Supervisor:
Mikkelsen, Peter Steen (Intern)
Main Supervisor:
Płösz, Benedek G. (Intern)
Examiner:
Trapp, Stefan (Intern)
Gumbau, Paloma Grau (Ekstern)
Vollertsen, Jes (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Modelling Illicit Drug Fate in Sewers for Wastewater-Based Epidemiology
Project: PhD

NanoDen: Nanomaterial - Occurrence and effects in the Danish Environment
The overall objective of the project is to provide answers to whether nanomaterials might cause a risk to the Danish environment, and if so under which conditions. Further the project will generate some new knowledge in relation to the fate of nanomaterials in the environment, knowledge generated with the aim of improving the exposure estimations in the project. The project will aim at answering the questions related to emissions, environmental fate, exposure/concentrations, effects and risks of nanomaterials in the Danish environment with the aim of eventually providing answers in relation to the overall objective. This will include an eventual summarising presentation and discussion in sub-project 6 of assumptions and uncertainties, including methodological issues encountered throughout the project. The focus in the project will be on translating existing knowledge into the best possible estimations of risks of nanomaterials within the scope of the project.
Department of Environmental Engineering
Environmental Chemistry
Period: 01/01/2013 → 01/07/2015
Number of participants: 4
Acronym: NanoDen
Project participant:
Baun, Anders (Intern)
Lützhøft, Hans-Christian Holten (Intern)
Hartmann, Nanna B. (Intern)
Hansen, Steffen Foss (Intern)

FiSCH4 – Fish Feed from Food Waste
Food waste represents a large fraction of total produced bio-waste and is composed of raw or cooked food materials generated before, during or after food preparation. It includes vegetable peelings, dairy leftovers products, meat
trimmings, and spoiled or excess ingredients or prepared food. Although EU measures intend to prevent the wastage of food, waste treatment processes, such as Anaerobic Digestion (AD), are necessary to handle non-edible food waste. Implementation of AD for treating food waste in Europe has increased at a large pace. The overall objective of FISCH4 is the demonstration of a novel biotechnological process that converts food waste (especially of plant and dairy origin) into fish feed ingredients, using unpurified biogas (CH4, CO2, H2S) as intermediate. The two step process involves: (i) anaerobic digestion of food waste for biogas production, with a focus on process application and not on fundamental research and, (ii) biogas conversion by mixed methanotrophic/ heterotrophic/sulfidotrophic biomass (here referred as mixed biomass – MB), using unpurified biogas containing CO2, CH4 and H2S and the liquid fraction of the anaerobic digester effluent, as source of carbon, energy and nutrients (Figure 1). Although the methanotrophic reactor will be designed and operated to maximize the utilization of methane from the biogas, applying e.g. high pressure and biogas recirculation, there will be a fraction of remaining biogas that can be used for energy production. The concept is envisaged for large-scale biogas plants where the biogas and the liquid effluent can be pumped to a separate industrial unit for MB production. Biogas remaining unused in the biological process will be used for electricity/biomethane production after upgrading. The co-production of energy will be evaluated through energy balances that will assess the possibility of turning the process energetically self-sufficient. Economic viability; environmental performance, including, but not limited to, low greenhouse gas (GHG) emissions over the complete life cycle (LC), and social acceptability, the three sets of criteria usually recognized as the tests for sustainability, will be assessed in the project. FISCH4 consortium gathers expertise on biotechnological processes, biogas processes, microbiology, food quality and safety, aquaculture and fisheries and environmental social and economic life cycle assessment. The consortium of 7 academic and 4 SME from 6 European countries and one participant from India has the scientific, technical and management expertise to promote an efficient transfer of lab-scale results into a novel industrial product that will contribute for the development of the EU sustainable economy. Figure 1

Department of Environmental Engineering
Period: 01/01/2013 → 31/12/2017
Number of participants: 1
Acronym: FISH4
Project Manager, organisational:
Angelidaki, Irini (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Reactive nanomaterials for water purification

Department of Environmental Engineering
Period: 15/12/2012 → 22/12/2016
Number of participants: 8
Phd Student:
Mines, Paul D. (Intern)
Supervisor:
Hwang, Yuhoon (Intern)
Jakobsen, Mogens Havsteen (Intern)
Yavuz, Cafer T. (Ekstern)
Main Supervisor:
Andersen, Henrik Rasmus (Intern)
Examiner:
Baun, Anders (Intern)
Dossi, Eleftheria (Ekstern)
Ranville, James (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)

Relations
Publications:
Hybridized reactive iron-containing nano-materials for water purification
Project: PhD
Resource quality indicators: Concept and methodology development
Department of Environmental Engineering
Period: 01/12/2012 → 31/05/2014
Number of participants: 2
Phd Student:
Rørbech, Jakob Thaysen (Intern)
Main Supervisor:
Astrup, Thomas Fruegaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Sustainable assessment of full chain bioenergy production
Department of Environmental Engineering
Period: 01/12/2012 → 05/04/2017
Number of participants: 9
Phd Student:
Saez de Bikuna Salinas, Koldo (Intern)
Supervisor:
Hauschild, Michael Zwicky (Intern)
Pilegaard, Kim (Intern)
Main Supervisor:
Ibrom, Andreas (Intern)
Examiner:
Damgaard, Anders (Intern)
Sin, Gürkan (Intern)
Damgaard, Anders (Intern)
Brandão, Miguel M. R. (Ekstern)
Cherubini, Francesco (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut/centerfinansieret

Relations
Publications:
Enquiring into the roots of bioenergy - epistemic uncertainties in life cycle assessments
Project: PhD

Innovative biogas process for ammonia-rich wastes
Department of Environmental Engineering
Period: 01/11/2012 → 30/06/2016
Number of participants: 6
Phd Student:
Wang, Han (Intern)
Supervisor:
Fotidis, Ioannis (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Dechesne, Arnaud (Intern)
Norddahl, Birgit (Ekstern)
Schnürer, Anna Liselotte (Ekstern)

Financing sources
Source: Internal funding (public)
**Kvantitativt potentiale for regnvandshåndtering**

**Department of Environmental Engineering**
**Period:** 01/11/2012 → 10/12/2018
**Number of participants:** 3
**Phd Student:**
Lerer, Sara Maria (Intern)

**Supervisor:**
Arnbjerg-Nielsen, Karsten (Intern)

**Main Supervisor:**
Mikkelsen, Peter Steen (Intern)

**Financing sources**
Source: Internal funding (public)

**Name of research programme:** Institut stipendie (DTU) Samf.
**Project:** PhD

**Composition of waste materials and recyclables**

**Department of Environmental Engineering**
**Period:** 01/10/2012 → 21/04/2016
**Number of participants:** 7
**Phd Student:**
Götze, Ramona (Intern)

**Supervisor:**
Boldrin, Alessio (Intern)
Scheutz, Charlotte (Intern)

**Main Supervisor:**
Astrup, Thomas Fruergaard (Intern)

**Examiner:**
Kjeldsen, Peter (Intern)
Grosso, Mario (Ekstern)
Riber, Christian (Intern)

**Financing sources**
Source: Internal funding (public)
**Name of research programme:** Institut stipendie (DTU) Samf.
**Project:** PhD

**Environmental assessment of biowaste management in the Danish-german border region**

**Department of Environmental Engineering**
**Period:** 01/10/2012 → 21/04/2016
**Number of participants:** 6
**Phd Student:**
Jensen, Morten Bang (Intern)

**Supervisor:**
Møller, Jacob (Intern)

**Main Supervisor:**
Scheutz, Charlotte (Intern)

**Examiner:**
Boldrin, Alessio (Intern)
Hansson, Per-Anders (Ekstern)
Kirkeby, Janus Søgaard (Intern)

**Financing sources**
Source: Internal funding (public)
**Name of research programme:** Ansat eksternt
**Fosfat-bioscavengers/biosensorer for osmotisk baseret detektion/ressource-genindvinding**

Department of Environmental Engineering  
Period: 01/10/2012 → 30/06/2016  
Number of participants: 5  
Phd Student:  
Gruber, Mathias Felix (Intern)  
Main Supervisor:  
Hélix-Nielsen, Claus (Intern)  
Examiner:  
Plósz, Benedek G. (Intern)  
Aurell, Erik (Ekstern)  
Jensen, Mogens Høgh (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU) Samf.

**Informing groundwater models with airborne time-domain electromagnetic data**

Department of Environmental Engineering  
Period: 01/10/2012 → 30/06/2016  
Number of participants: 6  
Phd Student:  
Marker, Pernille Aabye (Intern)  
Supervisor:  
Mosegaard, Klaus (Intern)  
Main Supervisor:  
Bauer-Gottwein, Peter (Intern)  
Examiner:  
Bjerg, Poul Løgstrup (Intern)  
Binley, Andrew (Ekstern)  
Hejberg, Anker Lajer (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU) Samf.

**Wastewater resource recovery via the Enhanced Biological Phosphorus Removal and Recovery (EBP2R) process coupled with green microalgae cultivation**

Department of Environmental Engineering  
Period: 01/10/2012 → 27/01/2016  
Number of participants: 6  
Phd Student:  
Valverde Pérez, Borja (Intern)  
Supervisor:  
Smets, Barth F. (Intern)  
Main Supervisor:  
Plósz, Benedek G. (Intern)  
Examiner:  
Trapp, Stefan (Intern)  
Oehmen, Adrian (Ekstern)  
Villez, Kris (Ekstern)

**Financing sources**  
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)

Relations
Publications:
Used water resource recovery using green microalgae  
Project: PhD

Projekt om afløb fra tagflader og befæstede arealer – vurdering af forureningsrisici for grundvand
Department of Environmental Engineering
Environmental Chemistry
Urban Water Engineering
Krüger A/S
Period: 27/09/2012 → 01/03/2013
Number of participants: 2
Acronym: Tag-risici
Project participant:
Eriksson, Eva (Intern)
Mikkelsen, Peter Steen (Intern)

Relations
Publications:
Afstrømning fra tagflader og befæstede arealer – Vurdering af forureningsrisici for grundvand
Project

Municipal organic waste management
Department of Environmental Engineering
Period: 15/09/2012 → 22/03/2016
Number of participants: 6
Phd Student:
Naroznova, Irina (Intern)
Supervisor:
Møller, Jacob (Intern)
Main Supervisor:
Scheutz, Charlotte (Intern)
Examiner:
Boldrin, Alessio (Intern)
La Cour Jansen, Jes (Intern)
Hansen, Trine Lund (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Algal biofilter optimization near fish farm
Department of Environmental Engineering
Period: 01/09/2012 → 29/02/2016
Number of participants: 6
Phd Student:
Silva Marinho, Goncalo (Intern)
Supervisor:
Holdt, Susan Løvstad (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Karakashev, Dimitar Borisov (Intern)
**Assessment of resource quality in waste management**

Department of Environmental Engineering  
Period: 01/09/2012 → 15/10/2013  
Number of participants: 4  
PhD Student:  
Vyzinkarova, Dana (Intern)  
Supervisor:  
Hellweg, Stefanie (Ekstern)  
Rechberger, Helmut (Ekstern)  
Main Supervisor:  
Astrup, Thomas Fruergaard (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU) Samf.  
Project: PhD

**Biomimetic polymeric membranes for water treatment**

Department of Environmental Engineering  
Period: 01/09/2012 → 15/12/2015  
Number of participants: 7  
PhD Student:  
Habel, Joachim Erich Otto (Intern)  
Supervisor:  
Almdal, Kristoffer (Intern)  
Geschke, Oliver (Intern)  
Main Supervisor:  
Hélix-Nielsen, Claus (Intern)  
Examiner:  
Ndoni, Sokol (Intern)  
Arleth, Lise (Intern)  
Bates, Frank (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: ErhvervsPhD-ordningen VTU  
Project: PhD

**Composition of municipal solid waste in Denmark**

Department of Environmental Engineering  
Period: 01/09/2012 → 01/09/2016  
Number of participants: 6  
PhD Student:  
Edjabou, Maklawe Essonanawe (Intern)  
Supervisor:  
Scheutz, Charlotte (Intern)  
Main Supervisor:  
Astrup, Thomas Fruergaard (Intern)  
Examiner:  
Kjeldsen, Peter (Intern)
Fischer, Christian (Ekstern)
Salhofer, Stefan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Environmental Effects and Risk Evaluation of Engineered Nanoparticles - Ecotoxicity
Department of Environmental Engineering
Period: 01/09/2012 → 15/12/2015
Number of participants: 6
Phd Student: Skjolding, Lars Michael (Intern)
Supervisor: Selck, Henriette (Ekstern)
Main Supervisor: Baun, Anders (Intern)
Examiner: Hansen, Steffen Foss (Intern)
Banta, Gary Thomas (Ekstern)
Henry, Theodore B. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Quantification and critical analysis of resource flows in Denmark
Department of Environmental Engineering
Period: 01/09/2012 → 29/09/2016
Number of participants: 6
Phd Student: Klinglmair, Manfred (Intern)
Supervisor: Astrup, Thomas Fruergaard (Intern)
Main Supervisor: Scheutz, Charlotte (Intern)
Examiner: Ibrom, Andreas (Intern)
Binder, Claudia R. (Ekstern)
Kirkeby, Janus Søgaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Anthropogenic phosphorus flows in Denmark
Project: PhD

Waste material recycling: Assessment of contaminants limiting recycling
Department of Environmental Engineering
Period: 15/08/2012 → 01/09/2016
Number of participants: 6
Phd Student: Pivnenko, Kostyantyn (Intern)
An innovative process for simultaneous utilization of hydrogen and in-situ biogas upgrading

This project proposes an innovative process in which hydrogen produced by water electrolysis using excess electricity from wind mills, will be biologically converted by binding CO2 to CH4 in biogas reactors. Simultaneous H2 utilization and in-situ biogas upgrading will be achieved in such process, giving synergistic advantages for both wind mills and biogas plants. The effects of hydrogen on the biochemistry and microbiology of the process, and the technical solutions for improving hydrogen utilization in the biogas reactors will be studied in order to optimize the conversion of hydrogen to methane in biogas reactors. This idea of the current project has never been applied and it offers several advantages: (1) Contributes to cheaper upgrading cost of biogas due to low CO2 content in biogas; (2) Increased energy efficiency by full utilization of the wind mill capacity; (3) Possibility to control electricity production according to the energy demand variations.

Department of Environmental Engineering
Period: 01/07/2012 → 30/06/2015
Number of participants: 2
Project ID: 30954
Project participant:
Angelidaki, Irini (Intern)
Project Manager, organisational:
Luo, Gang (Intern)
Project

Qualitative and Quantitative Methods for Evaluation of Human Exposure to Nanomaterials

Department of Environmental Engineering
Period: 01/06/2012 → 17/11/2016
Number of participants: 7
Phd Student:
Liguori, Biase (Intern)
Supervisor:
Hansen, Steffen Foss (Intern)
Jensen, Keld Alstrup (Ekstern)
Main Supervisor:
Baun, Anders (Intern)
Examiner:
Olsen, Stig Irving (Intern)
Riediker, Michael (Ekstern)
Tongeren, Martie Van (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Occupational Exposure Assessment of Nanomaterials using Control Banding Tools
Project: PhD
**Sustainable Production and Utilization of Microalgae for industrial wastewater treatment**

Department of Environmental Engineering  
Period: 01/06/2012 → 30/08/2017  
Number of participants: 7  
Phd Student:  
Podevin, Michael Paul Ambrose (Intern)  
Supervisor:  
Fotidis, Ioannis (Intern)  
Main Supervisor:  
Angelidaki, Irini (Intern)  
Examiner:  
Zhang, Yifeng (Intern)  
Zhang, Yifeng (Intern)  
Schmidt, Jens Ejbye (Intern)  
Schmidt, Jens Ejbye (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU) Samf.

**Relations**  
Publications:  
Microalgae biorefinery symbiosis: screening, production, and process analytical technology  
Project: PhD

**Energy-efficient, community-based water and wastewater-treatment systems for deployment in India**  
The overall aim of ECO-India is to design and develop innovative cost-effective solutions for community-based water- and wastewater-treatment systems. These systems will be deployed at pilot sites in arsenic-affected water-stressed regions in India. The two consortia, Indian (DST) and European (FP7), will establish pilot schemes for:  

- Catchment area and reservoir management  
- Surface water supply schemes  
- Arsenic removal (including monitoring using UFZ’s field-tested Arsolux arsenic sensor)  
- Disinfection treatment for potable water based on Trustwater’s CE-certified mixed-oxidant generation systems.  
- Online monitoring of water quality  
- Water distribution network, together with online/offline water quality monitoring programmes  
- Sewerage and wastewater treatment.

In addition, prototype energy-efficient modules for water deionisation and heavy metal removal will be developed. A feasibility study will be performed to assess the potential for energy harvesting from sludge.

Department of Environmental Engineering

**Residual Resource Engineering**  
Period: 18/04/2012 → 18/04/2015  
Number of participants: 2  
Acronym: ECO-India  
Project participant:  
Fotidis, Ioannis (Intern)  
Angelidaki, Irini (Intern)

**Aquatic toxicity testing for hazard identification of engineered nanoparticles**  
Department of Environmental Engineering  
Period: 01/04/2012 → 30/06/2016  
Number of participants: 7  
Phd Student:  
Sørensen, Sara Nørgaard (Intern)  
Supervisor:
Modelling the Fate and Optimizing the Removal of Selected Xenobiotic Organic Micropollutants from Point and Network Water Resources

Department of Environmental Engineering
Period: 01/04/2012 → 27/01/2016
Number of participants: 7
Phd Student:
Polesel, Fabio (Intern)
Supervisor:
Andersen, Henrik Rasmus (Intern)
Trapp, Stefan (Intern)
Main Supervisor:
Płosz, Benedek G. (Intern)
Examiner:
Eriksson, Eva (Intern)
Jeppsson, Ulf A. C. (Ekstern)
Johnson, David R. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Sustainable Production and Utilization of Microalgae

Department of Environmental Engineering
Period: 01/04/2012 → 21/04/2016
Number of participants: 6
Phd Student:
von Wagenen, Jonathan Myerson (Intern)
Supervisor:
De Francisci, Davide (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Karakashev, Dimitar Borisov (Intern)
Barbosa, Maria (Ekstern)
Eriksen, Niels Thomas (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Anvendelse af okker i Holbæk forsyning A/S
Ansøgning til VTU fonden om fuldskala afprøvning af anvendelse af okker internt i forsyningsselskabet.
Demonstrationsanlæg for Filtrering af vejvand for udledning til ferskvandsområde (DemFil).


Modeling the impact of soakaways on urban water flooding

Department of Environmental Engineering
Period: 01/02/2012 → 29/02/2016
Number of participants: 8
PhD Student:
Locatelli, Luca (Intern)
Supervisor:
Ambjerg-Nielsen, Karsten (Intern)
Helwigh, Ole Mark (Ekstern)
Mikkelsen, Peter Steen (Intern)
Main Supervisor:
Binning, Philip John (Intern)
Examiner:
Bauer-Gottwein, Peter (Intern)
Stovin, Virginia (Ekstern)
Troldborg, Lars (Intern)
Forbedret Rensning Og Desinfektion af Overløbsvand (FRODO)


Department of Environmental Engineering
Period: 30/01/2012 → 30/01/2014
Number of participants: 3
Acronym: MoreDesiCSO
Project participant:
Albrechtsen, Hans-Jørgen (Intern)
Mikkelsen, Peter Steen (Intern)
Project Manager, organisational:
Andersen, Henrik Rasmus (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Analysis of Requirments and Design og Epidemiological Studies in Cohorts og Nanomaterial Workers
Analysis of Requirments and Design og Epidemiological Studies in Cohorts og Nanomaterial Workers

Department of Environmental Engineering
Period: 01/01/2012 → 31/12/2016
Number of participants: 1
Acronym: COH-NAN
Project Manager, organisational:
Baun, Anders (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Environmental Effects and Risk Evaluation of Engineered Nanoparticle

The objective of the project Environmental Effects and Risk Evaluation of Engineered Nanoparticles (EnvNano) is to elucidate the particle specific properties that govern the ecotoxicological effects of engineered nanoparticles and in this way shift the paradigm for environmental risk assessment of nanomaterials. While current activities in the emerging field of nano-ecotoxicology and environmental risk assessment of nanomaterials are based on the assumption that the methodologies developed for chemicals can be adapted to be applicable for nanomaterials, EnvNano has a completely different starting point: The behaviour of nanoparticles in suspension is fundamentally different from that of chemicals in solution. Therefore, all modifications of existing techniques that do not take this fact into account are bound to have a
limited sphere of application or in the worst case to be invalid. By replacing the assumption of dissolved chemicals with a particle behaviour assumption, the traditional risk assessment paradigm will be so seriously impaired that a shift of paradigm will be needed. EnvNano is based on the following hypotheses: 1. The ecotoxicity and bioaccumulation of engineered nanoparticles will be a function of specific physical and chemical characteristics of the nanoparticles. 2. The environmental hazards of engineered nanoparticles cannot be derived from hazard identifications of the material in other forms. 3. Existing regulatory risk assessment procedures for chemicals will not be appropriate to assess the behaviour and potential harmful effects of engineered nanoparticles on the environment. These research hypotheses will be addressed in the four interacting research topics of EnvNano: Particle Characterization, Ecotoxicity, Bioaccumulation, and Framework for Risk Evaluation of Nanoparticles aimed to form the foundation for a movement from coefficient-based to kinetic-based environmental nanotoxicology and risk assessment. When successful, this will lead to significant changes in the way risk assessments of ENPs are performed. Thereby potential problematic ENPs may be identified at an early stage in the product development and safer alternatives may be found. In the light of the public concerns such knowledge is a prerequisite to a successful large-scale commercialization of nanotechnology.

Department of Environmental Engineering
Period: 01/01/2012 → 31/12/2017
Number of participants: 1
Acronym: EnvNano
Project Manager, organisational:
Baun, Anders (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Relations
Activities:
A Critical and in-depth analysis of the environmental aspect of the OECD SP dossiers
Project

Fjernelse af trikloramin og andre klorbiprodukter i svømmehaller med fotokemisk UV-behandling (DBP-UV)
...

Department of Environmental Engineering
Period: 01/01/2012 → 31/12/2012
Number of participants: 1
Acronym: DBP-UV
Project Manager, organisational:
Andersen, Henrik Rasmus (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Innovative biogas process for treating ammonia-rich wastes
One of the main causes for imbalance and low substrate utilization in Danish biogas plants is the high ammonia load. Ammonia is mainly inhibiting acetate-utilizing (acetoclastic) methanogens. There is however, another metabolic pathway, the acetate oxidation pathway, where acetate is oxidized by syntrophic acetate oxidizing bacteria (SAO) to hydrogen and carbon dioxide, followed by hydrogenotrophic methanogenesis, which is much less liable to ammonia inhibition. Up to now, six SAO bacteria have been identified and five of them were classified as acetogenic bacteria. Acetogenic bacteria are following the reductive Wood-Ljungdahl pathway to produce acetate as basic end-product. Acetogenic SAO bacteria, under high ammonia conditions, use reversed Wood-Ljungdahl pathway to syntrophically convert acetate to methane in association with hydrogenotrophic methanogens. These findings are a strong indication that reversed Wood-Ljungdahl pathway of SAO bacteria has significant role in methanogenesis of high ammonia containing waste. In the current project we’ll develop a new approach to avoid or counteract ammonia inhibition and optimize the anaerobic digestion of ammonia-rich wastes. The main objective of the project is to establish a process promoting acetate oxidation, for optimal digestion of ammonia rich waste. A pilot scale bioreactor digesting ammonia-rich wastes will implement, for further process development.

Department of Environmental Engineering
Period: 01/01/2012 → 31/12/2015
Number of participants: 1
**SAO-Dom**

**Project participant:**
Angelidaki, Irini (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

**KOMBI-cultivation: Integrated aquaculture of fish, seaweed, and mussels for feed and food**

Projektets grundidé er at muliggøre en femdobling af havbrugsproduktionen i Danmark og sikre erhvervets internationale konkurrencedygtighed uden at belaste vandmiljøet med kvælstof (N), samtidig med at der udvikles et forretningsområde baseret på produktion af tang til konsum og muslinger til foder.

Department of Environmental Engineering
Period: 01/01/2012 → 31/03/2015
Number of participants: 1
Acronym: KOMBI-cultivation
Project participant:
Angelidaki, Irini (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

**Regn med kvalitet**


Department of Environmental Engineering
Environmental Chemistry
Period: 01/01/2012 → 01/07/2014
Number of participants: 6
Acronym: RegnKval
Project participant:
Eriksson, Eva (Intern)
Mikkelsen, Peter Steen (Intern)
Andersen, Henrik Rasmus (Intern)
Lützhøft, Hans-Christian Holten (Intern)
Sharma, Anitha Kumari (Intern)
Nielsen, Katrine (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

**Space technology for water management**

Floods and droughts are among the most dangerous and costly natural hazards. Within just the past 12 months, catastrophic floods have affected Pakistan, Brazil and Australia, while extreme drought is presently threatening China’s grain harvest and causing a global food price hike. The aim of HydroSpace is to significantly improve the real-time forecasting of extreme hydrological events at regional scales by combining new space-borne earth observation data with
advanced numerical simulation models. HydroSpace results will support management of water-related hazards and will provide the technology for a global hydrological forecasting and early warning system.

Department of Environmental Engineering
Period: 01/01/2012 → 31/12/2015
Number of participants: 1
Acronym: Hydrospace
Project Manager, organisational:
Bauer-Gottwein, Peter (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

SvømSundt
Innovationskonsortio om teknik til konstruktion af sundere svømmehallar

Department of Environmental Engineering
Period: 01/01/2012 → 01/01/2015
Number of participants: 1
Acronym: SvømSundt
Project Manager, organisational:
Andersen, Henrik Rasmus (Intern)

Project

The MacroAlgae Biorefinery
The MacroAlgae Biorefinery

Department of Environmental Engineering
Period: 01/01/2012 → 31/12/2015
Number of participants: 2
Acronym: MAB
Project participant:
Angelidaki, Irini (Intern)
Karakashev, Dimitar Borisov (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Kombinationsopdræt af havbrugfisk, tang, muslinger til foder og konsum

National Food Institute
Research Group for Bioactives – Analysis and Application
Department of Environmental Engineering
Residual Resource Engineering
Period: 15/12/2011 → 01/04/2015
Number of participants: 3
Acronym: Kombiopdræt
Project participant:
Holdt, Susan Løvstad (Intern)
Silva Marinho, Goncalo (Intern)
Angelidaki, Irini (Intern)

Financing sources
Source: Public research programme (public)
Name of research programme: GUDP
Amount: 14,600,000.00 Danish Kroner
Biorefinery
Department of Environmental Engineering
Period: 15/12/2011 → 26/01/2015
Number of participants: 6
Phd Student:
Gunnarsson, Ingólfur Bragi (Intern)
Supervisor:
Karakashev, Dimitar Borisov (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Dechesne, Arnaud (Intern)
Norddahl, Birgir (Ekstern)
Verstraete, Willy (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Characterisation and treatment of nano-sized and colloidal xenobiotic pollution in stormwater
Department of Environmental Engineering
Period: 15/12/2011 → 02/09/2015
Number of participants: 7
Phd Student:
Nielsen, Katrine (Intern)
Supervisor:
Baun, Anders (Intern)
Stromvall, Ann-Margret (Ekstern)
Main Supervisor:
Eriksson, Eva (Intern)
Examiner:
Lützhøft, Hans-Christian Holten (Ekstern)
Holm, Peter Engelund (Intern)
Viklander, Maria (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Integrated environmental and economical assessment of waste management systems
Department of Environmental Engineering
Period: 15/12/2011 → 22/03/2016
Number of participants: 5
Phd Student:
Martinez Sanchez, Veronica (Intern)
Main Supervisor:
Astrup, Thomas Fruergaard (Intern)
Examiner:
Rygaard, Martin (Intern)
Eriksson, Ola Norman (Ekstern)
Herczeg, Márton (Ekstern)

Financing sources
Occurrence and degradation of contaminants at the groundwater surface water interface

Department of Environmental Engineering
Period: 15/12/2011 → 29/02/2016
Number of participants: 7
Phd Student:
Brauns, Bentje (Intern)
Supervisor:
Jakobsen, Rasmus (Intern)
Song, Xianfang (Ekstern)
Main Supervisor:
Bjerg, Poul Logstrup (Intern)
Examiner:
Albrechtsen, Hans-Jørgen (Intern)
Holm, Peter Engelund (Intern)
Liu, Suxia (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Resistance to gene flow in soil microbial communities

Department of Environmental Engineering
Period: 15/12/2011 → 02/09/2015
Number of participants: 6
Phd Student:
Klümper, Uli (Intern)
Supervisor:
Dechesne, Arnaud (Intern)
Main Supervisor:
Smets, Barth F. (Intern)
Examiner:
Albrechtsen, Hans-Jørgen (Intern)
Graham, David W. (Ekstern)
Rensing, Christopher (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Groundwater resources of the Barotse Sub-basin in the Western Province of Zambia

Department of Environmental Engineering
Period: 01/12/2011 → 01/07/2015
Number of participants: 8
Phd Student:
Chongo, Mkhuzo (Intern)
Supervisor:
Christiansen, Anders Vest (Ekstern)
Larsen, Flemming (Intern)
Nyambe, Imasiku (Ekstern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)
Intelligent Barriers: Management of Microbial Activity in Groundwater Extraction Wells for Pesticide Attenuation

Department of Environmental Engineering
Period: 01/12/2011 → 12/09/2016
Number of participants: 6
Phd Student: Papadopoulou, Aikaterini (Intern)
Supervisor: Albrechtsen, Hans-Jørgen (Intern)
Main Supervisor: Smets, Barth F. (Intern)
Examiner: Andersen, Henrik Rasmus (Intern)
Aamand, Jens (Ekstern)
Springael, Dirk (Ekstern)

Origin and sustainable use of fresh groundwater in Western Zambia

Department of Environmental Engineering
Period: 01/12/2011 → 23/09/2015
Number of participants: 8
Phd Student: Banda, Kawawa Eddy (Intern)
Supervisor: Jakobsen, Rasmus (Intern)
Larsen, Flemming (Intern)
Nyambe, Imasiku (Ekstern)
Main Supervisor: Bauer-Gottwein, Peter (Intern)
Examiner: Rolle, Massimo (Intern)
Post, Vincent E.A. (Ekstern)
Postma, Diederik Jan (Intern)

The role of micro-niches and chemical gradients for the degradation of contaminants in groundwater

Department of Environmental Engineering
Period: 01/12/2011 → 02/09/2015
Number of participants: 7
Phd Student:
Pedersen, Lasse (Intern)
Supervisor:
Dechesne, Arnaud (Intern)
Jakobsen, Rasmus (Intern)
Main Supervisor:
Smets, Barth F. (Intern)
Examiner:
Binning, Philip John (Intern)
Brandt, Kristian K. (Ekstern)
Tebbe, Christoph (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Eco-toxicity of Engineered Nanoparticles - Towards Standardized Procedures for Hazard Assessment
Department of Environmental Engineering
Period: 15/11/2011 → 01/07/2015
Number of participants: 6
Phd Student:
Cupi, Denisa (Intern)
Supervisor:
Hartmann, Nanna B. (Intern)
Main Supervisor:
Baun, Anders (Intern)
Examiner:
Lützhøft, Hans-Christian Holten (Ekstern)
Joner, Erik Jautris (Ekstern)
Winther-Nielsen, Margrethe (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Risk Management of Climate Extremes in an Urban Environment
Department of Environmental Engineering
Number of participants: 8
Phd Student:
Äström, Helena Lisa Alexandra (Intern)
Supervisor:
Friis-Hansen, Peter (Intern)
Madsen, Henrik (Intern)
Rosbjerg, Dan (Intern)
Main Supervisor:
Arnberg-Nielsen, Karsten (Intern)
Examiner:
Mikkelsen, Peter Steen (Intern)
Henriksen, Hans Jørgen (Ekstern)
Merz, Bruno (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD
**Miljøprofil projektet. Samarbejdsaftale om Samfinansieret Forskning mellem DTU og Vestforbrænding.**


**Department of Environmental Engineering**

**Period:** 04/11/2011 → 31/12/2012  
**Number of participants:** 1  
**Acronym:** Miljøprofil projektet  
**Project ID:** 30899  
**Project Manager, organisational:** Møller, Jacob (Intern)

**Financing sources**

**Source:** Sam.arb.aftaler, Private danske - Andre virksomheder  
**Name of research programme:** Ukendt  
**Amount:** 0.00 Danish Kroner  
**Project**

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**Increased removal of the priority substances under the EU Water framework directive by enhanced biological treatment using mobile carriers.**

Can the removal of PS and PHS be increased using mobile carriers, and if so, what benefit has this on the sludge quality.

**Department of Environmental Engineering**

**Period:** 01/11/2011 → 30/06/2012  
**Number of participants:** 2  
**Acronym:** 1178  
**Project participant:** Olsson, Mikael Emil (Intern)  
**Project Manager, organisational:** Eriksson, Eva (Intern)

**Financing sources**

**Source:** Unknown  
**Name of research programme:** Ukendt  
**Amount:** 0.00 Danish Kroner  
**Project**

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**New processes in anoxic groundwater systems: the anaerobic oxidation of ammonia (anammox)**

**Department of Environmental Engineering**

**Period:** 01/11/2011 → 31/08/2013  
**Number of participants:** 3  
**Phd Student:** Uldahl, Anne Graham (Intern)  
**Supervisor:** Jakobsen, Rasmus (Intern)  
**Main Supervisor:** Bjerg, Poul Legstrup (Intern)

**Financing sources**

**Source:** Internal funding (public)  
**Name of research programme:** Institut stipendie (DTU)  
**Project:** PhD
Redegørelse om sundhedseffekter af blødgøring spicielt med fokus på caries

Department of Environmental Engineering
Period: 15/10/2011 → 01/02/2012
Number of participants: 2
Acronym: sundhedseffekter - caries
Project participant:
Albrechtsen, Hans-Jørgen (Intern)
Rygaard, Martin (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Does spreading of digested sludge on agricultural land generate an increase in the levels of organic pollutants in soil and crop?
Pre-screening of accumulation of organic pollutants in soil and crops in Southern Sweden (Malmö). The DTU contribution consists of application of "CHIAT : Chemical hazard identification and assessment tool for selection of priority pollutants"

Department of Environmental Engineering
Lund Institute of Technology
Period: 01/10/2011 → 31/03/2012
Number of participants: 2
Acronym: CHIAT-Sludge
Project participant:
Eriksson, Eva (Intern)
Hörsing, Maritha (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Relations
Publications:
Organiska miljögifter i sockerbetor och blast odlade på mark gödslad med kommunalt avloppsslam

Sustainable Remediation
Development of tool for assessment of sustainability of remediation projects

Department of Environmental Engineering
Period: 01/10/2011 → 31/12/2013
Number of participants: 3
Acronym: SustRem
Project ID: 30877
Project participant:
Binning, Philip John (Intern)
Vanddikvalitet og terminologi for alternativ vandforsyning; Rammeaftale Fremtidens vandhåndtering i storbyer


Department of Environmental Engineering
Period: 01/10/2011 → 30/03/2012
Number of participants: 2
Acronym: terminologi
Project participant:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Managing flow equalised storm- and wastewater

Hverdagsaktiviteter som transport, boligopvarmning, bilvask, brug af medicin og rengøring resulterer i udledning af miljøfremmede stoffer til vandmiljøet gennem regnvand og husholdningsspildevand. Det samme gør sig gældende for byggematerialer, bygninger og elektroniske produkter, der tilsvarende ved brug og bortskaffelse kan resultere i udledning af miljøfremmede stoffer. I tilfælde af kraftig regn, kan kombinerede husholdningsspildevandsoverløb til rekreative vandmiljøer undgås? Således at idrætsudøvere ikke udsættes for bakterier og miljøfremmede stoffer, som det eks. skete ved et sportsstævne i sommeren 2010 og for at urbane aktiviteter ikke er med til at ødelægge vores vandmiljø. Formålet med dette projekt er at undersøge udvalgte miljøfremmede stoffers binding til partikler som bæres med regnvand og spildevand og derfor bliver transporteret fra det urbane miljø til vandmiljøet. Det vil blive undersøgt om forlænget opholdstid i regnvandsbassiner, der tillader partikler at falde til bunds, er en tilstrækkelig og anvendelig renseteknologi, således at det rensende vand uden risiko kan udledes til vandmiljøet. Når detaljeret viden om miljøfremmede stoffers binding til partikler og viden om partiklernes evne til at bundfældes er opnået, kan denne viden medvirke til at forbedre matematiske modeller for regnvandsbassiner. Disse modeller bruges til at beregne opholdstid og størrelse af regnvandsbassiner, hvorfor sådanne krav kan tages med i designfasen af regnvandsbassiner.

Department of Environmental Engineering
Period: 01/09/2011 → 31/08/2014
Number of participants: 3
Acronym: MagiqStorm
Project participant:
Mikkelsen, Peter Steen (Intern)
Trapp, Stefan (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Resource Recovery from Waste Incineration Bottom Ashes
Using hydro-economic modelling to support water resources and water quality management in China

Department of Environmental Engineering
Period: 01/09/2011 → 01/07/2015
Number of participants: 8
Phd Student:
Davidsen, Claus (Intern)
Supervisor:
Liu, Suxia (Ekstern)
Mo, Xingguo (Ekstern)
Rosbjerg, Dan (Intern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)
Examiner:
Rygaaard, Martin (Intern)
Jia, Shaofeng (Ekstern)
Tilmant, Amaury (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Virkemidler til sikker anvendelse af nanomaterialer.
Projektet tilvejebringer ny og mere nuanceret viden om de grundlæggende behov for vejledning og virkemidler på dette område. I regeringens udspil til en ny arbejdsmiljøstategi frem mod 2020 er der lagt op til en prioritering af et nanovidencenter med fokus på arbejdsmiljø. Indeværende projekt skaber ligeledes indput til relevante aktiviteter og tiltag under denne satsning. Projektets forventes yderligere at give viden om virksomhedernes indsamling og prioritering af arbejdsliter relevant viden, som kan være gavnlig inden for andre risikområder præget af videnskabelig usikkerhed og sparsom regulering.

Department of Environmental Engineering
Period: 01/08/2011 → 31/12/2012
Number of participants: 1
Acronym: VirkNano
Project Manager, organisational:
Baun, Anders (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,367,523.00 Danish Kroner
Chemical options for desinfection of combined sewer overflows
(Kemisk desinfektion af kloakoverløb)

Department of Environmental Engineering

Urban Water Engineering
Period: 01/07/2011 → 31/12/2012
Number of participants: 6
Acronym: DesiCSO
Project ID: 30879
Project participant:
Eriksson, Eva (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Mikkelsen, Peter Steen (Intern)
Sharma, Anitha Kumari (Intern)
Chhetri, Ravi Kumar (Intern)

Project Manager, organisational:
Andersen, Henrik Rasmus (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Relations
Activities:
Design of Chemical Disinfection of Combined Sewer Overflows (CSO) by Peracetic Acid & Performic Acids
IP06 DesiCSO - Desinfektion af "Combined Sewer Overflow", CSO

CentrE for Environmental and Agricultural Microbiology2.
Collaborative research project that aims at identifying barriers to microbial degradation of pesticides and antibiotics in agricultural soils and at identifying mechanisms underpinning to the spread of antibiotic resistance genes and resistant organism in this type of systems.

Department of Environmental Engineering
Period: 01/06/2011 → 31/05/2014
Number of participants: 2
Acronym: CREAM2
Project ID: 30817
Project participant:
Dechesne, Arnaud (Intern)

Project Manager, organisational:
Smets, Barth F. (Intern)

Financing sources
Source: Forsk. Private danske - Fonde
Name of research programme: Ukendt
Amount: 3,000,000.00 Danish Kroner

Heat Storage in Hot aquifers
Department of Civil Engineering
Section for Geotechnics and Geology
Center for Energy Resources Engineering
Department of Environmental Engineering
Investigatin the feasibility of phytoremediation and phytoscreening

Department of Environmental Engineering
Period: 01/06/2011 → 01/07/2015
Number of participants: 7
Phd Student: Nielsen, Mette Algreen (Intern)
Supervisor: Broholm, Mette Martina (Intern)
Mayer, Philipp (Intern)
Main Supervisor: Trapp, Stefan (Intern)
Examiner: Kjeldsen, Peter (Intern)
Burken, Joel Gerard (Ekstern)
Larsen, Morten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

AFATEK
Det er samarbejdsaftalens formål at udarbejde en miljøvurdering af nye teknikker til sortering af slagger hos AFATEK. Forskningen ligger inden for følgende fagområde: Livscyklusvurdering af sortering af slagger fra affaldsforbrændingsanlæggene under AFATEK baseret på nye sorteringsteknikker: 1 project management 2 recovery of metals 3 recovery of minerals 4 product development and applications 5 environment and economy

Department of Environmental Engineering
Period: 17/05/2011 → 31/12/2014
Number of participants: 1
Acronym: AFATEK
Project ID: 30875
Project Manager, organisational: Astrup, Thomas Fruergaard (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Ukendt
Amount: 1,570,000.00 Danish Kroner
Project

AV Miljø Deponeringsanlæg
Det er samarbejdsaftalens formål af gennemføre et pilotstudie for benyttelse af biocover metoden til reduktion af metanmission fra AV Miljøs deponeringsanlæg

Department of Environmental Engineering
Period: 01/05/2011 → 15/12/2012
Number of participants: 1
Acronym: Biocover AV Miljø
Project ID: 30855
Project Manager, organisational:
Bayesian methods for uncertainty analysis of extremes based on multi-model techniques

Department of Environmental Engineering
Period: 01/04/2011 → 27/08/2014
Number of participants: 6
Phd Student:
Sunyer Pinya, Maria Antonia (Intern)
Supervisor:
Rosbjerg, Dan (Intern)
Main Supervisor:
Arnbjerg-Nielsen, Karsten (Intern)
Examiner:
Binning, Philip John (Intern)
Kilsby, Chris (Ekstern)
Refsgaard, Jens Christian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Innovationskonsortiet: Renseteknologier til fremtidens akvakultur
Innovationskonsortiet: Renseteknologier til fremtidens akvakultur

Department of Environmental Engineering
Period: 01/04/2011 → 31/03/2014
Number of participants: 0
Acronym: REFA
Project ID: 30861

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Heat Storage in Hot Aquifers

Department of Civil Engineering
Section for Geotechnics and Geology
Center for Energy Resources Engineering
Department of Informatics and Mathematical Modeling
Scientific Computing

Department of Environmental Engineering
Period: 01/03/2011 → 28/02/2012
Number of participants: 4
Project participant:
Mosegaard, Klaus (Intern)
Kjøller, Claus (Intern)
Phd Student:
Rosenbrand, Esther (Intern)
Managing Risks of NanoMATERIALs
MARINA will address the four central themes: Materials, Exposure, Hazard, and Risk and develop beyond-state-of-the-art referential tools and integrate them for both human health and environment.

Department of Environmental Engineering
Period: 01/03/2011 → 28/02/2015
Number of participants: 3
Acronym: MARINA
Project ID: 30860
Project participant:
Hansen, Steffen Foss (Intern)
Hartmann, Nanna B. (Intern)
Project Manager, organisational:
Baun, Anders (Intern)

Financing sources
Source: Forsk. EU - Andre EU-midler
Name of research programme: Ukendt
Amount: 2,115,000.00 Danish Kroner

Microbiologically coupled Fe-oxide reduction and methanogenesis – a new type of microbial consortium
Frigivelsen af CH4 (metan) og forekomsten af opløst Fe og CH4 har betydning for både klima, vandmiljø og vandforsyningen. Mikrobiel omsætning af organisk stof ved redoxprocesser sker overordnet i en sekvens: O2→O(-II), nitrat→N(0), Mn-oxid→Mn(II), Fe-oxid→Fe(II), sulfat→S(-II) og CO2→CH4, hvorved mikroorganismerne kan udnytte energien bundet i det organiske stof. Der er mange modifikationer til dette forenkledte bilde. Fe(II) og S(-2) dannet fra Fe-oxid og sulfat bruges som elektron donor ved reduktion af nitrat, ligesom CH4 kan indgå som elektron donor for sulfat reduktion i et særligt samspil mellem bestemte mikroorganismer. Udgangspunktet for dette projekt er at flere undersøgelser tyder på at der kan opstå en anden type relation, i form af en samtidig reduktion af Fe-oxide og dannelsen af methan. En faktor der kan betinge dette er at nogle Fe-oxide er så stabile at det kræver meget reducerede forhold, som dem man finder ved methandannelse, for at de overhovedet kan reduceres. De parallelle løbende processe giver mulighed for en ny type konsortie af mikroorganismere som udnytter at når de to processer foregår samtidigt, så vil produktlerne i form af uorganisk kulstof (carbonat) og opløst Fe(II) fjernes som FeCO3 (siderit) så den energi der kan opnås ved reaktionen forbliver høj. Det er endda muligt at mikroorganismere selv medierer udgræsningen af siderit. Interaktionen kan have stor betydning for methanproduktionen i rismarker, en vigtig klimakomponent, for biogas dannelsel udfra slam tilsat Fe-oxid med henblik på fosfat fjernelse, for anarobe drikkevandsforekomster med methan og Fe - herunder den frigivelse af arsen fra Fe-oxide som foregår i sådanne systemer i SØ-Asien hvor > 50 mill mennesker forgiftes af deres drikkevand.

Department of Environmental Engineering
Period: 01/02/2011 → 31/01/2013
Number of participants: 1
Acronym: FeRedMethGen
Project Manager, organisational:
Jakobsen, Rasmus (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Rötning av slam vid 35, 55 och 60 oC – utvärdering av hygieniseringseffekt, biogasproduktion samt reduktion av läkemedel och andra industri kemikalier
Projektets syfte är att utvärdera om rötning av slam vid 60 °C går att etablera och driva stabilt för att säkerställa det av Naturvårdsverket föreslagna slamhygieniseringskravet. Vidare skall det i projektet fastställas om rötning vid 60 °C ger en signifikant bättre hygienisering än vid 55 °C vilket skulle kunna motivera en kortare exponeringstid. Dessutom värderas om exponeringstider 2-2,5 timmar ger signifikant sämre hygienisering än rötning vid längre exponeringstid (6h). Rötning vid 35 °C utförs parallellt med de andra testerna för att användas som referens. Inom projektet utvärderas om utrötning och metanproduktion ger så mycket energivinster att rötning vid högre temperatur kan motiveras. Nedbrytning av läkemedel
och andra industriemikalier kan även utvärderas parallellt i en separat del av projektet (del 2).

Department of Environmental Engineering

Lund Institute of Technology
Period: 01/02/2011 → 01/04/2012
Number of participants: 1
Acronym: 1174
Project ID: 30814
Project Manager, organisational: Eriksson, Eva (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Ukendt
Amount: 82,000.00 Danish Kroner

Relations
Publications:
Rötning av avloppsslam vid 35, 55 och 60 °C

Risk based design in a changing climate
The main objective of the RiskChange project is to establish a consistent scientifically-based framework for risk-based design of critical infrastructure that includes state-of-the-art knowledge of projected changes in climate extremes.

Department of Environmental Engineering
Period: 03/01/2011 → 31/12/2014
Number of participants: 2
Acronym: RiskChange
Project ID: 30809
Project participant:
Rosbjerg, Dan (Intern)
Ambjerg-Nielsen, Karsten (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 2,616,480.00 Danish Kroner

Risk-based design in a changing climate
The main objective of the RiskChange project is to establish a consistent scientifically-based framework for risk-based design of critical infrastructure that includes state-of-the-art knowledge of projected changes in climate extremes.

Department of Management Engineering

Systems Analysis

DTU Climate Centre

Energy Systems Analysis

Department of Environmental Engineering

Urban Water Engineering
Period: 01/01/2011 → 31/12/2014
Number of participants: 5
climate change adaptation, climate risk, extreme events, infrastructure
Acronym: RiskChange
Project participant:
Gregg, Jay Sterling (Intern)
Halsnæs, Kirsten (Intern)
Kaspersen, Per Skougaard (Intern)
Åström, Helena Lisa Alexandra (Intern)
Biological removal of iron and manganese in rapid sand filters - Process understanding of iron and manganese removal

Department of Environmental Engineering
Period: 01/01/2011 → 15/12/2013
Number of participants: 3
Phd Student:
Lin, Katie (Intern)
Supervisor:
Smets, Barth F. (Intern)
Main Supervisor:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

From surveillance to risk management – Risk management in the water supply
The goal of the project is to develop and implement risk management as part of the climate change adaptation strategy in the water supply.

Department of Environmental Engineering
Department of Systems Biology
Urban Water Engineering
Period: 01/01/2011 → 31/12/2013
Number of participants: 6
Acronym: RiskStyr-VF
Project ID: 30850
Project participant:
Corfitzen, Charlotte B. (Intern)
Ambjerg-Nielsen, Karsten (Intern)
Larsen, Sille Lyster (Intern)
Rygaard, Martin (Intern)
Christensen, Sarah Christine Boesgaard (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 1,150,000.00 Danish Kroner

Relations
Publications:
Erfaringsopsamling af vandforsyningers læring i relation til Dokumenteret Drikkevandssikkerhed, monitoring ogforureningssituationer
Project

Future water management in big cities
Large cities (>200 000 inhabitants) are facing a range of challenges in managing the urban water cycle. Climate change, EU Water Framework Directive, over-exploited groundwater resources and pollution makes it increasingly difficult to manage the urban water infrastructure development. This collaboration is a framework for the development of tools and methods for enlightened decision making in urban water management.

Department of Environmental Engineering
Period: 01/01/2011 → 31/12/2015
Number of participants: 2
Acronym: FVS
Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

LCA model for sewage sludge - an EASEWASTE extension
Department of Environmental Engineering
Period: 01/01/2011 → 19/12/2014
Number of participants: 6
Phd Student: Yoshida, Hiroko (Intern)
Supervisor: Christensen, Thomas Højlund (Intern)
Main Supervisor: Scheutz, Charlotte (Intern)
Examiner: Damgaard, Anders (Intern)
Jönsson, Håkan (Ekstern)
Hansen, Trine Lund (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Microbial Ecological Investigation of Rapid Sand Filtration
Department of Environmental Engineering
Period: 01/01/2011 → 05/11/2014
Number of participants: 6
Phd Student: Gülay, Arda (Intern)
Supervisor: Albrechtsen, Hans-Jørgen (Intern)
Main Supervisor: Smets, Barth F. (Intern)
Examiner: Bælum, Jacob (Intern)
Schramm, Andreas (Ekstern)
Sloan, William T. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Activities:
DNA and RNA SIP reveal nitrifiers in groundwater fed biofilters
DNA and RNA SIP reveal ammonium and nitrite oxidizers in groundwater fed biofilters
Project: PhD

Model-based analysis and optimization of biological rapid sand filters at pilot and full scale
Department of Environmental Engineering
**Molecular and Microbial Analysis of Nitritation/Anammox Aggregates towards Optimization of Autotrophic Nitrogen Removal in Membrane Bioreactors**

Department of Environmental Engineering  
Period: 01/01/2011 → 27/05/2015  
Number of participants: 6  
Phd Student: Mutlu, A. Gizem (Intern)  
Supervisor: Sin, Gürkan (Intern)  
Main Supervisor: Smets, Barth F. (Intern)  
Examiner: Plósz, Benedek G. (Intern)  
Joss, Adriano (Ekstern)  
Wilén, Britt-Marie (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU) Samf.  
Project: PhD

**Recirculation technology for future aquaculture (REFA) (38843)**

An Innovation Consortia with many industrial partners. In the project, basic and applied research was performed by several partners to support the development of new and energy-efficient technologies for recirculation systems.

Some of the research issues were:  
- to develop new filter technologies and energy-efficient aeration systems  
- to develop process- and CFD models to improve our understanding and insight into dynamic variation in water quality parameters  
- to determine the importance of particulate matter for biofilter operation (this was the DTU Aqua research package)  
- to develop tools and instruments for advanced regulation and control of recirculating aquaculture systems  
- to develop technologies for waste management

Twelve larger Danish companies were further partners in this project.

The project was coordinated by Danish Hydraulic Institute, Denmark.

The project was funded by the Danish Agency for Science, Technology and Innovation and the participating companies.

Department of Environmental Engineering
National Institute of Aquatic Resources
Section for Aquaculture
DHI Denmark
Aalborg University
Period: 01/01/2011 → 31/03/2015
Number of participants: 3
Research area: Aquaculture
Project participant:
Pedersen, Lars-Flemming (Intern)
Fernandes, Paulo (Intern)
Project Manager, academic:
Pedersen, Per Bovbjerg (Intern)

Remediation stop criteria
DTU will address the major NorthPestClean project aim of developing measurable remediation stop criteria for the cleanup of Høfde 42 based on risk assessments of the site. Specifically, DTU will provide: 1) A risk assessment for the site including i) an assessment of the post cleanup contaminant flux leaching from the site ii) an assessment of the transport pathways to the downstream receptor, here defined to be the North Sea iii) An assessment of the PEC (Predicted Environmental Concentration). PNEC (predicted No Effect Concentration) values in the North Sea and ecological assessments will be based on existing information. 2) Recommendations for remediation stop criteria for the site. These criteria will be based on the risk assessment and will define how to assess when acceptable clean up of the site has been achieved. Points of compliance will be identified and the relevant measurement/reporting parameters defined. The points of compliance are the locations and times at which to monitor remediation outcomes.

Department of Environmental Engineering
Period: 01/01/2011 → 31/12/2013
Number of participants: 3
Acronym: NorthPestClean
Project ID: 30851
Project participant:
Kusk, Kresten Ole (Intern)
Bjerg, Poul Løgstrup (Intern)
Project Manager, organisational:
Binning, Philip John (Intern)

Financing sources
Source: Unknown
Name of research programme: Uknown
Amount: 300,000.00 Danish Kroner
Tailored Improvement of Brownfield Regeneration in Europe

Brownfield regeneration is essential for sustainable land management in European Member States. Currently, the success in brownfield regeneration is unsatisfying in terms of financial and eco-efficiency or social acceptance. Many useful and innovative technologies site clean-up as well as methods to support decision making processes exist, but they are only rarely applied using their full potential. An immense diversification of tools with little connection to each other as well as a lack of consideration of regional and cultural specificities deters end-users from application. Sometimes the non-visibility of tools is the reason that problem owners, managers, local authorities and other stakeholders do not regenerate brownfields using the best technology available. Additionally, emerging challenges, such as the urgent demand for soil remediation and the reuse of on-site infrastructures, call for the development of new and integrated solutions. This project will overcome existing barriers to brownfield regeneration by developing and providing customised problem- and target-oriented packages of approaches, technologies and tools. As a unique asset, these packages deliberately include the cultural and administrative characteristics and their regionally distinctive features. By providing a customisable toolbox specifically addressing the diverse processes that have to be dealt with during the course of a regeneration project, end-users will be enabled to find best practice based solutions. Improvement of existing means to support brownfield regeneration will be further accomplished by filling methodological core topics such as intelligent remediation in terms of technological advancements with regard to phytoremediation and partial source removal technologies. The project will deliver a tailored training and dissemination programme as part of an information centre that will transfer existing and emerging knowledge to the scientific community and end-users.

Department of Environmental Engineering
Period: 01/01/2011 → 30/06/2014
Number of participants: 0
Acronym: TIMBRE
Project ID: 30807

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Ukendt
Amount: 2,400,000.00 Danish Kroner
Project

Reducing uncertainty in future extreme precipitation

Department of Environmental Engineering
Period: 15/12/2010 → 19/12/2014
Number of participants: 7
Phd Student:
Sørup, Hjalte Jomo Danielsen (Intern)
Supervisor:
Ambjerg-Nielsen, Karsten (Intern)
Christensen, Ole B (Ekstern)
Main Supervisor:
Mikkelsen, Peter Steen (Intern)
Examiner:
Binning, Philip John (Intern)
Jonas, Olsson (Ekstern)
Thorndahl, Søren (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Innovationskonsortiet: Byer i Vandbalance
Konsortiets formål er at forbedre danske byers balancen og at styrke danske virksomheders position på det internationale marked for klimatopslasing og bæredygtig forvaltning af ferskvandsressourcen, ved 1. at udvikle et koncept for urbane vandsystemer (drikkevand, spildevand, naturlige vandelementer), der opererer på deloplandsniveau, og som imødekommer den universelle ideal-situation karakteriseret i Figur 1, for hvilken det gælder a. at byen ikke overudnytter sit hydrologiske opland, b. at byen ikke belaster det omgivende miljø med miljøskadelige stoffer, samt Figur 1: Når den aktuelle danske dagsorden (venstre cirkel) sammenholdes med den dominerende globale dagsorden (højre cirkel) for urban vandhåndtering, ses der at være et skalamæssigt stort spænd i udfordringernes omfang, men et interessant sammenfald hvad angår temaer. Dette kan udnyttes til at definere en række fælles målsætninger under overskriften byer i vandbalance, repræsentere værdiskabelser af relevans på begge skalaer og for både danske og udenlandske markede. c. at byen etablerer en stærk grøn struktur i og omkring byen til håndtering af klimafordømninger, dæmpning af klimafordømninger, understøttelse af biodiversitet, og som element i byboernes velbefindende 2. at efterprøve tilhørende
systemteknologier i fysiske 1:1 anlæg for følgende udvalgte aspekter

Department of Environmental Engineering
Period: 10/12/2010 → 31/12/2014
Number of participants: 2
Acronym: Byer i Vandbalance
Project ID: 30844
Project participant:
Binning, Philip John (Intern)
Project Manager, organisational:
Binning, Philip John (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Resins for disinfection of drinking water
SafeWater APS develops new surfaces for disinfection of drinking water. The project will develop protocols for test and documentation of effects of new surfaces at three levels. Test protocols will be used to investigate surfaces in the development process.

Department of Environmental Engineering
Number of participants: 2
Acronym: REDD
Project ID: 30811
Project participant:
Corfitzen, Charlotte B. (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Ukendt
Amount: 74,475.00 Danish Kroner

DUC EOR Feasibility
chalk and shale characterization for CO2 injection experiments.

Department of Environmental Engineering
Period: 01/11/2010 → 31/12/2011
Number of participants: 2
Acronym: 1171
Project participant:
Alam, Mohammad Monzurul (Intern)
Project Manager, organisational:
Fabricius, Ida Lykke (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 590,000.00 Danish Kroner

Kjærgård grube 3-6.
I forbindelse med risikovurdering af udvaskningen fra gruberne til havmiljøet, foreslås det derfor, at supplere de øvrige undersegelser med udførelse af økotoksikologiske tests, således at risikovurderingen også inkluderer en effektvurdering baseret direkte på målinger af grundvandprøvernes toksicitet overfor marine organismer. De første erfaringer fra det igangværende arbejde i Kærgård Plantage viser, at de mest følsomme organiserne marine alger og krebsdyr. Det foreslås derfor, at der fra hver af gruberne 3-6 udtages én vandprøve, som undersøges i tests med alger og krebsdyr. For en nærmere beskrivelse af metoderne henvises til bilag toX. Resultaterne af de udførte tests vil blive sammenlignet med
resultater fra det igangværende projekt til vurdering af oprensningstekniker i Kærgård Plantage og med tidligere udførte
økotoxikologiske undersøgelser af prøver fra Kærgård Plantage-området afrapporteret bl.a. i Delrapport 9 til
"Arbejdsgruppen for Kjærgård Plantage" i 2006. Resultaterne af testene vil sammen med resultaterne af de kemiske
analyser tillige indgå i risikovurderingen af afstrømningen fra gruberne til Vesterhavet.

Department of Environmental Engineering
Period: 01/11/2010 → 31/03/2011
Number of participants: 2
Acronym: Tox3-6KP
Project ID: 30801
Project participant:
Bjerg, Poul Legstrup (Intern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Forsk. - Amter og kommuner
Name of research programme: Ukendt
Amount: 105,000.00 Danish Kroner
Project

Modelling of water quality in sewer-WWTP systems during normal and extreme condition

Department of Environmental Engineering
Period: 01/10/2010 → 04/06/2014
Number of participants: 6
Phd Student:
Ramin, Elham (Intern)
Supervisor:
Mikkelsen, Peter Steen (Intern)
Main Supervisor:
Plösz, Benedek G. (Intern)
Examiner:
Bauer-Gottwein, Peter (Intern)
Bentzen, Thomas Ruby (Ekstern)
Comas, Joaquim (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Pharmas - Ecological and human health risk assessments of antibiotics and anti-cancer drugs found in the environment
The presence of human pharmaceuticals in the environment is not a new issue; their presence in the aquatic environment
in North America was highlighted several decades ago. In Europe, the first reports of human pharmaceuticals in the
environment were published a little later. These early reports from Europe were very far-sighted in that they identified sex
steroids, and in particular oestrogens, as being present in the aquatic environment, and likely to affect reproduction of fish
if concentrations were high enough. Research progressed steadily during the 1980’s and 1990’s, and this progress was
summarized a decade ago in two influential reviews by primarily European chemists who had been studying the presence
of pharmaceuticals and personal care products in the environment. Since, an increasing interest in this area resulted in an
“explosion” in the number of references. However, all this research merely documented the presence, fate and behaviour
of human pharmaceuticals in the environment; it did little to address the issue of whether or not their presence constituted
a hazard to either wildlife (especially aquatic organisms) and humans drinking water containing minute quantities of these
pharmaceuticals. PHARMAS will focus on:
• The risk to human health and the environment from anti-cancer and antibiotic
drugs
• It will include an assessment of the transformation products of the selected drugs
• The exposure routes considered will be via water and food
• Exposure will include modelling (all 27 EU countries) and direct measurements
• Mixture effects will be considered
• Comparison of effects of the drugs on the embryo and adults on a test fish will be
examined
• Human health and environment risks evaluated
• Socio-economic impact of risks evaluated

Department of Environmental Engineering
Period: 01/10/2010 → 01/10/2013
Number of participants: 2
Acronym: PHARMAS
Project ID: 30847
BIOTREATMENT OF DRINKING WATER POLLUTED BY PESTICIDES AND OTHER MICROPOLLUTANTS

Clean drinking water is a limited resource in many countries and development of sustainable techniques to purify water polluted by pesticides and other micro-pollutants are urgent. Groundwater is an important drinking water resource in Europe, but surface waters are also used for drinking water in many countries. In general, groundwater has a higher quality than surface water and it is often distributed to the consumer without any prior advanced purification processes. Securing this unique situation requires that the groundwater remains without organic residues such as pesticides and other micro-pollutants including estrogens and pharmaceuticals. Unfortunately, such contaminants are more and more frequently detected in aquifers and surface waters in concentrations above the EU-threshold concentrations and they constitute a serious treat to our drinking water resources. The aim of BIOTREAT will be to develop much needed sustainable biotechnologies for remediating contaminated drinking water derived from either groundwater or surface water. In the present context, bioaugmentation is the introduction of specific degrading microorganisms or microbial consortia into sand-filters at waterworks or into barriers between surface water and drinking water reservoirs.

Department of Environmental Engineering
Period: 01/09/2010 → 31/08/2013
Number of participants: 1
Acronym: BIOTREAT
Project ID: 30865
Project Manager, organisational:
Smets, Barth F. (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Gad generation and emission at waste disposal sites receiving low organic waste

Department of Environmental Engineering
Period: 01/09/2010 → 01/12/2014
Number of participants: 6
Phd Student:
Mou, Zishen (Intern)
Supervisor:
Scheutz, Charlotte (Intern)
Main Supervisor:
Kjeldsen, Peter (Intern)
Examiner:
Damgaard, Anders (Intern)
Gregory, Robert G. (Ekstern)
Rintala, Jukka Antero (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Life cycle assessment of energy technologies and energy systems

Department of Environmental Engineering
Period: 01/09/2010 → 04/06/2014
Number of participants: 5
Phd Student: Turconi, Roberto (Intern)
Main Supervisor: Astrup, Thomas Fruegaard (Intern)
Examiner: Scheutz, Charlotte (Intern)
Olsen, Stig Irving (Intern)
Powers, Susan E. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Model-driven process research in soil systems – minerals, organic matter, water, fluxes and biota

International Training Network on organic matter cycling in soils as affected by soil structure, water, microbes and minerals

Department of Environmental Engineering
Period: 01/09/2010 → 01/09/2013
Number of participants: 2
Acronym: ProSoil
Project participant: Smets, Barth F. (Intern)
Dechesne, Arnaud (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Nitrification in rapid sand filters-process understanding and removal of organic micropolutants

Department of Environmental Engineering
Period: 01/09/2010 → 02/04/2014
Number of participants: 7
Phd Student: Tatari, Karolina (Intern)
Supervisor: Nielsen, Peter Borch (Ekstern)
Smets, Barth F. (Intern)
Main Supervisor: Albrechtsen, Hans-Jørgen (Intern)
Examiner: Andersen, Henrik Rasmus (Intern)
Pettersson, Thomas (Ekstern)
Uhl, Wolfgang (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD
Resource and environmental assessment of recycling of construction and demolition waste (C&D waste)

Department of Environmental Engineering
Period: 01/09/2010 → 01/04/2015
Number of participants: 6
PhD Student:
Butera, Stefania (Intern)
Supervisor:
Christensen, Thomas Højlund (Intern)
Main Supervisor:
Astrup, Thomas Fruergaard (Intern)
Examiner:
Kjeldsen, Peter (Intern)
Birgisdottir, Harpa (Intern)
Polettini, Alessandra (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

The use of iron hydroxide nano-composites for chlorinated solvent remediation

Department of Environmental Engineering
Period: 01/09/2010 → 31/12/2014
Number of participants: 4
PhD Student:
Kern, Kristina (Intern)
Supervisor:
Fjordbøge, Annika Sidelmann (Intern)
Jakobsen, Rasmus (Intern)
Main Supervisor:
Broholm, Mette Martina (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

LCA af gipsaffald
"LCA af gipsaffald" er et samarbejdssprojekt med Miljøstyrelsen, som skal danne grundlag for opstilling af behandlingskrav for håndtering af gipsaffald i Danmark. Dette gøres ved at udføre en miljøvurdering af et antal metoder til behandling af gipsaffald vha. LCA-modellen EASEWASTE. Miljøvurderingen indebærer, at der indsamles data for mængder og masseflow for gipsaffald i Danmark, samt at de involverede teknologier beskrives. På det grundlag kan potentielle miljøpåvirkninger fra teknologierne beregnes og de miljømæssigt set mest hensigtmæssige behandlingsmetoder identificeres. lignes og

Department of Environmental Engineering
Period: 26/08/2010 → 31/12/2010
Number of participants: 2
Acronym: 1167
Project ID: 30787
Project participant:
Christensen, Thomas Højlund (Intern)
Project Manager, organisational:
Møller, Jacob (Intern)

Financing sources
Source: Sam arb aftaler - Statslige danske
Name of research programme: Ukendt
Amount: 400,000.00 Danish Kroner
Project
**Effect of invasion on rockphysical and petrophysical properties**

**Aim** This project aims at developing a method for interpretation of the sonic log signal, where invasion by drilling fluid causes anomalous log readings. Background Sonic logs are used to measure acoustic velocities of formations penetrated during drilling. Together with data from other logging tools, such information is applicable for fluid identification and quantification in reservoirs. Sonic velocities also provide ties to seismic surveys (AVO, 4D analysis). An important tool in the interpretation of sonic log measurements is fluid substitution, which is a procedure developed by Gassmann (1951). Application of fluid substitution to multiple-phase saturated regions, such as the invaded region has been shown to be non-trivial, displaying hysteresis depending on formation wettability, formation fluids, and invading fluids (Cadoret et al., 1995). Hysteresis has also been found in electrical resistivity as quantified by the electrical saturation exponent (Van de Verg et al., 1999). These dual observations indicate correlation between hysteresis and homogeneity of fluid phase distribution. Previous studies have addressed systems of mixed gas and water and have led to definition of theoretical bounds for the velocity response of two-phase saturated rocks (Cadoret et al., 1995). In preliminary studies to this project, we have however shown repetitive breaching of these bounds primarily in rocks with heterogeneous pore size distributions. Breaching the bounds shifts the influence of invasion beyond the limits of the present interpretation. This motivates further quantification of the effects of invasion on sonic logs (Sørensen, 2010). Furthermore, sonic velocities and relative pore fluid related changes are frequency dependent. Sonic tools operate at much higher frequency than seismic surveys, while velocity measurements in the laboratory are conducted at even higher frequency. Proposed work This project comprises two parts. In the first part we will address the question of elastic and electrical properties of a two-phase saturated simple pore structure of quartzitic sandstone. Different saturations will be systematically studied according to a drainage and subsequent imbibition process. In the second part of the project similar procedures will be applied to greensand, in order to study the effect of a heterogeneous pore structure. All results will be discussed in context of rock- physics modeling. The results from laboratory data and rock-physical modeling will be used to formulate a strategy for improved interpretation of sonic logs in combination with other logs.

Department of Environmental Engineering  
Period: 15/08/2010 → 15/08/2013  
Number of participants: 1  
Acronym: 1163  
Project ID: 30774  
Project Manager, organisational: Fabricius, Ida Lykke (Intern)

**Financing sources**
Source: Sam.arb.aftaler, Private danske - Andre virksomheder  
Name of research programme: Ukendt  
Amount: 3,517,778.00 Danish Kroner  
Project

**Start and stop criteria for remedial actions. Delprojektaftale nr. 6**  
The project develops and test methods for estimation of start and stop criteria for remediation projects.

Department of Environmental Engineering  
Period: 02/08/2010 → 31/12/2010  
Number of participants: 1  
Acronym: 1158  
Project ID: 30781  
Project Manager, organisational: Bjerg, Poul Logstrup (Intern)

**Financing sources**
Source: Sam.arb.aftaler - Amter og kommuner  
Name of research programme: Ukendt  
Amount: 115,000.00 Danish Kroner  
Project

**Integrated organics pre-treatment system for new sludge management systems**
INTOPRS is a system solution containing •equipment for organics treatment with according design rules, •rules for process implementation to existing wwtp and SMS, •rules for required adjustments at different types of wwtp. LCA, basing on full scale experimental results will show impact of INTORPS on environmental footprint of European SMS including impact on sludge disposal.

Department of Environmental Engineering
Period: 01/08/2010 → 30/07/2013
Number of participants: 1
Acronym: INTORPS
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Fehmer Belt Clay (XRD)
XRD analysis
Department of Environmental Engineering
Period: 22/07/2010 → 28/02/2011
Number of participants: 1
Acronym: 1165
Project ID: 30776
Project Manager, organisational:
Fabricius, Ida Lykke (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 140,000.00 Danish Kroner
Project

Innovation network for environmental Technology (Innovationsnetværk på miljøteknologi)
Innovationsnetværket for Miljøteknologi skal være det oplagte forum for netværkets medlemmer og cleantech-branchen, når den tager initiativ til at igangsætte teknologi- og udviklingsprojekter der kræver supplerende, tværgående kompetencer og nye samarbejdsparter, uanset om medlemmernes forretningsområde og kernekompetencer primært er på luft-, vand-, jord- eller affaldsområdet.

Department of Environmental Engineering
Period: 01/07/2010 → 01/07/2014
Number of participants: 7
Acronym: 1113
Project ID: 30856
Project participant:
Baun, Anders (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Henze, Mogens (Intern)
Bjerg, Poul Løgstrup (Intern)
Astrup, Thomas Fruegaard (Intern)
Ambjerg-Nielsen, Karsten (Intern)
Project Manager, organisational:
Andersen, Henrik Rasmus (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 180,000.00 Danish Kroner
Project

NEEWTT - Network for Energy Efficient Wastewater Treatment Technologies
Marie Curie Initial Training Networks (ITN) Call: FP7-PEOPLE-2010-ITN Network application including 9-12 PhD projects of which 3-5 @ DTU. The core theme is energy effectiveness in wastewater treatment through new processes.

Department of Environmental Engineering
Thalis
The objective of the research project will be to investigate the fate of emerging organic micropollutants during wastewater and sludge treatment and to study their fate in the aquatic environment. The title of the proposed research project will be "Investigation of emerging organic micropollutants fate during wastewater treatment and study of their behaviour during treated wastewater disposal into the aquatic environment". The budget of this proposal is 480.0000 Euros and its duration is 4 years. The specific objectives of this project are as follows: a) to study the fate of several emerging micropollutants such as PFCs, EDCs, pharmaceuticals, benzotriazoles in different treatment processes (activated sludge, anaerobic digestion, chlorination), b) to study the fate of these compounds in aquatic environment after treated wastewater disposal (role of photodegradation, biodegradation, sorption) and c) to investigate the formation of metabolites of selected micropollutants using LC-MS MS techniques.
Department of Environmental Engineering
Period: 01/06/2010 → 30/11/2010
Number of participants: 2
Acronym: CO2 opgørelse
Project ID: 30772
Project participant:
Astrup, Thomas Fruegaard (Intern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

**Financing sources**
Source: Samarb.aftaler, Private danske - Andre virksomheder
Name of research programme: Ukendt
Amount: 225,000.00 Danish Kroner

Environmental assessment of CO2 contamination in aquifers; Groundwater geochemical effects of CO2 from underground storage

Department of Environmental Engineering
Period: 01/06/2010 → 30/09/2013
Number of participants: 6
Phd Student:
Cahill, Aaron Graham (Intern)
Supervisor:
Jakobsen, Rasmus (Intern)
Main Supervisor:
Bjerg, Poul Legstrup (Intern)
Examiner:
Bauer-Gottwein, Peter (Intern)
Oelkers, Eric H. (Ekstern)
Trautz, Robert C. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Whole gaseous emission measurements from waste treatment facilities / Gasemissionsmålinger fra affaldshåndteringssystemer

Department of Environmental Engineering
Period: 01/06/2010 → 27/08/2014
Number of participants: 6
Phd Student:
Mønster, Jacob (Intern)
Supervisor:
Kjeldsen, Peter (Intern)
Main Supervisor:
Scheutz, Charlotte (Intern)
Examiner:
Boldrin, Alessio (Intern)
Imhoff, Paul T. (Ekstern)
Oonk, Johan (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD
Non-stationary time series models of hydrologic extremes
Department of Environmental Engineering
Period: 01/05/2010 → 29/04/2015
Number of participants: 7
Phd Student:
Gregersen, Ida Bülow (Intern)
Supervisor:
Madsen, Henrik (Intern)
Rosbjerg, Dan (Intern)
Main Supervisor:
Arnbjerg-Nielsen, Karsten (Intern)
Examiner:
Christiansen, Lasse Engbo (Intern)
Berndtsson, Ronny (Ekstern)
Rauch, Wolfgang (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Uptake, metabolism, accumulation and toxicity of organic contaminants in wetland plants
DTU / team Stefan Trapp uses an experimental system where uptake, metabolism, accumulation and toxicity can be determined (Larsen et al. 2005). This experimental system (named "willow tree test") will be applied to contaminants found in Leuna and Bitterfeld. Parallel, mathematical models that can predict these processes will be further developed and adapted to wetlands. The models will be parameterized and calibrated using the measured data from the willow system. The models will further be parameterized for a wetland plant (Phragmites or Juncus sp.) in order to predict the processes in the constructed wetland at UFZ.

Department of Environmental Engineering
Period: 01/05/2010 → 30/04/2011
Number of participants: 1
Acronym: Wetlands
Project ID: 30763
Project Manager, organisational:
Trapp, Stefan (Intern)

Financing sources
Source: Forsk. Andre offentlige og private - Udenlandske
Name of research programme: Ukendt
Amount: 1,000,000.00 Danish Kroner
Project

Risikovurdering af forurenede grunde i forhold til grundvand og overfladevand på oplandsskala
Department of Environmental Engineering
Period: 15/04/2010 → 15/12/2015
Number of participants: 6
Phd Student:
Thomsen, Nanna Isbak (Intern)
Supervisor:
McKnight, Ursula S. (Intern)
Main Supervisor:
Binning, Philip John (Intern)
Examiner:
Kjeldsen, Peter (Intern)
Christophersen, Mette (Intern)
Nowak, Wolfgang (Ekstern)

Financing sources
Source: Internal funding (public)
**Enpera**  
Engineered nanoparticles (ENPs) are synthetic particles with at least one dimension.

**Department of Environmental Engineering**  
Period: 04/04/2010 → 04/04/2013  
Number of participants: 0  
Acronym: Enpera  
Project ID: 30791

**Financing sources**  
Source: Forsk. Andre offentlige og private - Udenlandske  
Name of research programme: Ukendt  
Amount: 100,000.00 Danish Kroner  
Project

**Molecular Approaches and MetaGenomic Investigations for optimizing Clean-up of PAH contaminated sites**  
MAGICPAH aims to explore, understand and exploit the catalytic activities of microbial communities involved in the degradation of persistent PAHs. It will integrate (meta-) genomic studies with in-situ activity assessment based on stable isotope probing particularly in complex matrices of different terrestrial and marine environments. PAH degradation under various conditions of bioavailability will be assessed as to improve rational exploitation of the catalytic properties of bacteria for the treatment and prevention of PAH pollution.

**Department of Environmental Engineering**  
Period: 01/04/2010 → 30/09/2015  
Number of participants: 2  
Acronym: MagicPAH  
Project ID: 30738  
Project participant:  
Rasmussen, Birte Kastrup (Intern)  
Project Manager, organisational:  
Trapp, Stefan (Intern)

**Financing sources**  
Source: Forsk. EU - Rammeprogram  
Name of research programme: Ukendt  
Amount: 2,045,204.00 Danish Kroner  
Project

**Concept proof of usability of ocher as a source of iron in wastewater treatment**  
Confidential

**Department of Environmental Engineering**  
Period: 15/03/2010 → 01/02/2011  
Number of participants: 3  
Acronym: JuniorOchre  
Project ID: 30771  
Project participant:  
Mikkelsen, Peter Steen (Intern)  
Angelidaki, Irini (Intern)  
Project Manager, organisational:  
Andersen, Henrik Rasmus (Intern)

**Financing sources**  
Source: Sam.arb.aftaler, Private danske - Andre virksomheder  
Name of research programme: Ukendt  
Amount: 250,000.00 Danish Kroner  
Project

**Gl. Kongevej. Evaluation of SRD in clayey till.**  
The effect of full scale SRD of a chlorinated solvent source zone in clayey till at Gl. Kongevej is evaluated. Particular focus is on the effects in the clayey till matrix, where reactions may be diffusion limited and on the effects on contaminant flux to
the primary aquifer underlying the source zone.

Department of Environmental Engineering
Period: 01/02/2010 → 31/12/2010
Number of participants: 2
Acronym: 1151
Project ID: 30759
Project participant:
Broholm, Mette Martina (Intern)
Bjerg, Poul Løgstrup (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Ukendt
Amount: 120,000.00 Danish Kroner

Groundwater quality effects of CO2 escaping from carbon storages (CO2-CS)
WP 3: If CO2 escapes from a storage and migrates up through the geological sequence, there is a risk of contaminating aquifers used for drinking water supply. In itself, CO2 dissolved in water is not poisonous, but adding CO2 to the water will increase the acidity of the water, causing mineral dissolution in the sediments and increased adsorption of carbonate species on the mineral surfaces. A decrease in groundwater pH may lead to the mobilization of Ni and other trace metals (Kjøller et al), adsorption of carbonate species may displace other oxyanions like arsenate and arsenite, phosphate or selenate (Appelo et al 2002; CD-Music) bound to the sediment grains. Dissolution of minerals may release undesirable components into the groundwater and may lead to the formation of preferential flow paths, lowering transit times of any pollutant. It is the objective of this WP to investigate the effect that highly CO2 charged waters (PCO2 = 1 atm) and its interaction with the sediment may have on the groundwater composition. First a series of column experiments will be carried out with common aquifer sediments (non calcareous sand, calcareous sand and limestone), the sediments will be leached by CO2 charged groundwater in order to study the release of contaminants. Subsequently, push-pull tests in the aquifers will be carried out, by injecting and later retrieving CO2 charged and tracer marked groundwater (Assayag et al., 2009) and through water analysis identify the geochemical processes occurring. Repetitions will reveal whether the ongoing geochemical reactions are directly modifying the permeability/porosity of the rocks. Push-pull tests will be supplemented by a dipole test in a shallow aquifer. Sediment cores are taken before CO2 charged water is circulated through the aquifer while the geochemical effects are monitored in water samples. When circulation is stopped, new sediment cores will enable direct studies of the effects on the sediment. Column and field results will be modelled with reactive transport models considering mineral dissolution, redox processes and surface complexation in order to obtain a quantitative understanding of the problems involved.

Department of Environmental Engineering
Period: 01/02/2010 → 31/01/2013
Number of participants: 1
Acronym: coogwat
Project ID: 30770
Project Manager, organisational:
Jakobsen, Rasmus (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 1,860,081.00 Danish Kroner

Multi-objective management of multi-reservoir systems using Artificial Intelligence
Department of Environmental Engineering
Period: 01/02/2010 → 31/01/2012
Number of participants: 2
Acronym: 1042
Project participant:
Rosbjerg, Dan (Intern)
Bauer-Gottwein, Peter (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Project

Værktøjer til brug for risikovurdering og prioritering af grundvandstruede forureninger. Delprojekt 4
Der vil i projektet blive præciseret hvad den nuværende risikovurdering i DK er i forhold til vandressourcen og drikkevand. 2 risikovurderingsværktøjer sammenkobles i et integreret værkøj, som kan anvendes til beslutningsstøtte for prioritering af punktkilder på oplandsskala.

Department of Environmental Engineering
Period: 01/02/2010 → 31/12/2010
Number of participants: 4
Acronym: RiskVærk
Project ID: 30764
Project participant:
Binning, Philip John (Intern)
Søndergaard, Gitte Lemming (Intern)
Troldborg, Mads (Intern)
Project Manager, organisational:
Bjerg, Poul Legstrup (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Ukendt
Amount: 165,000.00 Danish Kroner

Project

A new framework for integrated monitoring of the environment
Monitoring is essential in order to evaluate the state and development of our environment and to take action on the anthropogenic influence (climate change, eutrophication, impacts on human health, etc.). This project will develop a new framework and innovative technologies for monitoring of the environment. The principal idea is to integrate measurements of environmental variables from in-situ and remote sensing with process-based environmental modelling to provide the best and most cost-effective estimate of the environmental state and its uncertainty in space and time. The project will integrate monitoring of environmental variables in soil, inland water bodies (groundwater, rivers, wetlands and lakes), marine waters and air in one unified system, providing the optimal basis for understanding and predicting the state of the environment in all media. The framework will address monitoring at a range of scales, from national and regional environmental monitoring programmes to the monitoring of ecosystems at local scales in order to monitor local and regional effects of environmental legislation and implementation of new environmental technologies. The framework will provide the basis for a more effective detection of trends in environmental variables caused by changes in the driving forces such as changes in the emission of nutrients and climate change, and will provide important information for assessing impacts on human health. A key issue and innovative component of the project is estimation of the uncertainty of the environmental state. Uncertainty estimation is critical and very important for impact risk assessment and decision-making and for optimising the monitoring efforts in the most cost-effective way. The developed technologies will be applied for integrated monitoring and prediction of nitrogen and phosphorus, which are key indicators of the ecological state.

Department of Environmental Engineering
Period: 01/01/2010 → 31/12/2013
Number of participants: 2
Acronym: FRAME
Project participant:
Bauer-Gottwein, Peter (Intern)
Project Manager, organisational:
Rosbjerg, Dan (Intern)
Biorefinery for sustainable Reliable Economical Fuel production from energy crops. Second call.

Biorefinery systems use one species or one category of plants to produce bio-based products and energy. An advanced biorefinery system should be able to use different biomass feedstock as well as to produce a wide range of high-value products, in order to be environmental, economic and social sustainable and to have flexibility for changes. These can not be achieved by the "traditional" biorefinery systems, because one plant species is used and for this reason, the biomass supply is not secured and a limited range of bio-products are produced. Moreover, "traditional" biorefineries systems with one culture can not be eco-sustainable in contrast to an advanced polyculture biorefinery. Sustainability and polyculture are interrelated for the following reasons: a) the diversity of crops avoids the susceptibility of monocultures to disease and pest problems , b) cropping systems that include a variety of crops replenish nitrogen (if legumes are included) and use resources such as sunlight, water, or nutrients more efficiently and c) biodiversity is protected in polyculture. Therefore, there is a need for more eco-efficient polyculture biorefinery system. Our proposed biorefinery system uses oilseed crops, as the main biomass feedstock, in combination with other species of plants, especially, from the family Leguminosae (legumes), due to the advantages that this combination offers to the sustainability of the whole system. Also, this combination will eliminate the disadvantages that separately each crop could give in a biorefinery system. Two different biorefinery systems "oilseed biorefinery" and "green biorefinery" injected with new ideas and innovative processes will be integrated into a new advance and sustainable biorefinery system, namely Eco-BioREF, to achieve a breakthrough beyond the "business as usual" scenario. The present project is aiming at the development of a sustainable, novel, technically and economically viable biorefinery for conversion of the biomass -oilseed plants and legumes- into a diverse range of biofuels, food and high-value added chemicals. This will be achieved by overcoming the identified, critical process bottlenecks in the biomass supply chain and by improving the refining section.

Department of Environmental Engineering
Period: 01/01/2010 → 31/12/2013
Number of participants: 2
Acronym: 903
Project participant:
Angelidaki, Irini (Intern)
Karakashev, Dimitar Borisov (Intern)

Design of microbial communities in membrane bioreactors: The next generation of environmental biotechnologies

The fundamental idea of the Centre’s activities is to apply a novel approach to reveal identity, function and interactions of key microorganism or groups of organisms involved in selected processes in environmental biotechnology to identify the factors that control their activity and ecology in mixed communities. These control factors will then be exploited to optimise their growth and activity (ecosystem design) through process studies in the membrane bioreactor (MBR) reactors in collaboration with industrial and public partners. MBR is a new technology in water and wastewater treatment and in other environmental and industrial biotechnologies. Three applications of the MBR technology will be studied at lab-scale and pilot-scale: 1) removal/recovery of phosphorus, 2) a new energy efficient process for nitrogen removal, and 3) removal of micropollutants. The research activities include a survey of major European MBR plants to achieve a mutual starting point for all participants. The novel approach will be applied in each case to identify selective factors for ecosystem design or addition of particular performance-enhancing bacteria (bioaugmentation). The concurrent study of membrane fouling in each system along with the development of a model to describe fouling as function of operation parameters, allows for an optimization of the MBR system with respect to microbial as well as membrane processes. This Centre will gather the world-class competencies within Denmark (universities, GTS-institutions, industries and consultants) and complement these with leading partners from abroad to create a synergy required to deliver these solutions. The Danish industry partners are positioned to rapidly implement these developments into products for the national and global market and in so doing create a billion kroner export market with spin off environmental and public health benefits.

Department of Environmental Engineering
Period: 01/01/2010 → 31/12/2015
Number of participants: 1
Acronym: BIOMBR
Project ID: 30745
Project Manager, organisational:
Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 2,338,000.00 Danish Kroner

DTU centre for recirculation technology (38159)
Despite the obvious scientific relationship and correlation between recirculation technology, specifically biofiltration, and municipal waste-water treatment only limited scientific knowledge has been interchanged between these two areas.

DTU Environment has for many years been an internationally renowned actor within biofiltration processes and kinetics in waste water treatment. Combining this stronghold with the DTU Aqua expertise in recirculating systems is the basis for this project. Through project cooperation, student interchange and common research set-ups knowledge is exchanged and new insights developed.

In recirculation systems feed is the major input to the system, and the linkage between feed, water quality and system operation is important, yet missing knowledge, which will also be addressed by the group through a combined experimental and modeling approach.

Department of Environmental Engineering

National Institute of Aquatic Resources

Section for Aquaculture
Period: 01/01/2010 → 31/12/2015
Number of participants: 3
Research area: Aquaculture

Flexible model structure for waste-LCA modelling - The next generation of the EASEWASTE model

Department of Environmental Engineering
Period: 01/01/2010 → 18/09/2013
Number of participants: 6
Phd Student:
Clavreul, Julie (Intern)
Supervisor:
Baumeister, Hubert (Intern)
Main Supervisor:
Christensen, Thomas Højlund (Intern)
Examiner:
Astrup, Thomas (Intern)
Eriksson, Ola Norman (Ekstern)
Kirkeby, Janus Søgaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

High rate algal biomass production for food, feed, biochemicals and biofuels
Increased population, shortage of fossil fuels and climatic changes constitute global challenges demanding actions and strategic planning for securing access of food, feed and energy supply in the future. Therefore, alternative biomass sources are needed. Algal biomass for production of food, feed, biochemicals and biofuels offers a great potential for meeting the future challenges. Algae possess numerous possibilities that have so far not been exploited. With the proposed project we are going to: •Develop promising technologies for production of alginates, polyunsaturated fatty acids, β-carotene, and sterols that can be used as functional food. •Develop technologies for production of pigments like...
fucoxanthin and other high value chemicals like chlorophyll a and c, beta-carotene and other xanthophylls from brown algae. Additionally, technologies for production of other high value chemicals such as vitamins, toxins, enzymes etc. will be developed. • Develop technologies for utilisation of algae (both micro and macro algae) with high growth rates for biomass production for production of bioenergy (hydrogen, methane, ethanol, and biodiesel). • Optimise algae cultivation conditions for increased biomass production, including development of an algae cultivation rotation system. • A new concept integrating biofuel production with algae cultivation, based on recycling of CO2 from the exhaust gas from gas motors for autotrophic algae growth and recycling of process effluents as nutrients for promoting algal biomass growth will be developed. • Develop an innovative bioflocculation method for sustainable harvesting of microalgae. • Investigate algae as biofertilisers for promotion of rice, wheat growth. • Evaluate the sustainability of utilisation of algae for food, feed and biofuels production.

Department of Environmental Engineering
Period: 01/01/2010 → 31/12/2012
Number of participants: 2
Acronym: 958
Project participant:
Karakashev, Dimitar Borisov (Intern)
Project Manager, organisational:
Angelidaki, Irini (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 4,957,776.00 Danish Kroner

Modeling the transfer of ionisable organic compounds to crops
Ionisable compounds are currently hardly covered by existing quantitative structure-activity relation-ships (QSAR) methods or mechanistic models for predicting their environmental fate. However, they are frequent, typical for many compound classes and advances in analytical chemistry has made them measurable and raised concerns about their presence in the environment. Compound classes that include ionisable organic compounds are among others pesticides, pharmaceuticals and detergents. These compound classes are unwanted in the environment due to concerns about their effects on environmental and human health. One issue is their transfer to crops. This project will develop a simple and valid approach for estimating the transfer of ionisable organic compounds to crops. The assumption is that current physiology-based approaches for modelling the transfer of neutral organic compounds to plants can be combined with a newly formulated Fick-Nernst-Planck equation to develop models for ionisable compounds.

Department of Environmental Engineering
Period: 01/01/2010 → 31/12/2010
Number of participants: 2
Acronym: Ion Crop Model
Project participant:
Trapp, Stefan (Intern)
Project Manager, organisational:
Legind, Charlotte Nielsen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

NanoRiskClass - et nyt risikoklassifikations system for nanomaterialer
**Optimal digestion of high ammonia containing wastes**
The main objective of the project is to develop a process promoting acetate oxidation, for optimal digestion of high ammonia containing wastes. More specifically with this project we are aiming to: -Investigate the extent of acetate oxidation in full scale biogas plants; and identify the environmental conditions promoting acetate oxidation on the cost of aceticlastic methanogenesis. -Identify best process configuration (temperature, hydraulic retention time, organic loading rate, concentration of ammonia and volatile fatty acids) promoting high syntrophic acetate oxidation activity -Enrich, isolate, characterize and identify acetate oxidising microorganisms; -Find cultures with highest potential for syntrophic acetate oxidation in order to reach maximum exploitation level of the results in the energy sector.
Quantitative health and microbial risk assessment for public warning during flood

Department of Environmental Engineering
Period: 01/01/2010 → 01/04/2015
Number of participants: 6
Phd Student:
Andersen, Signe Tanja (Intern)
Supervisor:
Helwigh, Ole Mark (Ekstern)
Main Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Examiner:
Mikkelsen, Peter Steen (Intern)
Djordjevic, Slobodan (Ekstern)
Ethelberg, Steen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Reducing uncertainty in future extreme precipitation (RUFEP)
Current estimates of extreme precipitation impacts from climate change range from a 20-60% increase over the next decade, but are based on climate model simulations at larger spatial and temporal scales than what is relevant for typical urban drainage systems. Thus this PhD fellowship will focus on reducing the uncertainty in future projections of extreme precipitation and quantifying the spatial and temporal scaling properties of extreme precipitation characteristics from observations and climate model simulations. This calls for a strategic collaborative research collaboration mobilizing both urban water and climatology expertise, which are among the key competencies at DTU Environment and the Danish Meteorological Institute.

Department of Environmental Engineering
Period: 01/01/2010 → 31/12/2014
Number of participants: 2
Acronym: 1049
Project ID: 30765
Project participant:
Arnbjerg-Nielsen, Karsten (Intern)
Project Manager, organisational:
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 2,400,000.00 Danish Kroner
Project

Submersible Microbial Fuel Cell (SMFC) for electricity production from wastewater
MFC is a novel technology that can generate electricity directly from organic compounds. It has been known for several years that bacteria can be used to generate electricity that can be harvested in microbial fuel cells (MFCs). An innovative MFC for direct conversion of organic material to electricity has been invented at DTU-Environment, and the patent application was submitted in 2007. The main purpose of the present project is therefore to optimize the SMFC and to upscale it to a small pilot scale in order to demonstrate and validate the optimized SMFC technology for treatment of real wastewaters.

Department of Environmental Engineering
Period: 01/01/2010 → 31/12/2012
Number of participants: 1
Sustainable drinking water treatment biological filters
The project will cover a range of compounds and biological filter activities, but regarding the bulk compounds emphasis will be on ammonium removal (nitrification) and iron/manganese removal. Regarding organic micropollutants the activities will focus on pesticides (MCPP, BAM and Isoproturon as model compounds) and pharmaceuticals (with synthetic estrogen 17α-ethinylestradiol (EE2) as model compound). See section 6 in Project description, App D.

Department of Environmental Engineering
Period: 01/01/2010 → 31/12/2013
Number of participants: 3
Acronym: DW BIOFILTERS
Project ID: 30766
Project participant:
Arvin, Erik (Intern)
Smets, Barth F. (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Relations
Activities:
Phosphorus limitations when ammonium removal is incomplete
Nutrient limitations in drinking water rapid sand filters with incomplete ammonium removal

The effect of varying pH on bioaccumulation of weak electrolytes
Department of Environmental Engineering
Period: 01/01/2010 → 28/02/2013
Number of participants: 6
Phd Student:
Rendal, Cecilie (Intern)
Supervisor:
Kusk, Kresten Ole (Intern)
Main Supervisor:
Trapp, Stefan (Intern)
Examiner:
Eriksson, Eva (Intern)
Backhaus, Thomas (Ekstern)
Eggen, Trine (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Water in Urban Areas - partnership for climate change adaptation and innovation
The partnership addresses the challenge of adaptation of cities to a changing climate and aims at develop, document and disseminate sustainable technologies and water management methods.
Department of Environmental Engineering
Period: 01/01/2010 → 31/12/2014
Number of participants: 2
Acronym: Vand_i_byer
Project ID: 30760
Project participant:
Mikkelsen, Peter Steen (Intern)
Project Manager, organisational:
Ambjerg-Nielsen, Karsten (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 4,750,000.00 Danish Kroner
Project

Underøgelser af gasproduktion og emission på Uggerløse Losseplads
Det overordnede formål med projektet er at underøgelse gasproduktion og emission på Uggerløse Losseplads

Department of Environmental Engineering
Period: 15/12/2009 → 15/02/2010
Number of participants: 1
Acronym: 1094
Project ID: 30754
Project Manager, organisational:
Scheutz, Charlotte (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 96,200.00 Danish Kroner
Project

Development and delivery of an IWRM/IRBM training course
The course must address the different aspects of IWRM including: Enabling environment (policy, legislation, finance); Institutions (river basin organisation and management, role of government, private sector and water users); Management tools (water resources assessment, water resources planning, technical tools, administrative tools, financial and economic tools, conflict resolution, stakeholder involvement); Public awareness and monitoring.

Department of Environmental Engineering
Period: 01/12/2009 → 30/04/2010
Number of participants: 2
Acronym: 1071
Project ID: 30762
Project participant:
Bauer-Gottwein, Peter (Intern)
Project Manager, organisational:
Rosbjerg, Dan (Intern)

Financing sources
Source: Forsk. EU - Andre EU-midler
Name of research programme: Ukendt
Amount: 50,000.00 Danish Kroner
Project

Future climate change technologies
An assessment of emerging and future climate change technologies is needed that focus on national needs and possibilities for export of Danish technologies and services.

Department of Environmental Engineering
Urban Water Engineering
Period: 01/12/2009 → 01/07/2010
Number of participants: 8
Acronym: 1073
Project ID: 30746
Project participant:
Eriksson, Eva (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Henze, Mogens (Intern)
Binning, Philip John (Intern)
Andersen, Henrik Rasmus (Intern)
Rygaard, Martin (Intern)
Sharma, Anitha Kumari (Intern)
Project Manager, organisational:
Arnbjerg-Nielsen, Karsten (Intern)

_financing sources_
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 430,000.00 Danish Kroner

_relations_
Publications:
Fremtidige klimatilpasningsteknologier
Project

Optimization of a titration method for monitoring of VFA
ForskEL contract no. 2009-1-10231
Department of Environmental Engineering
Period: 01/11/2009 → 31/10/2010
Number of participants: 2
Acronym: Titration-VFA
Project ID: 30736
Project participant:
Boe, Kanokwan (Intern)
Project Manager, organisational:
Angelidaki, Irini (Intern)

_financing sources_
Source: Forsk. Private danske - Andre
Name of research programme: Ukendt
Amount: 814,000.00 Danish Kroner

Ozonation of swimming pool water
Designdata om ozons omsætningshastighed i et konkret svømmebassin. Eksperimentel og teoretisk vidensoverførsel om ozonbehandling af vand.
Department of Environmental Engineering
Period: 01/11/2009 → 31/07/2010
Number of participants: 1
Acronym: 949
Project Manager, organisational:
Andersen, Henrik Rasmus (Intern)

_financing sources_
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Renere teknologi til håndtering og rensning af separat regnvand
Projektet har til formål at skabe grundlag for en kvalificeret anvendelse og udbredelse af renseteknologi for separatkloakeret regnvand. Dette sker ved at opsamle, systematisere, dokumentere og formidle viden om renere teknologier til håndtering og rensning af separat regnvand.

Department of Environmental Engineering
Period: 01/11/2009 → 31/10/2011
Number of participants: 1
Acronym: 965
Project Manager, organisational: Arnbjerg-Nielsen, Karsten (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Foaming problems in biogas plants
Department of Environmental Engineering
Residual Resource Engineering
Period: 01/10/2009 → 30/09/2014
Number of participants: 3
foaming, biogas
Project participant:
Kougias, Panagiotis (Intern)
Boe, Kanokwan (Intern)
Angelidaki, Irini (Intern)
Project

Centre for regional change in the Earth system
To improve climate change predictions and its impacts, there is an urgent need for better quantification of how human activities, interacting with natural processes affect climate and vice versa. CRES will establish a common Danish multidisciplinary climate research platform to target Danish and wider regional needs.

Department of Environmental Engineering
Period: 01/10/2009 → 01/10/2014
Number of participants: 1
Acronym: CRES
Project ID: 30742
Project Manager, organisational: Arnbjerg-Nielsen, Karsten (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 2,272,000.00 Danish Kroner
Project

Danish Nanosafety Center
Expression of interest to Højteknologifonden
Department of Environmental Engineering
Period: 01/10/2009 → 01/10/2011
Number of participants: 2
Acronym: Nanosafety
Project participant:
Baun, Anders (Intern)
Project Manager, organisational: Baun, Anders (Intern)

Financing sources
Development of new microbial fuel cell configuration for optimization of electricity production with simultaneous wastewater treatment

Department of Environmental Engineering
Period: 01/10/2009 → 30/09/2012
Number of participants: 5
Phd Student:
Zhang, Yifeng (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Karakashev, Dimitar Borisov (Intern)
Norddahl, Birgir (Ekstern)
Verstraete, Willy (Ekstern)

Project

P2M2: Physical and physiological properties of membrane-aerated and membrane-supported biofilms

Department of Environmental Engineering
Period: 01/10/2009 → 24/04/2013
Number of participants: 5
Phd Student:
Pellicer i Nàcher, Carles (Intern)
Main Supervisor:
Smets, Barth F. (Intern)
Examiner:
Plósz, Benedek G. (Intern)
Galceran, Jesús Colprim (Ekstern)
Nielsen, Per Halkjaer (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Regional-scale hydrological modeling and water resources management in the Zambezi River Basin
Department of Environmental Engineering
Period: 01/10/2009 → 24/04/2013
Number of participants: 5
Phd Student:
Michailovsky, Claire Irene B. (Intern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)
Examiner:
Mikkelsen, Peter Steen (Intern)
Bates, Paul David (Ekstern)
Madsen, Henrik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Siemens Water Technology AOP
-classified
Department of Environmental Engineering
Period: 01/10/2009 → 01/10/2010
Number of participants: 1
Acronym: SAOP
Project ID: 30734
Project Manager, organisational:
Andersen, Henrik Rasmus (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Sustainable Environmental Technology. Application for 5 fellowships
Sustainable Environmental Technology is one of the focus areas in the Danish research strategy FORSK 2015. Sustainable environmental technology is seen as an important research area both for securing continued welfare and for potential development of Danish industry and services useful in a global context. Sustainable environmental technology thus can contribute at the domestic level as well as at the international level. At the domestic level sustainable environmental technology can help develop increased resource efficiency and recovery through improved waste management and help developing intelligent water anagement in cities under pressure from increased rain and storm intensities, a water resource limited by increasing groundwater pollution and by competition from protection of natural water habitats an wetlands. At the international level similar issues are developing and Danish research within sustainable environmental technology can help Danish technology and service provider to maintain and expand their international activities. The PhD fellowships will be announced within sustainable environmental technology with focus on waste and resource management, and urban water technology, which are among the key research competences of DTU Environment
A simulation-optimization approach for coupled water-energy systems

Department of Environmental Engineering
Period: 15/09/2009 → 30/09/2013
Number of participants: 7
PhD Student:
Cardenal, Silvio Javier Pereira (Intern)
Supervisor:
Ambjerg-Nielsen, Karsten (Intern)
Madsen, Henrik (Intern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)
Examiner:
Mikkelsen, Peter Steen (Intern)
Fosso, Olav Bjarte (Ekstern)
Pulido-Velázquez, Manuel A. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Investigation of the potential risk posed to drinking water by man-made nanoparticles. Department of Environment, Rules and Foreign Affairs
Identify those uses likely to result in man-made nanoparticles reaching water sources and obtain estimates of quantities used, task 2

Department of Environmental Engineering
Period: 15/09/2009 → 31/12/2009
Number of participants: 1
Acronym: Rural-foreign
Project ID: 30755
Project Manager, organisational:
Hansen, Steffen Foss (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 45,000.00 Danish Kroner
Project
Demonstration of combined thermal gasification and bio-gasification – determination of synergy effects

Biological gasification, such as at Lemvig Biogas plant, is an established technology which has been shown socio-economically to be the most profitable method to obtain CO2 reductions compared to other biofuels. However, biogas plants can not efficiently utilize dry lignocellulosic biomasses such as wood chips etc. including the fibre fraction of manure. Thermal updraft gasification, such as at Harboøre CHP, on the other hand is a well suited technology to utilize these types of dry lignocellulosic biomasses. However, it faces some disadvantages, such as generation of tar which need to be removed before the gas (termed product gas) is suitable for gas engine CHP use. By combination of both processes, mutual synergetic advantages can be achieved, with improved energy utilization of approx 30%, by increase of the yield of manure by 20% (gasification of un-degraded biofibers), by process energy savings of thermal gasification of approx. 20% and by improved electrical efficiency in gas engine utilization of 5%. At the same time the combination can create the basis for a process that can utilize versatile types of biomasses and the possibility to vary energy production to better suit consumption variations, both on a daily and seasonal basis. The overall aim with this project is to develop an energy effective technology for co-gasification of lignocellulosic biomass, along with wet-types of biomass. More specifically with this project we are aiming to: -Establish conversion capacity of product gas in a biogas reactor, hereby identify: a) optimal flow for product gas which is not inhibiting the biogas process; b) extend of degradation of other volatile compounds (phenols, volatile acids etc.) in the biogas process c) dynamic response of a biogas reactor upon changes in product gas flow. -Establish conditions for bioconversion of tar water in the biogas reactor (hereby, max. tolerated concentrations, necessary pre-treatment of tar water etc.). -Investigate the stability and robustness of the biogas process upon application of gasification gas and tar water. -Evaluate energy economy and stability by a combined thermal gasification and biogas process. -Demonstrate the concept at Harboøre CHP with pilot scale biogas reactor.

Department of Environmental Engineering
Period: 01/09/2009 → 31/08/2012
Number of participants: 0
Acronym: Co-gasification

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Diatomites -hydraulic properties and diagenesis

Diatomit kendes i Danmark som moleret fra Mors og Fur, hvor det er synligt i skrænter og i moler-grave. Hovedbestanddelen i moleret er over 50 millioner år gamle rester af diatomeer, der har opal-skelet. Det har i de senere år vist sig, at tilsvarende lag findes begravet under yngre lag i den nordlige del af Nordsen, og her kan diatomitene formentlig være kulbrinteførende. Det er derfor aktuelt at udvikle metoder til at vurdere denne bjergart af længere sigst på grund af deres høj porøsitet samtidig med lav permeabilitet og en ikke ubetydelig stivhed, og af at den opal, der udgør sedimentet, er kemisk ustabil og med tiden og temperaturen omdannes til en turgere fase, hvad der drastisk ændrer de geofysiske egenskaber. Dette kompliceres nemlig af, at sedimentet kan have en voldsomt høj porøsitet samtidig med lav permeabilitet og en ikke ubetydelig stivhed, og af at den opal, der udgør sedimentet, er kemisk ustabil og med tiden og temperaturen omdannes til en turgere fase, hvad der drastisk ændrer de geofysiske egenskaber. Dette kompliceres nemlig af, at sedimentet kan have en voldsomt høj porøsitet samtidig med lav permeabilitet og en ikke ubetydelig stivhed, og af at den opal, der udgør sedimentet, er kemisk ustabil og med tiden og temperaturen omdannes til en turgere fase, hvad der drastisk ændrer de geofysiske egenskaber.

Projektet vil tage udgangspunkt i metoder der er udviklet for vurderingen af skrivekridt og derudfra bør udvikle metoder til vurdering af moleret. Diatomiters fysiske egenskaber er hidtil mest studeret i dybhavsaflejringer og i forholdsvis unge lag i Californien, men der er publiceret meget få geofysiske undersøgelser af disse lag, og for ældre diatomit, som de danske, foreligger i denne sammenhæng uhyre få oplysninger. Projektet vil indebære samarbejde med forskere i Californien, der har erfaring i geokemiske studier af diatomit.

Department of Environmental Engineering
Period: 01/09/2009 → 31/08/2011
Number of participants: 0
Acronym: 948

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Iron hydroxide intercalates for degradation of chlorinated solvents in sediment and groundwater

A newly discovered class of layered iron hydroxides intercalated with fatty acids (carboxylate-LIH) will be used as reactive sorbents to degrade chlorinated solvents. Soil and groundwater polluted by halogenated hydrocarbons present one of the most serious treats to drinking water resources and human health – and efficient clean-up of these sites continues as one of the major challenges in environmental technology. The project comprise engineering of the LIH particles to optimise their efficiency for degradation of chloro-alkanes and -alkenes in sediments and aquifers. We will quantify sorption and subsequent reduction kinetics and pathways depending on the formulation of LIH. Sorbent size selectivity will be induced.
by pillaring, while an “on/off” reactivity mechanism will be attempted using silicate “switches”. The geochemical functioning of the optimised LIH particles will be tested first in sediment batch and column studies and next in situ by pressurized geoprobe injection of LIH or LIH-oil suspensions into contaminated sediments, either in the contaminant source area and/or into the pollutant plume with subsequent monitoring of degradation products. Conceptual models based on the intrinsic sorption and reactivity properties of the LIH particles modified by flow characteristics will be developed to describe the performance of LIH for clean-up of chlorinated solvents.

Department of Environmental Engineering
Period: 01/09/2009 → 31/08/2012
Number of participants: 3
Acronym: Iron-X
Project participant:
Bjerg, Poul Løgstrup (Intern)
Jakobsen, Rasmus (Intern)

Conceptual models based on the intrinsic sorption and reactivity properties of the LIH particles modified by flow characteristics will be developed to describe the performance of LIH for clean-up of chlorinated solvents.

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 2,445,984.00 Danish Kroner

Life cycle assessment of waste management: Assessing technical externalities

Department of Environmental Engineering
Period: 01/09/2009 → 18/09/2013
Number of participants: 5
Phd Student:
Brogaard, Line Kai-Sørensen (Intern)
Main Supervisor:
Christensen, Thomas Højlund (Intern)
Examiner:
Scheutz, Charlotte (Intern)
Eriksson, Ola Norma (Ekstern)
Olsen, Stig Irving (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Micro2-Managed Biofilms: Towards a New Generation of Robust Environmental Bio/Technologies

Microbes are amazingly diverse in terms of the biochemical reactions that they catalyze. This diversity can be used to create competitive biotechnological solutions to many environmental challenges. Indeed, the right combination of existing microbial reactions can usually be found to convert any unwanted pollutant into a useful or harmless end-product. There are, however, scientific and technical challenges in order to combine potentially useful microbial reactions into a workable biotechnology: A case in point is the autotrophic conversion of reduced ammonia (NH4+-N) to N2: a process which requires the cooperation between microbial groups with very different kinetics, substrate preferences, and redox requirements. We contend that biofilm-based systems, wherein microbes grow attached to surfaces, are suitable to harness these microbial potentials. In this project, we specifically aim to develop, apply and validate generic tools for the management of the microbial composition and the micro-scale structure of biofilms (micro2-management) with redox zonation. As an example, these tools will be implemented for the rapid start-up and high-rate long-term performance of membrane-supported biofilm-based reactors for autotrophic N removal.

Department of Environmental Engineering
Period: 01/09/2009 → 31/08/2012
Number of participants: 1
Acronym: Micro2Man
Project Manager, organisational:
Smets, Barth F. (Intern)

Financing sources
Real-time hydro-economic modeling for water resources management in the Zambezi River Basin
Developing Research Project, DFC project no. 09-043DTU

Department of Environmental Engineering
Period: 01/09/2009 → 01/09/2012
Number of participants: 1
Acronym: ZambeziRiver
Project ID: 30719
Project participant:
Bauer-Gottwein, Peter (Intern)

Financing sources
Source: Forskningsprojekter - Udenrigsministeriet (Danida)
Name of research programme: Ukendt
Amount: 2,201,141.00 Danish Kroner
Project

Enhanced degradation of pesticides in transition zones around water abstraction fields

Department of Environmental Engineering
Period: 15/08/2009 → 30/09/2013
Number of participants: 6
PhD Student:
Levi, Suzi (Intern)
Supervisor:
Bjerg, Poul Legstrup (Intern)
Main Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Examiner:
Dechesne, Arnaud (Intern)
Aamand, Jens (Ekstern)
Springael, Dirk (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

How microniches control the diversity of microbe-mediated redox processes in aquatic systems

Microniches can lead to a higher diversity of microbes in a given systems. The "extra" microorganisms can be pathogens that hide out in the microniches or degraders that have the right conditions for degradation in the microniches, or methanogens in system with sulfate reduction and/or Fe-oxide reduction. The project will be the first to look into the controlling mechanisms as the processes occur by using microfluidic devices and bioreporter microbial strains and modelling.

Department of Environmental Engineering
Period: 07/08/2009 → 31/12/2013
Number of participants: 3
Acronym: MIPAS
Project participant:
Jakobsen, Rasmus (Intern)
Smets, Barth F. (Intern)
Dechesne, Arnaud (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
**Microbially mediated redox processes in aquatic systems with micro-niches**

Sub-domains in the mm-µm range are often termed micro-niches and are present in many systems e.g. porous media (oil and groundwater reservoirs), water supply and waste water systems. If reactants are exclusive to a micro-niche and reaction rates are fast compared to diffusive transport, the chemical environment in the micro-niche will be different from the bulk environment and may imply that also the microbe(s) residing in the micro-niche are different from the microbes in the bulk system. This micro-scale arrangement will significantly affect the microbial ecology of a natural or technical system and the ecosystems ability to adapt to changing conditions on a bulk scale, e.g. changing redox conditions in soils. The micro-niches may also have adverse as well as beneficial effects. Adverse effects could be sustaining pathogens by providing "hiding places" in e.g. water supply systems or housing sulfate reducing bacteria and organic matter resulting in sulfide in the supplied water. Benefits may occur when locally lowered redox conditions inside micro-niches containing reductants enable microbially mediated degradation of chlorinated ethenes that would otherwise not be degraded. These examples show that the effects of micro-niches on the microbial ecology may determine important issues such as the mobility of redox sensitive compounds in soils, supplied water quality and the success of groundwater remediation schemes. In spite of this the quantitative circumstances that make micro-niches problematic or beneficial are not known in any detail. How are the micro-niches populated, how do they sustain microbial reactions, how small can these micro-niches be and still house viable microbial populations ? These are the type of questions that need to be answered if we are to exploit or avoid the effects of the micro-niches present in most systems. The project will use micro-models etched in fused silica mounted in flow cells, in vivo fluorescent protein labeling of specific microbes and advance individual based modeling to include the geochemistry of the surroundings.

Department of Environmental Engineering  
**Period:** 03/08/2009 → 29/07/2011  
**Number of participants:** 2  
**Acronym:** MiMeRePaSym  
**Project participant:**  
Jakobsen, Rasmus (Intern)  
Smets, Barth F. (Intern)

**Financing sources**  
Source: Unknown  
Name of research programme: Ukendt  
Amount: 0.00 Danish Kroner  
Project

**Have-park affald: Sammenlignende vurdering af disponeringsmuligheder. Forprojekt 060609**

Affaldsselskaberne står over for fortsat stigende have-affaldsmængder og har behov for gode, billige og fleksible løsninger.Produktion af råkompost og udbringning på dedikerede arealer er en ny og udokumenteret metode som kan anvendes i stedet for centralkompostering. Problemstillingen belyses og vurderes ud fra en kombination af forsøg og modellering.

Department of Environmental Engineering  
**Period:** 01/08/2009 → 28/02/2010  
**Number of participants:** 2  
**Acronym:** Have-park affald  
**Project ID:** 30726  
**Project participant:**  
Møller, Jacob (Intern)  
Project Manager, organisational:  
Christensen, Thomas Højlund (Intern)

**Financing sources**  
Source: Forsk. Private danske - Andre  
Name of research programme: Ukendt  
Amount: 210,000.00 Danish Kroner  
Project

**RiskCycle**  
Risk-based management of chemicals and products in a circular economy at a global scale (Co-ordination action)  
Department of Environmental Engineering
Review and assessment of organic substances in sewage sludge
Gennemgang og vurdering af organiske stoffer i slam

PhD Project 12 - Life cycle assessment of special and hazardous waste types and fractions
Biologisk nedbrydning af kemikalier i renseanlæg. Afslag
Life cycle assessment of emerging waste-to-energy technologies

Department of Environmental Engineering
Period: 01/05/2009 → 27/03/2013
Number of participants: 5
PhD Student:
Tonini, Davide (Intern)
Main Supervisor:
Astrup, Thomas Fruegaard (Intern)
Examiner:
Scheutz, Charlotte (Intern)
Hellweg - SLET, Stefanie (Ekstern)
Jensen, Lars Stoumann (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Livscyklus- og risikoanalyse af alternative teknologier og ressourcer til drikkevandsforsyningen

Department of Environmental Engineering
Period: 01/05/2009 → 06/02/2013
Number of participants: 8
PhD Student:
Godskesen, Berit (Intern)
Supervisor:
Hauschild, Michael Zwicky (Intern)
Rygaard, Martin (Intern)
Zambrano, Kim Cecilia (Intern)
Main Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Examiner:
Astrup, Thomas (Intern)
Lindgaard-Jørgensen, Palle (Ekstern)
Lundie, Sven (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

The role of spatial heterogeneity as a limiting factor for pesticide biodegradation in contaminated aquifers

Department of Environmental Engineering
Period: 01/05/2009 → 27/03/2013
Number of participants: 6
PhD Student:
Pazarbasi, Meric Batioglu (Intern)
Unravelling the microbiological limitations for degradation of low pesticide concentrations in aquifers

Department of Environmental Engineering
Period: 01/05/2009 → 30/09/2012
Number of participants: 5
Phd Student:
Gozdereliler, Erkin (Intern)
Supervisor:
Aamand, Jens (Ekstern)
Main Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Examiner:
Jakobsen, Rasmus (Intern)
Springael, Dirk (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Urban Runoff Design under influence of Climate Change

Department of Environmental Engineering
Period: 01/05/2009 → 21/11/2012
Number of participants: 8
Phd Student:
Zhou, Qianqian (Intern)
Supervisor:
Halsnæs, Kirsten (Intern)
Mikkelsen, Peter Steen (Intern)
Nielsen, Susanne Balslev (Intern)
Main Supervisor:
Ambjerg-Nielsen, Karsten (Intern)
Examiner:
Bauer-Gottwein, Peter (Intern)
Krebs, Peter (Ekstern)
Merz, Bruno (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

AQUA Fingerprint
On-line detection and characterization of feacal contamination by in aquatic systems by fluorescence technology
**Department of Environmental Engineering**

**Period:** 01/04/2009 → 31/12/2010

**Number of participants:** 1

**Acronym:** AQUA_Fingerprint

**Project ID:** 30693

**Project Manager, organisational:** Arvin, Erik (Intern)

**Financing sources**

**Source:** Sam.arb.aftaler - Statslige danske

**Name of research programme:** Ukendt

**Amount:** 611,882.00 Danish Kroner

**Project**

**Attenuation of landfill leachate pollutants at a groundwater - surface water interface**

**Department of Environmental Engineering**

**Period:** 01/04/2009 → 22/08/2012

**Number of participants:** 6

**PhD Student:** Milosevic, Nemanja (Intern)

**Supervisor:** Albrechtsen, Hans-Jørgen (Intern)

**Main Supervisor:** Bjerg, Poul Legstrup (Intern)

**Examiner:** Kjeldsen, Peter (Intern)

**Rivett, Michael O. (Ekstern)**

**Tuxen, Nina (Intern)**

**Financing sources**

**Source:** Internal funding (public)

**Name of research programme:** Marie Curie (EU-stipendium)

**Project:** PhD

**Biogenic Carbon in Danish Combustible Waste**

The ratio between biogenic (biomass) and fossil carbon in fuels affects the "sustainability" of the fuel and the energy technology using this fuel. Today waste contribute with a significant share of Danish renewable energy, however the current data for contents of biogenic and fossil carbon in Danish combustible waste are highly uncertain. To provide accurate accounts of national CO2 emissions, assess whether reduction targets can be met or new renewable energy projects need to be initiated, and overall to further develop the waste-to-energy sector, better carbon data has to be provided. This project combine actual full-scale measurements of carbon in off-gases with modeling approaches to provide documented sampling/measurement procedures and recommendations for implementation of upcoming CEN standards in DK, robust data on biogenic carbon in Danish combustible waste, and suggestions for future use of modeling/estimation approaches. The project is done in collaboration with Force Technology, NERI, and 5 Danish Waste-to-Energy plants (affald danmark)

**Department of Environmental Engineering**

**Period:** 01/04/2009 → 30/10/2011

**Number of participants:** 2

**Acronym:** 889

**Project ID:** 30697

**Project participant:** Astrup, Thomas Fruergaard (Intern)

**Project Manager, organisational:** Astrup, Thomas Fruergaard (Intern)

**Financing sources**

**Source:** Forsk. Andre statslige danske i øvrigt

**Name of research programme:** Ukendt

**Amount:** 1,928,000.00 Danish Kroner

**Project**
Clean and environmentally friendly animal waste technologies for fertilizer and energy production
This project aims to research and develop novel, environmentally friendly technologies which from livestock manure can recover the nitrogen (N) and phosphorous (P), in the form of marketable fertilizers. Energy production technology is optimally an integrated part of manure management systems and is included as an important, but minor R&D activity. Animal manure contains large amounts of plant nutrients and organic carbon, which if left untreated, may potentially pollute surface waters and is a source of greenhouse gases (GHG), ammonia (NH3) and odour. Phosphorous (P) is a very limited global resource which has a supply horizon of 60-130 years. Continuously wasting this limited plant nutrient resource constitutes a risk to the global feed and food supply. The energy rich organic material may supply 3-4% of the Danish energy consumption. Novel technologies for sustainable management and utilisation of animal manure and biowaste are necessary because the continued increase in specialisation and scale of operation of animal farms makes it difficult to comply with new environmental regulations of waste management on limited land, and attractive due to the rapidly increasing prices on the resources of fuels and fertilisers. The vision of this project is to i) develop unit operations to treat slurry and recover plant nutrients into marketable products and ii) to integrate environmental, nutrient recovery and bioenergy technologies for animal manure and biowaste processing in a whole system approach to ensure cost-effectiveness. The project will provide verified analyses (systems modelling, life cycle assessment (LCA), environmental economics) on the impact of these new environmentally friendly bio-energy technologies. This is needed for policy making as well as when marketing on a rapidly growing world market for cleantech.

Department of Environmental Engineering
Period: 01/04/2009 → 31/03/2013
Number of participants: 1
Acronym: CLEANWASTE
Project Manager, organisational: Angelidaki, Irini (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

The Eocene Fur Formation of Denmark - an indicator of global warming
The Palocene-Eocene Thermal Maximum is correlated between ocean and continent

Department of Environmental Engineering
Period: 01/04/2009 → 30/06/2011
Number of participants: 1
Acronym: 882
Project Manager, organisational: Fabricius, Ida Lykke (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Investigation of the effect of UV treatment on the microbial quality in Odense Waters distribution system – Phase 2
The project will investigate the effect on the microbial drinking water quality of applying UV treatment with medium pressure lamps within the distribution system. A range of chemical and microbial water quality parameters will be analysed over a one year period and compared to base line levels measured over a 3-year period prior to the implementation.

Department of Environmental Engineering
Period: 23/03/2009 → 31/07/2010
Number of participants: 2
Acronym: UVOV
Project ID: 30696
Project participant: Albrechtsen, Hans-Jørgen (Intern)
Project Manager, organisational: Corfitzen, Charlotte B. (Intern)

Financing sources
Flow cytometer and UV-laser for Confocal Laser Scanning Microscope

The Flow cytometer will increase our options in cell quantification and the UV-laser for the Confocal Laser Scanning Microscope will enhance our possibilities in terms of direct observations of methanogens and of using tags and labels excited by UV-light.

Department of Environmental Engineering
Period: 02/03/2009 → 31/12/2009
Number of participants: 6
Acronym: 946
Project participant:
Albrechtsen, Hans-Jørgen (Intern)
Henze, Mogens (Intern)
Jakobsen, Rasmus (Intern)
Angelidaki, Irini (Intern)
Dechesne, Arnaud (Intern)

Project Manager, organisational:
Smets, Barth F. (Intern)

Financing sources
Source: Unknown
Project

Integrated hydrological ecological modelling

Department of Environmental Engineering
Period: 01/03/2009 → 19/09/2012
Number of participants: 6
Phd Student:
Loinaz, Maria Christina (Intern)
Supervisor:
Butts, Michael Brian (Intern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)
Examiner:
Binning, Philip John (Intern)
Bierkens, Marinus F. P. (Ekstern)
Bøgh, Eva (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Egen vandressource projekt 5: Helhedsorienteret analyse af vandforsyningsalternativer - afsaltning

Indsættelse af erfaring vedrørende afsaltning i vandforsyning og etablering af vandforsyningsscenarier baseret på afsaltet havvand samt analyse af nødvendigt beslutningsgrundlag for indførelse af sådanne teknologier.

Department of Environmental Engineering
Period: 25/02/2009 → 31/08/2009
Number of participants: 5
Acronym: Afsaltning-A5
Project ID: 30670
Project participant:
Corfitzen, Charlotte B. (Intern)
Arvin, Erik (Intern)
Binning, Philip John (Intern)
Rygaard, Martin (Intern)

Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Ukendt
Amount: 582,359.00 Danish Kroner

Assessment of Nanoparticle Specific Effects in Environmental Toxicity Testing - Expression of interest
The overall aim of the proposed project is to explore those factors and mechanisms affecting the release, behaviour and uptake of current and future use engineered nanoparticles in the aquatic environment. The results will be used to develop guidance on the design and interpretation of aquatic environmental fate and effects studies.

Department of Environmental Engineering
Period: 01/02/2009 → 01/02/2011
Number of participants: 1
Acronym: NanoCEFIC
Project ID: 30717
Project Manager, organisational:
Baun, Anders (Intern)

Financing sources
Source: Forsk. Andre offentlige og private - Udenlandske
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Developing tools for optimised risk assessment of nanoparticles in humans and the environment
FP7 application, 2 stage procedure

Department of Environmental Engineering
Period: 01/02/2009 → 01/02/2012
Number of participants: 0
Acronym: NanoValued

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Sino-Danish Workshop to initiate strategic research collaboration on soil and water resources, environment and human health - expression of interest
to be uploaded

Department of Environmental Engineering
Period: 01/02/2009 → 02/02/2009
Number of participants: 0
Acronym: Sino Water

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Control of hazardous substances in the Baltic Sea Region
Pollution caused by hazardous substances still poses risks to the Baltic Sea area. Loads and impacts of some hazardous substances have been reduced considerably during the past 20-30 years, but concentrations of some other substances have increased in the marine environment. The COHIBA Project will identify the sources and inputs of the 11 hazardous...
substances, which are largely unknown and develop measures to reduce these substances. With HELCOM Baltic Sea Action Plan (BSAP) the Baltic Sea countries have committed themselves to achieve a "Baltic Sea with life undisturbed by hazardous substances. The overall objective of COHIBA is to support the implementation of the BSAP with regard to hazardous substances by developing joint actions to reach the goal. COHIBA will last three years (2009-2012). It's co-financed by the European Union within the Baltic Sea Region Programme 2007-2013. It's total budget amounts to around EUR 4.9 million.

Department of Environmental Engineering
Period: 25/01/2009 → 24/01/2012
Number of participants: 3
Acronym: COHIBA
Project ID: 30730
Project participant:
Mikkelsen, Peter Steen (Intern)
Rasmussen, Birte Kastrup (Intern)
Project Manager, organisational:
Lützhøft, Hans-Christian Holten (Intern)

Financing sources
Source: Forsk. EU - Andre EU-midler
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

High-performance two-step process for biological production of hydrogen and methane from organic residues
The main goal of "BioHyMeth" is to develop an innovative two-step fermentation process in which hydrogen is produced in the first step and methane in the second. The target is to obtain a mixture of hydrogen and methane by using methane to strip the hydrogen from the first step. In this way, productivity in the hydrogen fermentation is increased by eradicating the inhibition at H2 partial pressure above 20 kPa (Van Niel, Claassen, Stams, 2003) and a mixture of hydrogen and methane is the end-product. The mixture of hydrogen and methane (BioHyMeth-gas) will be a tailor-made biofuel for stationary CHP units (combined heat and power) because of significant lower NOx emission and a reduction of CO2 emission, already shown by combustion of a similar mixture of hydrogen and natural gas: the Hythane®-gas. This project builds on the extensive knowledge in anaerobic digestion, where separation into two steps has been shown to give an optimisation in organic loading rate and gas productivity (Ueno et al, 2007). Furthermore, knowledge recently acquired in hydrogen fermentation in the FP6 IP HYVOLUTION FP-6 SES 019825 will be at the foundation of this project. In BioHyMeth an alternative strategy is provided for substrates not suitable for photofermentation, which is the second fermentation step in the bioprocess in HYVOLUTION. As such, this project adds to the variety of biofuels and the increased security of energy supply at a regional level. The optimised process will be upscaled to a combined pilot plant (approximately 500 l total fermenter volumes).

Department of Environmental Engineering
Period: 04/01/2009 → 02/01/2012
Number of participants: 0
Acronym: 836

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Biorefinery for sustainable Reliable Economical Fuel production from energy crops. First call.
The project focuses on development of a novel, technically and economically viable process for conversion of whole plant biomass into a diverse range of biofuels, foods and high-value added chemicals from a single feedstock, rapeseed. This will be achieved by overcoming the identified, critical process bottlenecks of present rapeseed – to- biodiesel, -bioethanol, -biohydrogen, -biogas, -and high value-added products conversion technologies. The project aims at an innovative biorefinery process approach focusing on 1) Field studies to investigate and optimize rapeseed crop production, harvesting, storage and transport, 2) Laboratory scale studies devoted to the rapeseed oil extraction, production of high value-added chemicals from oilseed bioprocessing, development of new enzymatic transesterification process for biodiesel production, pre-treatment and enzymatic hydrolysis of cellulose and hemicellulose for downstream bioconversion to bioethanol and biohydrogen, 3) Pilot scale study at DTU to optimize a two steps process for biohydrogen and biomethane production from the process wastewaters, 4) Supply chain analysis based on Life-Cycle – assessment methodologies for comparison of different process chains from well to product. Sensitivity analysis will be devoted to determine bottlenecks for different processes. Additionally, key emissions and/or resource consumption data related to the individual processes will be identified for further optimization of the overall biorefinery concept, 5) Demonstration of the final biorefinery concept at DONG existing infrastructure.
Development of Quantitative Structure-Activity Relationships models for nanoparticles

The purpose of this project is to develop Quantitative Structure-Activity Relationships models for engineered nanoparticles (QSARNP) that can predict the human health and environmental effect based on inherent physico-chemical properties of nanoparticles. Based on the hypothesis that the biological effects of engineered nanoparticles are directly linked to the inherent physico-chemical properties, the aim of this project is to provide guidance to companies, material developers, and regulators to screen and rank engineered nanoparticles according to their toxicity. Within a two-year period, we will carry out research dedicated to the following objectives: To identify and select appropriate human health and environmental toxicological endpoints and nanoparticle characteristics to be used as hazard descriptors. To develop and validate model(s) for estimation of the (eco)toxicity of engineered nanoparticles based on existing knowledge on physico-chemical properties and hazards documented in laboratory studies.

Effective land surface representation in water resource modelling

The overall goal of the project is to develop methodologies to quantify the relative impacts of land use and climate variability on water yields and extreme hydrological events, i.e. floods and droughts, at multiple spatial scales. An important objective is to relate land use change to its position in landscape (and its spatial variations) and quantify its cumulative effects on hydrological processes at larger scale. For this purpose, new and innovative data types will be used to improve the knowledge basis required to develop efficient land surface schemes and model techniques facilitating prediction of cumulative and large-scale hydrological and atmospheric processes. The combined use of new data types and cross-disciplinary modeling approaches will facilitate 1) quantification of relationships between site-specific, spatial and cumulative hydrological processes and 2) prediction of the relative impacts of climate and land use changes on water yield and extreme hydrological events at different spatial scales. Such tools are particularly important to mitigate climate change impacts and optimize land use and water management planning in relation to ecosystem health, agricultural production, human/industrial water needs, and flood protection in urban, coastal and near-stream regions.
Efficient integrated Data and Information Technology for monitoring the environment. Rejected

The project will develop a new framework and innovative technologies for monitoring of the environment. The principal idea of the proposed framework is integration of measurements of environmental variables from in-situ and remote sensing with process-based environmental modelling to provide the best (most cost-effective) estimate of the environmental state and its uncertainty in space and time. The project will develop integrated solutions that consider monitoring of environmental variables in soil, inland water bodies (groundwater, rivers, wetlands and lakes), marine waters and air in one unified system. The framework will be flexible in order to address monitoring at a range of scales, from national and regional environmental monitoring programmes to the monitoring of eco-systems at local scales. Furthermore, the framework can be used to monitor the effects of implementation of new environmental technologies, regionally as well as locally. The proposed framework is also essential for effective detection of trends in environmental variables due to changes in the driving forces such as changes in emissions or climate change. A key issue and innovative component of the project is estimation of the uncertainty of the environmental state. Provision of the uncertainty is important to optimise the monitoring efforts. The project will develop optimisation procedures that consider uncertainty and costs of the monitoring for optimal location and measurement frequency of in-situ sensors in combination with remote sensing information to provide the most cost-effective monitoring strategy. The developed technologies will be demonstrated in a regional-scale case study for integrated monitoring and modelling of nitrogen including atmospheric deposition on land and water bodies, agricultural loading of soils and transformation in hydrological media and marine waters. In addition, a number of minor case studies will demonstrate the value of monitoring and modelling at local scale for selected environmental variables and media.

Department of Environmental Engineering
Period: 01/01/2009 → 31/12/2012
Number of participants: 2
Acronym: EDIT
Project participant:
Bauer-Gottwein, Peter (Intern)
Project Manager, organisational:
Rosbjerg, Dan (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Electricity assisted biological hydrogen production using single chamber membrane-free anaerobic reactor

Bio-hydrogen is a CO2-neutral energy source with very promising perspectives, as an alternative to fossil fuels for future energy production. Hydrogen can be produced from organic waste, i.e. utilizing an otherwise undesirable burden to society, as a useful raw material for production of fuel for road vehicles or for production of electricity. Biohydrogen production through conventional fermentation has a serious disadvantage, limited by a maximum hydrogen production of only 33% of the energy content in the organic material. A new method, where electricity is assisting the biological process to overcome its limitations and fully recover the energy in the organic matter in the form of hydrogen, has recently been discovered. The method is however in it infancy and requires expensive membranes which makes the application of such technology not practically feasible. Preliminary results at the DTU-Environment indicate however, that membranes-free anaerobic environment can be used for hydrogen production from organic matter. The aim with this project is to investigate possibilities for develop an efficient and economic process for electricity assisted biological hydrogen production. With the proposed project we intent to: -Disclose the fundamental biological process for the fully oxidation of organic matter to hydrogen and carbon dioxide by electrically assisted hydrogen fermentation -Evaluate the parameters important for biohydrogen production in an anaerobic reactor -Develop an innovative process configuration, with membrane-free reactors, for efficient biohydrogen production -Evaluate the process by system analysis.

Department of Environmental Engineering
Period: 01/01/2009 → 31/12/2011
Number of participants: 2
Acronym: 874
Project participant:
Angelidaki, Irini (Intern)
Karakashev, Dimitar Borisov (Intern)
Evaluation tools targeted at Water and Water Supply Technologies

Deterioration of water quality and reduced availability of water caused by anthropogenic and climate pressures require prompt actions by water managers in order to maximize the economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. Technologies for e.g. waste water treatment, water saving and reduction of non-point source pollution are being developed to mitigate the deterioration of the water resources and ecosystems. Efficient selection and implementation of these technologies requires advanced tools. The aim of this research proposal is to extend, improve, adopt and test a suite of management tools targeted at evaluation of water related environmental technologies. The development of tools will consider the specific technological, hydrological and socioeconomic context of the implementation and at the same time ensure a consistent comparison of the efficiency of different technologies. The ET-WATER framework will enable use of systematic and analytical approaches in identifying appropriate and efficient water related environmental technologies required e.g. in order to fulfill goals of the Water Framework Directive or needs related to climate change adaptation, by integrating economic and hydrological tools addressing uncertainties and probabilities. Expected results include flexible water management tools based on state-of-the-art technical, hydrologic and economic knowledge aiming at identifying cost-efficient measures and implementation modalities facilitating the water and environmental management and decision-making process. The water and environmental managers at national, regional and local level and the water management industry will benefit from this development through knowledge transfer using the rich Danish experiences. The export potential of water management tools and advisory services from Denmark will increase.

Groundwater Prism

Groundwater sustains a great number of biologically diverse ecosystems, yet we only now begin to fully appreciate their inter-dependent nature. Our knowledge on how groundwater quality and quantity is affected by human activities is limited. Consequently, risk assessment strategies, the resulting formulation and implementation of regulations to protect aquifers and groundwater dependent ecosystems have to be adjusted.

Highly effective conversion of C5 and C6 sugars to ethanol by new yield type ethanol-tolerant microorganisms: challenge for sustainable 2nd generation bioethanol production from lignocellulose

A limiting factor for the full-scale utilization of lignocellulosic material for bioethanol production is the lack of wild-type (native) microorganisms that are able to efficiently ferment pentoses and hexoses with high tolerance to ethanol. Industrial application of the recombinant microbial strains for bioethanol production is still restricted by legislations with respect to human health and environment protection. High efficient microbial conversion of hexoses to ethanol is a well developed
industrial process. On the contrary all known pentose utilizing wild-type microorganisms were characterized with low ethanol yields and low ethanol tolerance. The overall goal of this project is to screen and select microorganisms and conditions for optimal hexose and pentose fermentation to ethanol. More specifically we aim to: -enrich, isolate and identify a number of wild-type ethanologens with high ethanol tolerance and ability for high rate fermentation of both hexoses and pentoses; -identify optimal process conditions for bioethanol production from real lignocellulosic hydrolysate; -demonstrate bioethanol production with selected microorganisms in pilot scale conditions

Department of Environmental Engineering
Period: 01/01/2009 → 31/12/2011
Number of participants: 2
Acronym: 876
Project participant:
Angelidaki, Irini (Intern)
Karakashev, Dimitar Borisov (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Impact of climate change on the quality of urban and coastal waters (diffuse pollution)
DiPol intends to make a contribution to retain sustainable and healthy urban and coastal waters despite potential adverse effects of climate change. European urban areas face a number of environmental problems such as air pollution, traffic volumes, scarcity of recreational areas, generation of large volumes of waste and waste water, and historical industrial legacies. Within the Water framework Directive (WFD, 2000) the water related problems are mapped and linked to their sources. However, the management options don’t take into account the risks in a catchment area (from urban areas to coastal zones) under extreme conditions. Solutions need to be forward-looking and anticipate future risks such as the impacts of climate change as well as contribute to national, regional and global policies (Technical Report of the EC 2007-013). Education and awareness of the link between societal behaviour and development, environmental quality and economic development is necessary for the long-term mitigation of environment and climate related problems. While direct consequences of climate change on urban development (e.g. flooding) have been addressed in a number of projects (see 3.9), secondary implications of increased urban runoff, higher contaminant loads of rivers during more frequent floods, the risks of rising ground water levels in industrialized areas and of stronger rainfalls on the contamination of urban waters has received little attention until now. Ultimately these contaminated fresh water ends up in the coastal waters. Increased introduction of contaminants into surface waters in the coastal zone may counteract sustainable urban development (human health, quality of life, economic attraction) as well as European environmental strategies such as the Water Framework Directive (WFD) and the planned European Marine Strategy. Starting from visions of school children and of the public on future environmental services (e.g. suitability of public waterways for swimming), those climate change related processes that support or endanger these visions by affecting the quality of urban and coastal waters will be in the focus of this project. They will be used to develop a plan for sustainable development in their communities. Quality-related impacts of rainfall, sea level rise, and river discharges will be investigated relative to the way they may alter the living environment and endanger the realization of these visions within the next 50 years, and measures or alternatives will be suggested to either prevent or adapt to the expected impacts. Experts on atmospheric, river and marine pollution from Norway, Sweden, Denmark, the Netherlands and Germany will work together with local administrators and regional managers to identify impediments to this sustainable development that are related to climate change. Risks due to different emission pathways (e.g. urban water run-off) will be related to each other and prioritized with regard to their impact and potential management measures. These measures will then be communicated to the public. Approaches to address and counter risks to the goals of the European Environmental policies through changes in the emission of priority substances will be introduced by the EU-Joint Research Centre into the international working group level that drafts guidance for the monitoring concepts of the WFD, and realizes the Oslo-Paris Convention on the protection of the North Sea.

Department of Environmental Engineering
Period: 01/01/2009 → 31/12/2011
Number of participants: 3
Acronym: DiPol
Project ID: 30729
Project participant:
Albrechtsen, Hans-Jørgen (Intern)
Lützhøft, Hans-Christian Holten (Intern)
Project Manager, organisational:
Mikkelsen, Peter Steen (Intern)

Financing sources
**INTERREG IVC**
The basic idea of the project is to determine the good practices and to design the best policy, which successfully tackle the problem of waste prevention and management for the benefit of regional/local communities not only of the participating but all the EU countries. Many regional/local authorities, with weak knowledge endowments, are confronted with the challenge of supporting the Green concept in environment. However, the ability of local authorities to facilitate or underpin the necessary knowledge transfer from universities with the help of national/regional agencies definitely assists the implementation of ETAP at the participating regions. So, providing the aforementioned background, the main project objective is to enhance the interaction between universities and local authorities, with the aim of facilitating knowledge exchange that can lead not only to increased environmental consciousness but also to the adoption of actions and mechanisms through a solid action plan.

**Department of Environmental Engineering**
*Period:* 01/01/2009 → 31/12/2011
*Number of participants:* 2
*Acronym:* EnGreenCIE
*Project participant:* Angelidaki, Irini (Intern)
Karakashev, Dimitar Borisov (Intern)

**Financing sources**
*Source:* Unknown
*Name of research programme:* Ukendt
*Amount:* 0.00 Danish Kroner

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**Microbial Remediation of Contaminated Soil and Water Resources**
This project aims at developing new biotechnologies for remediation of pesticide-polluted soil and water resources. Bioaugmentation technology is the introduction of specific degradative micro-organisms to treat contaminated soil or water. In this project, new bioaugmentation technologies will be developed taking advantage of novel strategies for isolation of specific microorganisms with specialized degradation capabilities. Until now, research on contaminant degradation has focused on the role of bacteria, but in this project the potential of fungi will also be studied to explore the possibility of using fungal-bacterial consortia for bioaugmentation. To prevent predation by protozoa and to secure optimal conditions for degradation, selected strains or consortia will be immobi-lized on specifically designed carriers. The developed bioaugmentation technologies will be evalu-ated at the field-scale 1) for remediation of pesticide-polluted soil to prevent leaching of the com-pounds to underlying aquifers, 2) for treatment of pesticide-polluted drinking water in sand filters at waterworks and 3) in reactive barriers protecting drinking water wells by degrading pesticides be-fore they enter the waterworks. The project will bring together a consortium of national and foreign research institutions, wa-terworks, private companies and environmental agencies, all of which will benefit from this new constellation. Moreover, new candidates within the field of environmental biotechnology will be educated. Two postdoctoral fellows and six PhD students will be financed directly by the project and several MSc students will also participate.

**Department of Environmental Engineering**
*Period:* 01/01/2009 → 31/12/2013
*Number of participants:* 3
*Acronym:* MiReSoWa
*Project ID:* 30695
*Project participant:* Smets, Barth F. (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Dechesne, Arnaud (Intern)

**Financing sources**
*Source:* Forskningsrådene - Andre
*Name of research programme:* Ukendt
*Amount:* 3,729,985.00 Danish Kroner

The core of the proposed project is to investigate and further advance multi-objective, multi-reservoir management by use of surrogate modelling with evolutionary algorithms within a simulation-optimisation framework for optimisation of water resources systems under different climate projections. The research will focus on development of downscaling techniques and weather generators, as well as multi-fidelity and adaptive surrogate modelling techniques that use a sequence of surrogates with varying fidelity in the optimisation. Surrogate models are continuously updated by models with greater physical fidelity as the optimisation proceeds. The developed techniques will be tailored towards application in complex water resources systems, involving multiple objectives as well as multiple reservoir systems. Special emphasis will be given to develop cost-effective methods that are feasible for real-time applications, where real-time data and forecast information are used in the optimisation process. An important aspect that will be considered in the project is how to handle uncertainties and stochasticity in the optimisation process. Uncertainties are related to the inherent errors in the input data used to force the modelling system as well as errors in the modelling system itself. Stochasticity is related to the inherent stochastic nature of the meteorological variables forcing the modelling systems. Uncertainties and stochasticity are normally represented by multiple system states in an ensemble setting, which adds an additional computational challenge to the optimisation problem. The use of weather generators and surrogate modelling is seen as a viable way to solve this problem. The developed techniques will be tested and evaluated on the Red River basin reservoir system in Vietnam.

Department of Environmental Engineering
Period: 01/01/2009 → 30/06/2012
Number of participants: 1
Acronym: 886
Project Manager, organisational:
Rosbjerg, Dan (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

NanoSafe 2
Application to FP7

Department of Environmental Engineering
Period: 01/01/2009 → 31/12/2012
Number of participants: 0
Acronym: NanoSafe 2

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

RESCOBIR-2
Removal of reduced nitrogen (organic and ammonia-N) is mandatory before discharge of treated wastewaters to receiving waters. Currently available biotechnologies are very resource intensive and can results in unwanted GHG emissions. We have previously demonstrated a novel way to attain N removal: it involves the use of aerobic and anaerobic ammonium oxidizing bacteria, which are grown together to high density on oxygen permeable membranes. The current project aims to optimize and delineate the technological capacities of the ReSCoBiR concept for N removal. By using a combination of experimental and computational tools, reactor-scale and microscale analyses, and advanced bioprocess monitoring and control methods, we will build, operate, and optimize several bioreactor modules and develop and calibrate supporting process models and control algorithms. We expect succesful technology transfer at project end.

Department of Environmental Engineering
Period: 01/01/2009 → 31/12/2012
Number of participants: 0
Acronym: 877

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project
Reuse of treated sewage
A single household sewage treatment plant is investigated for pathogens in the effluent and the possibility to disinfect the effluent with either UV or UV and ozone is investigated for purifying the wastewater to different standards of reuse.

Department of Environmental Engineering
Period: 01/01/2009 → 31/10/2009
Number of participants: 2
Acronym: 871
Project participant:
Ledin, Anna (Intern)
Project Manager, organisational:
Andersen, Henrik Rasmus (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Strategies for chemical healthy public swimming pools
Department of Environmental Engineering
Period: 01/01/2009 → 27/03/2013
Number of participants: 6
Phd Student:
Kaarsholm, Kamilla Marie Speht (Intern)
Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Mosbæk, Hans (Intern)
Main Supervisor:
Andersen, Henrik Rasmus (Intern)
Examiner:
Lützhøft, Hans-Christian Holten (Intern)
Grønborg, Ole (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Uncertainty and adaptive estimation in storm- and wastewater system modelling
Department of Environmental Engineering
Period: 01/01/2009 → 02/07/2014
Number of participants: 7
Phd Student:
Borup, Morten (Intern)
Supervisor:
Grun, Morten (Intern)
Madsen, Henrik (Intern)
Main Supervisor:
Mikkelsen, Peter Steen (Intern)
Examiner:
Ambjerg-Nielsen, Karsten (Intern)
Savic, Dragan A. (Ekstern)
Weerts, Albrecht (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
**Inventory modelling and documentation of four landfilling technologies for ELCD using EASEWASTE**

The objective is to develop inventory modelling (in-put / out-out tables) and documentation for four landfilling technologies for ELCD using EASEWASTE. ELCD is the European database for life-cycle-inventories hosted by the JRC in Ispra. The ELCD datasets will be represented as default technologies in EASEWASTE in the future.

Department of Environmental Engineering  
**Period:** 15/12/2008 → 30/04/2009  
**Number of participants:** 2  
**Acronym:** 918  
**Project ID:** 30727  
**Project Manager, organisational:**  
Christensen, Thomas Højlund (Intern)  
Manfredi, Simone (Intern)

**Financing sources**
- **Source:** Indtægtsdækket virksomhed UK 90  
- **Name of research programme:** Ukendt  
- **Amount:** 211,950.00 Danish Kroner

**Environmental hazard evaluation of the SIN-list**

This project aims at performing an environmental hazard assessment of the 270 compounds presently included on the SIN-list (Substitute It Now)

Department of Environmental Engineering  
**Period:** 01/12/2008 → 30/04/2009  
**Number of participants:** 3  
**Acronym:** SIN-list  
**Project ID:** 30654  
**Project participant:**  
Eriksson, Eva (Intern)  
Lützhøft, Hans-Christian Holten (Intern)  
**Project Manager, organisational:**  
Ledin, Anna (Intern)

**Financing sources**
- **Source:** Sam.arb.aftaler - Udenlandske offentlige og private  
- **Name of research programme:** Ukendt  
- **Amount:** 75,000.00 Danish Kroner

**Relations**
- **Publications:** Second opinion on the hazards associated with the substances selected for the REACH SIN* List 1.0

**MILjøefektiv TEKnologi til videregående rensning af overløbsvand og spildevand**

Formålet er at skaffe ny viden og demonstere tre multifunctionsteknologier til rensning af overløbsvand og videregående rensning på rensningsanlæg, som hver især i ét anlæg kombinerer flere supplerende rensefunktioner. Det er således målet, at kombinere konventionelle renseteknologier (mikrosifiltrering, sandfiltrering og bundfældning) med udvidede funktioner, hvorved teknologierne får større alsidighed i forhold til bl.a. flowbelastning og mindre pladsbehov. Desuden er det målet at undersøge hvilken betydning udvidelse af konventionelle renseteknologier har på renseefekt overfor hormonforstyrrende stoffer, patogene bakterier og næringsstoffer. Der er målet, at demonstreringsprojektet giver anledning til, at flere større byer etablerer renseteknologi for at mindske belastningen på bynære vandressourcer, herunder at:  • flere regnbetingede spildevandsaflastninger fra kloaksystemerne renes inden det udledes  • videregående rensning på renseanlæg bliver mere udbredt og der derfor udledes mindre mængder hormonforstyrrende stoffer, patogene mikroorganismer og næringsstoffer. Med projektet kommer vi nærmere omkring, at det rensede spildevand ikke er et affaldsprodukt, der skal ledes væk, men nu kan indtænkes som en positiv ressource i vore recipiinter. F.eks. kan det rensede spildevand ledes/pumpes til en recipient som en sund basisvandføring. Samtidig vil det rensede spildevand ikke belaste badevandskvaliteten, som det ellers er tilfældet ved udled fra mange renseanlæg. Konkret vil der i de tre demonstrations-cases opnås erfaringer med drift i stor skala og blive belyst en sammenhæng mellem belastning/kapacitet og resulterende renseefektivitet. Ligesom det overordnede mål, med at teknologierne skal give mest miljø for pengene, forfølges. Det er valgt at gennemføre testprogrammet for de tre teknologier på to sites (Renseanlæg Damhusåen og Egå...
Renseanlæg), der begge er repræsentative for store bynære anlæg, der afleder vand til recipienter med højt rekreativt potentiale. Testresultaterne skal hjælpe forsyninger og miljømyndigheder til at identificere tekniske, miljømæssige og økonomisk relevante teknologier, der kan være med til at forbedre den kemiske og mikrobiologiske vandkvalitet i de områder, der modtager renset spildevand og overløbsvand.

Department of Environmental Engineering
Period: 01/12/2008 → 01/12/2009
Number of participants: 4
Acronym: MILTEK
Project ID: 30709
Project participant:
Ledin, Anna (Intern)
Qualmann, Signe (Intern)
Kruse, Susanne (Intern)

Project Manager, organisational:
Andersen, Henrik Rasmus (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Ukendt
Amount: 252,000.00 Danish Kroner

Multi-scale hydro geological characterisation of contaminated sites in clayey till

Department of Environmental Engineering
Period: 01/12/2008 → 27/06/2012
Number of participants: 7
Phd Student:
Kessler, Timo Christian (Intern)
Supervisor:
Klint, Knud Erik (Ekstern)
Nilsson, Bertel (Ekstern)
Main Supervisor:
Bjerg, Poul Løgstrup (Intern)
Examiner:
Jakobsen, Rasmus (Intern)
Piotrowski, Jan A. (Ekstern)
Therrien, René (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

On-line continuous monitoring of drinking water quality
To increase the safety for good drinking water, quality parameters should be monitored with a higher frequents than today's spot checks. This project will investigate the possibilities for online, continuous and real-time monitoring by:
•Investigating the suitability of different on-line sensors e.g. turbidity, conductivity, flow, pressure or temperature to ensure good drinking water quality based on long-term time series. •Improving the interpretation of the signal form on-line sensors by identifying the source causing the signal. •Comparing and evaluate sensors with the goal to select the best suited sensors. •Investigating to what degree a signal represents a significant chance in the drinking water quality by introduces changes to the system in connection with intensive measuring campaigns including a large range of parameters. •Combining measuring campaigns with newly developed equipment for on-line ATP-measurement.

Department of Environmental Engineering
Period: 01/12/2008 → 31/01/2010
Number of participants: 2
Acronym: OKDK
Project ID: 30652
Project participant:
Albrechtsen, Hans-Jørgen (Intern)
Project Manager, organisational:
Corfitzen, Charlotte B. (Intern)

Financing sources
Source: Sam.arb.aftaler - Statslige danske
Name of research programme: Ukendt
Amount: 400,275.00 Danish Kroner
Project

Reduktion af methanemission fra AVMiljø ved opbygning af biocover system. Forstudie
Reduktion af methanemission fra AVMiljø
Department of Environmental Engineering
Period: 01/12/2008 → 01/07/2009
Number of participants: 3
Acronym: AVMiljø-Biocover
Project ID: 30667
Project participant:
Skov, Bent Henning (Intern)
Scheutz, Charlotte (Intern)
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Ukendt
Amount: 262,900.00 Danish Kroner
Project

SUDS Project Handbook
The project aims to improve the knowledge basis and create and overview of methods for Sustainable Urban Drainage Systems (SUDS), for implementation in Copenhagen Municipality (in Danish: LAR - Lokal Afledning af Regnvand). A SUDS-project manual will be prepared, which can be used by the Center for Park and Nature and other departments in Copenhagen Municipality as well as by their consultants and contractors. DTU Environment's contribution to the project is focused on assessing the fate of priority pollutants (PPs) in SUDS-elements based the removal processes occuring in SUDS-elements and the inherent physical-chemical properties of the PPs.

Department of Environmental Engineering
Period: 01/12/2008 → 31/08/2009
Number of participants: 3
Acronym: LAR-Håndbog
Project ID: 30715
Project participant:
Eriksson, Eva (Intern)
Vezzaro, Luca (Intern)
Project Manager, organisational:
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 109,800.00 Danish Kroner

Relations
Publications:
Vurdering af renseeffekt for metoder til lokal rensning og afledning af regnvand
Project

Model for LCA screening of remediation technologies
The project aims at developing a screening model for environmental assessment of remediation technologies for soil and groundwater contamination based on life cycle assessment (LCA).

Department of Environmental Engineering
LCA-screening of 8 European waste management scenarios

Eight waste management scenarios representing various generic European approaches are screened by using EASEWASTE in collaboration with the Sustainable Landfill Foundation. The scenarios involve source separation of recyclables, MBT, incineration, composting, anaerobic digestion, RDF and landfilling.

Project

Injektionsprojekt på Vadsbyvej 2008, Delprojekt 3

Afprøvning og dokumentering af metoder (hydraulisk frakturering og geoprobeinjektion) til injektion af stoffer i moræneler.

Project

UV treatments effect on aftergrowth potential

Literature study on UV treatments effect on aftergrowth potential in drinking water distribution system in relation to Gentofte water supply.
Hydrogeophysical tools for the calibration and validation of coupled surface water / groundwater flow and transport models

Department of Environmental Engineering
Period: 01/11/2008 → 28/03/2012
Number of participants: 6
Phd Student:
Herckenrath, Daan (Intern)
Supervisor: 
Auken, Esben (Intern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)
Examiner:
Binning, Philip John (Intern)
Jensen, Karsten Høgh (Intern)
Vereecken, Harry L.V. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Optimization of bio-hydrogen production from carbohydrate rich wastes by extreme thermophilic microorganisms

Department of Environmental Engineering
Period: 01/11/2008 → 03/07/2013
Number of participants: 6
Phd Student:
Tomás, Ana Faria (Intern)
Supervisor: 
Karakashiev, Dimitar Borisov (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Dechesne, Arnaud (Intern)
Norddahl, Birgir (Ekstern)
Verstraete, Willy (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet
Project: PhD

National climate change adaptation webportal, input on Water
Levering af input til klimatilpasningsportalen om emnet Vand på vegne af Miljøministeriet, By- og Landskabsstyrelsen

Department of Environmental Engineering
Period: 27/10/2008 → 14/11/2008
Number of participants: 5
Acronym: Vandportal
START-funding II. Preparation of EU project proposal "Biorefinery for sustainable Reliable Economical Fuel production from energy crops" (Acronym: BioREF)

With this project we apply money for formulation, preparation and organization of an EU application under the 7th EU framework programme within "FP7, Cooperation, Theme 2, Food, Agriculture, Fisheries and Biotechnologies, area 2.3.7. BIOREFINERY joint call, call identifier FP7-2009-BIOREFINERY.

Department of Environmental Engineering
Period: 10/10/2008 → 02/12/2008
Number of participants: 3
Acronym: 896
Project ID: 30692
Project participant:
Angelidaki, Irini (Intern)
Boe, Kanokwan (Intern)
Karakashev, Dimitar Borisov (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 195,000.00 Danish Kroner

Evaluation of soil and groundwater pollution at the Collstrup site: Summary of site investigations
The old wood preservation site close to Hillerød is heavily polluted with arsenic and chromate. Especially arsenic is leaching out from the site and affects groundwater and surface waters in the surroundings. Site investigations have been carried out over a period of 30 years. This project summarizes the knowledge obtained from the investigations.

Department of Environmental Engineering
Period: 01/10/2008 → 01/04/2009
Number of participants: 2
Acronym: Collstrup
Project ID: 30640
Project participant:
Jakobsen, Rasmus (Intern)

Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Ukendt
Amount: 196,017.00 Danish Kroner

Remediation of TCE source zone in Skuldelev by the ZVI-Clay technology
Source zones of DNAPLs can be complicated and difficult to delineate precisely. ZVI-Clay is a technology which contain the source by soil mixing bentonite and zero valent iron (ZVI) into the source zone area. The bentonite gives an immediate flux reduction from the source while the ZVI leads to degradation of the contained TCE. The technology has never been used outside USA. This project will closely follow the degradation processes within the treated source zone and the
remedial effect on the TCE flux away from the source.

Department of Environmental Engineering  
Period: 01/10/2008 → 01/06/2010  
Number of participants: 2  
Acronym: ZVI-Clay  
Project ID: 30639  
Project participant:  
Fjordbøge, Annika Sidelmann (Intern)  
Project Manager, organisational:  
Kjeldsen, Peter (Intern)

Financing sources  
Source: Sam.arb.aftaler - Amter og kommuner  
Name of research programme: Ukendt  
Amount: 753,000.00 Danish Kroner  
Project

**Water Sector Programme Component 3 (Phase 1 2005-2010): Support to Integrated Water Resource Management in Zambia Output 4 - Capacity built through University of Zambia**

The governments of Zambia and Denmark are co-operating on a Water Sector Programme in Zambia, of which the first phase is planned to be implemented in the period from 2005 to 2010 (DANIDA, 2005a). Component 3 in this programme is a support to facilitate Integrated Water Resources Management (IWRM) at the Ministry of Energy and Water Development in Lusaka. A defined Output 4 in this programme is support to Capacity built through University of Zambia (DANIDA, 2005b), and objectives which shall be achieved through collaboration between UNZA and Danish Research Institutions. A representative from UNZA has visited research institutions during two trips to Denmark, and a fact finding report defining the set-up of a twinning arrangement have been written (Nyambe and Thygesen, 2006). In May 2008 a co-operation agreement was signed between UNZA and a Danish consortium consisting of The National Geological Survey of Denmark and Greenland (GEUS) and The Technical University of Denmark. The immediate objective of Output 4 is to: •Improved and sustainable water sector performance through human capacity building at University of Zambia. This objective will be achieved through the following activities: •Establish an Integrated Water Resource Management (IWRM) Centre at UNZA.  
•Develop a communication strategy for marketing of the IWRM Centre •Establish one-year diploma courses on IWRM and Hydrogeology at UNZA. •Carry out a number of applied research projects, relevant for improved planning, regulation and allocation of Zambia's water resources as well as for improved water services delivery. •Support to two PhD projects at UNZA •Support to eight M.Sc. projects at UNZA. •Support to tailor made courses for 150 IWRM in-service students.  
•Support to faculty exchanges between UNZA and Danish research institutions. The co-operation between UNZA and GEUS/DTU includes support to the development of course curricula for the two new diploma educations and joint supervision of M.Sc. and PhD students. The latter will be done in a close co-operation with Zambian researchers and through teaching of the students in Denmark at the Geocenter in Copenhagen and at DTU. The framework of the training of the post graduate students will be a joint research programme in Zambia with participants from the involved institutions. This document describes the contents of this research programme and outlines the contents of the integrated PhD and M.Sc. projects in the programme.

Department of Environmental Engineering  
Period: 01/10/2008 → 31/12/2010  
Number of participants: 1  
Acronym: 895  
Project ID: 30665  
Project Manager, organisational:  
Bauer-Gottwein, Peter (Intern)

Financing sources  
Source: Sam.arb.aftaler - Statslige danske  
Name of research programme: Ukendt  
Amount: 0.00 Danish Kroner  
Project

**Karakterisering af membran og UV vandbehandlingsanlægget i Marselisborgcentrets varmtvandsbassin**

Undersøgelsen består i, at der i en periode på ca. to måneder registreres alle relevante målte driftsparametre vedrørende vandbehandlingsanlægget i MarselisborgCentrets varmtvandsbassin. MarselisborgCentrets varmtvandsbassin udtager i perioden 15 gange prøver af bassinvandet som sendes til instituttet som foretager analyser af TOC, THM og AOX på hver prøve. I samarbejde med institution og MaC og producenten af vandbehandlingsanlægget behandles dataene mhp. at lave en massebalance for anlæggets energi, vand og kemikalieforbrug og karakterisering af vandkvaliteten i systemet.

Department of Environmental Engineering
Research Collaboration within wastewater treatment - phase 1. CONFIDENTIAL!!

Develop suggestions for DTU Environment - Siemens WT research collaborations in multiple areas.

Department of Environmental Engineering
Period: 12/09/2008 → 01/05/2009
Number of participants: 1
Acronym: 892
Project ID: 30646
Project Manager, organisational:
Smets, Barth F. (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 600,000.00 Danish Kroner

Development of e-learning courses in environmental technology and physics.

With Moodle as platform 4 e-learning courses in environmental technology and physics is developed. The 4 courses are: Drinking water treatment - Water Education, Wastewater treatment - Water Education, Kontrol af miljøfremmede stoffer i udledninger med regn og spildevand fra byer - Water Education and Fysik 1.

Department of Environmental Engineering

Department of Physics
Period: 01/09/2008 → 30/06/2011
Number of participants: 5
Acronym: IKT-støttet læring
Project ID: 30626
Project participant:
Arvin, Erik (Intern)
Mikkelsen, Peter Steen (Intern)
Rasmussen, Birte Kastrup (Intern)
Knudsen, Carsten (Intern)
Project Manager, organisational:
Eriksson, Eva (Intern)

Financing sources
Source: Uddannelse. Statslige. Andre statslige
Name of research programme: Ukendt
Amount: 900,000.00 Danish Kroner

Engineered Nanoparticles - Review of Health and Environmental Safety
See attachment

Department of Environmental Engineering
**Forgasning af afgasset biofibre fra biogasanlæg og udnyttelse af forgasningsgassen i biogasreaktoren**


Forgasningsgassen består primært af CO og brint, to gasser som kan omsættes af metanbakterier til methangas. Ved denne metode undgår man også at man skal oprense forgasningsgassen fra tøje og andre uønskede komponenter der kan genere motordriften. Det overordnede mål med dette projekt er at udvikle en energieffektiv teknologi for at udnytte energipotentialet i fibre separeret ved biogasanlæg. Det ansøgte projekt har følgende formål:

1. Fastlægge forholdene omkring forgasning af biofibre, herunder, fastlægge temperatur, tryk, TS indhold for optimum forgasning af afgassede biofibire.
2. Fastlægge omsætningsmuligheder af forgasningsgassen i biogasreaktoren.
3. Skabe en kombineret forgasning og biogas proces

**GOODWATER, Marie Curie ITN**

Department of Environmental Engineering
Period: 01/09/2008 → 02/10/2011
Number of participants: 0
Acronym: 835

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Department of Environmental Engineering
Period: 01/09/2008 → 31/08/2012
Number of participants: 1
Acronym: GOODWATER
Project ID: 30628
Project Manager, organisational: Albrechtsen, Hans-Jørgen (Intern)

**GOODWATER, Marie Curie ITN**

Department of Environmental Engineering
Period: 01/09/2008 → 31/08/2012
Number of participants: 1
Acronym: GOODWATER
Project ID: 30628
Project Manager, organisational: Albrechtsen, Hans-Jørgen (Intern)

**Financing sources**
Source: Forsk. EU - Rammeprogram
Name of research programme: Ukendt
Amount: 5,350,000.00 Danish Kroner

Department of Environmental Engineering

**Kvantificering af Geosmin og methylisoborneol i x antal vandprøver fra dambrug. Delprojekt under rammeaftale med DHI**

Department of Environmental Engineering
LIFELONG LEARNING ERASMUS NETWORK ESTIA-EARTH
Estia-Earth aims at increasing awareness about gender bias issues in education, informing and motivating young women, leading them to their educational and career paths, developing educational structures and implementing new interdisciplinarity-based postgraduate curricula. The main objective is to further develop the already existent Estia-Net TN (thematic network) and to focus on creating women-friendly multidisciplinary postgraduate education involving Engineering, Computers and Sciences.

Department of Environmental Engineering
Period: 01/09/2008 → 01/09/2012
Number of participants: 0
Acronym: 818

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Permeable Membrane Biofilm Reactor Technology for Complete Nitrogen Removal: Study on Feasibility & Control
Develop, optimize, and demonstrate at the laboratory-scale the feasibility of a PMBR to support oxygen limited biofilms for nitrogen removal from a high-strength synthetic wastewater. Develop and calibrate a supporting process model. Infer and verify suitable measures for performance and biofilm thickness control under steady-state and dynamic operational conditions.

Department of Environmental Engineering
Period: 01/09/2008 → 28/02/2010
Number of participants: 0
Acronym: PERMBIRT

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Geosmin and 2-methylisoborneol analyse in fishing farm water
I forbindelse med et projekt omkring afprøvnning af udstyr til fjernelse af geosmin (CAS 16423-19-1) og 2-methylisoborneol(CAS 2371-42-8) i dambrug, som DHI udfører, analyserer DTU-miljø koncentrationen af disse to stoffer i et antal vandprøver som stammer fra et dambrug.

Department of Environmental Engineering
Period: 20/08/2008 → 30/01/2009
Number of participants: 3
Acronym: 872
Project ID: 30635
Project participant:
Mosbæk, Hans (Intern)
Christensen, Nina (Intern)

Project Manager, organisational:
Andersen, Henrik Rasmus (Intern)
Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 65,000.00 Danish Kroner
Project

Analyseudvikling - rammekontrakt med DHI
Indgælse af rammeaftale med DHI om udvikling af nye analyser (Type 1 projekter) og analysering af prøver efter disse prøver eller specialanalyser (Type 2 projekter)

Department of Environmental Engineering
Period: 08/08/2008 → 31/12/2010
Number of participants: 4
Acronym: 870
Project participant:
Eriksson, Eva (Intern)
Mosbæk, Hans (Intern)
Lützhøft, Hans-Christian Holten (Intern)
Andersen, Henrik Rasmus (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Interactions between nanoparticles and marine algae
Application for Steno fellowship (FNU)

Department of Environmental Engineering
Period: 01/08/2008 → 01/08/2012
Number of participants: 0
Acronym: NanoFucus

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Collaboration with *Spildevandskomiteen*: Skrift 29
Preparation of Skrift 29 based upon Spildevandskomiteens recommendations

Department of Environmental Engineering
Period: 01/07/2008 → 31/12/2008
Number of participants: 1
Acronym: Skrift29
Project ID: 30627
Project Manager, organisational:
Arnbjerg-Nielsen, Karsten (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Ukendt
Amount: 50,000.00 Danish Kroner
Project

Development of modelling tools to assess design and performance of bioremediation of chlorinated ethenes in low permeable geologic media

Department of Environmental Engineering
Period: 01/07/2008 → 22/08/2012
Number of participants: 6
Phd Student:
Chambon, Julie Claire Claudia (Intern)
Supervisor:
Bjerg, Poul Løgstrup (Intern)
Main Supervisor:
Binning, Philip John (Intern)
Examiner:
Albrechtsen, Hans-Jørgen (Intern)
Barry, David Andrew (Ekstern)
Molson, John W. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Enhanced remediation of low permeability clayey till deposits contaminated with chlorinated solvents

Department of Environmental Engineering
Period: 01/07/2008 → 23/05/2012
Number of participants: 6
Phd Student:
Damgaard, Ida (Intern)
Supervisor:
Bjerg, Poul Løgstrup (Intern)
Main Supervisor:
Broholm, Mette Martina (Intern)
Examiner:
Jakobsen, Rasmus (Intern)
Barker, James F. (Ekstern)
Höhener, Patrick (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Optimering af biogas produktion fra affald i Arktis

Department of Environmental Engineering
Period: 01/07/2008 → 30/06/2011
Number of participants: 3
Phd Student:
Jørgensen, Marianne Willemoes (Intern)
Supervisor:
Jensen, Pernille Erland (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Reciltant COD removal in process water
Experimental determination of treatability of an industrial effluent with a high COD by advanced oxidation

Department of Environmental Engineering
Role of Water Connectivity On Bacterial Growth & Pollutant Removal In Unsaturated Conditions

Department of Environmental Engineering
Period: 01/07/2008 → 30/11/2011
Number of participants: 6
Phd Student:
Gülez, Gamze (Intern)
Supervisor:
Dechesne, Arnaud (Intern)
Main Supervisor:
Smets, Barth F. (Intern)
Examiner:
Jakobsen, Rasmus (Intern)
Nunan, Naoise (Ekstern)
Tolker-Nielsen, Tim (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Co-operation on reuse of biological treated wastewater from Biokubes wastewater treatment units
We will help Biokube to develop and test an advanced disinfection and polishing treatment, which can be integrated into the existing biokube biological wastewater treatment units. The goal is that the water can be used for technical purposes like washing, irrigation, garden ponds, pools etc..

Department of Environmental Engineering
Period: 19/06/2008 → 30/06/2009
Number of participants: 2
Acronym: IrrigationBiokube
Project participant:
Andersen, Henrik Rasmus (Intern)
Project Manager, organisational:
Henze, Mogens (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Determining the impact of point sources of contamination on groundwater based drinking water resources

Department of Environmental Engineering
Period: 15/06/2008 → 21/09/2011
Number of participants: 6
Phd Student:
ATP-målinger til monitering af mikrobiel drikkevandskvalitet

Department of Environmental Engineering
Period: 01/06/2008 → 27/11/2013
Number of participants: 6
Phd Student:
Vang, Óluva Karin (Intern)
Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Main Supervisor:
Binning, Philip John (Intern)
Examiner:
Boe-Hansen, Rasmus (Intern)
Hammes, Frederik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Model driven Soil Probing, Site Assessment and Evaluation
Non-invasive evaluation of soil- and groundwater contamination using trees as indicator

Department of Environmental Engineering
Period: 01/06/2008 → 31/03/2012
Number of participants: 1
Acronym: ModelProbe
Project ID: 30645
Project Manager, organisational:
Trapp, Stefan (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Utkendt
Amount: 1,594,400.00 Danish Kroner

VietAs Phase II
A continuation of the DANIDA-ENRECA project VietAS, related to As in the groundwater of the Red River sediments near Hanoi, Vietnam

Department of Environmental Engineering
Period: 01/06/2008 → 31/12/2012
Number of participants: 2
Acronym: VietAs II
Project ID: 30649
Project Manager, organisational:
Jakobsen, Rasmus (Intern)
Bauer-Gottwein, Peter (Intern)

Financing sources
Source: Sam.arb.aftaler - Statslige danske
Name of research programme: Ukendt
Amount: 841,800.00 Danish Kroner

Microbiological risk assessment of urban water. Development of methods for detection and analysis of pathogens with Legionella as model organism
Department of Environmental Engineering
Period: 15/04/2008 → 21/09/2011
Number of participants: 7
Phd Student:
Krøjgaard, Louise Hjelmar (Intern)
Supervisor:
Krogfelt, Karen Angeliki (Intern)
Uldum, Søren (Ekstern)
Main Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Examiner:
Arvin, Erik (Intern)
Ricci, Maria Luisa (Ekstern)
Roslev, Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet

Fuldskala demonstration og dokumentation mv. af seriøs drift på gyllebaseret biogasfællesanlæg (Lemvig Biogas)
Se attachment
Department of Environmental Engineering
Period: 01/04/2008 → 01/06/2009
Number of participants: 1
Acronym: ForskEL
Project ID: 30612
Project Manager, organisational:
Angelidaki, Irini (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Ukendt
Amount: 242,000.00 Danish Kroner

Implementation of Easewaste at VESTFORBRÆNDING as part of the environmental management system
VESTFORBRÆNDING, which is the largest waste management company in Denmark, has committed itself to base all environmental management on a life-cycle approach and has adopted the DTU model EASEWASTE as the supporting tool. DTU Environment contributes by setting up the waste management technologies specifically for VESTFORBRÆNDING and develops approaches for assessing operational problems by an LCA approach
Department of Environmental Engineering
Period: 01/04/2008 → 30/06/2010
Number of participants: 3
Acronym: Implementeringsprojektet
Project ID: 30613
Project participant:
Integrated modelling of sustainable urban stormwater systems

Department of Environmental Engineering
Period: 01/04/2008 → 17/10/2012
Number of participants: 7
Phd Student:
Roldin, Maria Kerstin (Intern)
Supervisor:
Helwigh, Ole Mark (Ekstern)
Mikkelsen, Peter Steen (Intern)
Main Supervisor:
Binning, Philip John (Intern)
Examiner:
Arnbjerg-Nielsen, Karsten (Intern)
Lerner, David (Ekstern)
Svensson, Gilbert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

NanolImpactNet
The objective of the NanolImpactNet co-ordination action is to create a widely supported scientific basis to ensure the safe and responsible development of engineered nanoparticles and nanotechnology-based materials and products, and to support the definition of regulatory measures and implementation of legislation in Europe. This framework includes a strong two-way communication, which will ensure efficient dissemination of information to the various stakeholder groups (notably the European Commission, industry and SMEs, and the general public) while at the same time obtaining input from these groups about their needs and questions. By combining excellence in research with open communication, NanolImpactNet aims to: • Develop a framework for the (intermediate and final) critical evaluation of methods, protocols and results of research supported by the FP5, and FP6 and FP7 programmes, as well as national funding agencies. • Guide the development of best practice to ensure that studies are comparable in terms of basic parameters such as particle type, cell types, dispersion and characterisation protocols and appropriate testing methodologies. • Enhance scientific output through better cross-talk and coordination between European scientists and research projects, identifying knowledge gaps and research strategies to address them.

Department of Environmental Engineering
Period: 01/04/2008 → 31/03/2012
Number of participants: 3
Acronym: NanolImpactNet
Project ID: 30605
Project participant:
Trapp, Stefan (Intern)
Rasmussen, Birte Kastrup (Intern)
Project Manager, organisational:
Baun, Anders (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Ukendt
Amount: 573,083.00 Danish Kroner
Optimised treatment technologies to improve the operation of recirculating aquacultures
Assists in identification of relevant treatment technologies for aquacultures and identification of the need for research & development

Department of Environmental Engineering
Period: 01/04/2008 → 31/10/2008
Number of participants: 1
Acronym: RENSTEK
Project ID: 30632
Project participant:
Arvin, Erik (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Udenfor
Amount: 89,520.00 Danish Kroner
Project

Stabilisering af arsen- og kromforurenet jord med okkerslam fra vandværker

Department of Environmental Engineering
Period: 01/04/2008 → 18/09/2013
Number of participants: 6
PhD Student:
Nielsen, Sanne Skov (Intern)
Supervisor:
Jakobsen, Rasmus (Intern)
Main Supervisor:
Kjeldsen, Peter (Intern)
Examiner:
Bjerg, Poul Jørgen (Intern)
Cundy, Andrew B. (Ekstern)
Østergaard, Peter Holm (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Miljøfaglig bistand i relation til spildevand og afløb ved udarbejdelse af regeringsmateriale om "Danish Lessons - Water
See Attachment

Department of Environmental Engineering
Period: 25/02/2008 → 01/05/2008
Number of participants: 1
Acronym: Danish Lessons-Water
Project ID: 30588
Project Manager, organisational:
Henze, Mogens (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Udenfor
Amount: 80,000.00 Danish Kroner
Project

AVIVA - Avanceret Industriel Vandbehandling
Vand er en værdifuld ressource - og en ressource under pres. Den kemiske forurening af vandmiljøet stiger i takt med den voksende industrialisering også i den tredje verden. Udvikling af nye renseteknologier er en nødvendighed for at afbøde denne trussel. Ikke-mikrobiologiske rensekoncepter baseret på højt ydende katalytiske systemer og energieffektiv mekanisk vanddampkompression er ideelle til tackling af netop industrielt spildevand. Implementering af sådanne
systemer vil betyde vandbesparelser i milliardklassen alene i Danmark og have enorm betydning for en bæredygtig håndtering af vandressourcer på globalt plan. Konsortiet vil derfor udvikle omkostningseffektive, automatiserbare og robuste turnkey vandrensesystemer baseret på disse teknologier. Dermed kan den globale vækst i vandsektoren udnyttes til at styrke danske virksomheders førerposition på dette område. Innovationskonsortiets sammensætning sikrer fokus på hele værdikæden fra ide, over produkt til aftager, idet det omfatter både stærke internationalt anerkendte videns- og forskningsgrupper i Danmark, udviklingsfokuserede teknologileverandører til vandsektoren og vandforbrugende industrier med specielle udfordringer i forhold til vandkvalitet.

Department of Environmental Engineering  
Period: 01/02/2008 → 01/02/2012  
Number of participants: 3  
Acronym: AVIVA  
Project participant:  
Andersen, Henrik Rasmus (Intern)  
Project Manager, organisational:  
Albrechtsen, Hans-Jørgen (Intern)  
Albrechtsen, Hans-Jørgen (Intern)  

Financing sources  
Source: Unknown  
Name of research programme: Ukendt  
Amount: 0.00 Danish Kroner  
Project

Bæredygtig udnyttelse af Grønlands affald  
Department of Environmental Engineering  
Period: 01/02/2008 → 22/06/2011  
Number of participants: 6  
Phd Student:  
Eisted, Rasmus (Intern)  
Supervisor:  
Kahlig, Wolfgang (Intern)  
Main Supervisor:  
Christensen, Thomas Højlund (Intern)  
Examiner:  
Kjeldsen, Peter (Intern)  
Kirkeby, Janus Søgaard (Intern)  
Persson, Kenneth M. (Ekstern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: Offentlig finansiering  
Project: PhD

DuPont 2007-2008 Unrestricted Science & Engineering Grants  
Modeling pesticide residues in crops  
Department of Environmental Engineering  
Period: 01/02/2008 → 30/08/2008  
Number of participants: 1  
Acronym: 826  
Project Manager, organisational:  
Trapp, Stefan (Intern)  

Financing sources  
Source: Unknown  
Name of research programme: Ukendt  
Amount: 0.00 Danish Kroner  
Project
Reduction of methane emission from Klintholm landfill by use of Engineered Bio-covers

Landfills containing organic wastes produce biogas, and are significant sources of methane which contributes to climate changes. Some landfills are not or cannot be utilized for landfill gas. In these cases the gas is flared with risk of producing toxic combustion products, or is just escaping the landfill to the atmosphere. Experiments have documented that a very high methane oxidation rate can be obtained in bio-covers, high enough to significant reduce the methane emission from the landfill. Bio-covers may also be a very cost-effective supplementary method at landfills with landfill gas utilization, since the efficiency of the gas extraction system often is in the range of 50-60 %. However, the documentation of the efficiency of biocovers has so far not been carried out in full scale. This project will demonstrate the methodology in full scale on a landfill in Denmark, Klintholm Landfill, located in Fuen.

Department of Environmental Engineering
Period: 01/02/2008 → 31/01/2010
Number of participants: 1
Acronym: BIOCOVER - Klintholm
Project ID: 30600
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Ukendt
Amount: 1,080,168.00 Danish Kroner

Undersøgelsesprojekt om afprøvning af forskellige renseteknologier på svømmebade

Formålet med dette projekt er at analyserede effekten af en række svømmebads UV teknikker for deres evne til at reducere forekomsten af skadelige desinfektionsbiprodukter (DBP) og teknikkernes evne til at reducere organiske stoffer, der er precursers for DBP.

Department of Environmental Engineering
Period: 02/01/2008 → 31/12/2008
Number of participants: 7
Acronym: SwimUV
Project ID: 30585
Project participant:
Ebert, Birthe (Intern)
Mosbæk, Hans (Intern)
Nguyen, Sinh Hy (Intern)
Kruse, Susanne (Intern)
Henriksen, Karina Bornholt (Intern)
Project Manager, organisational:
Arvin, Erik (Intern)
Andersen, Henrik Rasmus (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Ukendt
Amount: 650,000.00 Danish Kroner

19K: Innovation in the municipal technical administration and public utilities - in interplay with private companies, knowledge institutions and trade networks

A systematic focus on improved solutions is a precondition for innovation in the public sector, which is not driven by market forces like the private sector. This is in particular the case for municipal technical administrations and public utilities responsible for large and resource consuming infrastructures, which experience increasing expectations and performance demands but typically lack possibilities for developing and assessing innovative solutions. Accepting that learning is the strongest incentive for innovation in the public sector, the project aims to initiate a cross-municipal staff-driven innovation process, which is expected to result in new solutions and products as well as identification of factors that may contribute to strengthening the public innovation culture. Employing experienced researchers and consultants to facilitate the process and product developers from leading companies to bridge to the market, focus is on the Danish water supply and urban sewerage infrastructures, which due to climate change, urban growth and increasing demands to water quality are under constant pressure and where conventional solutions – even with major resource injections – cannot match the challenges. The process is anchored at the management level and communicated via trade associations.
Biogeochemistry of electron transfer to iron oxides in sediments

Iron oxides are abundant minerals in aquatic sediments, aquifer sediments, and soils. In natural environments iron easily changes oxidation state from Fe(III) to Fe(II) and this transition in many ways interrelates biotic and abiotic processes. In aquatic sediments the degradation of organic matter and pollutants is directly coupled to the reduction of iron oxides. Iron oxides may also act as a redox buffer trap for poisonous hydrogen sulfide. Adsorption to the surfaces of iron oxides in sediments controls the mobility of substances like phosphate, arsenic, nickel, lead and pesticides like glyphosate. The toxic and eutrophic state of lakes, coastal waters and aquifers are therefore directly related to the turnover of iron oxides. The coupling between adsorption processes and redox chemistry is very important because as the iron oxide is reductively dissolved, the adsorbed substances are mobilized. Probably this is the mechanism behind the release of arsenic to groundwater which threatens the health of millions of people in SE Asia. Because of the unique importance of the turnover of iron oxides in sediments, the involved processes have been studied for decades by researchers from different disciplines. Still, surprisingly large gaps remain in our basic understanding of the processes. In particular, fundamental aspects of the pathways of electron transfer during the reduction of iron oxides are inadequately understood. We know that microbial catalysis is important, but there is a poor understanding of how microbes transfer electrons to iron oxides or, for that matter, which microbes perform this process in natural sediments. Neither do we understand in detail how the transfer of an electron from an aqueous ion to the surface of an iron oxide takes place. Recently we have discovered that aqueous Fe(II) may induce catalytic changes in the structure of solid phase Fe(III) oxides and under certain conditions also highly reactive mixed Fe(II,III) oxides may form. These findings indicate that Fe-oxides are much more dynamic phases than we previously have perceived. The implications for the turnover of iron oxides in natural sediments are at present completely unknown and this uncertainty places some serious question marks at our process understanding and models of for example eutrophication of lakes and coastal waters. The project will bring together an interdisciplinary group of scientists. The group will use new state of the art methods and an integrated approach to hopefully provide some answers. OVERALL OBJECTIVE The overall aim of the project is therefore to bring together researchers from different fields to carry out fully integrated research on sediment model systems and in the field to obtain a more detailed understanding of the mechanisms controlling the rate of iron oxide reduction in natural sediments. Particular emphasis will be put on the role of electron exchange during both abiotic iron oxide reduction and microbially catalyzed iron reduction and the interrelationships between the abiotic and biological processes.
food supply, i.e. phosphor (P) is a very limited resource that will be exhausted within the next 60-130 years. The energy rich organic material may contribute 3-4% of the Danish energy consumption. The centre intends to develop environmental friendly technologies that will recover the nitrogen (N) and P in form of green mineral fertilizers and produce bioenergy. The recover of N and P and energy will contribute to reduce emission of greenhouse gases (GHG), (NH3) and odour. The novel technologies are needed because animal farms are increasing their production capacity and in specialisation. Consequently, the environmental friendly use of untreated manure for plant production is no more sustainable and the industrial livestock production farms cannot comply with regulations. Thus upcoming regulations encourage new technologies for managing animal manure and biowaste. This challenge is met by this centre activities, which have the vision that environmental and bioenergy technologies for animal manure and biowaste processing will be integrated in a whole system approach, where all environmental benefits and production of fertilizers are taken into account to ensure cost-effectiveness of mitigation strategies for livestock waste management. The technologies developed will be a commodity much in demand on the global market. This centre will provide valid information (LCA, environmental economics, validation of effects) of the effect of new technologies, which is needed when selling environmentally friendly and bio-energy technologies and for policy making.

Department of Environmental Engineering
Period: 01/01/2008 → 01/09/2012
Number of participants: 0
Acronym: CEMEF

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Project

Cirius - Ondrej Mikes

Department of Environmental Engineering
Period: 01/01/2008 → 01/07/2008
Number of participants: 1
Acronym: 790
Project ID: 30541
Project Manager, organisational:
Harsting, Anne (Intern)

Financing sources
Source: Uddannelse. Statslige. Andre statslige
Name of research programme: Ukendt
Amount: 30,000.00 Danish Kroner

Project

Discovery of new microorganisms that can effectively convert pentoses to ethanol: challenge for sustainable bioethanol production from lignocellulose

Bioethanol is an attractive, sustainable energy source that can be used for road vehicles. Current bioethanol production processes using crops such as sugar cane and corn are well established; however, utilization of a cheaper substrate such as lignocellulose from organic wastes could make bioethanol more competitive with fossil fuels. One limiting factor for the full utilization of lignocellulotic material for bioethanol production is the lack of good microorganisms that are able to efficiently ferment a broad variety of sugars (pentoses and hexoses) with high tolerance to the end product-ethanol. The overall goal of this project is to screen and select microorganism and conditions for optimal pentose fermentation to ethanol.

Department of Environmental Engineering
Period: 01/01/2008 → 31/12/2010
Number of participants: 0
Acronym: 736

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Project
Effekter af gentagne pulseksponeringer med pesticider


Department of Environmental Engineering
Period: 01/01/2008 → 31/12/2010
Number of participants: 2
Acronym: x-files
Project participant:
Baun, Anders (Intern)
Qualmann, Signe (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Effekter af gentagne pulseksponeringer med pesticider

Formålet med projektet er at undersøge akute (immobilitet/død) og kroniske (larveudvikling/reproduktion) effekter af gentagne pulseksponeringer med pesticider overfor krebsdyr for dermed at opnå en bedre forståelse af bekæmpelsesmidlernes miljøeffekter under eksponeringsforhold som er mere miljørealistiske end de forhold der anvendes ved de gængse laboratorie-standardtests. De opnåede resultater fra toksicitetstesten vil blive sammenholdt med oplysninger om miljøkoncentrationer for dermed at vurdere betegnelsen for de undersøgte stoffer. Yderligere er det formålet at evaluere om nye modeller kan forudsigge effekter svarende til de her opnåede og dermed om de kan bruges som værktyger til risikovurdering og regulering af kortvarige og fluktuerende pesticidforureninger i vandmiljøet.

Department of Environmental Engineering
Period: 01/01/2008 → 30/04/2009
Number of participants: 2
Acronym: 795
Project participant:
Baun, Anders (Intern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project
Elastic, electric and physical properties of greensand

Department of Environmental Engineering
Period: 01/01/2008 → 22/06/2011
Number of participants: 5
Phd Student:
Hossain, Zakir (Intern)
Main Supervisor:
Fabricius, Ida Lykke (Intern)
Examiner:
Bauer-Gottwein, Peter (Intern)
Johansen, Tor Arne (Ekstern)
Knudsen, Jørgen Elgaard (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Establishing an in vitro based testing-system for hazard identification of environmental pesticide-nanoparticle interactions

Many nanoparticles are engineered to carry active chemicals across biomembranes. Nanoparticles deliberately added to pesticide formulations or occurring in fields as a result of sludge amendment, deposition or accidental events may act to enhance transport of active substances to target and no-target organisms. This project develops our understanding of the mechanisms governing transport and effects of the pesticide-nanoparticle complex in several small scale in vitro test systems relevant for human and environmental exposure (human intestinal mucosa and lung epithelia, single cell phytoplankton, Dafnia and early life stage of zebra fish). The results will be evaluated in the light of the pesticide hazard identification schemes in Denmark and the EU. The project will generate valuable knowledge and new methods for testing and assessment of pesticides

Department of Environmental Engineering
Period: 01/01/2008 → 31/12/2009
Number of participants: 1
Acronym: 794
Project Manager, organisational:
Baun, Anders (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Evaluation of anaerobic dechlorination in clayey till: Danish experiences and modeling. Delprojekt 2

To be updated

Department of Environmental Engineering
Period: 01/01/2008 → 31/12/2009
Number of participants: 4
Acronym: MST-Ler
Project ID: 30582
Project participant:
Broholm, Mette Martina (Intern)
Binning, Philip John (Intern)
Søndergaard, Gitte Lemming (Intern)
Project Manager, organisational:
Bjerg, Poul Legstrup (Intern)

Financing sources
Source: Sam.arb.aftaler - Amtet og kommuner
Name of research programme: Ukendt
Amount: 1,158,160.00 Danish Kroner
Project
Forskeruddannelsesprogram i vandressourcer (FIVA)


Department of Environmental Engineering

Period: 01/01/2008 → 31/12/2010
Number of participants: 3
Acronym: 744
Project participant:
Rosbjerg, Dan (Intern)
Binning, Philip John (Intern)
Project Manager, organisational:
Bauer-Gottwein, Peter (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,000,000.00 Danish Kroner
Project

How to evaluate separate phase contamination (DNAPL) and contaminant flux? Delprojekt 1

See attachment

Department of Environmental Engineering

Period: 01/01/2008 → 31/12/2010
Number of participants: 1
Acronym: FaseFlux
Project ID: 30597
Project Manager, organisational:
Bjerg, Poul Løgstrup (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Ukendt
Amount: 3,000,000.00 Danish Kroner
Project
Improving toxicological and ecotoxicological effect studies by implementation of new sensor technologies
More efficient and sensitive IT-supported toxicity test technologies for the detection of harmful effects of chemicals and polluted water samples is the aim on non-vertebrate species and early life stages. New test methods and sensors will be developed and used. IT facilitated test technologies will increase the laboratory capacity of consulting firms and the new methods are intended to reduce the number of vertebrate test animals used for evaluation of chemicals.

Department of Environmental Engineering
Period: 01/01/2008 → 30/06/2011
Number of participants: 1
Acronym: New tox sensors
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Unknown
Name of research programme: Uendt
Amount: 0.00 Danish Kroner

Innovative REMediation and assessment TECHnologies for contaminated soil and groundwater
The project team proposes to conduct novel and applied research that will both advance the state-of-the-science in groundwater remediation engineering and improve the methods for application of remediation technologies in the field. Special emphasis will be paid to contamination in low permeable media with chlorinated solvents and treatment of source zones with complex mixtures of co-contaminants (including chlorinated solvents) with different physico-chemical properties. In addition, methods for remediation of polyaromatic hydrocarbons (PAH’s) and mobile heavy metals will be explored and tested with regards to their ability for contaminant stabilisation as well as reduction of risk.

Department of Environmental Engineering
Period: 01/01/2008 → 31/12/2011
Number of participants: 2
Acronym: REMTEC
Project ID: 30604
Project participant:
Bjerg, Poul Løgstrup (Intern)
Project Manager, organisational:
Bjerg, Poul Løgstrup (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Uendt
Amount: 15,000,000.00 Danish Kroner

Integrated European Network for biomass and waste reutilisation for Bio-products
AquaTERRE will promote the cooperation between research centres, business and other stakeholders in Europe devoted to the unification of efforts and the exchange of knowledge and expertise between partners, to promote the creation of a network for improving biomass and waste reutilisation. Mainly, AquaTERRE aims to make an inventory of existing biomass feedstock in Europe and quantify the potential and to the research, development and application of biomass and biofuel production and valorisation. It will aim integration and identify the best ones. In addition, to study the best possibilities for implementing different biomass sources in different environments to improve their utilisation. Pursuing this target, literature and data survey and current research review will be carried out. Furthermore, the scope of AquaTERRE consists also in mapping European biomass feedstock using different tools as geographical information system (GIS). Additionally, AquaTERRE expert members will identify economic and environmental impacts schemes to define the optimum Life Cycle Assessment (LCA). LCA is a standardized and structured method for calculating the environmental load of a product, process or activity throughout all its phases. The implementation of a new bioproduct / biofuel in the market requires the analysis of economical, social and environmental aspects, with the objective of attaining enough information for the decision making progress. The contribution of LCA study to this project can be framed in the identification of best sources of biomass feedstock as well as other agricultural waste for the sustainable obtaining of biofuels and other added value products.

Department of Environmental Engineering
Period: 01/01/2008 → 01/01/2010
Number of participants: 2
Acronym: AQUATERRE
Project ID: 30618
Project participant:
Angelidaki, Irini (Intern)
Karakashev, Dimitar Borisov (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Ukendt
Amount: 334,000.00 Danish Kroner

Methods for determining degradation of low pesticide concentrations in Danish aquifer environments
I Danmark stammer ca. 98% af drikkevandet fra grundvand. Gennem de sidste 10 år er der fundet mange indvindingsboringer, hvor råvandet indeholder pesticider eller nedbrydningsprodukter og for ti-den indeholder over 25% af de danske drikkevandsboringer i større eller mindre grad forskellige pestici-drester. Forekomsten af pesticider og nedbrydningsprodukter har krævet lukning af mange indvindingsboringer pga. overskridelse af EU grænseværdien på 0,1 gif for pesticider i drikkevand. Generelt findes pesticidresterne i meget lave koncentrationer, hvilket påvirker den naturlige nedbrydning af disse stoffer i negativ retning, og der er i dag en særdeles mangelfuld viden omkring nedbrydningsrater for lave koncentrationer af pesticider i grundvandsmagasiner.

Bestemmelse af realistiske nedbrydningsrater er centralt i forhold til regulering, risikovurdering og modellering af pesticider skæbne i de danske grundvandsmagasiner, fordi selv en meget lille nedbrydningsrate kan betyde, at pesticiderne omsættes før de når dybereliggende magasiner, hvorfra mange større vandværker i dag indvinder grundvand. In-gen standardiserede metoder til bestemmelse af nedbrydningsrater for lave koncentrationer af pesticider i grundvandsmagasiner er i dag tilgængelige. Nedbrydningsrater ekstrapoleres derfor ofte med data op-nået med urealistisk høje pesticidkoncentrationer i prøver udtaget fra overfladejord, hvor den biologi-ske omsætning er af en anden karakter end den, der finder sted i oligotrofe grundvandsmiljøer. I grundvandsmagasinerne er styrende faktorer som f.eks. indhold af organiske stof, temperatur og mikrobiel ak-tivitet meget lavere end i rodzonejord. Dette projekt vil sammenligne metoder udviklet i forskellige forskningslaboratorier til bestemmelse af nedbrydningsrater for lave pesticidkoncentrationer under realistiske grundvandsforhold. Sammenlig-ningen af disse metoder har til formål at afklare, hvilke parametre der er centrale i forhold til eksperi-mental bestemmelse af sådanne nedbrydningsrater i grundvandsmagasiner.

Department of Environmental Engineering
Period: 01/01/2008 → 30/11/2010
Number of participants: 1
Acronym: 763
Project participant:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Microbial community structure related to process conditions: a challenge for improving performance of anaerobic digesters
Anaerobic digestion is a technology for producing renewable energy as methane, used widely in the EU. Anaerobic degradation of organic matter is a complex process mediated by microbial communities. The process can be affected by many factors, including operational conditions and feed composition. The microbes mediating the process have generally been well described in terms of phylogeny and function. However, the link between microbial populations, operational parameters, and anaerobic reactors performance is not well established. This link can be used for development of strategies aiming to improve the anaerobic digestion process. Optimization of anaerobic digestion process is expecting to result in considerable reduction of environmental pollution combined with increase in renewable energy production. It will make contributions to the objectives of the overall EU research program, human society, industry, and natural sciences in general. The overall goal of the project proposed is to relate the microbial community composition to biogas reactor process parameters in order to improve anaerobic digesters performance.

Specifically we will: - identify the key microorganisms mediating the anaerobic digestion in variety of biogas producing systems; - elucidate the influence of process parameters on the microbial diversity; - use structured mathematical modeling for quantitatively assessment of the link between microbial community structure and operational conditions; - identify microbial markers for best digesters.
performance with respect to maximal biogas production and organic matter removal; - develop and demonstrate the practical applicability of a strategy for improvement of anaerobic digestion process performance via manipulation of microbial community composition in biogas reactors. The project aims will be achieved by laboratory work and data collection through the industrial contacts of the applicant which will promote future collaboration between the applicant and cooperative partners throughout the Europe.

Department of Environmental Engineering
Period: 01/01/2008 → 31/12/2010
Number of participants: 2
Acronym: MicrosConditions
Project participant:
Angelidaki, Irini (Intern)
Karakashev, Dimitar Borisov (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

MistraPharma – Identification and Reduction of Environmental Risks Caused by the Use of Human Pharmaceuticals
Recommendations to improve wastewater treatment technologies. For the 30 highest ranked APIs we will evaluate the present loading of APIs, and the discharge of these compounds from the different types of Swedish wastewater treatment plants. This evaluation will form the basis for defining, evaluating and development of promising methods for removal of a APIs through wastewater treatment. In this procedure we can work with bench, pilot and, when possible, full-scale investigations. The most promising treatment technologies will be analyzed in detail concerning their costs and benefits, including any positive or negative side-effects that may be associated with their use, such as the working environment in the wastewater treatment plant, elimination or generation of additional compounds, quality changes of residual products, changes in energy use, or in the hygienic quality of the treated wastewater.

Department of Environmental Engineering
Period: 01/01/2008 → 31/12/2011
Number of participants: 1
Acronym: MistraPharma
Project ID: 30661
Project Manager, organisational:
Andersen, Henrik Rasmus (Intern)

Financing sources
Source: Forsk. Andre offentlige og private - Nordiske
Name of research programme: Ukendt
Amount: 1,900,000.00 Danish Kroner
Project

Optimised Model-based Monitoring of Water Quality in Dynamic Discharges from Urban Areas

Department of Environmental Engineering
Period: 01/01/2008 → 19/09/2012
Number of participants: 6
Phd Student:
Birch, Heidi (Intern)
Supervisor:
Lützhøft, Hans-Christian Holten (Intern)
Main Supervisor:
Mikkelsen, Peter Steen (Intern)
Examiner:
Trapp, Stefan (Intern)
Deletic, Ana (Ekstern)
Østergaard, Peter Holm (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD
**Pesticides and nanovectors**
Studies of the role of carbon-based nanoparticles on the toxicity and bioaccumulation of pesticides

Department of Environmental Engineering
Period: 01/01/2008 → 01/07/2009
Number of participants: 0
Acronym: 762

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

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**Risikovurdering af området omkring Rundforbivej 76, Nærum. Fase 2**
See attachment

Department of Environmental Engineering
Period: 01/01/2008 → 30/04/2008
Number of participants: 2
Acronym: RAP, fase 2
Project ID: 30587
Project participant:
Troldborg, Mads (Intern)
Project Manager, organisational: Binning, Philip John (Intern)

**Financing sources**
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Ukendt
Amount: 148,000.00 Danish Kroner
Project

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**RISKPOINT-Assessing the risks posed by point source contamination to groundwater and surface water resources**
The Water Framework Directive considers subsurface and surface water quality and its impact on ecosystems. A major contributor to water quality problems are point contaminant sources such as industrial sites. In order to assess the risks posed by contaminated sites to groundwater and surface water resources it is necessary to understand how these resources are linked and how water flow between them affects water quality. This project will develop the monitoring and modelling tools required to quantify contaminant fluxes between ground and surface waters. The project will focus on water quality problems associated with chlorinated hydrocarbons and pesticides. It is aimed to improve the competitiveness of the consulting industry and Danish authorities in the management of water quality problems in water catchments. In particular it will:
1. Develop modelling and monitoring tools for managing the impact of point sources of contamination on groundwa-ter and surface water resources.
2. Determine the impact on water quality of the biogeochemically active zone between groundwater and surface water systems.
3. Develop tools for assessing the risk of point sources of contamination from the perspective of water supply.
4. Develop tools for quantifying the ecosystem impact of point sources of contamination.

Department of Environmental Engineering
Period: 01/01/2008 → 01/01/2012
Number of participants: 5
Acronym: RISKPOINT
Project ID: 30608
Project participant:
Bjerg, Poul Logstrup (Intern)
Binning, Philip John (Intern)
Smets, Barth F. (Intern)
Bauer-Gottwein, Peter (Intern)
Project Manager, organisational: Binning, Philip John (Intern)

**Financing sources**
Source: Forskningsrådene - Andre
**Storm- and Wastewater Informatics**

The main purpose of wastewater systems is to protect the health of the population, protect the environment and to provide welfare for society. Around the world a very high number of large and age-ing wastewater systems can be found nowadays. Many of these systems are located in densely populated city areas, making it impossible or very expensive to carry out major re-design of the systems. Today’s wastewater treatment plants apply real time optimisation of the plants, where as nearly all sewer systems are static, meaning that once the sewer pipes, pumps, basin and overflows have been put in the ground, no further/very little action is taken to optimise the performance of the sewer system in real time. Wastewater systems stress the aquatic environment and may put the health and safety of people at risk, e.g. when a mixture of rainwater and sewage floods residential areas or is discharged through overflows to receiving waters. Further, the operation of the wastewater systems is under an increas-ing pressure due to: 1.) The EU Water Framework Directive 2.) Increased rainfall and runoff, e.g. due to climate changes 3.) Ageing sewer systems with increased infiltration, exfiltration, structural problems and health risks. The present project addresses the problem of fragmented operation of the wastewater systems by closing the knowledge gaps within: process understanding; now- and forecasting of the current con-ditions in the wastewater system. Output from the project will be components for a real-time decision support system following a drop of water from the sky to the recipient. The benefits of such a real-time system are numerous and include improved water quality and reduced health risk, reduced energy consumption and op-eration costs, reduced flooding, increased reliability, and reduced environmental stress.

**Department of Environmental Engineering**

**Period:** 01/01/2008 → 31/12/2012  
**Number of participants:** 5  
**Acronym:** SWI  
**Project ID:** 30614  
**Project participant:**  
Albrechtsen, Hans-Jørgen (Intern)  
Henze, Mogens (Intern)  
Mikkelsen, Peter Steen (Intern)  
Smets, Barth F. (Intern)  
**Project Manager, organisational:**  
Mikkelsen, Peter Steen (Intern)

**Financing sources**

**Source:** Forskningsrådene - Andre  
**Name of research programme:** Ukendt  
**Amount:** 7,465,457.00 Danish Kroner

**Relations**

**Activities:**  
Investigating the use of stochastic forecast for RTC of urban drainage systems  
**Publications:**  
Investigating the use of stochastic forecast for RTC of urban drainage systems

**Surface Coating Enzyme Technology**

The vision is to establish a Danish world leading consortium in the field of surface coating technology by the development of ecofriendly active compounds for the use in marine antifouling systems. It is the purpose to replace existing toxic biocides by enzymes and related bioactive compounds in controlled release systems which are ready biodegradable in the environment, and besides, by development of non release bioactive coatings. BioLocus has already launched a commercial product, CoatZyme® in test marketing in Scandinavia. The product has been shown to be efficient to prevent fouling on yachts and is a polishing water based coating with enzymes as the active compound, replacing traditional biocides. The direct goal in this project is to develop 2. generation of “CoatZyme” in order to become world leading in environmentally friendly antifouling coatings for yachts.

**Department of Environmental Engineering**

**Period:** 01/01/2008 → 31/12/2010  
**Number of participants:** 1  
**Acronym:** 822  
**Project Manager, organisational:**  
Kusk, Kresten Ole (Intern)
Water Resources Research in Vietnam - The mobilisation of arsenic and the relation to the dynamic interaction between groundwater and surface water in the Red River Plain. (ENRECA) Phase II
DANIDA supported Research Capacity building project. The attached documents are almost in their final state. E&R signatures are needed on 1) samarbejdsaftale, 2) Letter of Support, Probably by Mogens Henze on originals in my possession after approval of THC

Department of Environmental Engineering
Period: 01/01/2008 → 31/12/2011
Number of participants: 3
Acronym: VietAs
Project participant:
Postma, Diederik Jan (Intern)
Larsen, Flemming (Intern)
Jakobsen, Rasmus (Intern)

Rock Physics and rock mechanics of greensand-effect of CO2
Palaeogene greensands are host to petroleum in the central North Sea. In the present project rock physical and petrophysical methods will be used in evaluating the effect of CO2 injection into greensand reservoir rocks.

Department of Environmental Engineering
Period: 03/12/2007 → 31/12/2010
Number of participants: 2
Acronym: 809
Project ID: 30574
Project participant:
Alam, Mohammad Monzurul (Intern)
Project Manager, organisational: Fabricius, Ida Lykke (Intern)

Development of method for reporting emissions from waste disposal sites to the PRTR-register
Waste disposal sites has to register gaseous and aqueous emissions exceeding specific threshold levels for a long range of compounds to the Pollutants Release and Transfer Register (PRTR). The project aims to develop methodologies for estimation of the emissions for waste disposal sites.

Department of Environmental Engineering
Period: 01/12/2007 → 31/12/2008
Number of participants: 2
Acronym: 908
Project ID: 30575
Project participant:
Scheutz, Charlotte (Intern)
Project Manager, organisational: Kjeldsen, Peter (Intern)
PERFORMANCE IMPROVEMENT AND DATA ASSIMILATION INTO CATCHMENT MODELS FOR THE EXPLOITATION OF RIVER AND LAKE PRODUCTS FROM ALTIMETRY

This proposal is made in response to RFQ ENVI-DTEX-EOPS-SW-07-0009. The pilot system which produces river and lake heights from EnviSat Near Real Time (NRT) altimeter data, has been running successfully for some time and has already attracted a significant userbase. However, analysis of the system and outputs, together with research progression since the design of the original system and significant user feedback, has identified critical enhancements to increase the usefulness of these data, both in terms of enhanced products from the EnviSat RA-2, and by increasing the system capability to handle Jason-1 NRT data; this proposal addresses these issues. The dissemination of these products and penetration of the ‘traditional’ hydrological community can also be greatly enhanced using a two pronged approach: firstly, by increasing the capability of the web based server and the associated outreach programme, to ensure that potential users are made aware of these unique datasets and secondly, by engaging directly with the hydrological community to address what is seen as the major limitation of these data: the temporal sampling. Whilst for a large lake, crossed by several tracks, the measurement temporal repeat will only be a few days, there is a fundamental difference with river networks. Here, where the unique ability of the RA-2 to maintain lock on the underlying surface allows the measurement at multiple locations along the earth’s major rivers, the temporal sampling of 35 days is perceived as a critical constraint by the hydrological user community. Experience with satellite oceanography suggests a remedy: incorporate these data into a model, and thus integrate the measurements occurring at various locations along the river system, either directly or as constraints on the model. In the developing world, where the number of gauged catchments is continually falling and the rainfall measurements are patchy at best, these data potentially provide a critical, and in many cases the only possible information to monitor the earth’s surface inland water resources. However, the very scarcity of rainfall data creates problems for hydrologists for whom this is the primary key input. Accordingly, this proposal includes small studies from three groups of river modellers, selected from the existing userbase of R&L data users. Each group uses different hydrological modelling techniques and different proposed approaches, and five river systems have been selected for this work, chosen as presenting a range of different river types and geographical locations for which this approach is likely to be viable. One river, the Mekong, is included from two groups, to assess the impact of different hydrological approaches where the input altimeter data are identical for both. It is proposed to publish the results of this work both on the River and Lake website and as widely as possible at conferences and in the literature, to inform the wider hydrological community of viable methods for including altimeter heights in their river monitoring programmes, and stimulate a much wider market for these unique data.

Department of Environmental Engineering
Period: 01/12/2007 → 31/12/2008
Number of participants: 1
Acronym: 803
Project ID: 30633
Project Manager, organisational: Bauer-Gottwein, Peter (Intern)

Financing sources
Source: Forsk. Andre offentlige og private - Udenlandske
Name of research programme: Ukendt
Amount: 297,405.00 Danish Kroner

RECETO grant for master students
Grant for Wenjing Fu to publish her master project results

Department of Environmental Engineering
Period: 01/12/2007 → 31/03/2008
Number of participants: 1
Acronym: 827
Project participant: Trapp, Stefan (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
The management of the waste water system in Greve Municipality in the case of flooding

Department of Environmental Engineering
Period: 10/11/2007 → 02/01/2008
Number of participants: 1
Acronym: 805
Project ID: 30570
Project Manager, organisational:
Henze, Mogens (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 60,000.00 Danish Kroner

International Peer Review of the Okavango Delta Management Plan
Peter Bauer-Gottwein (PBG), Rudolf de Groot (RDG) and Max Finlayson (MF) propose to perform an international peer review of the Okavango Delta Management Plan (ODMP) along the lines of the terms of reference issued by the Department of Environmental Affairs (DEA), Ministry of Environment, Wildlife and Tourism, Government of Botswana. The review will be completed by November 30th, 2007 and will be delivered to the DEA in electronic form. The three experts will share the review work according to their respective expertise. •PBG has done research on the Okavango Delta for 4 years (co-funded by the Department of Water Affairs, Government of Botswana) and has published 10 peer-reviewed scientific journal articles on the system, focusing on flooding dynamics and salt transport issues. He has cooperated with a number of groundwater consultants (Water Resources Consultants, Wellfield Consulting Services, Aqualogic) in various projects focusing on water resources development in and around the Delta. •RDG has much experience with (economic) valuation of goods and services provided by wetlands and the application of the “ecosystem approach” to wetland management in, among others, the Netherlands, Spain, Ukraine, Australia, Kenya and S. Africa. •MF has undertaken research in tropical wetlands in Africa, Asia and Australia and published widely on wetland management and ecology. He is familiar with many of the guidelines on wetlands management published by the Ramsar Convention and is currently completing a project considering wetland land use and cover with sites in 8 southern African countries.

Department of Environmental Engineering
Period: 01/11/2007 → 31/12/2007
Number of participants: 1
Acronym: 798
Project ID: 30586
Project participant:
Bauer-Gottwein, Peter (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 242,000.00 Danish Kroner

Optimization of Filters for Water Treatment by Development of new Diagnostic Tools

Department of Environmental Engineering
Period: 01/11/2007 → 24/08/2011
Number of participants: 6
Phd Student:
Lopato, Laure Rose (Intern)
Supervisor:
Binning, Philip John (Intern)
Main Supervisor:
Arvin, Erik (Intern)
Examiner:
Albrechtsen, Hans-Jørgen (Intern)
Gimbel, Rolf (Ekstern)
Grützmacher, Gesche (Ekstern)
**Financing sources**
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

**Sampling for drinking water quality in household installations (metals) - Method description (MeMet)**
Drikkevandskvaliteten, der stilles til rådighed for forbrugerne, skal kunne måles ved forbrugers taphane. For uorganiske sporstoffer - metaller - er kvalitetskravet i Drikkevandsbekendtgørelsen angivet som en beregnet gennemsnitsværdi. For at sikre en sikker og repræsentativ måling af de uorganiske sporstoffer – metaller – er der behov for en velbeskrevet prøvetagningsmetode. For at opnå dette, er formålet med dette projekt, at udvikle, definere og beskrive en prøvetagningsmetode, der er repræsentativ for et ugentligt gennemsnit af det vand, som forbrugeren indtager udforme beskrivelsen på engelsk med dansk resume sikre, at metoden er i overensstemmelse med de metoder, der udvikles inden for EU (Drikkevandsdirektivet) - dokumentere baggrunden for metodebeskrivelsen - sikre, at metoden er så simpel, robust og økonomisk som muligt - undersøge, i hvilket omfang det er muligt at opstille konverterings- eller omregningsfaktorer til andre prøvetagningsprincipper (fx henstand) og godkendelsesprocedurer for fx metalafgivelse fra enkeltkomponenter - validere metoden gennem målinger

Department of Environmental Engineering
Period: 01/11/2007 → 31/08/2008
Number of participants: 2
Acronym: 808
Project ID: 30578
Project participant:
Corfitzen, Charlotte B. (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

**Financing sources**
Source: Sam.arb.aftaler - Statslige danske
Name of research programme: Ukendt
Amount: 542,000.00 Danish Kroner
Project

**START-funding I. Preparation of international proposal"Biorefinery for sustainable Reliable Economical Fuel production from energy crops" (Acronym: BioREF)**
Application for grant to organize and formulate an application for the call FP7-KBBE-2007-2A within the Program "FP7, Cooperation, Theme 2, Food, Agriculture, Fisheries and Biotechnologies". together with partners from Denmark, Greece, Ireland, Poland, Sweden, and Germany (Table 1). The project application will be based on an a first stage application that was submitted in EU with the applicant as coordinator. The final project is intended to last for a period of 4 years with a joint budget of approximately 5.5 million EUR. DTU as the coordinator is expected to receive 1 million EUR as part of the budget.

Department of Environmental Engineering
Period: 01/11/2007 → 18/02/2008
Number of participants: 2
Acronym: 796
Project ID: 30576
Project participant:
Angelidaki, Irini (Intern)
Karakashev, Dimitar Borisov (Intern)

**Financing sources**
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 264,600.00 Danish Kroner
Project

**Assessment of chemical oxidation in the unsaturated zone at Kærgård Plantation**
Assessment of chemical oxidation in the unsaturated zone at Kærgård Plantation

Department of Environmental Engineering
Period: 11/10/2007 → 31/12/2007
Number of participants: 1
Acronym: 804
Project ID: 30566
Project Manager, organisational: 
Bjerg, Poul Løgstrup (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Ukendt
Amount: 13,300.00 Danish Kroner
Project

Miljøvurdering af affaldsforbrænding og alternative
Se attachments
Department of Environmental Engineering
Period: 01/10/2007 → 30/09/2008
Number of participants: 2
Acronym: Miljøvurdering Affald DK
Project ID: 30567
Project participant:
Møller, Jacob (Intern)
Project Manager, organisational: 
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 516,000.00 Danish Kroner
Project

Videreudvikling af on-line styring på Avedøre
Projektet omfatter opstilling af modeller for Avedøre Renseanlæg i simuleringsværktøjet WEST.
Department of Environmental Engineering
Period: 01/10/2007 → 31/12/2008
Number of participants: 2
Acronym: 807
Project ID: 30571
Project participant:
Lindblom, Erik Ulfson (Intern)
Project Manager, organisational: 
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Ukendt
Amount: 190,000.00 Danish Kroner
Project

Miljømæssige effekter af industrielt fremstillede nanopartikler
Department of Environmental Engineering
Period: 15/09/2007 → 18/05/2011
Number of participants: 6
Phd Student:
Hartmann, Nanna B. (Intern)
Supervisor:
Binderup, Mona-Lise (Intern)
Main Supervisor:
Baun, Anders (Intern)
Examiner:
Lützhøft, Hans-Christian Holten (Intern)
Ahtiainen, Jukka Heikki (Ekstern)
Stuer-Lauridsen, Frank (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Water treatment processes in Recirculation Aquaculture Systems (RAS)**
In Recirculation Aquaculture Systems (RAS) the water is recycled intensively between the fish tanks and the water treatment plant. The water treatment has to remove organic matter (COD), nitrogen, phosphorus, carbon dioxide and specific chemicals and oxygen has to be added. This project contains three subprojects: Removal of specific chemicals, 2. Integrated modelling of RAS, and 3. Monitoring of organic matter by fluorescence.

Department of Environmental Engineering  
Period: 03/09/2007 → 31/12/2009  
Number of participants: 1  
Acronym: 937  
Project Manager, organisational: Arvin, Erik (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project:

**Framework Development for Adaptive Environmental Risk Assessment and Uncertainty Analysis for Nanomaterials**
Department of Environmental Engineering  
Period: 01/09/2007 → 02/03/2011  
Number of participants: 5  
Phd Student: Grieger, Khara Deanne (Intern)  
Main Supervisor: Baun, Anders (Intern)  
Examiner: Kjeldsen, Peter (Intern)  
Davis, J. Michael (Ekstern)  
Ledin, Anna (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Framework for Real Time Control of Integrated Urban Wastewater Systems**
Department of Environmental Engineering  
Period: 01/09/2007 → 27/06/2012  
Number of participants: 7  
Phd Student: Breinholt, Anders (Intern)  
Supervisor: Grum, Morten (Intern)  
Madsen, Henrik (Intern)  
Main Supervisor: Mikkelsen, Peter Steen (Intern)  
Examiner: Bauer-Gottwein, Peter (Intern)  
Madsen, Henrik (Ekstern)  
Vanrolleghem, Peter (Intern)
Gas Generation and Emissions from Decomposition of Organic Wastes at Full-Scale Waste Treatment Facilities

Department of Environmental Engineering
Period: 01/09/2007 → 21/12/2010
Number of participants: 6
Phd Student:
Andersen, Jacob Kragh (Intern)
Supervisor:
Christensen, Thomas Højlund (Intern)
Main Supervisor:
Scheutz, Charlotte (Intern)
Examiner:
Kjeldsen, Peter (Intern)
Jönsson, Håkan (Ekstern)
Kranert, Martin (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Optimization of Microbial Fuel Cells via Directed Bio-Electricigenesis

One of the global trends in applied energy systems R&D encompasses electricity generation using renewable sources, such as microbial biofilm-powered fuel cells, where electrical energy is directly obtained from biochemical reactions. Although this microbial ability to generate electrons has been revealed for a long time, the achieved process understanding has been insufficient to optimize microbial fuel cells (MFCs) into efficient and practical power generators. The present proposal's primary goal is to achieve more efficient energy conversions in MFCs, by establishing and then manipulating the relationship between properties of the microbial biofilms—which develop in the MFCs' anodic compartment—and power generation. We contend that the biofilm structure and its architecture have a direct influence on the electric properties of the MFCs (by means of diffusional limitations and current transfer restrictions). These causal relationships will be determined. Directed bio-electricigenesis is proposed, which consists of manipulating and controlling biofilm properties (i.e. mass transport limitation, biofilm heterogeneity and distribution control) to maximize electroactive sites and hence improve power generation. Electrochemical studies are therefore proposed to allow real time monitoring of the systems' bio-electrochemical response and to establish the relationship between biofilm properties and electron transfer performance (e.g. the current transfer distribution), which establish current generation in the MFCs. The
electrochemical response will be measured using electrochemical impedance spectroscopy (EIS) and will be analyzed using a transmission-line approach, from which the biogenically-induced current transfer distributions will be determined. In addition, the biofilm structure and architecture heterogeneities which establish in the novel-design MFCs will be experimentally manipulated, measured using advanced microscopic techniques (i.e. confocal laser scanning microscopy) and microelectrodes, and predicted using a new Individual Based Modelling platform for Microbial Interactions (iDynMiCs). In summary, this proposal will combine knowledge on microbial fuel cells, biofilm structural modelling, advanced microscopic and techniques and electrochemical monitoring to operate and investigate novel microbial fuel cells based on anodic biofilms, where biofilm structure can be predicted and manipulated in order to rigorously establish the relationships between biofilm properties and electrochemical behaviour of MFCs, leading to MFCs that can obtain significantly higher energy transfer efficiencies via directed bio-electricigenesis.

Department of Environmental Engineering
Period: 01/09/2007 → 31/08/2009
Number of participants: 2
Acronym: 761
Project participant:
Angelidaki, Irini (Intern)
Smets, Barth F. (Intern)

Financing sources
Source: Unknown
Name of research programme: Unknown
Amount: 0.00 Danish Kroner
Project

The Connection between Residence Time and Water Quality in Water Distribution Networks - Effects of Small animals

Department of Environmental Engineering
Period: 01/09/2007 → 02/11/2011
Number of participants: 7
Phd Student:
Christensen, Sarah Christine Boesgaard (Intern)
Supervisor:
Arvin, Erik (Intern)
Juul, Henrik (Ekstern)
Main Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
 Examiner:
Smets, Barth F. (Intern)
Kooij, Dick van der (Ekstern)
Roslev, Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Validation and Identification Methods for Individual-based Models in Microbial Ecology

Department of Environmental Engineering
Period: 01/09/2007 → 02/03/2011
Number of participants: 5
Phd Student:
Seoane, Jose Miguel (Intern)
Supervisor:
Sternberg, Claus (Intern)
Main Supervisor:
Smets, Barth F. (Intern)
 Examiner:
Bailey, Mark Jonathan (Ekstern)
Kroer, Niels (Ekstern)
Optimal Allocation of Water and Land Resources at the Catchment Scale

Optimizing water and land use patterns is a key task of governments both in developing and developed countries. Recent years have seen a paradigm shift in the way water resources are managed. The new paradigm of integrated water resources management recognizes multiple objectives: Environmental sustainability, economic efficiency and social equity. Moreover, the economic and environmental dimensions of water resources management are key elements of the EU’s Water Framework Directive. The economic aspects of use and allocation of water resources has until now mainly been investigated through coupling of macroeconomic models with simplified hydrological models, often neglecting the important temporal and/or spatial variability of the resource. Spatially distributed hydrological and ecosystem modelling offers new opportunities to map water related externalities at the catchment scale. Remote sensing and GIS techniques enable a detailed spatial mapping of input parameter fields. This project will combine existing water resources simulation models, representing both the temporal and spatial variability of the water availability, with economic models in a catchment-scale simulation-optimization tool for science-based decision support. Its focus is the identification of optimal water and land allocation patterns. Both Pareto-optimal and economic tradeoff methods will be analyzed. The combined model will describe the major water and land-use activities in the catchment (irrigation agriculture, industry, hydropower generation etc.) including their physical and socioeconomic constraints, and the project will identify the appropriate extent of economic interactions to be internalized in the economic model in order for it to reflect the essential economic developments in the basin. Price elasticities, sensitivity to varying marked prices and sensitivity of the results to uncertainty in the input parameters will be investigated. The potential of agent-based simulation approaches to capture second-round effects of water allocation decisions in the economy may be explored. The simulation-optimization tool will enable new opportunities for cost benefit analysis of water and land management decisions. The tool will be applied to and tested on studies from Denmark, Europe and the developing world.

Department of Environmental Engineering
Period: 01/08/2007 → 31/07/2010
Number of participants: 2
Acronym: 797
Project participant:
Bauer-Gottwein, Peter (Intern)
Riegels, Niels (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Optimal Allocation of Water and Land Resources at the Catchment Scale

Department of Environmental Engineering
Period: 01/08/2007 → 20/04/2011
Number of participants: 7
Phd Student:
Riegels, Niels (Intern)
Supervisor:
Jensen, Roar A. (Ekstern)
Møller, Flemming (Ekstern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)
Examiner:
Ambjerg-Nielsen, Karsten (Intern)
Cai, Ximing (Ekstern)
Termansen, Mette (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD
Diagenesis of Upper Cretaceous Onshore and Offshore Chalk from the North Sea Area
Department of Environmental Engineering
Number of participants: 5
Phd Student:
Hjuler, Morten Leth (Intern)
Main Supervisor:
Fabricius, Ida Lykke (Intern)
Examiner:
Jakobsen, Rasmus (Intern)
Frykman, Peter (Intern)
Hildebrand-Habel, Tania (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Selvfinansierende (privatist)
Project: PhD

Improving Large-Scale Hydrological Models with Ground-Based and Space-Borne Time-Lapse Gravity
Department of Environmental Engineering
Period: 01/07/2007 → 21/12/2010
Number of participants: 7
Phd Student:
Christiansen, Lars (Intern)
Supervisor:
Binning, Philip John (Intern)
Rosbjerg, Dan (Intern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)
Examiner:
Fabricius, Ida Lykke (Intern)
Ferré, Ty P. A. (Ekstern)
Tscherning, Carl Christian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Microbial Fuel Cell - used in direct Conversion of Lignocellulosic Waste to Energy
Department of Environmental Engineering
Period: 01/07/2007 → 19/01/2011
Number of participants: 6
Phd Student:
Fang, Cheng (Intern)
Supervisor:
Boe, Kanokwan (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Karakashev, Dimitar Borisov (Intern)
Mattiasson, Bo (Ekstern)
Norddahl, Birgir (Ekstern)

Financing sources
Source: Internal funding (public)
Salt dynamics in natural and agricultural ecosystems
Salinization of soils is a major threat for natural and agricultural ecosystems on the global scale. Plants take up water and exclude salt by enzymatic action as detoxification strategy. In the long run, this increases the salinity of insufficiently drained soils and shallow aquifers. The salt and water budgets of vegetation are included in current groundwater models, but their implementation does not fit reality. A new model for salt uptake of plants shall be tested experimentally, parameterized by inverse modeling and well-designed experiments, and coupled to existing groundwater simulation models. The goal is to develop a tool to simulate, interpret and predict the evolution of ecosystems and salt budgets in arid zones, in order to optimize irrigation agriculture under saline conditions. Summarized, we aim at determining the relationship between salt and water uptake and the plant physiology for trees, grasses and food crops by well-designed experiments and inverse modeling; implementing a mathematical model for the simulation of salt and water budgets of ecosystems and agricultural systems; developing and applying a tool for interpretation and management of salinization of soils and shallow aquifers due to transpiration of vegetation.

Department of Environmental Engineering
Period: 01/07/2007 → 30/06/2009
Number of participants: 4
Acronym: 735
Project participant:
Rosbjerg, Dan (Intern)
Trapp, Stefan (Intern)
Bauer-Gottwein, Peter (Intern)
Blasone, Roberta-Serena (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

The Biofilm Matrix – A Target for Control of Biofilm Formation
Bacteria in environmental, industrial, and medical settings predominantly live in biofilms. Production by the bacteria of cell-to-cell interconnecting extracellular compounds is a prerequisite to biofilm formation. The proposed research project aims at obtaining knowledge about the mechanisms which are involved in the production of these cell-to-cell interconnecting compounds. Such knowledge will be useful for creating strategies to prevent unwanted biofilm formation, and to promote beneficial biofilm formation.

Department of Environmental Engineering
Period: 01/07/2007 → 30/06/2010
Number of participants: 1
Acronym: 729
Project participant:
Smets, Barth F. (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Veolia. Literature review on definitions, methodologies, calculations, monitoring and reporting of climate change indicators. Confidential
Collaboration with Veolia Environnement Resherche et Innovations SNC

Department of Environmental Engineering
Number of participants: 2
Acronym: 917
Project ID: 30552
Project participant:
Centre for biotechnological wastewater research


Department of Environmental Engineering
Period: 01/06/2007 → 31/05/2011
Number of participants: 4
Acronym: 718
Project participant:
Arvin, Erik (Intern)
Schmidt, Jens Ejbye (Intern)
Henze, Mogens (Intern)
Smets, Barth F. (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Degradation of 1,1,1-TCA
Investigation of the biological potential of using stimulated reductive dechlorination as a treatment method at three danish sites contaminated with 1,1,1-TCA.

Department of Environmental Engineering
Period: 01/05/2007 → 31/12/2007
Number of participants: 3
Acronym: 792
Project ID: 30540
Project participant:
Scheutz, Charlotte (Intern)
Broholm, Mette Martina (Intern)
Permeable Membrane Biofilm Reactors (PMBRs) for water treatment

Purpose of project: Review the technical/scientific state-of-the knowledge to answer the following questions, and provide experimental feasibility of biofilm growth on synthetic membranes

Department of Environmental Engineering
Period: 01/05/2007 → 31/12/2007
Number of participants: 1
Acronym: BIOFILM
Project ID: 30534

Compaction Modeling in Hydrocarbon Reservoir

Department of Environmental Engineering
Period: 01/04/2007 → 18/05/2011
Number of participants: 5
Phd Student: Alam, Mohammad Monzurul (Intern)
Main Supervisor: Fabricius, Ida Lykke (Intern)
Examiner: Foged, Niels Nielsen (Intern)
G. Stage, Morten (Ekstern)
Vadla Madland, Merete (Ekstern)

HYDROGRAV IMPROVING LARGE-SCALE HYDROLOGICAL MODELS WITH GROUND-BASED AND SPACE-BORNE TIMELAPSE GRAVITY SURVEYS

Temporal variations of the earth gravity field reflect, among other effects, temporal changes in total water storage (TWS) in the earth system. However, instrument accuracy has been insufficient in the past to measure the minimal changes in the gravitational acceleration due to changes in water storage. A new generation of outdoor absolute and relative gravimeters is now available (Scintrex A-10, Scintrex CG-5) which are accurate enough to monitor water storage changes in typical hydrological systems. Moreover, the Gravity Recovery and Climate Experiment (GRACE) has provided space-borne gravity measurements with unprecedented accuracy and global coverage.

Department of Environmental Engineering
Period: 01/04/2007 → 31/03/2010
Number of participants: 4
Acronym: 743
Project ID: 30543
Project participant: Rosbjerg, Dan (Intern)
Binning, Philip John (Intern)
Christiansen, Lars (Intern)
Project Manager, organisational:
Bauer-Gottwein, Peter (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 2,000,000.00 Danish Kroner

Novel Approach to Reduce the Operational Cost and Sludge Production of Existing Municipal Wastewater Treatment Plants: Biological Hydrolysis

Department of Environmental Engineering
Period: 01/04/2007 → 31/03/2009
Number of participants: 1
Acronym: 810
Project ID: 30521
Project participant:
Ucisik, Ahmed Süheyl (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 1,175,580.00 Danish Kroner

OSIRIS Optimized Strategies for Risk Assessment of Industrial Chemicals through Integration of Non-Test and Test Information

Department of Environmental Engineering
Period: 01/04/2007 → 31/03/2011
Number of participants: 1
Acronym: OSIRIS
Project ID: 30538
Project Manager, organisational:
Trapp, Stefan (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Ukendt
Amount: 4,000,000.00 Danish Kroner

Arsenic in Danish Aquifers and Drinking Water

The overall aim of the project is to develop methods to reduce the concentrations of arsenic in drinking water. The developed methods must ensure a sustainable use of the groundwater resource based on the best available technology and at the same time be economically feasible. The project includes studies of arsenic in aquifers, the relationships between pumping strategies and concentrations of arsenic in pumped water and water treatment on water works. The project is conducted in a co-operation with Watertech.

Department of Environmental Engineering
Period: 15/03/2007 → 01/04/2008
Number of participants: 4
Acronym: 759
Project ID: 30550
Project participant:
Postma, Diederik Jan (Intern)
Arvin, Erik (Intern)
A flexible and integrated energy system based on gasification of liquefied biomass and waste

The project develops a technology suitable for flexible and integrated production of power, heat and liquid fuels based on biomass and municipal waste. The process involves liquifaction of the organic materials using heat and enzymes, and gasification at high pressure. Outputs can be either heat and electricity or various liquid or gaseous fuels. The technology is evaluated in a life-cycle assessment perspective, including direct and indirect consequences for the waste management system as well as the energy system.

Department of Environmental Engineering
Period: 07/03/2007 → 07/03/2011
Number of participants: 1
Acronym: REnescience
Project ID: 30531
Project Manager, organisational:
Astrup, Thomas Fruergaard (Intern)

2BG: Black, blue and green - Integrated infrastructure planning as key to sustainable urban water systems

Quality in life is possible only within the frames of a healthy and sustainable environment. The ambition of 2BG is to contribute to global sustainable development by demonstrating novel ways for cities to interact with Earth’s water: from today’s «consume-and-discharge» to an integrated and recycling mode of interaction. To close the urban water cycle we need to focus on all assets of water in the city; from drinking water to ecosystem services and from industrial functions to water’s aesthetic and socio-cultural dimensions. The project aims to develop concepts, methods and tools for changing the prevailing sewer based discharge systems into self-sustaining and climate-change adapted solutions, based on infiltration of storm and wastewater at the source, combined with appropriate control of water quality and extended reuse. Thus, hydrological models that operate at and link between different sizes of affected catchments, ranging from single roof tops to groundwater aquifers, will be developed; risks related to pollutants being transported within the urban water flows will be described and mitigation options evaluated and developed further. The potential of water management techniques to make a positive contribution to the urban landscape will be elaborated. As inter-professional approaches are needed for realizing the suggested changes in urban water systems, new spatial IT-tools and planning methods will be developed for support of collaboration between urban planners, engineers and landscape architects, as well as suitable cost-benefit tools and economic instruments to support decision makers. These will be tested and evaluated in case studies. Finally, to make the project results operational within the Danish water resource base, concepts for exchange and transfer of knowledge will be developed and tested in pilot programs, aiming at both the national market and the global markets in rapidly developing cities. The "Forest and Landscape" unit of Copenhagen University, Faculty of Life Sciences is overall project coordinator.

Department of Environmental Engineering
Period: 01/03/2007 → 31/12/2011
Number of participants: 3
Acronym: 2BG
Project ID: 30530
Project participant:
Ledin, Anna (Intern)
Binning, Philip John (Intern)
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Forskningsrådene - Andre
Arsens mobilitet i kalkmagasiner

Department of Environmental Engineering
Period: 01/03/2007 → 20/04/2011
Number of participants: 7
Phd Student: 
Se, Helle Ugilt (Intern)
Supervisor: 
Larsen, Flemming (Intern)
Postma, Diederik Jan (Intern)
Main Supervisor: 
Jakobsen, Rasmus (Intern)
Examiner: 
Fabricius, Ida Lykke (Intern)
Charlet, Laurent (Ekstern)
Østergaard, Peter Holm (Ekstern)

Financing sources
Source: Internal funding (public)

Environmental Exposure Modeling for Chemical Risk Assessment

Department of Environmental Engineering
Period: 01/03/2007 → 24/03/2010
Number of participants: 5
Phd Student: 
Franco, Antonio (Intern)
Main Supervisor: 
Trapp, Stefan (Intern)
Examiner: 
Baun, Anders (Intern)
Wania, Frank (Ekstern)
vande Meent, Dirk (Ekstern)

Financing sources
Source: Internal funding (public)

Optimisation of Water Resources Systems using Evolutionary Algorithms with Surrogate Modelling

Department of Environmental Engineering
Period: 01/03/2007 → 30/09/2010
Number of participants: 6
Phd Student: 
Gelati, Emiliano (Intern)
Supervisor: 
Madsen, Henrik (Intern)
Main Supervisor: 
Rosbjerg, Dan (Intern)
Examiner: 
Bauer-Gottwein, Peter (Intern)
Blöschl, Günter (Ekstern)
Uvo, Cintia Bertacchi (Ekstern)
Evaluation of the permeable reactive barrier at the Vapokon site 7 years after construction
The permeable reactive barrier (PRB) at the Vapokon site is treating groundwater contaminated with a whole range of chlorinated compounds. The efficiency of the PRB is evaluated by a mass flux approach and by taking cores of the reactive material which are analyzed for physical, chemical and microbial parameters.

Department of Environmental Engineering
Period: 01/02/2007 → 30/06/2007
Number of participants: 1
Acronym: Vapokon2007
Project ID: 30533
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Ukendt
Amount: 205,472.00 Danish Kroner

Full-chain and UNCertainty Approaches for Assessing Health Risks in FUture ENvironmental Scenarios
Human exposure and health assessment

Department of Environmental Engineering
Period: 01/02/2007 → 31/01/2011
Number of participants: 1
Acronym: 2-FUN
Project ID: 30527
Project Manager, organisational:
Trapp, Stefan (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Ukendt
Amount: 983,400.00 Danish Kroner

Selection of organic priority pollutants in ReVAQ-project - stage 2 continued project development and testing in Eslöv
Vilka organiska ämnen ska vi fokuserar på inom ReVAQ projektet för att uppnå en bättre kvalitet på slamm? Projektet har fokus på organiska ämnen som kommer från industrierna och hur man ska gå till väga för att välja ut de ämnen vars förekomst i avloppsvattnet som man i första hand bör reducera. Denna etapp kommer att ta utgångspunkt i de erfarenheter som vi fick genom etapp 1 där Käppala verkets industrilistor bearbetades. Metoden som användes (se nedan) kommer att kompletteras och testas på Eslövs reningsverk.

Department of Environmental Engineering
Period: 01/02/2007 → 31/12/2007
Number of participants: 2
Acronym: ReVAQ-stage 2
Project participant:
Ledin, Anna (Intern)
Eriksson, Eva (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Val av fokus ämnen för miljögiftsarbetet i Stockholm – etapp 2 kombination av resultat från etapp 1 med KemI’s exponeringsindex

Vilka kemiska ämnen ska miljögiftsarbetet i Stockholm fokusera på inom de närmaste åren? Kan vi reducera den långa listan med ämnen som har inneboende egenskaper som gör dem potentiellt farliga, till en kortare och mer lätt hanterlig lista genom att utnyttja KemI’s exponeringsindex?

Department of Environmental Engineering
Period: 01/02/2007 → 30/04/2007
Number of participants: 3
Acronym: Nya gifter etapp 2
Project ID: 30525
Project participant:
Ledin, Anna (Intern)
Eriksson, Eva (Intern)
Lützhøft, Hans-Christian Holten (Intern)

Financing sources
Source: Samarbetal - Udenlandske offentlige og private
Name of research programme: Ukendt
Amount: 133,183.00 Danish Kroner
Project

Source-Flux-Fate Modelling of Priority Pollutants in Stormwater Systems

Department of Environmental Engineering
Period: 15/01/2007 → 20/04/2011
Number of participants: 6
Phd Student:
Vezzaro, Luca (Intern)
Supervisor:
Ledin, Anna (Intern)
Main Supervisor:
Mikkelsen, Peter Steen (Intern)
Examiner:
Plósz, Benedek G. (Intern)
Destouni, Georgia (Ekstern)
Stenstrom, Michael (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Upgrading the risk assessment tool JAGG to version 2.0 - external supervisor

The Danish risk assessment tool for contaminated site made by the Danish EPA is to be updated by incorporating new knowledge about governing processes and factors gained over the last decade. In collaboration with the consulting company Orbicon M&R will act as external supervisor hired by the Danish EPA to collaborate with the project holders (DHI and COWI) working on the upgrade of the risk assessment modules included in JAGG.

Department of Environmental Engineering
Period: 15/01/2007 → 15/10/2007
Number of participants: 2
Acronym: JAGG upgrade2
Project ID: 30536
Project participant:
Kjeldsen, Peter (Intern)
Bjerg, Poul Legstrup (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Ukendt
Amount: 135,060.00 Danish Kroner
Project
Upgrading the risk assessment tool JAGG to version 2.0 - unsaturated zone
The Danish risk assessment tool for contaminated site made by the Danish EPA is to be updated by incorporating new knowledge about governing processes and factors gained over the last decade. In collaboration with the consulting company NIRAS the outline for new calculation modules are constructed for estimation of the transport in the unsaturated zone of pollutants towards the underlying groundwater.

Department of Environmental Engineering
Period: 15/01/2007 → 15/10/2007
Number of participants: 4
Acronym: JAGG upgrade1
Project participant:
Binning, Philip John (Intern)
Troldborg, Mads (Intern)
Broholm, Mette Martina (Intern)
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energhiministeriet
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Assessment/documentation of natural attenuation of PAHs in groundwater.
Assessment/documentation of natural attenuation of PAHs in groundwater at Ringe Tar- and Asphaltfactory, Ringe, Fyn.

Department of Environmental Engineering
Period: 01/01/2007 → 31/12/2007
Number of participants: 1
Acronym: RTA-Fyn
Project ID: 30539
Project Manager, organisational:
Bjerg, Poul Løgstrup (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Ukendt
Amount: 100,000.00 Danish Kroner

Biomass and bioenergy production in organic agriculture - consequences for soil fertility, environment, spread of animal parasites and socio-economy
Biomass and bioenergy production in organic agriculture - consequences for soil fertility, environment, spread of animal parasites and socio-economy

Department of Environmental Engineering
Period: 01/01/2007 → 31/12/2010
Number of participants: 1
Acronym: FØJO III
Project ID: 30522
Project Manager, organisational:
Schmidt, Jens Ejbye (Intern)

Financing sources
Source: Forskningsprojekter - Fødevareministeriet
Name of research programme: Ukendt
Amount: 245,000.00 Danish Kroner

Biorefinery for Fuel production from energy crops
Sustainable use and production of renewable bio-resources is one of the key instruments for achieving the goal of 20% CO2 reduction that the European Community is aiming by year 2025 At the same time decrease of fossile fuels dependency and boosting of the rural development in Europe will be achieved. To gain full benefits from biomass
conversion it is important to utilise all parts of biomass in an integrated process scheme by a multi-product scheme, so called “biorefinery”. By producing multiple products (bioenergy and green chemicals), through an integrated process the differences in biomass components and intermediates can be exploited and maximize the value derived from the biomass and thus achieve a competitive economy. This project will investigate and develop an integrated and innovative whole crop approach to produce a multi-product biofuel (ethanol, biohydrogen, methane, biodiesel) and high-value products (glucosinolates, high-quality proteins rich in lysine and methionine etc.) from oily plants based on a number of novel and mutually synergistic production methods. The evaluation criteria assisting the development of the biorefinery concept will be based on an feed forwards and backwards assessment of the economical and environmental benefits and drawbacks related to the concept. With the proposed project we intend to: Optimise harvest, transportation logistics of oily plants to the biorefinery facilities and return the process effluents to be used as fertilisers on the agricultural soil. From the oil part of the plant biodiesel will be produced, by a new enzymatic transesterification method. High value products such as glucosinolates, high value proteins etc. extracted from the press cake will be compared with alternative utilizations From the straw part of the oily plant a chain of processes will result in bioethanol production (from hexoses), biohydrogen (from pentoses) and finally, effluents from different processes will be treated by anaerobic digestion for methane production. To document the level of sustainability, identify key environmental impacts, and evaluate market implementation aspects, the individual process as well as the combined biorefinery concept will be evaluated through life cycle assessment methods as well as with respect to process economy. The results from the above research will be used to demonstrate an integrated biorefinery operation for producing biofuels and high-value products from rapeseed or oilseed with a processing/marketing link between agriculture and industry.

Department of Environmental Engineering  
Period: 01/01/2007 → 31/12/2010  
Number of participants: 1  
Acronym: 777  
Project ID: 30519  
Project Manager, organisational: Angelidaki, Irini (Intern)  
Financing sources  
Source: Forskningsrådene - Andre  
Name of research programme: Ukendt  
Amount: 3,172,578.00 Danish Kroner  

Coherent Energy and Environmental System Analysis  
The project integrates existing energy and environmental analysis tools by combining life cycle assessment and energy system and market analysis methodologies. The project thereby aim to meet three of the major challenges of future sustainable energy systems: 1) how to integrate the transport sector, 2) how to develop future power systems suitable for the integration of distributed renewable energy sources, and 3) how to develop public regulation in an international market environment.

Department of Environmental Engineering  
Period: 01/01/2007 → 30/09/2011  
Number of participants: 1  
Acronym: CEESA  
Project ID: 30554  
Project Manager, organisational: Astrup, Thomas Fruergaard (Intern)  
Financing sources  
Source: Forskningsrådene - Andre  
Name of research programme: Ukendt  
Amount: 1,200,000.00 Danish Kroner  

Coherent Energy and Environmental System Analysis  

Department of Management Engineering  
Department of Environmental Engineering
Department of Electrical Engineering
Electric Energy Systems
Aalborg University
University of Southern Denmark
Royal Veterinary and Agricultural University
Copenhagen Business School
Anvendt KommunalForskning
DONG Energy A/S
Period: 01/01/2007 → 31/12/2010
Number of participants: 6
Acronym: CEESA
Project ID: 1200211
Project participant:
Münster, Marie (Intern)
Møller Andersen, Frits (Intern)
Pade, Lise-Lotte (Intern)
Astrup, Thomas (Intern)
Østergaard, Jacob (Intern)
Project Manager, organisational:
Morthorst, Poul Erik (Intern)

Financing sources
Source: Public research council
Name of research programme: Forsknings og innovationsstyrelsen – programkomiteen for energi og miljø
Amount: 14,958,866.00 Danish Kroner

Relations
Publications:
Danish Wind Power Export and Cost
Coherent Energy and Environmental System Analysis
Control Architecture Modeling for Future Power Systems

Enhanced oil Recovery through CO2 utilisation
With its efficient power plants located near the coast and the North Sea, Denmark has a unique position to enable
development of methods to combine the utilisation of CO2 with enhanced oil recovery (EOR). The purpose of the project
is to ensure the build-up of knowledge within EOR in Denmark, to establish the necessary research platform to attract
European research funds, to train candidates within the area and thus assist in supporting the establishment of new
knowledge jobs and business ensuring that Denmark solves a CO2 problem and at the same time increases the recovery
of oil and gas in the North Sea, which has a large social value.

Department of Environmental Engineering
Period: 01/01/2007 → 31/12/2009
Number of participants: 1
Acronym: 781
Project ID: 30523
Project Manager, organisational:
Fabricius, Ida Lykke (Intern)

Financing sources
Source: Forsk. Private danske - Fonde
Name of research programme: Ukendt
Amount: 2,280,000.00 Danish Kroner

EU-Vandnettet
EU – Vandnettet har til formål at støtte danske virksomheders muligheder for at deltage i EU finansierede forsknings- og
udviklingsprojekter. Forskningsplatformen – Vand, som er en del af Danish Water Forum har fået støtte til denne
Department of Environmental Engineering
Period: 01/01/2007 → 31/12/2008
Number of participants: 2
Acronym: EU-Vandnettet
Project participant:
Binning, Philip John (Intern)
Project Manager, organisational:
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Health and Environment Integrated Methodology and Toolbox for Scenario Assessment. The contributions of landfills, EU contract GOCE Contract No. 036913
The project is a large EU project modelling the health effects of environmental factors in Europe distributed with respect to geographical areas and sources. DTU Enviroment contributes with the modelling of methane and trace gas emission from landfills

Department of Environmental Engineering
Period: 01/01/2007 → 01/02/2012
Number of participants: 1
Acronym: HEIMTSA
Project ID: 30509
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Ukendt
Amount: 137,180.00 Danish Kroner

Influence of test conditions and exposure duration on the result of ecotoxicological tests - consequences for derivation of environmental quality

Department of Environmental Engineering
Period: 01/01/2007 → 03/07/2013
Number of participants: 7
Phd Student:
Rosenkrantz, Rikke Tjørnhøj (Intern)
Supervisor:
Kusk, Kresten Ole (Intern)
Loutseti, Stefania (Ekstern)
Main Supervisor:
Baun, Anders (Intern)
Examiner:
Lützhøft, Hans-Christian Holten (Intern)
Eklund, Britta Torp (Ekstern)
Ingerslev, Flemming (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Integration of modelling, monitoring and optimisation technologies for real-time management of groundwater resources
Due to the steadily increasing pressure on the water resources worldwide there is an emergent need to develop techniques that optimise the exploitable water resources, while protecting it from contamination and preventing over-use.
The project addresses the problem of operation and management of the groundwater resources at well-fields. By optimising water withdrawal and pump scheduling economic benefits in terms of reduced operation and maintenance costs as well as environmental benefits and improved water quality can be achieved. The project aims at establishing a knowledge base and developing methodologies and prototype hardware and software technology for real-time optimisation and control that allows for adaptive and interactive management of the groundwater resources at well-fields. The developments include combination of advanced numerical hydrological and hydraulic simulation models and stochastic models of the water flow processes in the well-field with optimisation techniques for on-line, optimal control of pump scheduling and water withdrawal. In addition, real-time, on-line monitoring data are integrated with the modelling system using data assimilation to continuously update the model description and control system. A geochemical sensor array is developed to monitor cation concentrations in the groundwater for providing real-time water quality measures, thereby allowing the control system to react on water quality changes. The developed optimisation and control system is implemented with modular pump controls and integrated with a data management and decision support system. Prototypes of the developed techniques, software and hardware tools are demonstrated and tested on a selected well-field.

Department of Environmental Engineering
Period: 01/01/2007 → 31/12/2010
Number of participants: 2
Acronym: Well fields
Project ID: 30544
Project participant:
Bauer-Gottwein, Peter (Intern)
Project Manager, organisational:
Rosbjerg, Dan (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 2,241,308.00 Danish Kroner

Life-cycle assessment of biorefineries and biofuel production based on biomass resources
The project involves evaluation of environmental consequences of producing biofuels from biorefineries. This is done using a life-cycle assessment approach with specific focus on potentials for process optimizations, but also includes evaluations of the utilization of residual biomass resources for biofuel production. The project is a sub-project of a larger project (BioREF) hosted at the departments Bioenergy research group.

Department of Environmental Engineering
Period: 01/01/2007 → 31/12/2011
Number of participants: 2
Acronym: Bio.REF2
Project ID: 30520
Project participant:
Boldrin, Alessio (Intern)
Project Manager, organisational:
Astrup, Thomas Fruergaard (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 1,952,866.00 Danish Kroner

Overlevelse af indikatorbakterier og patogener i ledningsnet
1. Formål Der er en lang række forhold og observationer i vandforsyningerne af forekomst af indikatororganismer i ledningsnet, som ikke kan forklares med den nuværende viden. For at kunne optimere valg af materialer til ledningsnet, sikre og forbedre vandets mikrobiologiske kvalitet i distributionssystemerne og optimere strategier til ledningsnettets vedligeholdelse og renovering vil der blive undersøgt: • overlevelsen af indikatororganismer og udvalgte patogener (sygdomsfremkaldende mikroorganismer) i drikkevandsrør • betydningen af materialevalg (stål, plast) for overlevelsen • styrende faktorer for disse bakteriers overlevelse, først og fremmest samspillet med rørens biofilm i nye og brugte rør • betydningen af arbejdsprocedurer ved udskiftning af rør i ledningsnet, fx sediment i bunden af ledningsnettet, indtrængen af boremudder eller jord Det ansgættede projekt vil således undervise ved virkelighedsnære forhold give ny viden om forekomst af bakterier og overlevelsen af patogener i distributionsnet, og om hvorledes materialevalg og renoveringer indvirker på denne overlevelse. Desuden forventes projektet at bidrage til at forbedre de hygiejniske procedurer ved ledningsrenoveringer.
SENSOWAQ - Sensors for monitoring and control of water quality

Scientific summary: The vision is to construct new sensors for on-line or close to on-line measurement. Sensors are devices that detect physical, chemical or biological stimuli and transform them into signals, which can be measured or recorded. Sensor technology may provide rapid responses in contrast to traditional monitoring methods with long incubations or complex extraction and concentration procedures. The technology opens for development of miniaturised devices for on-line measurement of organic- and inorganic pollutants and microorganisms in different water bodies including groundwater, drinking water and water in industry. Unfortunately, hardly any sensors are available for measuring such water quality parameters, and the scientific challenge for this project is to identify and develop detection principles to enable detection of the very low concentrations typical for these parameters, and to transfer these detection principles to sensor platforms. Sensors can be divided into physico-chemical- and biological sensors. Biological sensors integrate a biological recognition element and a transducer capable of detecting the biological reaction and converting it into a measurable signal. Sensors for the drinking water supply will be developed for detection of selected pesticides (dichlobenil, 2,6-dichlorobenzamide (BAM), triazine and phenoxyacid herbicides), metals (copper, arsenic), specific microorganisms (e.g. Bacteroides, Enterococci, Campylobacter, E. coli, Legionella, Cryptosporidium) and microorganisms in general (suspended organisms, biofilm and corrosive organisms). The research will use and develop several detection principles: 1) immunological and aptamer technology, 2) bioluminescent/fluorescent whole cell technology, 3) DNA and RNA array technology, 4) enzyme technology, 5) ATP-detection by bioluminescence, 6) auto-fluorescent biomolecule detection, and 7) electrical resistance for corrosion measurement. Depending on the target molecules these techniques will be transferred to the appropriate sensor platforms including 1) optical fibres, 2) cantilevers, 3) automated sampling, filtering and analysis robots, and 4) DNA/RNA array-technologies. The project is divided into two main working areas (WA) focusing on development of sensors for analysis of pesticides and metals (WA1) and microbial contamination, including biocorrosive processes (WA2).
ATP On-line
Continued 'real time' measurement of ATP and physical parameters in drinking water

Department of Environmental Engineering
Period: 21/12/2006 → 15/02/2007
Number of participants: 1
Acronym: 784
Project ID: 30507
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Coli Risk - MST
Risk Assessment of coliform bacteria in drinking water

Department of Environmental Engineering
Period: 14/12/2006 → 31/05/2007
Number of participants: 2
Acronym: 785
Project ID: 30506
Project participant:
Corfitzen, Charlotte B. (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Ukendt
Amount: 299,984.00 Danish Kroner
Project
Biodegradability of sulphur and organic matter in the well water from Bad Aibling Thermal bath
First phase: Characterize the degradability of the organic matter by OUR. Determine the distribution of easy degradable, easy hydrolysable and slowly hydrolysable COD. Investigate the effect of 3 weeks acclimatization of the activated sludge to the water. Second phase: If needed we investigate for toxicity for the water to OUR and nitrification.

Department of Environmental Engineering
Period: 11/12/2006 → 01/02/2007
Number of participants: 4
Acronym: Bad Aibling
Project ID: 30508
Project participant:
Eilersen, Ann Marie (Intern)
Schmidt, Jens Ejbye (Intern)
Sørensen, Margrethe (Intern)
Project Manager, organisational:
Andersen, Henrik Rasmus (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Indtægtsdækket virksomhed UK 90
Amount: 147,958.00 Danish Kroner

Improved Anaerobic Digestion of Energy Crops
Department of Environmental Engineering
Period: 01/12/2006 → 23/06/2010
Number of participants: 6
Phd Student:
Bruni, Emiliano (Intern)
Supervisor:
Jensen, Anders Peter (Ekstern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Baun, Anders (Intern)
Mattiasson, Bo (Ekstern)
Norddahl, Birgir (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Modeling concepts for the sustainable management of the Sian Ka'an Biosphere Reserve, Yucatan, Mexico
Department of Environmental Engineering
Period: 15/11/2006 → 21/04/2010
Number of participants: 6
Phd Student:
Gondwe, Bibi Ruth Neuman (Intern)
Supervisor:
Auken, Esben (Intern)
Main Supervisor:
Bauer-Gottwein, Peter (Intern)
Examiner:
Fabricius, Ida Lykke (Intern)
Birk, Steffen (Ekstern)
Jensen, Karsten Høgh (Intern)
**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Biogrowth - VF**
LCA modelling of a combined anaerobic-aerobic process for treatment of source-sorted organic waste mixed with a quantity of garden waste. Implementation of the model on actual problems in chosen municipalities within 'Vestforbrændings' area.

Department of Environmental Engineering
Period: 19/10/2006 → 30/04/2007
Number of participants: 1
Acronym: 783
Project ID: 30500
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

**Financing sources**
Source: Samarb.aftaler, Private danske - Andre virksomheder
Name of research programme: Ukendt
Amount: 478,000.00 Danish Kroner

**Kvantificering af usikkerheder ved risikovurdering af grundvandsforurening fra punktkilder**

Department of Environmental Engineering
Period: 15/10/2006 → 25/08/2010
Number of participants: 6
PhD Student:
Trolborg, Mads (Intern)
Supervisor:
Bjerg, Poul Løgstrup (Intern)
Main Supervisor:
Binning, Philip John (Intern)
Examiner:
Bauer-Gothwein, Peter (Intern)
Lerner, David (Ekstern)
Refsgaard, Jens Christian (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Afværgesatetegier for in-situ oprensning af chlorerede opløsningsmidler - udvikling af ramme for livscyklausvurdering og cost-effectiveness nalyse**

Department of Environmental Engineering
Period: 01/10/2006 → 22/09/2010
Number of participants: 4
PhD Student:
Søndergaard, Gitte Lemming (Intern)
Supervisor:
Hauschild, Michael Zwicky (Intern)
Main Supervisor:
Bjerg, Poul Løgstrup (Intern)
Examiner:
Finkel, Michael (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Psuedo kinetics arising from the upscaling of geochemical equilibrium

In order to ensure good groundwater quality for our drinking water supplies, it is important that we have access to modelling tools that can be used to interpret monitoring data and foresee the impacts of changed management practices. Groundwater quality models now frequently couple simulations of water flow with geochemistry. These models are typically built on an assumption of geochemical equilibrium. Such models do not seek to describe the detailed configuration of minerals, micro-organisms and other geochemically active materials in the subsurface. Instead, they rely on simulations of average properties. However, the variation is still important, because it can take time for contaminants to flow from a geochemically active region into an inactive region. Models based on average properties do not properly take this time into account, and consequently do not correctly simulate the actual geochemistry. This proposal seeks to address this problem, by developing a new theoretical basis for coupling geochemical properties with groundwater flows. The theory will show how to properly account for small scale variability. The project will implement the new theory in computer software that can be used in practice. Finally, the theory will be tested for some case studies that will be chosen from relevant geochemical problems in groundwater. For example, in Denmark, there is some concern that nickel contamination is a problem in our groundwater supplies. The project will fund a PhD student and is collaborative with Princeton University, an international leader in this area of research.

Source Control Options for Reducing Emissions of Priority Pollutants

The overall aim of the SCOREPP project is to develop comprehensive and appropriate source control strategies that authorities, cities, water utilities and chemical industry can employ to reduce emissions of priority pollutants (PPs) from urban areas into the receiving water environment. The SCOREPP project focuses on the 33 priority substances identified in the Water Framework Directive (WFD), and specifically on the 11 priority hazardous substances. However, this list may be expanded to include emerging pollutants or reduced if appropriate model compounds can be identified, depending on the local context. The specific scientific objectives of the SCOREPP project are to identify the sources of PPs in urban areas, to identify and assess appropriate strategies for limiting the release of PPs from urban sources and for treating PPs on a variety of spatial scales. Furthermore to develop GIS-based spatial decision support tools for identification of appropriate emission control measures, to develop integrated dynamic urban scale source-and-flux models that can be used to assess the effect of source control options on PP-emissions and to optimise monitoring programmes, and to assess the direct and indirect costs, the cost-effectiveness and the wider societal implications of source control strategies. The developed approaches, models and assessments will be used to formulate a set of appropriate PP-emission reducing strategies, and a multi-criteria approach will be used to compare and evaluate these strategies in relation to their economic, societal and environmental impacts. The SCOREPP project will interact with the European chemical industry and water utility trade associations together with representatives from ministerial, regional, municipal and community organisations to ensure that these key urban stakeholders can provide input to framing the scope of the project, adapting the project outcomes and communicating the results of the project to a wide audience.
Period: 01/10/2006 → 20/09/2009
Number of participants: 7
Acronym: SCOREPP
Project ID: 30502
Project participant:
Mikkelsen, Peter Steen (Intern)
Grieger, Khara Deanne (Intern)
Lützhøft, Hans-Christian Holten (Intern)
Eriksson, Eva (Intern)
Ledin, Anna (Intern)
Henze, Mogens (Intern)
Project Manager, organisational:
Rasmussen, Birte Kastrup (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 4,728,500.00 Danish Kroner

Relations
Activities:
Balancing complexity and uncertainty in model-based estimation of micropollutant fluxes in integrated urban drainage-
wastewater systems
Project

Waste Management Strategies of the Future: A Consistent European and National Technology Platform
Department of Environmental Engineering
Period: 01/10/2006 → 02/03/2011
Number of participants: 6
Phd Student:
Gentil, Emmanuel (Intern)
Supervisor:
Hauschild, Michael Zwicky (Intern)
Main Supervisor:
Christensen, Thomas Højlund (Intern)
Examiner:
Astrup, Thomas (Intern)
Fischer, Christian (Ekstern)
Wilson, David C. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Egen vandressource projekt A3: International erfaringopsamling.
Tætbefolkede områders erfaringer med alternativ vandhåndtering og høj grad af selvforsyning.
Department of Environmental Engineering
Period: 07/09/2006 → 31/03/2007
Number of participants: 1
Acronym: KE, projekt A3
Project ID: 30493
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project
Oprensning af kilder til grundvandsforurening ved brug af nano- og mikroskala jernpartikler

Department of Environmental Engineering
Period: 01/09/2006 → 18/05/2011
Number of participants: 6
PhD Student:
Fjordbøge, Annika Sidelmann (Intern)
Supervisor:
Baun, Anders (Intern)
Main Supervisor:
Kjeldsen, Peter (Intern)
Examiner:
Broholm, Mette Martina (Intern)
Bastiaens, Leen (Ekstern)
Tuxen, Nina (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Environmentally Sustainable Utilization of Waste Resources for Energy Production

Department of Environmental Engineering
Period: 01/08/2006 → 21/04/2010
Number of participants: 5
PhD Student:
Fruergaard, Thilde (Intern)
Main Supervisor:
Christensen, Thomas Højlund (Intern)
Examiner:
Scheutz, Charlotte (Intern)
Olsen, Stig Irving (Intern)
Tillman, Anne-Marie (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Kortlægning af kilder til miljøskadelige stoffer i affaldet.
Der udføres en opgørelse af potentielle miljømæssige besparelser ved udsortering af 3 udvalgte affaldstyper/fractioner tilført Århus Forbrændingsanlæg. De miljø- og energimæssige konsekvenser af udsorteringen modelleres i EASEWASTE baseret på konkrete målinger ved forbrændingstests.

Department of Environmental Engineering
Period: 01/08/2006 → 31/01/2007
Number of participants: 3
Acronym: Århus F2
Project ID: 30446
Project participant:
Astrup, Thomas Fruergaard (Intern)
Riber, Christian (Intern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 440,000.00 Danish Kroner
**Redox Stratification Controlled Biofilm Reactor: A novel bioreactor concept for environmental and biochemical engineering applications.**

Department of Environmental Engineering  
Period: 01/08/2006 → 31/07/2009  
Number of participants: 2  
Acronym: ReSCOBiR  
Project ID: 30465  
Project participant:  
Terada, Akihiko (Intern)  
Project Manager, organisational:  
Smets, Barth F. (Intern)

**Financing sources**

Source: Forskningsrådene - STVF  
Name of research programme: Forskningsrådene - STVF  
Amount: 1,800,000.00 Danish Kroner  
Project

**Waste Disposal - Getting the "End of Life" right in Life-Cycle-Assessment Modeling of Waste Management Systems**

Department of Environmental Engineering  
Period: 01/08/2006 → 01/07/2009  
Number of participants: 5  
Phd Student:  
Manfredi, Simone (Intern)  
Main Supervisor:  
Christensen, Thomas Højlund (Intern)  
Examiner:  
Kjeldsen, Peter (Intern)  
Kirkeby, Janus Søgaard (Intern)  
Lagerkvist, Anders (Ekstern)

**Financing sources**

Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

**Maximization of gaseous energy recovery by simultaneous biohydrogen production and biomethanation.**

Maximization of gaseous energy recovery by simultaneous biohydrogen production and biomethanation.

Department of Environmental Engineering  
Period: 03/06/2006 → 31/12/2007  
Number of participants: 1  
Acronym: Dansk-Indisk samarbejde  
Project ID: 30491  
Project Manager, organisational:  
Angelidaki, Irini (Intern)

**Financing sources**

Source: Unknown  
Name of research programme: Ukendt  
Amount: 25,000.00 Danish Kroner  
Project

**Århus - Garden Waste**

Characterisation of garden waste, description of treatment and use of garden waste and on the basis hereof modelling of the environmental impact (LCA). Experimental investigations also included as a means of obtaining central data for the environmental assessment.
CenteR for Environmental and Agricultural Microbiology.

Modern agricultural practices introduce a variety of contaminating chemicals to surface soils through practices such as chemical pest management, manure application, and deposition of biosolids from wastewater treatment plants. In addition, diffuse pollution of residential and agricultural soils in urban areas or near traffic corridors may constitute an underestimated problem. Many of these contaminants are degraded slowly or incompletely in top soils, and may therefore leach to lower soil horizons, and ultimately contaminate aquifers. As a result, soil contamination, e.g. by pesticides, hydrocarbons, and veterinary as well as human pharmaceuticals is creating a legitimate concern in the public: Are residential soils safe? Can agricultural soils continue to generate safe crops for human consumption? Will the underlying aquifers continue to provide safe drinking waters? Microbial transformation and degradation of contaminating compounds are of major importance in soil environments. Yet, few studies have identified and quantified the true rate limiting processes of contaminant degradation at low concentrations of contaminants in undisturbed soil samples, and at the scale relevant for microbial life forms. The goals of the proposed cross-disciplinary and multiinstitutional research center are to elucidate, quantify, and ultimately find ways to control the rate limiting processes for biodegradation of selected contaminants in soil systems.
**Kompetenceudvikling indenfor miljøteknik med tværinstitutionel samarbejdsplatform.**
Medfinanciering af netværk bestående af offentlige og private aktører med det formål at forberede og koordinere dansk deltagelse i de større strategiske EU-projekter.

**Department of Environmental Engineering**
**Period:** 30/05/2006 → 31/12/2006  
**Number of participants:** 1  
**Acronym:** Netværk-Miljøteknik  
**Project ID:** 30484  
**Project Manager, organisational:**  
Arvin, Erik (Intern)

**Financing sources**
**Source:** Unknown  
**Name of research programme:** Ukendt  
**Amount:** 1,000,000.00 Danish Kroner

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**Afværgestrategi for Kærgård Plantage.**
Kortlægning af grundvandsforurening ved afskæringsløsning og udstrømningsforhold til havstokken. Undersøge naturlig nedbrydning af forureningskomponenter i grundvandszonen.

**Department of Environmental Engineering**
**Period:** 09/05/2006 → 31/12/2006  
**Number of participants:** 2  
**Acronym:** Kærgård Plantage-afværge  
**Project ID:** 30469  
**Project participant:**  
Scheutz, Charlotte (Intern)  
**Project Manager, organisational:**  
Bjerg, Poul Legstrup (Intern)

**Financing sources**
**Source:** Sam.arb.aftaler, Private danske - Andre virksomheder  
**Name of research programme:** Sam.arb.aftaler, Private danske - Andre virksomheder  
**Amount:** 46,500.00 Danish Kroner

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**Fremtidens indsamling og disponering af husholdningsaffald i Århus Kommune: En integreret analyse af miljø, service og økonomi. Del 2 - det fremtidige affaldssystem.**
Del 2 har til formål at give en integreret vurdering af forslag til fremtidige affaldsordninger i århus Kommune

**Department of Environmental Engineering**
**Period:** 01/04/2006 → 30/09/2007  
**Number of participants:** 2  
**Acronym:** Århus Frem Affald  
**Project ID:** 30447  
**Project participant:**  
Larsen, Anna Warberg (Intern)  
**Project Manager, organisational:**  
Christensen, Thomas Højlund (Intern)

**Financing sources**
**Source:** Unknown  
**Name of research programme:** Ukendt  
**Amount:** 470,000.00 Danish Kroner

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**Improved energy efficiency and bottom ash quality for waste incinerators**
The project involves test in pilot-scale of bottom ash sintering in a rotary kiln designed for waste incinerators. Ash qualities are evaluated with respect to leaching behavior as a function of rotary kiln design and operation parameters. In addition to this, the project evaluates potential improvements in furnace design with an aim to improve overall energy recovery.
efficiency while at the same time improving bottom ash qualities by sintering.

Department of Environmental Engineering  
Period: 01/04/2006 → 30/06/2009  
Number of participants: 2  
Acronym: PSO-Kemiteknik  
Project ID: 30496  
Project participant:  
Hyks, Jiri (Intern)  
Project Manager, organisational:  
Astrup, Thomas Fruergaard (Intern)  

Financing sources  
Source: Forskningsprojekter - Miljø- og Energiministeriet  
Name of research programme: Ukendt  
Amount: 492,000.00 Danish Kroner  

Technical collaboration on Fluoride remediation in Japan  
1) Expert appraisal of the applicability of fluoride remediation technologies to Japanese project  2) Expert advice on the application of other remediation technologies

Department of Environmental Engineering  
Period: 01/04/2006 → 31/03/2007  
Number of participants: 1  
Acronym: Expert-Floride remediation  
Project ID: 30477  
Project Manager, organisational:  
Binning, Philip John (Intern)  

Financing sources  
Source: Unknown  
Name of research programme: Ukendt  
Amount: 23,500.00 Danish Kroner  

Massestrømsanalyse for miljøfremmede stoffer i afløbssystemer.  
Projektets formål er at opstille en forenklet model for et afløbssystem incl. rensningsanlæg, som kan benyttes til massestrømsanalyse for relevante stoffer. Modellen udvikles på Lynetten med opland.

Department of Environmental Engineering  
Period: 10/03/2006 → 31/12/2008  
Number of participants: 3  
Acronym: Massestrømsanalyse  
Project ID: 30464  
Project participant:  
Lindblom, Erik Ulfson (Intern)  
Henze, Mogens (Intern)  
Project Manager, organisational:  
Mikkelsen, Peter Steen (Intern)  

Financing sources  
Source: Unknown  
Name of research programme: Ukendt  
Amount: 100,000.00 Danish Kroner  

Confocal Scanning Laser Microscope for Environmental Biotechnological & Microbiological Applications.  
Confocal Scanning Laser Microscope for Environmental Biotechnological & Microbiological Applications.

Department of Environmental Engineering  
Period: 01/03/2006 → 31/08/2007  
Number of participants: 2  
Acronym: Laser Microscope
Project ID: 30478
Project participant:
Musovic, Sanin (Intern)
Project Manager, organisational:
Smets, Barth F. (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,500,000.00 Danish Kroner

Environmental Assessment of the Management of Garden and Yard Waste
Department of Environmental Engineering
Period: 01/03/2006 → 23/09/2009
Number of participants: 5
Phd Student:
Boldrin, Alessio (Intern)
Main Supervisor:
Christensen, Thomas Højlund (Intern)
Examiner:
Angelidaki, Irini (Intern)
Jensen, Lars Stoumann (Ekstern)
Kranert, Martin (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Implementation of LCA-models in Waste Management
Department of Environmental Engineering
Period: 01/03/2006 → 23/06/2010
Number of participants: 5
Phd Student:
Damgaard, Anders (Intern)
Main Supervisor:
Christensen, Thomas Højlund (Intern)
Examiner:
Kjeldsen, Peter (Intern)
Grosso, Mario (Ekstern)
Kirkeby, Janus Søgaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Methods for enhanced delivery of in situ remediation amendments to contaminated clay till
Department of Environmental Engineering
Period: 01/03/2006 → 23/06/2010
Number of participants: 5
Phd Student:
Christiansen, Camilla Maymann (Intern)
Main Supervisor:
Bjerg, Poul Løgstrup (Intern)
Examiner:
Jakobsen, Rasmus (Intern)
PSO-VFA. Anwendung von fedtsyresensor for at kontrollere og optimere anaerob processen for lav omkostnings biogas fra gyllen.

Department of Environmental Engineering
Period: 01/03/2006 → 29/02/2008
Number of participants: 2
Acronym: PSO - VFA
Project ID: 30441
Project participant:
Boe, Kanokwan (Intern)
Project Manager, organisational:
Angelidaki, Irini (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukedt
Amount: 1,660,700.00 Danish Kroner
Project

Funktionen af den reaktive væg på Vapokon grunden - 7 år efter etablering - flux af stof gennem væggen.

Department of Environmental Engineering
Period: 15/02/2006 → 31/12/2006
Number of participants: 1
Acronym: Vapokon A7Y
Project ID: 30458
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukedt
Amount: 97,000.00 Danish Kroner
Project

Donation to a Phd-student with the purpose of encouraging and supporting the study in chalc and silica from the North Sea area.
Donation to a Phd-student with the purpose of encouraging and supporting the study in chalc and silica from the North Sea area.

Department of Environmental Engineering
Period: 01/02/2006 → 30/06/2006
Number of participants: 2
Acronym: BP Norway
Project ID: 30462
Project participant:
Hjuler, Morten Leth (Intern)
Project Manager, organisational:
Fabricius, Ida Lykke (Intern)

Financing sources
Source: Unknown
Pesticidforskningsprojekt: Statistisk analyse og biologisk tolkning af toksicitetsdata.

Department of Environmental Engineering
Period: 01/02/2006 → 31/12/2007
Number of participants: 4
Acronym: STABTOK
Project ID: 30498
Project participant:
Nyholm, Niels (Intern)
Andersen, Henrik Rasmus (Intern)
Kusk, Kresten Ole (Intern)
Project Manager, organisational:
Baun, Anders (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Ukendt
Amount: 113,040.00 Danish Kroner

Potentialet for membranafsaltdet vand i vandforsyningen

Department of Environmental Engineering
Period: 01/02/2006 → 23/06/2010
Number of participants: 6
Phd Student:
Rygaard, Martin (Intern)
Supervisor:
Arvin, Erik (Intern)
Main Supervisor:
Binning, Philip John (Intern)
Examiner:
Henze, Mogens (Intern)
Gimbel, Rolf (Ekstern)
Ødegaard, Hallvard (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Oprensning af Høfde 42-depotet ved hjælp af nul-valent jern.

Formål er at vurdere nul-valent baserede teknologiers egnethed med speciel focus på kildeoprensning til fjernelse af forureningen i sediment og grundvand i og omkring Høfde 42-depotet.

Department of Environmental Engineering
Period: 24/01/2006 → 30/06/2006
Number of participants: 3
Acronym: HØFDE 42
Project ID: 30463
Project participant:
Fjordbæge, Annika Sidelmann (Intern)
Krus, Susanne (Intern)
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources

Pig farming is a major EU agricultural industry, with about 300 million tons of manure produced annually by the SME farmers. This is a major environmental problem, resulting in severe pollution of ground water and eutrophication of surface waters due to high nitrate, ammonia and phosphate emissions. This project provides an integrated solution using a combination of innovative technologies, thereby enabling the farmers to attain environmental compliance with the IPPC, and Waste directives. The project develops UASB technology for a digester, combined with dilution by Brammox effluent to prevent ammonia and sulphur inhibition. C-digestion with several other organic wastes will improve biogas output. The Anphos process will remove phosphate as struvite, as well as ammonia removal with precipitation of the non-digested solids. The Brammox process will be used for the first time for the removal of ammonia from the digested pig manure. PIGMAN will develop nitrification/denitrification in an activated sludge process combined with ultra filtration membranes (Biomembrane process).

Department of Environmental Engineering
WasteMan
Knops pork B.V.
ROL-KON Spolka z o.o
Hegndal svineproduktion
KAILAS&SONS LTD
Lahav Institute of Animal Research
Ghent University
Adviesburo voor milieutechniek Colsen BV
SELR eeg
University of Ioannina
Period: 01/01/2006 → 31/12/2007
Number of participants: 3
Acronym: PIGMAN
Project ID: 30452
Project participant:
Schmidt, Jens Ejbye (Intern)
Karakashev, Dimitar Borisov (Intern)
Project Manager, organisational:
Angelidaki, Irini (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 900,975.00 Danish Kroner
Project

Bevilling fra Rektors Strategiske Omstillingspulje til at fremme innivationsaktiviteter på DTU, in casu EASEWASTE
Bevilling fra Rektors Strategiske Omstillingspulje til at fremme innivationsaktiviteter på DTU, in casu EASEWASTE.

Department of Environmental Engineering
Period: 01/01/2006 → 31/12/2008
Number of participants: 1
Acronym: EASEWASTE RSO
Project ID: 30455
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: [Ordinaer drift UK 10]
Name of research programme: [Ordinær drift UK 10]
Amount: 1,500,000.00 Danish Kroner
Project

Environmentally sustainable utilization of waste resources for energy production

Department of Environmental Engineering
Period: 01/01/2006 → 31/12/2008
Number of participants: 2
Acronym: ENSUWE
Project ID: 30449
Project participant:
Fruergaard, Thilde (Intern)
Project Manager, organisational:
Astrup, Thomas Fruergaard (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 2,500,000.00 Danish Kroner
Project

Environmentally sustainable utilization of waste resources for energy production

Department of Environmental Engineering
Department of Management Engineering
Residual Resource Engineering
Aalborg University
Elsam A/S
Period: 01/01/2006 → 31/12/2008
Number of participants: 3
Acronym: ENSUWE
Project ID: 1200196
Project participant:
Münster, Marie (Intern)
Fruergaard, Thilde (Intern)
Project Manager, organisational:
Astrup, Thomas (Intern)

Financing sources
Source: Public research council
Name of research programme: Forskningstyrelsen – programkomiteen for energi og miljø
Amount: 4,700,000.00 Danish Kroner

Relations
Publications:
Comparing Waste-to-Energy technologies by applying energy system analysis
Energy Systems Analysis of Waste to Energy Technologies by use of EnergyPLAN
Energy system analyses of the marginal energy technology in life cycle assessments
Importance of Flexible Use of Waste for Energy for the National Energy System
Optimization of use of waste in the future energy system
Long-term affected energy production of waste to energy technologies identified by use of energy system analysis
Uncertainties related to the identification of the marginal energy technology in consequential life cycle assessments
Waste-steknologiers CO2-fortrængning i energisystemet
Waste-to-energy technologies in TIMES models
Use of waste for heat, electricity and transport—Challenges when performing energy system analysis
Use of Waste for Heat, Electricity and Transport – Challenges when performing Energy System Analysis
Modelling Waste-To-Energy Technologies in National Energy Systems
Production of bio-fuel, electricity and heat through gasification of waste

Fjernelse af Mechlorprop i Kerteminde Vandværk
Formål med denne undersøgelse er at undersøge, hvordan mechlorprop tilsyneladende kan forsvinde i vandbehandlingen på Kerteminde Vandforsyningsværk, herunder hvilken betydning udskiftning af filtrene har.

Department of Environmental Engineering
Period: 01/01/2006 → 01/10/2006
Number of participants: 3
Acronym: Fyns Amt-Mechlorprop
Project ID: 30453
Project participant:
Ferguson, Camilla Keinicke Hamilton (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 400,000.00 Danish Kroner

Fremtidens integrerede indsamling af affald
Department of Environmental Engineering
Period: 01/01/2006 → 11/11/2009
Number of participants: 5
Phd Student:
Larsen, Anna Warberg (Intern)
Main Supervisor:
Christensen, Thomas Højlund (Intern)
Examiner:
Scheutz, Charlotte (Intern)
Bilitewski, Bernd (Ekstern)
Björklund, Anna (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Interaction of nanoparticles with xenobiotic compounds
The presence of engineered nanoparticles may influence the toxicity and bioaccumulation of xenobiotic compounds. Therefore this project is aimed at studying the interaction of carbon nanoparticles with organic contaminants using algae and crustaceans as test organisms.

Department of Environmental Engineering
Period: 01/01/2006 → 01/01/2009
Number of participants: 1
Acronym: I
Project participant:
Baun, Anders (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
MFC-Risø. Microbial fuel cell - used in direct conversion of lignocellulosic waste to energy.

Department of Environmental Engineering

Forskningscenter Risø
Period: 01/01/2006 → 31/12/2008
Number of participants: 1
Acronym: MFC-Risø
Project ID: 30423
Project Manager, organisational:
Angelidaki, Irini (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,700,000.00 Danish Kroner

Mitigation of the Groundwater Arsenic Problem in Rural Areas of the Red River Flood Plain, Vietnam

Department of Environmental Engineering
Period: 01/01/2006 → 09/12/2009
Number of participants: 8
Phd Student:
Jessen, Søren (Intern)
Supervisor:
Larsen, Flemming (Intern)
Postma, Diederik Jan (Intern)
Viet, Pham Hung (Ekstern)
Main Supervisor:
Jakobsen, Rasmus (Intern)
Examiner:
Kjeldsen, Peter (Intern)
Kinniburgh, David G. (Ekstern)
Østergaard, Peter Holm (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD


RaMAda

Department of Environmental Engineering
Period: 01/01/2006 → 31/12/2009
Number of participants: 4
Acronym: RaMAda
Project ID: 30437
Project participant:
Smets, Barth F. (Intern)
Lardon, Laurent (Intern)
Bazire, Alexis (Intern)
Project Manager, organisational:
Smets, Barth F. (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 14,254,600.00 Danish Kroner
Reduction of Greenhouse Gas Emissions from Landfills by use of Engineered Biocovers: Full Scale Studies

Department of Environmental Engineering
Period: 01/01/2006 → 26/05/2010
Number of participants: 6
PhD Student:
Fredenslund, Anders Michael (Intern)
Supervisor:
Scheutz, Charlotte (Intern)
Main Supervisor:
Kjeldsen, Peter (Intern)
Examiner:
Christensen, Thomas Højlund (Intern)
Börjesson, Gunnar (Ekstern)
Poulsen, Tjalfe (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Student Sponsorship Programme.
COWI A/S sponsors two students.

Department of Environmental Engineering
Period: 01/01/2006 → 31/12/2007
Number of participants: 1
Acronym: Sponsorship
Project ID: 30454
Project Manager, organisational:
Henze, Mogens (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 120,000.00 Danish Kroner
Project

PSO-ELSAM. Undersøgelse af restprodukter (slagger og flyveske/øggasaffald) fra affaldsforbrænding.
Investigation of the correlation between waste input to MSW incinerators and residue quality. Specific waste fractions are co-incinerated at a full scale incinerator, and all emission routes are monitored.

Department of Environmental Engineering
Period: 09/12/2005 → 01/05/2009
Number of participants: 2
Acronym: PSO-Elsam
Project ID: 30428
Project participant:
Riber, Christian (Intern)
Project Manager, organisational:
Astrup, Thomas Fruergaard (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 4,482,000.00 Danish Kroner
Project

Del 1 har til formål at opstille en model, der kan beskrive de miljømæssige og økonomiske aspekter af det nuværende affaldssystem for husholdningsaffald i Århus Kommune som et grundlag for udvikling af fremtidige affaldsordninger.

Department of Environmental Engineering
Period: 01/12/2005 → 30/04/2007
Number of participants: 2
Acronym: Århus Nu Affald
Project ID: 30448
Project participant:
Larsen, Anna Warberg (Intern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 470,000.00 Danish Kroner

Håndtering af problemer med Arsen i grundvandet i landdristriktet på flodplanet langs den Røde Flod.

Department of Environmental Engineering
Period: 01/12/2005 → 30/11/2008
Number of participants: 2
Acronym: 602
Project ID: 30433
Project participant:
Jessen, Søren (Intern)
Project Manager, organisational:
Postma, Diederik Jan (Intern)

Financing sources
Source: Forskningsprojekter - Udenrigsministeriet (Danida)
Name of research programme: Forskningsprojekter - Udenrigsministeriet (Danida)
Amount: 1,931,210.00 Danish Kroner

En model opstilles for Århus Forbrændingsanlæg i EASEWASTE, og en vurdering af de miljø- og energimæssige forhold omkring anlægget foretages.

Department of Environmental Engineering
Period: 01/12/2005 → 30/11/2006
Number of participants: 3
Acronym: Århus F1
Project ID: 30445
Project participant:
Astrup, Thomas Fruergaard (Intern)
Riber, Christian (Intern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 710,000.00 Danish Kroner

Svømmebadsteknologi

Department of Environmental Engineering
Period: 01/12/2005 → 31/12/2005
Number of participants: 1
Project ID: 30436
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Ukendt
Amount: 52,000.00 Danish Kroner
Project

ReVAQ pilotprojekt. Prioriterede organiske emner i slam.
ReVAQ pilotprojekt. Prioriterede organiske emner i slam.

Department of Environmental Engineering
Number of participants: 2
Acronym: ReVAQ pilotprojekt
Project ID: 30427
Project participant:
Eriksson, Eva (Intern)
Project Manager, organisational:
Ledin, Anna (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Ukendt
Amount: 83,300.00 Danish Kroner
Project

Specialanalyser til vurdering af naturlig nedbrydning samt nedbrydningsforsøg, Ringe Tjære og Asfaltfabrik.

Department of Environmental Engineering
Period: 02/11/2005 → 31/12/2006
Number of participants: 2
Acronym: Fyns Amt-Tjære Del 2
Project ID: 30422
Project participant:
Broholm, Mette Martina (Intern)
Project Manager, organisational:
Bjerg, Poul Legstrup (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Sam.arb.aftaler - Amter og kommuner
Amount: 167,500.00 Danish Kroner
Project

DAN-ED: Endocrine disrupters in food and environment: exposure routes and impact on humand

Department of Environmental Engineering

Environmental Chemistry
University of Copenhagen
Period: 01/11/2005 → 31/10/2008
Number of participants: 3
Acronym: DAN-ED
Project ID: 30432
Project participant:
Andersen, Henrik Rasmus (Intern)
Eriksson, Eva (Intern)
Project Manager, organisational:
Baun, Anders (Intern)

Financing sources
Fondsstøtte til apparaturindkøb til projekt om reduktion af drivhusgasemission fra lossepladser
Fondsstøtte fra Brd. Hartmanns Fond til apparaturindkøb til projekt om reduktion af drivhusgasemission fra lossepladser (medfinansiering til BIOCOVER)

Department of Environmental Engineering
Period: 01/11/2005 → 31/10/2008
Number of participants: 2
Acronym: Biocover medfinansiering
Project participant:
Kjeldsen, Peter (Intern)
Project Manager, organisational: Kjeldsen, Peter (Intern)

Financing sources
Source: Unknown
Name of research programme: Udendørs
Amount: 0.00 Danish Kroner


Department of Environmental Engineering
Period: 25/10/2005 → 30/09/2008
Number of participants: 2
Acronym: 608
Project ID: 30425
Project participant:
Press-Kristensen, Kåre (Intern)
Project Manager, organisational: Tjell, Jens Christian (Intern)

Financing sources
Source: Unknown
Name of research programme: Udendørs
Amount: 100,000.00 Danish Kroner

Undersøgelse af planters oprensningspotentiale af tungmetal- og olieforurenet jord påforsøgsstation hos KMC. Fyto remediering.

Department of Environmental Engineering
KMC
Period: 24/10/2005 → 31/05/2006
Number of participants: 2
Acronym: 580
Project ID: 30426
Project participant:
Press-Kristensen, Kåre (Intern)
Project Manager, organisational: Trapp, Stefan (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Sam.arb.aftaler - Amter og kommuner
Amount: 152,232.00 Danish Kroner
Lærebog "Air Pollution - the European Perspective"
Department of Environmental Engineering
Period: 18/10/2005 → 31/10/2006
Number of participants: 1
Acronym: Lærebog Air Pollution
Project ID: 30457
Project Manager, organisational:
Tjell, Jens Christian (Intern)

Financing sources
Source: Gaver, Private danske Fonde
Name of research programme: Ukendt
Amount: 75,000.00 Danish Kroner
Project

Pilot scale experiments at Rugårdsvæj, Odense, for evaluation of anaerobic dechlorination as a remedy.
Department of Environmental Engineering
COWI A/S
GeoSyntec
Hedeselskabet
Number of participants: 1
Acronym: Fase 3, Fyns Amt
Project ID: 30419
Project Manager, organisational:
Bjerg, Poul Løgstrup (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Sam.arb.aftaler - Amter og kommuner
Amount: 255,000.00 Danish Kroner
Project

Problem-Oriented Project Based Learning in Environmental Management & Technology. Contract No: MY/ASIA-LINK/002 (102-652)
Department of Environmental Engineering
Period: 01/10/2005 → 30/09/2007
Number of participants: 1
Acronym: MY/ASIA-LINK/002
Project ID: 30497
Project Manager, organisational:
Thygesen, Niels (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 245,200.00 Danish Kroner
Project

Towards Rational Design of Redox-Stratified Biofilms: A Novel Approach for Developing Robust Biotechnologies for Nutrient Removal from Wastewaters
Department of Environmental Engineering
Period: 01/10/2005 → 01/07/2009
Number of participants: 6
Phd Student:
Lackner, Susanne (Intern)
Supervisor:
Henze, Mogens (Intern)
Main Supervisor:
Smets, Barth F. (Intern)
Examiner:
Arvin, Erik (Intern)
Casey, Eoin (Ekstern)
Nogueira, Regina (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

CHIAT - Chemical Hazard Identification and Assessment Tool
Chemical Hazard Identification and Assessment Tool
Department of Environmental Engineering
Period: 28/09/2005 → 01/03/2006
Number of participants: 2
Acronym: 596
Project ID: 30417
Project participant:
Eriksson, Eva (Intern)
Project Manager, organisational:
Ledin, Anna (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Ukendt
Amount: 66,569.00 Danish Kroner
Project

Apparaturindkøb: Photoacustic Field Gas Monitor
Apparaturindkøb: Photoacustic Field Gas Monitor
Department of Environmental Engineering
Period: 20/09/2005 → 01/05/2006
Number of participants: 1
Acronym: Biocover medfinansiering
Project ID: 30418
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Gaver, Private danske Fonde
Name of research programme: Ukendt
Amount: 75,000.00 Danish Kroner
Project

Systematic leaching data for waste incineration bottom ashes
Formål er på systematisk vis at frembringe et skalerbart datasæt for udvaskningen af udvalgte slagger
Department of Environmental Engineering
Number of participants: 2
Acronym: BA Leaching
Project ID: 30416
Project participant:
Hyks, Jiri (Intern)
Project Manager, organisational:
Astrup, Thomas Fruergaard (Intern)

Financing sources
Source: Samarb.aftaler - Amter og kommuner
Name of research programme: Samarb.aftaler - Amter og kommuner
Amount: 168,000.00 Danish Kroner
Project

Nanotechnology, Innovation and the Precautionary Principle
Department of Environmental Engineering
Period: 01/09/2005 → 01/04/2009
Number of participants: 4
Phd Student:
Hansen, Steffen Foss (Intern)
Main Supervisor:
Baun, Anders (Intern)
Examiner:
Møller Christensen, Frans (Ekstern)
Owen, Richard (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Stabilitet af salt-ferkvandsgrænsen i opsprækkede kalkbjergarter
Department of Environmental Engineering
Number of participants: 3
Phd Student:
Bonnesen, Ellen Prip (Intern)
Supervisor:
Larsen, Flemming (Intern)
Main Supervisor:
Jakobsen, Rasmus (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Beslutningsstøtteværktøj vedrørende indsamling og behandling af kildesorteret dagrenovation
Department of Environmental Engineering
Period: 06/08/2005 → 01/12/2005
Number of participants: 1
Acronym: NM-model
Project ID: 30408
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Samarb.aftaler - Statslige danske
Name of research programme: Samarb.aftaler - Statslige danske
Amount: 220,000.00 Danish Kroner
Project
BIOCOVER. "Reduction of Greenhouse Gas Emission from European Landfills by use of Engineered Biocovers".

Landfills containing organic wastes produce biogas, and are significant sources of methane which contributes to climate changes. Some landfills are not or cannot be utilized for landfill gas. In these cases the gas is flared with risk of producing toxic combustion products, or is just escaping the landfill to the atmosphere. Experiments have documented that a very high methane oxidation rate can be obtained in bio-covers, high enough to significant reduce the methane emission from the landfill. Bio-covers may also be a very cost-effective supplementary method at landfills with landfill gas utilization, since the efficiency of the gas extraction system often is in the range of 50-60 %. However, the documentation of the efficiency of biocovers has so far not been carried out in full scale BIOCOVER is a LIFE III Environment project with the full title “Reduction of Greenhouse Gas Emissions from Landfills by use of Engineered Bio-covers”. The aim of the project is to develop a methodology for reducing methane emission from covered landfills based on microbial methane oxidation in established passively vented biofilter areas, so-called bio-windows. The project will demonstrate the methodology in full scale on a landfill in Denmark, Fakse landfill, located in Southeastern Zealand.
Department of Environmental Engineering  
Period: 01/08/2005 → 31/03/2006  
Number of participants: 4  
Project ID: 25699  
Project participant:  
Kjeldsen, Ane Mette (Intern)  
Christensen, Thomas Højlund (Intern)  
Astrup, Thomas Fruergaard (Intern)  
Project Manager, organisational:  
Geiker, Mette Rica (Intern)  

Financing sources  
Source: Sam.arb.aftaler, Private danske - Andre virksomheder  
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder  
Amount: 600,000.00 Danish Kroner  

Analyseprogram for fjernelse af hormonforstyrrende kemikalier i biologisk renset spildevand  
Department of Environmental Engineering  
Hedeselskabet  
Scan Research A/S  
Hørsholm kommune  
Period: 01/07/2005 → 31/05/2006  
Number of participants: 2  
Acronym: APOP-LIFE 03  
Project ID: 30404  
Project participant:  
Andersen, Henrik Rasmus (Intern)  
Project Manager, organisational:  
Baun, Anders (Intern)  

Financing sources  
Source: Sam.arb.aftaler, Private danske - Andre virksomheder  
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder  
Amount: 385,000.00 Danish Kroner  

Efficiency of PFA as a disinfectant for wastewater from a treatment plant  
Department of Environmental Engineering  
Period: 27/06/2005 → 01/04/2006  
Number of participants: 1  
Acronym: 590  
Project ID: 30403  
Project Manager, organisational:  
Henze, Mogens (Intern)  

Financing sources  
Source: Sam.arb.aftaler - Udenlandske offentlige og private  
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private  
Amount: 283,500.00 Danish Kroner  

Vandrensning med membraner  
Department of Environmental Engineering  
Period: 27/06/2005 → 01/06/2006  
Number of participants: 1  
Acronym: 587  
Project ID: 30400
The hydrology of the Sian Ka’an biosphere reserve, Quintana Roo, Mexico

The Sian Ka’an Biosphere Reserve (SBKR) is located on the Caribbean Coast of the Yucatan Peninsula, in the Mexican state of Quintana Roo. This coastal wetland, about 5280 km2 in size, is primarily fed by subsurface flow through the fissured limestone of the Yucatan plain. The reserve is home to a wide variety of wildlife including puma and jaguar and it hosts dozens of colonial waterbird species. SBKR encompasses different types of ecosystems, including freshwater and saltwater marshes, tropical rainforests, coastal dunes mangroves and coral reefs. Pressure on the reserve has been increasing over the years due to accelerated tourism development in the region, increased domestic water demand, contamination with agricultural fertilizers and pesticides as well as infrastructure projects, illegal hunting activities and extensive fishing. This situation calls for an integrated approach towards the management of SBKR. One of the prerequisites of integrated management is good quantitative understanding of the system’s water balance, preferably based on a numerical flow model of the region. The model should take into account the overland flow in the wetland as well as subsurface flow in the Karst aquifer. The most critical issue in this context is the identification of the recharge area where the groundwater flows into the reserve originate. Protection of this area from agricultural pollutants must be prioritized. To identify the main subsurface flow pathways and Karst conduits, and to delineate the recharge area, a high-resolution airborne geophysical survey will be employed. Target variables include the electric conductivity of the subsurface (airborne EM), its magnetic susceptibility (airborne magnetics), gamma emission intensity, brightness temperature (infrared sensing) and dielectric permittivity (microwave).
Miljøvurdering af genanvendelse og slutdisponering af spildevandslam


Department of Environmental Engineering

Hedeselskabet
Period: 07/04/2005 → 30/08/2005
Number of participants: 5
Acronym: 558
Project ID: 30392
Project participant:
Hansen, Trine Lund (Intern)
Baun, Anders (Intern)
Kirkeby, Janus Søgaard (Intern)
Gabriel, Søren (Intern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder
Amount: 187,000.00 Danish Kroner
Project

Døp projekten A2. Opstilling og analyse af scenarier for fremtidens håndtering af Københavns Energi’s vandressource.

Det specifikke formål for projektet er: At identificere, opstille og foretage en indledende vurdering af 8-10 scenarier, der hver især varetager den samlede håndtering af drikkevand, spildevand og sekundavand i København. Den grove vurdering af scenarierne vil være en screening for scenariernes potentielle som en realistisk løsning ud fra nogle få udvalgte kriterier.

Department of Environmental Engineering

Københavns Energi A/S
Period: 01/04/2005 → 31/03/2006
Number of participants: 2
Acronym: A2 Grovacensærlige
Project ID: 30395
Project participant:
Eilersen, Ann Marie (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Sam.arb.aftaler - Amter og kommuner
Amount: 553,500.00 Danish Kroner
EMG. Inter-laboratory testing for Enhancement of Microbial Growth.
Inter-laboratory testing regarding the assessment of the microbial growth concerning construction products in contact with drinking water -
Department of Environmental Engineering
Kiwa Water Research
DVGW-Technologiezentrum Wasser
Centre de Recherche D’Expertise et de Contrôle des Eaux de Paris
Thames Water Utilities Ltd
Period: 01/04/2005 → 31/12/2005
Number of participants: 2
Acronym: EMG
Project ID: 30397
Project participant:
Corfitzen, Charlotte B. (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 185,850.00 Danish Kroner

Migration of organic compounds from plastic pipes into drinking water.

Department of Environmental Engineering
Technical University of Denmark
Period: 01/04/2005 → 01/08/2008
Number of participants: 3
Acronym: 547
Project ID: 30374
Project participant:
Mosbæk, Hans (Intern)
Denberg, Martin (Intern)
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Ukendt
Amount: 1,800,000.00 Danish Kroner

Udvikling af innovativ proces for udnyttelse af biomasse til produktion af brint og biogas

Department of Environmental Engineering
Period: 21/03/2005 → 31/01/2006
Number of participants: 1
Acronym: 561
Project ID: 30394
Project Manager, organisational:
Angelidaki, Irini (Intern)
Financing sources
Source: Sam.arb.aftaler, Private danske - Fonde
Name of research programme: Sam.arb.aftaler, Private danske - Fonde
Amount: 750,000.00 Danish Kroner
Project

Development of microbially mediated remediation technologies and remediation of low permeable settings (AND)
Development of microbially mediated remediation technologies and remediation of low permeable settings. See project homepage for further details (in Danish)
Department of Environmental Engineering
Period: 01/03/2005 → 31/12/2006
Number of participants: 6
Acronym: Kbh. Amt, del B, Anaerob dechlorering
Project ID: 30383
Project participant:
Broholm, Mette Martina (Intern)
Christensen, Stine Brok (Intern)
Hansen, Maria Heisterberg (Intern)
Scheutz, Charlotte (Intern)
Christiansen, Camilla (Intern)
Project Manager, organisational:
Bjerg, Poul Løgstrup (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 2,200,000.00 Danish Kroner
Project

Process imbalance in biogas plants and strategies for prevention and reestablishment of process stability. EFP05
Department of Environmental Engineering
Period: 01/03/2005 → 01/05/2008
Number of participants: 1
Acronym: EFP05-Biogas-ustabilitet
Project ID: 30384
Project Manager, organisational:
Angelidaki, Irini (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 1,878,000.00 Danish Kroner
Project

Risk assessment of point sources (RAP)
Chlorinated solvents originating from industrial facilities are a common pollutant in the environment, and can be a major threat to the groundwater quality. There is a need for qualified knowledge-based methods for risk assessment at such sites, in order to focus investigation and remediation efforts. The flux of contaminants from the point sources to groundwater aquifers and vapor fluxes to indoor climates are of particular interest when determining contaminant risk. Since many sources of chlorinated solvents are positioned in the unsaturated zone, a better understanding of the processes controlling the pollutant flux across the capillary fringe such as diffusion and advection will enhance the quality of a risk assessment. The project covers 3 areas: 1. Estimation of fluxes of chlorinated solvents in groundwater from point sources 2. Understanding of governing processes controlling the fate of chlorinated solvents in the unsaturated zone, including the mass transport from the unsaturated zone across the capillary fringe to the groundwater 3. Risk assessment and prioritization of point sources at regional scale. The project covers laboratory experiments, field experiments, field observations and solute transport modeling (at local and regional scale).
Department of Environmental Engineering
Københavns Amt
CONTROL-AD4H2. Control of Anaerobic Digestion Processes for Optimisation of Hydrogen Production

Hydrogen can be biologically produced from organic wastes by several methods among which anaerobic fermentation is a very attractive one. However, the main obstacles in bio-hydrogen application as industrial process are the low yields and non-optimized process. This project focuses on these points studying the following main objectives: 1. Identify important parameters influencing metabolic pathways for optimal hydrogen production 2. Compare the different modelling approaches available in the literature for anaerobic digestion processes and include the hydrogen pathways. 3. Investigate process configurations for maximising energy output of combined biohydrogen (as first priority) and biogas (as second priority) in a combined treatment process. 4. Develop appropriate control laws to optimise hydrogen and biogas production.

Defining Quality Indicators in Waste Management

Department of Environmental Engineering
Period: 01/02/2005 → 01/07/2009
Number of participants: 5
Phd Student: Merrild, Hanna Kristina (Intern)
Main Supervisor: Christensen, Thomas Højlund (Intern)
Examiners: Scheutz, Charlotte (Intern)
Hansen, Jens Aage (Ekstern)
Salhofer, Stefan (Ekstern)

Financing sources

Source: Forsk. EU - Andre EU-midler
Name of research programme: Forsk. EU - Andre EU-midler
Amount: 973,720.00 Danish Kroner
Optimisation of Biohydrogen Production by In-Situ Hydrogen Extraction

Department of Environmental Engineering
Period: 01/02/2005 → 31/12/2005
Number of participants: 3
Phd Student:
Siriwongrusong, Vilailuck (Ekstern)
Supervisor:
Zeng, Raymond Jianxiong (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Treatment Trains for the Remediation of Aquifers Polluted MTBE and other Xenobiotic Compounds

Department of Environmental Engineering
Period: 01/02/2005 → 01/09/2008
Number of participants: 7
Phd Student:
Tsitonaki, Aikaterini (Intern)
Supervisor:
Mosbæk, Hans (Intern)
Smets, Barth F. (Intern)
Main Supervisor:
Bjerg, Poul Legstrup (Intern)
Examiner:
Broholm, Mette Martina (Intern)
Aamand, Jens (Ekstern)
Barker, James F. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

High temperature slagging gasifier for waste.
The project concerns modification and testing of an existing slagging gasifier developed by TK Energi AS in order to verify the mechanical principle and the quality of the produced slag. Furthermore the project investigates the feasibility of the high temperature slagging gasification plant for waste.

Department of Environmental Engineering
TK Energi A/S
Period: 30/01/2005 → 31/12/2006
Number of participants: 1
Acronym: 559
Project ID: 30393
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 500,000.00 Danish Kroner
Project
Ring-testing and reproduction test.
Ring-testing of the copepod development and reproduction test with the harpacticoid copepod NITOCRA SPINIPES and the calanoid copepod ACARTIA TONSA, respectively.

Department of Environmental Engineering
Stockholm University
Period: 25/01/2005 → 31/12/2005
Number of participants: 1
Acronym: 570
Project ID: 30410
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Sam.arb.aftaler - Statslige danske
Name of research programme: Sam.arb.aftaler - Statslige danske
Amount: 73,500.00 Danish Kroner

MERTRAN. Importance of mobile genetic elements and conjugal gene transfer for subsurface microbial community adaptation to biotransformation of metals.
Department of Environmental Engineering
University of Copenhagen
Period: 14/01/2005 → 14/01/2007
Number of participants: 1
Acronym: MERTRAN
Project ID: 30450
Project Manager, organisational:
Smets, Barth F. (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 917,000.00 Danish Kroner

Water for Billions. Start-programmet.
Department of Environmental Engineering
Period: 05/01/2005 → 17/06/2005
Number of participants: 1
Acronym: 564
Project ID: 30375
Project Manager, organisational:
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 98,400.00 Danish Kroner

Biologisk nedbrydning af miljøfremmede stoffer i renseanlæg.
Department of Environmental Engineering
Period: 01/01/2005 → 31/12/2008
Number of participants: 2
Acronym: Lynetten biologisk nedbrydning
Project ID: 30386
Project participant:
Copenhagen's water resources and investigation of possible future water supplies

Formålet er både at analysere en række væsentlige vandressourceforhold samt at undersøge/udvikle en række teknologier og redskaber til at løse de vandmængder og den ønskede kvalitet. Vigtige forudsætninger for de forhold der skal samarbejdes om er at: 

- Udnyttelsen af ressourcen skal være bæredygtig
- Klimaeffekter vil kun indgå såfremt de vurderes at have effekt indenfor de næste 10 år
- Da arbejdet har langsigtede karakter baseres det ikke på at opfylde nuværende lovgivning eller vandkvalitetskriterier. Gennemførelse af en del af samarbejdsforslag eller anbefalinger vil derfor i nogen grad afhænge af den fremtidige udvikling indenfor miljøforvaltningen i Danmark.

Det er samarbejdets formål at sikre at KE frem til 2010 har den til enhver tid fornødne viden til at kunne tage de rigtige beslutninger baseret på den bedst tilgængelige viden og den gennem projektet opbyggede erfaring.

Department of Environmental Engineering

Københavns Energi A/S
Period: 01/01/2005 → 01/01/2006
Number of participants: 6
Acronym: 531
Project participant:
Henze, Mogens (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Ledin, Anna (Intern)
Mikkelsen, Peter Steen (Intern)
Arvin, Erik (Intern)

Project Manager, organisational:
Binning, Philip John (Intern)

Environmental Risk Assessment of Antidepressive Pharmaceuticals

Department of Environmental Engineering

Danmarks Farmaceutiske Højskole
Period: 01/01/2005 → 20/03/2006
Number of participants: 2
Acronym: Lykkepiller
Project ID: 30371
Project participant:
Hedberg, Camilla Berg (Intern)

Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 65,000.00 Danish Kroner

Pesticiders nedbrydning i umættet zone og i grundvandszonen

Department of Environmental Engineering
Period: 01/01/2005 → 26/05/2010
Number of participants: 5
Phd Student:
Aktivt kuls kapacitet til fjernelse af pesticidrester fra renset overfladevand fra Haraldsted sø.

Department of Environmental Engineering
Period: 20/12/2004 → 01/09/2005
Number of participants: 1
Acronym: 586
Project ID: 30378
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Dynamic Modelling of Xenobiotik Organic Compounds in the Integrated Urban Wastewater System

Department of Environmental Engineering
Period: 15/12/2004 → 01/04/2009
Number of participants: 6
Phd Student:
Lindblom, Erik Ulfson (Intern)
Supervisor:
Henze, Mogens (Intern)
Main Supervisor:
Mikkelsen, Peter Steen (Intern)
Examiner:
Trapp, Stefan (Intern)
Bertrand-Krajewski, Jean-Luc (Ekstern)
Rauch, Wolfgang (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD


Projektets formål er at indsamle og systematisere viden om kortlægning af nuværende ressourcer og forbrug samt eksisterende renseteknologier inden for vand- og spildevand til brug i det videre projektforløb, herunder identifikation af scenarier.

Department of Environmental Engineering
Københavns Energi A/S
Period: 01/12/2004 → 31/05/2005
Number of participants: 3
Acronym: A1: Kortlægning
Forundersøgelse i forbindelse med projekt til belysning af stimuleret in-situ redukktiv deklorering som afværgemetode overfor forurening med klorerede opløsningsmidler i moræneler på Rugårdsvej 234, O

Department of Environmental Engineering

COWI A/S
Period: 01/12/2004 → 30/06/2006
Number of participants: 4
Acronym: 548
Project ID: 30369
Project participant:
Broholm, Mette Martina (Intern)
Scheutz, Charlotte (Intern)
Begtrup, Eline (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Ukendt
Amount: 702,500.00 Danish Kroner

Vurdering af nedbrydning og udvaskning af oliestoffer fra restforurening ved villaolietanke.

Department of Environmental Engineering

Number of participants: 1
Acronym: 537
Project ID: 30360

Anvendeligheden af avancerede oxidationsprocesser til desinfektion af vand.

Formål med projektet er at udvikle et beslutningsstyrkende værktøj, til brug ved beslutningsprocesser omkring desinfektion af vand i private og offentlige virksomheder. Samtidig forventes projektet at kunne bidrage til en teknologiøverførsel inden for området.

Department of Environmental Engineering

Environmental Chemistry

Rambøll Danmark A/S
Period: 01/11/2004 → 21/12/2005
Number of participants: 4
Acronym: AOP-Desinfektion  
Project ID: 30373  
Project participant:  
Ledin, Anna (Intern)  
Arvin, Erik (Intern)  
Eriksson, Eva (Intern)  
Project Manager, organisational:  
Albrechtsen, Hans-Jørgen (Intern)  

Financing sources  
Source: Forskningsprojekter - Miljø- og Energiministeriet  
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet  
Amount: 200,000.00 Danish Kroner  
Project  

Indsamling og systematisering af den eksisterende viden om gaspotentialet i forskellige typer biomasse og afgrøder.  
Department of Environmental Engineering  
Period: 01/11/2004 → 30/04/2005  
Number of participants: 2  
Acronym: 563  
Project ID: 30361  
Project participant:  
Hejnfelt, Anette (Intern)  
Project Manager, organisational:  
Angelidaki, Irini (Intern)  

Financing sources  
Source: Unknown  
Name of research programme: Ukendt  
Amount: 48,750.00 Danish Kroner  
Project  

Udarbejdelse af LIFE-proposal: "Reduction of Greenhouse Gas Emission from European Landfills by use of Engineered Biocovers".  
Department of Environmental Engineering  
Period: 01/11/2004 → 15/12/2004  
Number of participants: 1  
Acronym: 543  
Project ID: 30366  
Project Manager, organisational:  
Kjeldsen, Peter (Intern)  

Financing sources  
Source: Unknown  
Name of research programme: Ukendt  
Amount: 149,200.00 Danish Kroner  
Project  

Øresundsuniversitet sommer 2005.Kursus: Avanceret spildevandsrensning i storbyer  
Department of Environmental Engineering  
Period: 25/10/2004 → 01/10/2005  
Number of participants: 1  
Acronym: 584  
Project ID: 30385  
Project Manager, organisational:  
Henze, Mogens (Intern)  

Financing sources  
Source: Sam.arb.aftaler - Udenlandske offentlige og private  
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Miljøvurdering af systemer til håndtering af husholdningsaffald i Herning Kommune.
Der opstilles systematiske databaser om affaldssystemets funktion (data fra Herning bruges) med henblik på brug i et dansk miljøvurderingsværktøj og - dette værktøj bruges til en konkret vurdering af de ressource- og miljømæssige forhold omkring affaldshåndteringen i Herning.

Department of Environmental Engineering
Period: 21/10/2004 → 31/12/2006
Number of participants: 2
Acronym: 540
Project ID: 30357
Project participant: Hansen, Trine Lund (Intern)
Project Manager, organisational: Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 785,000.00 Danish Kroner

Use of membranes for extraction of H2 produced by fermentation
In order to optimize hydrogen production by fermetation process it is imptant to develop technologies for effective reduction of hydrogen in the fermetation liquid. Selective membranes for extraction and removal of hydrogen during fermentation is a promising way for improving process effectivity and increasing hydrogen productivity from wastes.

Department of Environmental Engineering
Period: 15/10/2004 → 31/12/2007
Number of participants: 1
Acronym: 398
Project Manager, organisational: Angelidaki, Irini (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Combined Biohydrogen Biomethane Production from Waste

Department of Environmental Engineering
Period: 01/10/2004 → 04/07/2008
Number of participants: 7
Phd Student: Liu, Dawei (Intern)
Supervisor: Min, Booki (Intern)
Zeng, Raymond Jianxiong (Intern)
Main Supervisor: Angelidaki, Irini (Intern)
Examiner: Schmidt, Jens Ejbye (Intern)
Nielsen, Eduard W. J. van (Ekstern)
Svensson, Bo Håkan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
**Hydrogen from biomass. START-programme.**
A grant to organize and formulate an application for a “Specific Targeted Research Project (STRP)” of the 6. Framework Programme.

Department of Environmental Engineering  
Period: 01/10/2004 → 01/05/2005  
Number of participants: 1  
Acronym: BioHydro  
Project ID: 30356  
Project Manager, organisational:  
Angelidaki, Irini (Intern)

**Financing sources**  
Source: Forskningsrådene - STVF  
Name of research programme: Forskningsrådene - STVF  
Amount: 100,000.00 Danish Kroner

**Kvantificering af miljøeffekter fra RGA.**  
Projektet forventes at beskæftige sig med stabiliseret, deponeret RGA og en til to genanvendelsesteknologier. De faktiske teknologier udvælges af styringsgruppen, idet relevans og tilgængelighed af relevante prøveemner er afgørende. Selve værktøjet,dvs. en sammenhængende procedure for sammenstilling af data, laboratorie-testning samt modellering er projektets hovedformål, men værdien heraf øges ved at basere sig på relevante RGA-teknologier.

Department of Environmental Engineering  
Energy Research Centre of the Netherlands  
Period: 01/10/2004 → 30/09/2007  
Number of participants: 3  
Acronym: 432  
Project ID: 30333  
Project participant:  
Astrup, Thomas Fruergaard (Intern)  
Sloot, Hans van der (Ekstern)  
Project Manager, organisational:  
Christensen, Thomas Højlund (Intern)

**Financing sources**  
Source: Sam.arb.aftaler - Amter og kommuner  
Name of research programme: Sam.arb.aftaler - Amter og kommuner  
Amount: 1,965,000.00 Danish Kroner

**Prediction of Leaching from Waste Incineration Residues**  
Department of Environmental Engineering  
Period: 01/10/2004 → 01/09/2008  
Number of participants: 6  
Phd Student:  
Hyks, Jiri (Intern)  
Supervisor:  
Astrup, Thomas Fruergaard (Intern)  
Main Supervisor:  
Christensen, Thomas Højlund (Intern)  
Examiner:  
Jakobsen, Rasmus (Intern)  
Jensen, Dorthe Lærke (Intern)  
Johnson, Carola Annette (Ekstern)

**Financing sources**  
Source: Internal funding (public)
**Fase 2. Development of remediation technologies for chlorinated solvents.**

Samarbejdsaftale med Fyns Amt: *Gennemføre studier af de grundlæggende geokemiske, mikrobiologiske og hydrogeologiske processer for forskellige oprensningsteknikker for klorerede opløsningsmidler med det formål at kunne forbedre anvendelsen af teknikkerne ved praktiske oprensninger *Udvikle, afprøve og dokumentere forskellige afværgeteknikkers anvendelse ved konkrete oprensninger *Udvikle og anvende egnede test i felt og laboratorium *Udviklings af data mhp. nærmere studier foretaget af speciale- eller Ph.D.studerende *Udvikle viden om processer og teknikker *Publicering af artikler *Muliggøre praktikordning for studerende fra M&R i Fyns Amt

Department of Environmental Engineering  
Period: 15/09/2004 → 01/05/2005  
Number of participants: 3  
Acronym: 536  
Project ID: 30354  
Project participant:  
Jakobsen, Rasmus (Intern)  
Scheutz, Charlotte (Intern)  
Bjerg, Poul Legstrup (Intern)

**Financing sources**
Source: Sam.arb.aftaler - Amter og kommuner  
Name of research programme: Sam.arb.aftaler - Amter og kommuner  
Amount: 290,000.00 Danish Kroner  
Project

**BIOTOOL Biological procedures for diagnosing the status and predicting evolution of polluted environments**

Role of DTU: The normal way to find subsurface pollution is to bore holes. We will investigate whether vegetation can be used to find pollutants residing in the soil. We will use physiological parameters, such as growth, photos from airplanes, leaf fluorescense, and chemical parameters, such as analysis of leafs and wood. We will develop and apply models to predict the accumulation of chemicals in trees and other plants. The goal is to find indicator chemicals and/or indicator plants for subsurface pollution. Test sites are the Danish phytorem sites, e.g., Vassingerød, Axelved, Søllerød. Other work packages of the project will try to develop methods to determine the enzymatic reactions in the pollution plume - ideally by a chip determining the active RNA. Or, more detailed: The objective of BIOTOOL is the assessment, evaluation and prediction of natural attenuation processes to implement natural attenuation as the accepted key groundwater and soil remediation strategy in Europe. This will require benchmarked monitoring tools for diagnosing biological status and predicting evolution of contaminated soil and groundwater which have to be rooted in biological processes. The generation and validation of such novel instruments will be materialized through the application of a suite of state-of-the-art genomic, proteomic and analytical technologies to environmental samples and sites themselves. We will exploit the translocation of indicator chemicals from below ground into above-ground vegetation as a cheap and rapid monitoring tool for subsurface contamination. Diagnosis of the biological status and evolution models for polluted environments will be achieved through [i] the design and utilization of DNA and specifically DNA-array technology for examining the catabolic potential of any given particulate sample and [ii] the identification of protein biomarkers as descriptors of soil and groundwater conditions and biological attenuation. The progress in microbial community functional genomics and proteomics will be employed to gain a mechanistic understanding of microbial responses to chemical insults, plant/microbe interactions and microbial community adaptations that determine microbial-driven soil and groundwater attenuation processes. Such mechanistic understanding will add a considerable predictive power to the genomic and proteomic approaches. Determining the links between environmental factors and expression of degradation abilities will be crucial for strategies aiming at an optimal expression of the catalytic power of the indigenous microbial community. The robustness of diagnostic instruments for future normative applications will be validated in microcosms and used for assessment of contaminated sites under study.

Department of Environmental Engineering  
De Montfort University  
Centro Nacional de Biotecnología  
Helmholtz Centre for Environmental Research  
GBF  
Ecole Polytechnique Federale de Lausanne (EPFL)  
IMIC
Bionostra S.L.  
Number of participants: 1  
Acronym: Biotool  
Project ID: 30352  
Project Manager, organisational: Trapp, Stefan (Intern)  

**Financing sources**  
Source: Forsk. EU - Rammeprogram  
Name of research programme: Forsk. EU - Rammeprogram  
Amount: 1,300,000.00 Danish Kroner  

Reduction of Methane Emissions from Landfills by Use of Engineered Biocovers  
Department of Environmental Engineering  
Period: 01/09/2004 → 25/08/2010  
Number of participants: 6  
Phd Student: Pedersen, Gitte Bukh (Intern)  
Supervisor: Scheutz, Charlotte (Intern)  
Main Supervisor: Kjeldsen, Peter (Intern)  
Examiner: Christensen, Thomas Højlund (Intern)  
Gebert, Julia (Ekstern)  
Rintala, Jukka Antero (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  

Disposal of refrigerators - Freezers in the US: State of the practice.  
Department of Environmental Engineering  
Association of Home Appliance Manufacturers  
Period: 31/08/2004 → 01/03/2005  
Number of participants: 1  
Acronym: 539  
Project ID: 30350  
Project Manager, organisational: Kjeldsen, Peter (Intern)  

**Financing sources**  
Source: Sam.arb.aftaler - Udenlandske offentlige og private  
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private  
Amount: 96,000.00 Danish Kroner  

Udarbejdelse af statusnotat vedrørende forbrændingsslager.  
Projektet skal skabe en udtømmende, men kort oversigt over væsentlige projekter vedr. slagger fra affaldsforbrænding, beskrive det nuværende vidensniveau mht. håndtering af forbrændingsslager, og fremhæve centrale udviklingsområder fremover. Afrapportering består af en sammenskrivning af disse forhold i et engelsksproget statusnotat.  

Department of Environmental Engineering  
Period: 30/08/2004 → 31/12/2004  
Number of participants: 1
The main objective is to investigate and suggest methods for increasing the biogas yield in manure based biogas plants with focus on the following 3 areas: 1) to investigate different reactor configurations for biogas plants for achieving more effective biogas production and more stable operation. 2) to investigate operational procedures, aiming to selectively retain/return degradable material in the reactor. 3) to investigate methods for degradation of undegraded material, by returning without/with aftertreatment to the main reactor.

Department of Environmental Engineering
Burmeister & Wain Scandinavian Contractor A/S
Period: 01/08/2004 → 31/12/2007
Number of participants: 2
Acronym: EFP-04
Project ID: 30338
Project participant:
Kaparaju, Prasad Laxmi-Narasimha (Intern)
Project Manager, organisational:
Angelidaki, Irini (Intern)

Reduction of hazardous compounds found in the sewage sludge by bioprocessing - DETOX.START-programme.
Department of Environmental Engineering
Period: 01/08/2004 → 01/02/2005
Number of participants: 1
Acronym: DETOX.START
Project ID: 30353
Project Manager, organisational:
Schmidt, Jens Ejbye (Intern)

Ringe Tar and Asfalt Plant. Transport and degradation of coal-tar compounds. Riskassessment.
Department of Environmental Engineering
WaterTech
Fyns Amt
Period: 01/08/2004 → 30/11/2004
Number of participants: 2
Acronym: RTA
Samtidig måling af lydhastighed og elektrisk ledningsevne af sedimenter som funktion af spændingstilstand og væskemængde.

B gevillen er givet til anskaffelse af nyt apparatur, som monteres i eksisterende triaxialt trykapparat, således at målingerne udføres ved trykbetingelse svarende til reservoirets tryk.

Department of Environmental Engineering

Department of Chemical and Biochemical Engineering

Period: 01/08/2004 → 01/06/2005

Number of participants: 3

Acronym: 441

Project participant:
Olsen, Casper (Intern)
Stenby, Erling (Ekstern)

Project Manager, organisational:
Fabricius, Ida Lykke (Intern)

Financing sources

Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 357,600.00 Danish Kroner

Water Resources Research in Vietnam - The mobilisation of arsenic and the relation to the dynamic interaction between groundwater and surface water in the Red River Plain.

The main research objective is to obtain a fundamental understanding of the processes controlling the groundwater arsenic content in the flood plain aquifers of the Red River Basin in Vietnam, through detailed hydrogeological and geochemical investigations at a field site near Hanoi. The ultimate object is to upscale this understanding to a regional scale and develop tools applicable for prediction of stream-aquifer interaction and arsenic contamination in regional flood plains.

Department of Environmental Engineering

Hanoi University of Mining and Geology

Northern Hydrogeological and Engineering Geological Division

De Nationale Geologiske Undersøgelser for Danmark og Grønland

Period: 01/08/2004 → 31/07/2007

Number of participants: 5

Acronym: ENRECA

Project participant:
Lange, Erik Rønn (Intern)
Hansen, Ellen Zimmer (Intern)
Larsen, Flemming (Intern)
Binning, Philip John (Intern)

Project Manager, organisational:
Postma, Diederik Jan (Intern)

Financing sources

Source: Forskningsprojekter - Udenrigsministeriet (Danida)
Name of research programme: Ukendt
Amount: 1,421,000.00 Danish Kroner
Belysning af konsekvenser/sammenhænge ved indtagelse/kontakt med forurenet drikkevand af varierende mikrobiologisk kvalitet.

Department of Environmental Engineering

Miljøstyrelsen
Number of participants: 5
Acronym: 440
Project ID: 30344
Project participant:
Boe-Hansen, Rasmus (Intern)
Andersen, Ulla Tolstrup (Intern)
Engelsborg, Caroline Christine (Intern)
Bagge, Linda (Ekstern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 333,014.00 Danish Kroner

Fase 2B: Nikkelfrigivelse ved pyritoxidation.
Miljøstyrelsen ønsker undersøgt hvilke faktorer, der har betydning for nikkelfrigivelse til grundvandet i kalkmagasinerne i typeområdet ved Køge Bugt.

Department of Environmental Engineering
Period: 02/06/2004 → 31/12/2004
Number of participants: 3
Acronym: 439
Project ID: 30343
Project participant:
Jessen, Søren (Intern)
Kjøller, Claus (Intern)
Project Manager, organisational:
Larsen, Flemming (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 249,999.00 Danish Kroner

AquaTerra. Integrated modelling of the river-sediment-soil groundwater system; advanced tools for the management of catchment areas and river basins in the context of global change.

Department of Environmental Engineering

Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek
Wageningen IMARES
Université de Neuchâtel
BRGM

Consejo Superior de Investigaciones Científicas
Period: 01/06/2004 → 31/05/2009
Number of participants: 5
Acronym: AquaTerra
Project ID: 30340
Project participant:
Bjerg, Poul Løgstrup (Intern)
Bio-hydrogen production by anaerobic fermentation of waste

Department of Environmental Engineering
Period: 01/06/2004 → 31/05/2007
Number of participants: 3
Acronym: BioH2
Project ID: 30312
Project participant:
Zeng, Raymond Jianxiong (Intern)
Liu, Dawei (Intern)
Project Manager, organisational:
Angelidaki, Irini (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Ukendt
Amount: 2,400,000.00 Danish Kroner

Improved development of QSAR model for algal toxicity

Department of Environmental Engineering
Environmental Protection Agency
Period: 01/06/2004 → 31/12/2004
Number of participants: 3
Acronym: 437
Project ID: 30342
Project participant:
Nyholt, Niels (Intern)
Hedberg, Camilla Berg (Intern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 226,000.00 Danish Kroner

Materialer anvendt i boringer - betydning for vandkvaliteten. Første del: Mikrobiologisk vækst.
Formålet med projektet er at foretage en vurdering af materialer der anvendes til boringer og til boringsfiltre med henblik på at afgøre, hvornår de befordrer/ giver anledning til mikrobiologisk vækst. Om mikroorganismer faktisk kan vokse på disse materialer afgøres af M&R DTU.

Department of Environmental Engineering
Dansk Toksikologi Center
Period: 01/06/2004 → 15/09/2004
Number of participants: 3
Acronym: 438
Biologisk rensning af organiske stoffer i grundvand for PROM.

Department of Environmental Engineering
Period: 01/05/2004 → 31/08/2004
Number of participants: 1
Acronym: 435
Project ID: 30330
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Sam.arb.aftaler - Statslige danske
Name of research programme: Sam.arb.aftaler - Statslige danske
Amount: 150,000.00 Danish Kroner

Langsomfiltres effekt på drikkevands biostabilitet

En opsamling af erfaringer og gennemgang af den åbne internationale litteratur omkring praktiske erfaringer i forbindelse med biostabilisering af drikkevand ved langsom sandfiltrering.

Department of Environmental Engineering
Københavns Energi A/S
Period: 01/05/2004 → 15/07/2004
Number of participants: 2
Acronym: 426
Project ID: 30339
Project participant:
Bennedsen, Lars (Ekstern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Sam.arb.aftaler - Amter og kommuner
Amount: 276,000.00 Danish Kroner

Udvikling af deponeringsanlægget AV-Miljø - Et dynamisk samarbejde mellem AV-Miljø og Miljø & Ressourcer DTU.

Formålet med projektet er:
- at undersøge gasemissionen fra AV-Miljø via måling af gassammensætning, gasemission og methanoxidation i afsluttede etaper, samt total gasemission fra AV-Miljø vha. storskala sporstofforsøg
- at generere overblik over nuværende perkolatkvalitet og udvaskningsbetingelser
- at etablere facilitet til storskala udvaskningstest med efterfølgende test af ét affaldstype

Department of Environmental Engineering
AV Miljø
Period: 01/05/2004 → 31/12/2005
Number of participants: 5
Acronym: 433
Project ID: 30331
Development of a Flexible Bioprocess for Handling and Recycling Seasonal Industrial Wastewaters

Department of Environmental Engineering
Period: 15/04/2004 → 04/07/2008
Number of participants: 7
Phd Student:
Maya Altamira, Larisa (Intern)
Supervisor:
Baun, Anders (Intern)
Hauschild, Michael Zwicky (Intern)
Main Supervisor:
Schmidt, Jens Ejbye (Intern)
Examiner:
Eilersen, Ann Marie (Intern)
Alves, Maria M. dos Santos (Ekstern)
Petersen, Gert (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

Arsenic removal in water works
After implementation of the new EU drinking water directive in Denmark, many water works can not comply with the 5 ug As/L limit for the water leaving the water works (10 ug As/L at the consumers tap). 16% of the water in the wells exceed the 5 ug As/L limit. However, a significant removal of arsenic takes place in the water works and therefore arsenic is only a problem in some of the water works among the 16%. The purpose of this project is to improve the basic knowledge of the processes that determine the arsenic removal in water works treating groundwater. The arsenic removal is studied in the field and in laboratory systems on the basis of water samples and sand cores from sand filters. Data is analysed by PHREEQC and AQUASIM. Various modifications of existing water treatment plants are studied and the results are interpreted on the basis of the process understanding.

Department of Environmental Engineering
Number of participants: 4
Acronym: 402
Project ID: 30315
Project participant:
Larsen, Flemming (Intern)
Jessen, Søren (Intern)
Mosbæk, Hans (Intern)
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Samarb - Amt og kommuner
Name of research programme: Samarb - Amt og kommuner
Amount: 360,912.00 Danish Kroner
Project

**Disinfection in swimming pools**

There is increasing focus on the water quality in swimming pools because of biological and chemical health risks. At the same time, new types of swimming pools have developed, some with elevated temperatures (baby swimming) and some with more complicated hydraulics than traditional swimming pools (recreational water lands). There is a demand for reducing the concentration of chlorine and in particular harmful disinfection by-products and there is a demand for improved methods of water quality monitoring. The aim of this project is in the first place to summarize the state of the art and identify potential methods of improving the water quality, including monitoring of quality.

Department of Environmental Engineering

DHI Denmark

Danish Technological Institute

Scan Research A/S

Ejcan Aps.

**Period:** 01/04/2004 → 31/12/2005  
**Number of participants:** 2  
**Acronym:** 424  
**Project participant:**  
Albrechtsen, Hans-Jørgen (Intern)  
Arvin, Erik (Intern)

**DTUs bidrag til koordinering og udredning.**

Formål er at: - sikre DTU en gennemgående rolle i koordineringsarbejdet af samarbejdets projekter(Affald Danmark, RGA-samarbejde(ELSAM, AF, VF) - udføre, efter konkret aftale, mindre udrednings-og sammenskrivningsopgaver

Department of Environmental Engineering  
**Period:** 01/04/2004 → 31/03/2007  
**Number of participants:** 3  
**Acronym:** 429  
**Project participant:**  
Astrup, Thomas Fruergaard (Intern)  
Röttger, Ulla (Ekstern)  
Christensen, Thomas Højlund (Intern)

**Financing sources**

**Source:** Sam.arb.aftaler, Private danske - Andre virksomheder  
**Name of research programme:** Ukendt  
**Amount:** 300,000.00 Danish Kroner

**Hvidbog om RGA-teknologier**

Projektet udarbejder en teknisk hvidbog over eksisterende teknologier, dvs. en mere miljøorienteret og data-specifik fremstilling end den eksisterende BAT-note. For hver teknologi sammenstilles en standardbeskrivelse på basis af foreliggende materiale. En særlig indsats gøres for at indsamle erfaringer fra de japanske termiske behandlinger.

Department of Environmental Engineering  
Affald Danmark  
**Period:** 01/04/2004 → 31/12/2006  
**Number of participants:** 3  
**Acronym:** 430  
**Project ID:** 30334  
**Project participant:**  
Christensen, Thomas Højlund (Intern)  
Röttger, Ulla (Ekstern)
Remediation of contaminated groundwater from a former industrial site by a fixed film reactor

Contaminated groundwater from industrial sites may contain a complex mixture of compounds, including many organic chemicals. On-site remediation of the groundwater is often carried out by physical-chemical methods because their function may be more predictable. However, the cost of treatment can be high for example when the organic compounds adsorb poorly to activated carbon, which is the case for vinyl chloride. The idea behind this project is to remove general biodegradable organic matter, including those that adsorb poorly to activated carbon ahead of a subsequent sorption process. This is done with a fixed biofilm reactor where the oxygen input is done with a membrane system in order to avoid stripping of the volatile compounds to the atmosphere.

Department of Environmental Engineering
Storstrøms County
NIRAS A/S
Period: 01/04/2004 → 31/12/2005
Number of participants: 1
Acronym: 425
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Vurderingsværktøj for RGA-disponering (LCA RGA).

Department of Environmental Engineering
Affald Danmark
Period: 01/04/2004 → 31/01/2008
Number of participants: 2
Acronym: 431
Project ID: 30332
Project participant:
Rüttger, Ulla (Ekstern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Samarb aftaler - Amter og kommuner
Name of research programme: Samarb aftaler - Amter og kommuner
Amount: 1,315,000.00 Danish Kroner

Effekt af UV-bestråling i ledningsnet.
**Biohydrogenproduktion fra affald**

Department of Environmental Engineering  
Period: 15/03/2004 → 31/05/2006  
Number of participants: 3  
PhD Student: Christiansen, Trine Løbner (Intern)  
Supervisor: Batstone, Damien J. (Intern)  
Main Supervisor: Angelidaki, Irini (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Amount: 1,600,800.00 Danish Kroner

**Characterizing stormwater runoff and developing advanced technical solutions for secondary treatment**

The main objectives of the project are: 1) to characterize Danish urban storm-water, especially in terms of heavy metal, PAH, chloride and organic matter distribution 2) to study the chemical and physical processes involved during the storm-water treatment, and thus develop the most appropriate technical solution for the treatment prior to discharge.

Department of Environmental Engineering  
University of Gothenburg  
Period: 11/03/2004 → 10/03/2006  
Number of participants: 4  
Acronym: 395  
Project ID: 30314  
Project participant: Eriksson, Eva (Intern)  
Genc-Fuhrman, Hülya (Intern)  
Mikkelsen, Peter Steen (Intern)  
Project Manager, organisational: Ledin, Anna (Intern)

**Financing sources**  
Source: Forskningsrådene - STVF  
Name of research programme: Forskningsrådene - STVF  
Amount: 1,600,800.00 Danish Kroner
Udvikling af organisk udvaskningstest

Department of Environmental Engineering
Period: 03/03/2004 → 31/12/2004
Number of participants: 1
Acronym: 421
Project ID: 30322
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder
Amount: 20,000.00 Danish Kroner
Project

Bogas Forum Øresund. (INTERREG IIIA Øresundsregionen)
Formålet er at etablere et netværk bestående af universiteter, virksomheder, rådgivere og offentlige myndigheder for at fremme funktionaliteten og forøge anvendelsen af biogas i regionen (Øresund) til gavn for samfundet og miljøet.

Department of Environmental Engineering

Lund University
Period: 01/03/2004 → 28/06/2006
Number of participants: 3
Acronym: 415
Project ID: 30321
Project participant:
Boe, Kanokwan (Intern)
Hejnfelt, Anette (Intern)
Project Manager, organisational:
Angelidaki, Irini (Intern)

Financing sources
Source: Forsk. EU - Andre EU-midler
Name of research programme: Forsk. EU - Andre EU-midler
Amount: 1,216,715.00 Danish Kroner
Project

Preproject: Strategies for pesticides from points sources at catchment scale
Forprojektet er et udredningsprojekt, og formålet er at give en nøjere beskrivelse af problemstillingerne og beskrive en række projekter, der kan højne vidensniveauet på området. Forprojektet er støttet af Miljøstyrelsens Teknologiudviklingspulje.

Department of Environmental Engineering

WaterTech A/S

Fyns Amt
Period: 01/03/2004 → 01/07/2004
Number of participants: 4
Acronym: 428
Project ID: 30336
Project participant:
Tuxen, Nina (Intern)
Elkjær, Lars (Ekstern)
Olesen, Ida Holm (Ekstern)
Project Manager, organisational:
Bjerg, Poul Løgstrup (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Sam.arb.aftaler - Amter og kommuner
Amount: 60,500.00 Danish Kroner
Project
Risk assessment for uptake of organic chemicals into vegetables and fruits.

Department of Environmental Engineering

DHI Denmark
Period: 01/03/2004 → 01/11/2004
Number of participants: 1
Acronym: 418
Project ID: 30320
Project Manager, organisational: Trapp, Stefan (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 61,000.00 Danish Kroner
Project

Innovationskonsortiet - Overvågning og begrænsning af mikrobiel vækst.

Department of Environmental Engineering

Aarhus Kommunale Værker
Aarhus University
Teknologisk Institut
Period: 01/02/2004 → 30/06/2007
Number of participants: 4
Acronym: BAKMAT
Project ID: 30329
Project participant: Corfitzen, Charlotte B. (Intern)
Arvin, Erik (Intern)
Boe-Hansen, Rasmus (Intern)
Project Manager, organisational: Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Ukendt
Amount: 995,000.00 Danish Kroner
Project

Miljøoptimering af affaldsforbrændingsanlæg

Department of Environmental Engineering
Period: 01/02/2004 → 21/12/2007
Number of participants: 5
Phd Student: Riber, Christian (Intern)
Main Supervisor: Christensen, Thomas Højlund (Intern)
Examiner: Kjeldsen, Peter (Intern)
Bilitewski, Bernd (Ekstern)
Lundtorp, Kasper (Intern)

Financing sources
Thermodynamics of Transient and Steady-State Sub-Oxic Redox Processes Relevant to Groundwater Contamination

Department of Environmental Engineering
Period: 01/02/2004 → 18/06/2007
Number of participants: 6
Phd Student:
Heimann, Axel Colin (Intern)
Supervisor:
Blodau, Christian (Ekstern)
Main Supervisor:
Jakobsen, Rasmus (Intern)
Examiner:
Smets, Barth F. (Intern)
Sanford, Robert A. (Ekstern)
Thamdrup, Bo (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Development of new generation of ASM models (ASM3+)

Department of Environmental Engineering
Period: 01/01/2004 → 01/01/2005
Number of participants: 1
Acronym: 423
Project Manager, organisational:
Henze, Mogens (Intern)

Financing sources
Source: Unknown
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Jernreduction ved organisk stof i sedimenter, rater og mekanismer

Department of Environmental Engineering
Period: 01/01/2004 → 31/12/2005
Number of participants: 2
Acronym: 409
Project ID: 30316
Project participant:
Pedersen, Hanne Dahl (Intern)
Project Manager, organisational:
Postma, Diederik Jan (Intern)

Financing sources
Source: Forskningsrådene - SNF
Name of research programme: Forskningsrådene - STVF
Amount: 204,000.00 Danish Kroner
Project

Oasis-hydrophere-desert Interaction Influencing Overall Economical Development

Department of Environmental Engineering
Lund University
Period: 01/01/2004 → 31/12/2005
Number of participants: 2
Acronym: 589
Project ID: 30323
Pedersen, Annette Oelert (Intern)
Rosbjerg, Dan (Intern)

Financing sources
Source: Forsk. EU - Andre EU-midler
Name of research programme: Forsk. EU - Andre EU-midler
Amount: 287,000.00 Danish Kroner

The importance of colloidal particles for heavy metal transport in urban stormwater runoff - multi function approaches to local disposal
Department of Environmental Engineering
University of Gothenburg
Chalmers University of Technology
Technische Universität Hamburg-Harburg
Period: 01/01/2004 → 31/12/2007
Number of participants: 2
Acronym: 394
Genc-Fuhrman, Hülya (Intern)
Ledin, Anna (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Using IT&C through Web-based technologies to enhance the learning experience in higher education.
Department of Environmental Engineering
Period: 01/01/2004 → 31/12/2006
Number of participants: 1
Acronym: 362
Baun, Anders (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 0.00 Danish Kroner

Heavy metals in residential waste and incineration bottom ashes
The project performs five full scale incineration test (300 - 1200 tons) with residential waste of various origin in order to established the heavy metal content of the waste. By controlling all emissions and determing their compositions the composition of the original waste can be found. In addition, the composition of individual material fractions in the waste are analyzed. The aim is to determined the contribution of residential waste and thereby indirectly the contribution by non-residential waste to the heavy metal burden of incinerator bottom ash as a basis for future improvements in source controls. The projects is funded by the National Danish EPA and the incinerator plants associated with Affald Danmark.
PestPulse. Ecotoxic effects of pulsed exposures of pesticides


Department of Environmental Engineering

Miljøstyrelsen
Period: 15/12/2003 → 31/03/2005
Number of participants: 2
Acronym: PestPulse
Project ID: 30303
Project participant:
slothuus, Tina (Intern)
Project Manager, organisational:
Baun, Anders (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 732,540.00 Danish Kroner
Project
Local management of the arsenic contaminated drinking water in West Bengal

This project deals with the problem of arsenic contamination of the drinking water in West Bengal, India. Through participatory work and a broad approach to problem solutions we will introduce sustainable solutions to the problem in a number of villages. The project is managed by two Danish organisations, UBU and IGF, and E&R is doing research in the project by sending students to field work and quality assuring arsenic measurements.

Department of Environmental Engineering
Period: 01/12/2003 → 01/01/2006
Number of participants: 1
Acronym: 391
Project Manager, organisational:
Bregnøj, Henrik (Intern)

Undersøgelse af BAMs skæbne i grundvand.

Department of Environmental Engineering
Rambøll Danmark A/S
Hedeselskabet
Period: 01/12/2003 → 31/12/2004
Number of participants: 4
Acronym: 414
Project ID: 30306
Project participant:
Clausen, Liselotte (Intern)
Janniche, Gry Sander (Intern)
Nygaard, Bolette (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energimisteriet
Name of research programme: Forskningsprojekter - Miljø- og Energimisteriet
Amount: 725,000.00 Danish Kroner

Validation of full life cycle test with the copepod "Acartia tonsa"

An OECD guideline for a life cycle test with the marine pelagic copepod Acartia tonsa is under development. One main purpose is testing of hormonal disrupters. A draft guideline is to verified in 2004. Prepare a new draft guideline on Acartia tonsa. Collect and compile comments on the revised draft and include where relevant (Jan 2004). Plan and co-ordinate (in co-operation with the Swedish partner) the validation ringtest (Feb-Marts 2004). Perform validation tests with one or two of the proposed reference compounds according to the revised draft (Feb-April 2004). Report the outcome of the validation to NordUtte and OECD (April/May 2004).

Department of Environmental Engineering
Stockholm University
EPA

Nordic Council of Ministers
Period: 01/12/2003 → 01/12/2005
Number of participants: 3
Acronym: 405
Project ID: 30309
Project participant:
Wollenberger, Leah (Intern)
Hedberg, Camilla Berg (Intern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Sam.arb.aftaler - Statslige danske
DUO-Denmark exchange programme

Within the Research Network "Chemical Assessment of the Environment" a number of stipends for exchange of students and staff have been obtained. The two counterparts in this programme are The Chiang Mai University and the Prince of Songkla University in Thailand.

Department of Environmental Engineering

Chiang Mai University

Prince of Songkla University

Period: 01/11/2003 → 31/05/2004

Number of participants: 2

Acronym: 392

Project participant:

Mosbæk, Hans (Intern)

Project Manager, organisational:

Tjell, Jens Christian (Intern)

Kemisk oxidation som in situ afværgeteknologi ved oprensning af forurenet grundvand i heterogene akviferer

Department of Environmental Engineering


Number of participants: 5

Phd Student:

Henning, Jirij (Intern)

Main Supervisor:

Bjerg, Poul Løgstrup (Intern)

Examiner:

Kjeldsen, Peter (Intern)

Siegrist, Robert L. (Ekstern)

Østergaard, Peter Holm (Ekstern)

Financing sources

Source: Internal funding (public)

Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet

Project: PhD

Removal of xenobiotic compounds in water works sand filters

Sand filters in conventional water works treating groundwater harbour an active and diverse flora of micro organisms that are able to remove a range of easily biodegradable organic compounds concomitantly with the removal of the usual compounds methane, hydrogen sulphide, ammonia, iron, and manganese. The purpose of this project is to study the capacity of filters to remove gasoline compounds, BTEX, pesticides, phenols, and other biodegradable xenobiotic compounds. The study is conducted with filters that contain quarts sand and Filtralite (expanded clay) as filter materials. It has been observed that the gasoline compounds can be biodegraded effectively in the filters even in the low microgram per litre concentration range. The presences of iron, even in concentrations of 3 mg/L, did not have a significant inhibitory effect on the removal of gasoline compounds.

Department of Environmental Engineering

Period: 01/11/2003 → 31/12/2005

Number of participants: 6

Acronym: 411

Project ID: 30304

Project participant:

Skov, Bent Henning (Intern)

Albrechtsen, Hans-Jørgen (Intern)

Boe-Hansen, Rasmus (Intern)

Wolter, Uwe A. F. (Intern)
XENOMIC. Characterisation of microbial communities degrading xenobiotics. Contract nr.: MEIF-CT-2003-500956

Removal of xenobiotics under strict anaerobic conditions is now being proven and offers a great potential. At this date, only a little is known about the micro-organisms involved in such biodegradation. The aim of the project is to identify and characterize the microbial community degrading xenobiotics, such as Polycyclic Aromatic Hydrocarbons (PAHs), linear alkylbenzene sulfonate (LAS), nonylphenols and nonylphenols ethoxylate (NPE). For this, current molecular technologies are used to characterize the phylogeny of enriched cultures such as in situ hybridization, single strand chain polymorphism, cloning and sequencing. By association of these molecular techniques, we can also examine symbiosis between the different types of microbes involved.

Department of Environmental Engineering
Period: 15/10/2003 → 31/12/2005
Number of participants: 3
Acronym: XenoMic
Project ID: 30318
Project participant:
Batstone, Damien J. (Intern)
Trably, Eric (Intern)
Project Manager, organisational:
Schmidt, Jens Ejbye (Intern)

Financing sources
Source: Forsk. EU - Andre EU-midler
Name of research programme: Forsk. EU - Andre EU-midler
Amount: 1,420,000.00 Danish Kroner

Biological Removal of MTBE in Anaerobic Reactors

Department of Environmental Engineering
Period: 01/10/2003 → 21/12/2007
Number of participants: 6
Phd Student:
Waul, Christopher Kevin (Intern)
Supervisor:
Schmidt, Jens Ejbye (Intern)
Main Supervisor:
Arvin, Erik (Intern)
Examiner:
Smets, Barth F. (Intern)
La Cour Jansen, Jes (Intern)
Schirmer, Mario (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

ELAC. European and Latin American Consortium for IST Enhanced Continued Education in Environmental Management and Planning

To achieve the overall objective the following programme components are performed. 1. A Project Management Unit (PMU) has been established to facilitate and assist meetings and to ensure that objectives and deadlines are met. 2. Sustainability of the Project work will be ensured by established Continued Education Facility units (CEF). 3. An Information Management System (IMS) will be formed for consortium members. This will serve as the basis for...
communication and courses. 4. Learning approaches and ICT applications will be developed and implemented in relation to stakeholders needs. 5. Courses will be implemented and offered to targeted stakeholders with adapted technologies. 6. The courses will be evaluated and revised in accordance with experience from Europe and the participating Central American countries.

Department of Environmental Engineering
Centro Internacional de Política Económica, Universidad Nacional de Costa Rica
Aalborg University
Universidad Nacional Autonoma de Nicaragua
La Universidad Centroamericana
Universidad Autonoma Metropolitana
Universidad de Barcelona
Lancaster University
Period: 01/10/2003 → 30/09/2006
Number of participants: 2
Acronym: ELAC
Project ID: 30300
Project participant:
Thygesen, Niels (Intern)
Project Manager, organisational:
Warnaars, Eric (Intern)
Financing sources
Source: Forsk. EU - Andre EU-midler
Name of research programme: Forsk. EU - Andre EU-midler
Amount: 3,705,000.00 Danish Kroner

**ELAC. European and Latin American consortium for IST enhanced education in environment management and planning (ELAC) ("the Operation"), corresponding to action 5 of the @LIS programme.**

Department of Environmental Engineering
Aalborg University
Lancaster University
Universidad de Barcelona
Universidad Nacional de Rosario
Universidad Nacional Autonoma de Nicaragua
La Universidad Centroamericana
Metropolitan Autonomous University
Period: 01/10/2003 → 30/09/2006
Number of participants: 2
Acronym: ELAC
Project ID: 30300
Project participant:
Warnaars, Eric (Intern)
Project Manager, organisational:
Thygesen, Niels (Intern)

**Mechanical sorting of municipal solid waste for recovery of organic fraction.**
Samarbejdsaftale med NML Combineering har til formål at gennemføre: En karakterisering af out-put fra NMLs koncept-anlæg, opstillet på Fyns Værket, Odense til sortering af dagrenovation, med henblik på dokumentation af anlæggets funktion.
Petrophysical properties and architecture of reservoir bodies in Latvian Cambrian deposits

Department of Environmental Engineering
Period: 01/10/2003 → 01/01/2010
Number of participants: 1
Acronym: 374
Project Manager, organisational:
Molenaar, Nicolaas (Intern)

Project

Petrophysical properties, depositional facies and distribution of reservoir bodies in Lithuanian Silurian carbonate ramp systems

Silurian carbonates are studied along a section from the coastal environments towards the deeper off shelf. The project aims to reconstruct the depositional facies, their geometries, the susceptibility to diagenetic processes, and the effects of diagenetic processes on petrophysical properties. Together with petrophysical characterization of the different facies, this will lead to modelling the reservoir quality and hydrocarbon prospectivity of Silurian carbonates in the Baltic region.

Department of Environmental Engineering
Lithuanian Geological Institute
Vilnius University
Period: 01/10/2003 → 01/01/2010
Number of participants: 1
Acronym: 373
Project Manager, organisational:
Molenaar, Nicolaas (Intern)

Project

Projekt om vandforbrug og forbrugsvariationer.

Department of Environmental Engineering
Dansk Vand- og Spildevandsforening
Period: 01/10/2003 → 31/12/2004
Number of participants: 2
Acronym: 408
Project ID: 30301
Project participant:
Boe-Hansen, Rasmus (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)
Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder
Amount: 124,200.00 Danish Kroner
Project

Risk, source strength and variation of pesticide contamination at Sjoelund Landfill in County of Soenderjylland
Tilvejebringelse af et øget videngrundlag for anvendelse af naturlig nedbrydning som en afværgestrageti ved pesticidpunktkilder.
Department of Environmental Engineering
County of Sønderjylland
Period: 01/10/2003 → 31/12/2004
Number of participants: 2
Acronym: 406
Project ID: 30308
Project participant:
Tuxen, Nina (Intern)
Project Manager, organisational:
Bjerg, Poul Løgstrup (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Sam.arb.aftaler - Amter og kommuner
Amount: 150,000.00 Danish Kroner
Project

Uptake of Chemicals and Metabolism Kinetics in Plants Related to Toxic Effects
Department of Environmental Engineering
Period: 01/10/2003 → 11/06/2007
Number of participants: 6
Phd Student:
Ucisik, Ahmed Süheyl (Intern)
Supervisor:
Kusk, Kresten Ole (Intern)
Main Supervisor:
Trapp, Stefan (Intern)
Examiner:
Baun, Anders (Intern)
Forchammer, Nina Cedergreen (Ekstern)
Kästner, Matthias (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Adaptive Optimal Control for Reservoir Management
Department of Environmental Engineering
Period: 01/09/2003 → 02/01/2007
Number of participants: 7
Phd Student:
Ngo, Long le (Intern)
Supervisor:
Hoa, Trinh Quang (Ekstern)
Madsen, Henrik (Intern)
Main Supervisor:
Rosbjerg, Dan (Intern)
Application of the Environmental Flows Concept in the Evaluation of Development Projects

Department of Environmental Engineering
Period: 01/09/2003 → 29/01/2007
Number of participants: 7
Phd Student:
Korsgaard, Louise (Intern)
Supervisor:
Jønch-Clausen, Torkil (Intern)
Schou, Jesper S. (Intern)
Main Supervisor:
Rosbjerg, Dan (Intern)
Examiner:
Bauer-Gottwein, Peter (Intern)
Bergkamp, Ger (Ekstern)
Hasler, Berit (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet
Project: PhD

Parameter Estimation and Uncertainty Assessment in Hydrological Modelling

Department of Environmental Engineering
Number of participants: 6
Phd Student:
Blasone, Roberta-Serena (Intern)
Supervisor:
Preparedness and Mitigation Measures to Cope with Drought in Vietnam's Central Highland

Department of Environmental Engineering
Period: 01/09/2003 → 02/01/2007
Number of participants: 7
Phd Student:
Nguyen, Tinh Dang (Intern)
Supervisor:
Kim Quang, Nguyen (Ekstern)
Uvo, Cintia Bertacchi (Ekstern)
Main Supervisor:
Rosbjerg, Dan (Intern)
Examiner:
Mikkelsen, Peter Steen (Intern)
Kundzewicz, Zbigniew W. (Ekstern)
Schumann, Andreas (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Evaluation of the M1b1 in Dan West Flank and Halfdan areas. Physical and micro textural analyses.
The main objective of this microtextural study is to improve understanding of porosity variation and preservation.

Department of Environmental Engineering
Metode til at bestemme skrivekridts sammensætning og stivhed udfra geofysiske borehulsmålinger

Department of Environmental Engineering
Number of participants: 5
Phd Student:
Olsen, Casper (Intern)
Main Supervisor:
Fabricius, Ida Lykke (Intern)
Examiner:
Foged, Niels Tækker (Intern)
Sørensen, Alexis Hammer (Intern)
Smith, Brackin A. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Forbrændingstest med rent dagrenovation.

Department of Environmental Engineering
Period: 01/06/2003 → 30/06/2004
Number of participants: 1
Acronym: 350
Project ID: 30278
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Sam.arb.aftaler - Amter og kommuner
Amount: 540,000.00 Danish Kroner
Project

ENRECA - Water resources management in Vietnam. Preparation of Project.
The aim of the project is to prepare an application for a research and training project in Vietnam. The project group includes three vietnamese and three danish institutions. The research topic is the release of arsenic from sediments controlled by the interaction between surface and ground water. The study is planned to be conducted in the Red River Plain around Hanoi.

Department of Environmental Engineering
De Nationale Geologiske Undersøgelser for Danmark og Grønland
DHI Denmark
Use of QSAR for classification and environmental evaluation of chemicals.

Department of Environmental Engineering

Environmental Protection Agency
Period: 01/05/2003 → 30/05/2003
Number of participants: 2
Acronym: 360
Project participant:
Nyholm, Niels (Intern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 0.00 Danish Kroner
Project

Development of reproducible and ecological relevant methods for assessments of herbicide effects on natural communities of phytoplankton.

Department of Environmental Engineering

Environmental Protection Agency
Period: 30/04/2003 → 01/07/2003
Number of participants: 2
Acronym: 361
Project participant:
Wollenberger, Leah (Intern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 0.00 Danish Kroner
Project

Øresund Sommer University 2003.

Department of Environmental Engineering

Period: 02/04/2003 → 01/09/2003
Number of participants: 2
Acronym: 347
Project ID: 30282
Project participant:
Kusk, Kresten Ole (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

**Financing sources**
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 20,000.00 Danish Kroner
Project

**Innovative reactor configurations for biogas production**
Innovative reactor configurations for biogas production

Department of Environmental Engineering
Period: 01/04/2003 → 01/04/2007
Number of participants: 1
Acronym: 399
Project Manager, organisational:
Angelidaki, Irini (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

**Introducing student centred oriented learning approaches (POL), higher education project, Mozambique.**

Department of Environmental Engineering

The World Bank Group
Period: 01/04/2003 → 31/05/2004
Number of participants: 1
Acronym: 353
Project ID: 30275
Project Manager, organisational:
Thygesen, Niels (Intern)

**Financing sources**
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 555,000.00 Danish Kroner
Project

**Variability of the chalk background velocity in the South Arne area**
Quantification of how the chalk background velocity (the low-frequent velocity variations which define the absolute level of the chalk velocity) in the South Arne area is affected by effective stress, presence of hydrocarbons as well as porosity, composition, texture and cementation of chalk. Estimation of upper and lower bounds on chalk porosity estimated from seismic inversion based on the analysis of these factors. Evaluation of the usefulness of velocities estimated from seismic processing as a supplement to well log data for establishing chalk background velocity.

Department of Environmental Engineering

De Nationale Geologiske Undersøgelser for Danmark og Grønland
Period: 01/04/2003 → 31/03/2005
Number of participants: 5
Acronym: 348
Project ID: 30284
Project participant:
Diaz, Hektor Osvaldo Ampuero (Intern)
Nguyen, Sinh Hy (Intern)
Ødegaard (Ekstern)
Mavko, Gary (Ekstern)
Project Manager, organisational:
Fabricius, Ida Lykke (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 450,000.00 Danish Kroner

**Extension of the domain of QSAR model for algal toxicity.**
See the project: "A QSAR-based model for prediction of algal toxicity"

Department of Environmental Engineering

Environmental Protection Agency
Period: 01/03/2003 → 01/12/2003
Number of participants: 3
Project ID: 30272
Project participant:
Nyholm, Niels (Intern)
Qualmann, Signe (Intern)

Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 200,000.00 Danish Kroner

**Research in elastic properties and composition of chalk core plugs.**
Financial support to build a library of velocity, density and porosity measurements of the chalk so the seismic response of expected changes of physical properties can be studied. This research will help to provide the rock mechanical basis needed to assess the feasibility for 4-D seismic in the contiguous area chalk hydrocarbon accumulations.

Department of Environmental Engineering
Period: 21/02/2003 → 01/03/2004
Number of participants: 3
Acronym: 388
Project ID: 30273
Project participant:
Diaz, Hektor Osvaldo Ampuero (Intern)
Nguyen, Sinh Hy (Intern)

Project Manager, organisational:
Fabricius, Ida Lykke (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder
Amount: 150,000.00 Danish Kroner

**CityNet AM. The network of European research projects on integrated urban water management.**
Contract no: EVK1-CT-2002-80013-CITYNET
CityNet is a cluster of six projects of which most were independently conceptualised. E&R DTU will organize an international conference with worldwide attendance to position the CityNet cluster, its partners and their products on the international research scene. Issues related to fast urbanising regions and mega-cities in the developing world will be particularly addressed.

Department of Environmental Engineering
SINTEF
ENPC
University of Karlsruhe

Insvalor S:A:

Dresden University of Technology
Period: 01/02/2003 → 31/12/2006
Number of participants: 1
Acronym: CityNet AM
Project ID: 30269
Project Manager, organisational:
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 216,500.00 Danish Kroner

Detection and Quantification of Subsurface Pesticide Degrading Microbial Populations
Department of Environmental Engineering
Period: 01/02/2003 → 16/04/2007
Number of participants: 6
Phd Student:
Lindberg, Ingrid Ellinor (Intern)
Supervisor:
Schmidt, Jens Ejbye (Intern)
Main Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Examiner:
Bjerg, Poul Løgstrup (Intern)
Martin-Laurent, Fabrice (Ekstern)
Nybroe, Ole (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Mikrobiel nedbrydning efter dampoprensning af forventet jord og grundvand
Department of Environmental Engineering
Period: 01/02/2003 → 31/03/2006
Number of participants: 7
Phd Student:
Friis, Anne Kirketerp (Intern)
Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Udell, Kent S. (Ekstern)
Main Supervisor:
Bjerg, Poul Løgstrup (Intern)
Examiner:
Christensen, Thomas Højland (Intern)
Jacobsen, Carsten Suhr (Ekstern)
Major, David W. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD
Modeller for anvendelse af drikkevandskvalitetsdata - fra boring til forbruger

Department of Environmental Engineering
Period: 01/02/2003 → 28/02/2006
Number of participants: 2
Phd Student:
Andersen, Ulla Tolstrup (Intern)
Main Supervisor:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Status om forbrændingsslager

Department of Environmental Engineering
Period: 01/02/2003 → 01/07/2003
Number of participants: 1
Acronym: 346
Project ID: 30274
Project Manager, organisational:
Astrup, Thomas Fruergaard (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Sam.arb.aftaler - Amter og kommuner
Amount: 150,000.00 Danish Kroner
Project

Start-programmet. Improved monitoring and control of the biogas process for reliable efficient and cost-effective energy production.

Department of Environmental Engineering
Period: 20/01/2003 → 20/03/2003
Number of participants: 1
Acronym: 338
Project ID: 30270
Project Manager, organisational:
Angelidaki, Irini (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 55,200.00 Danish Kroner
Project

Acoustic properties and consolidation of deep-sea chalk

Department of Civil Engineering

Department of Environmental Engineering
Period: 01/01/2003 → 31/12/2003
Number of participants: 2
Acronym: 358
Project participant:
Røgen, Birte (Intern)
Project Manager, organisational:
Fabricius, Ida Lykke (Intern)

Financing sources
Oh no, not the wiggles again! A revisit of an old problem and a new approach.

Lumping is often used to control oscillations in method of weighted residuals numerical methods. Standard lumping procedures add numerical diffusion indiscriminately resulting in excessively diffused solutions. Here it is shown that the mass matrix can be selectively lumped (SLUMPED), with an optimal amount of diffusion added to each row of the mass matrix. The amount of diffusion added is calculated from the right hand side vector. The optimal amount of diffusion is found in 4 steps. First the monotonicity problem is recast in the form of a maximum principle. Secondly, for a two by two, or element matrix, the amount of diffusion is calculated for an arbitrary right hand side so that the solution obeys a maximum principle. Thirdly, the result is generalised for larger matrices. And finally, the result is recast to meet the monotonicity requirement. The result is an equation giving the amount of diffusion to be added in terms of a given right hand side vector. Selective lumping is shown to be effective for both an Eulerian Lagrangian Localized Adjoint Method (ELLAM) solution of the transport equation and a finite element solution of the heat equation. In both cases, solutions were monotonic and contained less numerical diffusion than in standard lumping schemes. The SLUMPING method is general and can be applied to any numerical approximation based on the method of weighted residuals. The project will also investigate the relationship of SLUMPING schemes to flux limiter schemes used in finite difference approximations and to streamline upwind Petrov Galerkin methods.

Department of Environmental Engineering
National Science Foundation
Period: 01/01/2003 → 01/01/2006
Number of participants: 1
Acronym: 364
Project Manager, organisational:
Binning, Philip John (Intern)

Removal of arsenic in water works treating drinking water

Department of Environmental Engineering
Period: 01/01/2003 → 31/12/2003
Number of participants: 1
Acronym: 378
Project Manager, organisational:
Arvin, Erik (Intern)

SAFEWATER. Hazardous chemicals and micro-organisms in urban water management.
proposal to Marie Curie Host Fellowships for Early Stage Research Training (EST) No funding!

Department of Environmental Engineering
Water Tech
Period: 01/01/2003 → 02/01/2003
Number of participants: 8
Acronym: 356
Project participant:
Eilersen, Ann Marie (Intern)
Arvin, Erik (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Schmidt, Jens Ejbye (Intern)
Christensen, Nina (Intern)
Mikkelsen, Peter Steen (Intern)
Angelidaki, Irini (Intern)
Project Manager, organisational:
Ledin, Anna (Intern)

Financing sources
Source: Unknown
The balance between advection and diffusion in reactive gas transport in the unsaturated zone

Oxygen diffusion has long been held to be the rate limiting factor on aerobic reactions in the unsaturated zone and models of these systems have been driven by this assumption. However, oxygen comprises 23.2% by mass of dry air. When oxygen is consumed at depth in the unsaturated zone a pressure gradient is created between the reactive zone and the soil surface. This causes substantial air flow into the subsurface. To determine the balance between advective and diffusive transport, a one-dimensional unsaturated zone gas transport model is developed. The model includes advection, diffusion and dispersion in the oxygen and nitrogen gas components. Density and viscosity are dependent on the gas composition and the flux determined using Darcy’s law. The equations are cast in terms of the total gas pressure and the nitrogen mass fraction. This formulation is chosen because the total gas pressure is slowly varying and the total gas equation and nitrogen transport equation are only weakly coupled. Boundary conditions are driven by atmospheric conditions at the top of the column. At the bottom of the column a zero flux of nitrogen and unit mass fraction of nitrogen are imposed. Equations are solved using a backward Euler linear Galerkin finite element scheme with an iterative decoupling of the equations. The model is used to investigate the balance between advective and diffusive oxygen transport in the unsaturated zone in both steady and transient states. Barometric forcing at the top boundary can also induce advective flow in the unsaturated zone and is also investigated. Finally, the model is compared with existing field data and results from current approaches.

Department of Environmental Engineering

National Science Foundation
Period: 01/01/2003 → 01/01/2006
Number of participants: 2
Acronym: 363
Project participant:
Postma, Diederik Jan (Intern)
Project Manager, organisational:
Binning, Philip John (Intern)

VO@NET. Virtual open-access network for education and training-enhancing interconnectivity between European and Asian universities.
This project aims to establish a virtual network to advance information exchange, increase communications, improve networking and develop joint courses and curricula through the introduction of new technologies to existing networks in Asia and Europe.

Department of Environmental Engineering
Aalborg University
Universitat de Barcelona
Mahidol University
Malaysian University
Period: 01/01/2003 → 31/12/2005
Number of participants: 2
Acronym: VO@NET
Project ID: 30253
Project participant:
Warnaars, Eric (Intern)
Project Manager, organisational:
Thygesen, Niels (Intern)

Financing sources
Source: Forsk. EU - Andre EU-midler
Name of research programme: Forsk. EU - Andre EU-midler
Amount: 12.00 Danish Kroner

Development of remediation technologies for chlorinated solvents
Samarbejdsgafta med Fyns Amt: “Gennemføre studier af de grundlæggende geokemiske, mikrobiologiske og hydrogeologiske processer for forskellige oprensningsteknikker for klorerede opløsningsmidler med det formål at kunne
forbedre anvendelsen af teknikkerne ved praktiske oprensninger *Udvikle, afprøve og dokumentere forskellige afværgteknikkers anvendelse ved konkrete oprensninger *Udvikle og anvende egne test i felt og laboratorium *Udvoksling af data mhp. nærmere studier foretaget af speciale- eller Ph.D.studerende *Udveksle viden om processer og teknikker *Publicering af artikler *Muliggøre praktikordning for studerende fra M&R i Fyns Amt

Department of Environmental Engineering

Fyns Amt
Period: 05/12/2002 → 31/12/2006
Number of participants: 7
Acronym: 337
Project ID: 30260
Project participant:
Scheutz, Charlotte (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Broholm, Mette Martina (Intern)
Jakobsen, Rasmus (Intern)
Henriksen, Karina Bomholt (Intern)
Henning, Jirj (Intern)
Project Manager, organisational:
Bjerg, Poul Logstrup (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Ukendt
Amount: 105,000.00 Danish Kroner

Bjergsted. Groundwater protection. Fase 2
Teknisk bistand i forbindelse med detaljkortlægning i Bjergsted Indsatsområde.

Department of Environmental Engineering
Period: 01/12/2002 → 30/09/2005
Number of participants: 3
Acronym: 351
Project ID: 30279
Project participant:
Poulsen, Lene Hjelm (Intern)
Sonnenborg, Torben Obel (Intern)
Project Manager, organisational:
Larsen, Flemming (Intern)

Financing sources
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Sam.arb.aftaler - Amter og kommuner
Amount: 325,000.00 Danish Kroner

DayWater - Adaptive decision support system for stormwater pollution control
Stormwater source control is perceived today as an efficient solution to problems in connection with flooding and pollution of stormwater. However, implementing the best solution remains difficult because the range of possible "best management practices" is vast and individual needs have to be met. The main objective of the DayWater project is to develop a tool for use by stakeholders in urban storm water management. As the decisions are made on various space and time scales (topography and dynamic nature of urban development) the tool has to be adaptive. E&R DTUs major role in the project is to develop methodolodies and tools for hazard and risk assessment of potential stormwater priority pollutants. EC-contract no: EVK1-CT-2002-00111.

Department of Environmental Engineering
ENPC
DHI Hydroinform
Tauw bv, The Netherlands
BIOWASTE. Bioprocessing of sewage sludge for safe recycling on agricultural land

Disposal and handling of sewage sludge are an increasing problem in Europe due to increasing quantities of sewage sludge produced. A large amount of the sewage sludge contains small fractions of toxic chemicals, which results in problems with safe use of the sewage sludge on agricultural land. From an ecological and economical point of view, it would be essential to establish methodologies, which could allow sewage sludge to be reused as fertilizers on agricultural land. Energy efficient biotreatment processes of organic waste are, therefore, of crucial importance. BIOWASTE will offer an integrated study of this area. The typical composition of sewage sludge will be characterized with regard to key contaminating compounds. Analytical techniques suitable for qualitative and quantitative evaluation of the chemical species involved in the processes under investigation will be determined. Bacteria that are able to degrade selected contaminating compounds under anaerobic and aerobic conditions will be isolated, characterized and bioaugmented for decontamination of sewage sludge by bioprocessing. Aerobic, anaerobic and combination of aerobic/anaerobic bioprocessing of sewage sludge will be applied. A mathematical model will be developed to describe the biodegradation processes of the contaminating compounds after establishing the kinetic parameters for degradation of contaminating compounds. The bioprocessed sewage sludge will be used in eco- and planttoxicology tests to evaluated the impact of the xenobiotics on the environment. Methodologies will be developed and applied to assess the cleanliness of the bioprocessing as a safe method for waste recycling.
Trably, Eric (Intern)
Eriksson, Eva (Intern)
Project Manager, organisational:
Schmidt, Jens Ejbye (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 5,463,000.00 Danish Kroner

COMPRENDO. Comparative research on endocrine disrupters - phylogenetic approach and common principles focussing on androgenic/antiandrogenic compounds.

Comprendo is an interdisciplinary, integrated approach addresses endocrine disruption in human and wildlife species, focused on androgenic/antiandrogenic compounds (AACs). The project will identify human and environmental exposures to AACs. A variety of human-relevant models (cell lines, tissues, rodents) and wildlife species (amphibians, fish, echinoderms, crustaceans, molluscs) will be exposed to 13 chemicals and various environmental samples to develop new biological effect measures, including a molecular screen for genomic AAC effects. Common principles of AAC action will be identified and new models for the extrapolation on human health developed. Lab cultures of suitable invertebrates will be established and their baseline endocrinology analysed, facilitating the use of these species as standard test organisms. Finally, an evaluation of the risk originating from AACs for humans and wildlife will be performed.

Department of Environmental Engineering
Johann Wolfgang Goethe-Universität Frankfurt
Universitätsklinikum Bonn
Forschungsverbund Berlin e.V.
Brunel University
Hatherly Laboratories
Lund University
BRGM
Spanish National Research Council
University of Milan
University of Insubria
University of Ioannina
University of Gdansk

Project Webpage
Period: 01/10/2002 → 30/09/2005
Number of participants: 3
Acronym: COMPRENDO
Project ID: 30249
Project participant:
Wollenberger, Leah (Intern)
Hedberg, Camilla Berg (Intern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 2,118,000.00 Danish Kroner

Jernreduktion og arsenfrigivelse ved oxidation af organisk stof
Department of Environmental Engineering
Monitoring of the anaerobic biogas process by on-line VFA measurement
Development of on-line VFA meter based on gas phase gas chromatographic analysis of VFA. VFA and other parameters are evaluated as indicators for the biogas process. Advanced control based on several process parameters will be developed.

Department of Environmental Engineering
Period: 01/10/2002 → 31/12/2005
Number of participants: 3
Acronym: 397
Project participant:
Boe, Kanokwan (Intern)
Batstone, Damien J. (Intern)
Project Manager, organisational:
Angelidaki, Irini (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

On-line Monitoring and Control of the Biogas Process
Department of Environmental Engineering
Period: 01/10/2002 → 30/06/2006
Number of participants: 5
Phd Student:
Boe, Kanokwan (Intern)
Supervisor:
Batstone, Damien J. (Intern)
Main Supervisor:
Angelidaki, Irini (Intern)
Examiner:
Schmidt, Jens Ejbye (Intern)
Norddahl, Birgir (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD
Removal of MTBE from drinking water in biological active sand filters.

MTBE can be removed from contaminated water in water works by a range of treatment methods. Biological destruction of MTBE with MTBE as the primary substrate offers an attractive method of removing MTBE without the disadvantages, as known from several of the other MTBE-removing technologies. It is the purpose of the project to investigate the effect of operating conditions (filter velocities, backwashing, etc.) on the biological removal of MTBE in sand filters in conventional water works. A field study at Svendborg Water Works, Denmark, showed that MTBE could be removed from 10-65 ug/L to a few 5 ug/L.

Department of Environmental Engineering
Svendborg Water Supply
Period: 01/10/2002 → 31/12/2005
Number of participants: 2
Project ID: 30248
Project participant:
Albrechtsen, Hans-Jørgen (Intern)
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 760,800.00 Danish Kroner

Evaluation of the attenuation of (NMOCs) in the top cover of Grand’Landes landfill

The specific goal of this project is to evaluate both a) the potential for NMOC attenuation as determined by laboratory batch studies; and b) the measured rates of NMOC emissions in the landfill cover material at the Grand’Landes Landfill.

Department of Environmental Engineering
Landfills+, Inc.
University of California
Period: 01/08/2002 → 01/11/2003
Number of participants: 2
Acronym: 340
Project ID: 30252
Project participant:
Scheutz, Charlotte (Intern)
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 220,800.00 Danish Kroner

Risikovurdering af protozoerne “Crystosporidium parvum og Giardia intestinalis” i vand

Department of Environmental Engineering
COWI A/S
Statens Veterinærinstitut
Dansk Veterinær Consult
Smittskyddsinstituttet, Stockholm
Period: 01/08/2002 → 31/12/2002
Number of participants: 3
Acronym: 330
Project ID: 30243
Project participant:
Boe-Hansen, Rasmus (Intern)
Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 900,000.00 Danish Kroner
Project

Klassificeringsforslag for miljøfare på baggrund af QSAR beregninger sammenlignet med klassificering baseret på data
Forbedring af QSAR-modellen (algetest)

Department of Environmental Engineering
Period: 15/07/2002 → 07/12/2002
Number of participants: 2
Acronym: 329
Project ID: 30242
Project participant:
Nyholm, Niels (Intern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 50,000.00 Danish Kroner
Project

Development bioprocesses for handling and recycling seasonal industrial wastewaters.
Food processing and other industries typically generate wastewaters that contain a high organic content. An optimal basic treatment for such wastewater could be anaerobic digestion, a process, on top of significantly reduction of the organic matter, can generate biogas. The proposed work will:
- examine the characteristics of seasonally produced wastewater
- investigate the co-digestibility of these wastewaters from a kinetic and microbial point of view
- determine the optimal planning and scheduling for digestion process
- investigate alternative digesters types, configurations and designs for flexibility
- evaluate overall processes that exploit fully the by-products of anaerobic digestion

Department of Environmental Engineering
Period: 01/07/2002 → 01/08/2002
Number of participants: 2
Acronym: 287
Project participant:
Angelidaki, Irini (Intern)
Project Manager, organisational:
Schmidt, Jens Ejbye (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Øresund Summer University; udvikling af kurset/kurserne indenfor emnet "miljø".
Foreløbig tilkendegivelse af bevilling på 400.000 SEK til gennemførelse af Øresund Summer University 2002.

Department of Environmental Engineering
Period: 01/06/2002 → 01/09/2002
Number of participants: 1
Acronym: 322
Project ID: 30237
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)
Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 320,000.00 Danish Kroner
Project

Underskudsgaranti til konferencen ISSM02.

Department of Environmental Engineering
De Nationale Geologiske Undersøgelser for Danmark og Grønland
Period: 01/06/2002 → 01/09/2003
Number of participants: 1
Project ID: 30167
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 100,000.00 Danish Kroner
Project

Development of leaching tests for organic compounds in contaminated soils.
Inexpensive and fast performing column leaching tests are developed for both volatile and non-volatile organic compounds. The column leaching tests are able to avoid artifacts for non-volatile compounds due to colloids which make more traditionel batch leaching tests difficult to use.

Department of Environmental Engineering
DHI Denmark
Period: 31/05/2002 → 31/12/2004
Number of participants: 4
Acronym: 333
Project ID: 30247
Project participant:
Kjeldsen, Peter (Intern)
Christensen, Thomas Højlund (Intern)
Gamst, Jesper (Intern)

Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 996,168.00 Danish Kroner
Project

Removal of MTBE from LEUNA groundwater by biological filtration
The groundwater at the LEUNA chemical company, Germany, has been contaminated by MTBE due to former production facilities. The project is part of a research consortium that focuses on various technologies to remove MTBE in-situ in horizontal filters/treatment units. In this project, the removal of MTBE by biological filtration was studied. MTBE is removed as a primary substrate with bacteria enriched from the local groundwater. The experiments were conducted with artificial LEUNA groundwater using a filtration unit with Filtralite (expanded clay) as the support material. MTBE and ammonia were effectively oxidized using either pure oxygen or hydrogen peroxide as oxidation agents. The MTBE degraders are growing very slowly, even more slowly than the nitrifyers. Under optimal conditions (20 dg, C), the doubling time for MTBE degraders was 7.5 days.

Department of Environmental Engineering
Helmholtz Centre for Environmental Research
Period: 01/05/2002 → 31/12/2005
Number of participants: 2
Acronym: 345
Project ID: 30256
Project participant:
Kagstrup, Tanja (Intern)
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 966,000.00 Danish Kroner

Project

See also research project no 282.

Department of Environmental Engineering
Period: 01/05/2002 → 15/11/2002
Number of participants: 1
Acronym: 313
Project ID: 30167
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 65,000.00 Danish Kroner

Project

EESD. European forum on integrated environmental assessment.
Integrated environmental assessment is policy-relevant on complex environmental issues. The proposed concerted action seeks to improve and demonstrate policy relevance through organizing 2-3 controlled policy-science interface workshops, and 2-3 rapid assessment workshops on topics such as climate, energy and water. It seeks to improve scientific quality and to consolidate and extend the peer community through organizing 2 summer workshops and 2-3 short, specialized workshops on topics such as uncertainty, decision analysis, and scenario design. It seeks to train young researchers through 2 summer schools, and grant fellowships to young researchers for exchange. It seeks to disseminate its findings widely to both the science and the policy community. Kontrakt: EKV2-2001-20011

Department of Environmental Engineering
Period: 01/04/2002 → 31/03/2005
Number of participants: 1
Acronym: EESD
Project Manager, organisational:
Harremoës, Poul (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Project

Environmental assessment of solid waste management in the municipality of Aarhus

Department of Environmental Engineering
Municipality of Århus
**Period:** 01/04/2002 → 30/06/2004  
**Number of participants:** 6  
**Project ID:** 30225  
**Project participant:**  
Kirkeby, Janus Søgaard (Intern)  
Christensen, Thomas Højlund (Intern)  
Hansen, Trine Lund (Intern)  
Riber, Christian (Intern)  
Janniche, Gry Sander (Intern)  
**Project Manager, organisational:**  
Christensen, Thomas Højlund (Intern)  

**Financing sources**  
**Source:** Sam.arb.aftaler - Amter og kommuner  
**Name of research programme:** Sam.arb.aftaler - Amter og kommuner  
**Amount:** 500,000.00 Danish Kroner

**Project**  
Kortlægning og dokumentation af procesforhold på danske biogasanlæg.  

Department of Environmental Engineering  
**Period:** 01/04/2002 → 31/12/2005  
**Number of participants:** 1  
**Project ID:** 30206  
**Project Manager, organisational:**  
Angelidaki, Irini (Intern)  
**Financing sources**  
**Source:** Forskningsprojekter - Miljø- og Energiministeriet  
**Name of research programme:** Forskningsprojekter - Miljø- og Energiministeriet  
**Amount:** 768,000.00 Danish Kroner

**Project**  
Optagelse af organiske stoffer i grøntsager og frugt.  
Beskrivelse/vurdering af sammenhængen mellem forureningsniveau af organiske forureningskomponenter i jord - incl. poreluft - og i grøntsager og frugt vil blive baseret på matematiske modeller. Arbejdet vil blive baseret på litteraturstudier og eksisterende modeller.  

Department of Environmental Engineering  
**Period:** 08/03/2002 → 31/12/2002  
**Number of participants:** 1  
**Acronym:** 309  
**Project ID:** 30218  
**Project Manager, organisational:**  
Trapp, Stefan (Intern)  
**Financing sources**  
**Source:** Unknown  
**Name of research programme:** Ukendt  
**Amount:** 120,000.00 Danish Kroner

**Project**  
Attenuation of alternative foam blowing agents in landfill  
The objective of this project is to evaluate the potential for degradation of alternative foam blowing agents in landfill and landfill soil covers, using HCFC-14b, HFC-134a and HFC-245fa. CFC-11 will be used as reference.  

Department of Environmental Engineering  
**Period:** 01/03/2002 → 01/01/2004  
**Number of participants:** 2  
**Acronym:** 311
Kursusnoter til: Grundkursus i grundvandskemi med henblik på zonering og udarbejdelse af indsatsplaner.
Udarbejdelse af kursusmateriale med henblik på afholdelse af ”Grundkursus i Grundvandskemi” for personale, ansat i Amterne . Kurset påregnes afholdt første gang i sep. 2002 og herefter 2 gange årligt, hvis der er behov.

Department of Environmental Engineering
Period: 01/03/2002 → 31/08/2002
Number of participants: 1
Acronym: 317
Project ID: 30236
Project Manager, organisational:
Larsen, Flemming (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 295,000.00 Danish Kroner
Project

Opfølgende testning til udvikling af en non-congenerisk universal QSAR-model for algetoksicitet.
Toxicitetstest (fisk, dafnier, alger) til evaluering af kemiske stoffer effekt i vandmiljøet. Forbedring af QSAR modellen.

Department of Environmental Engineering
Period: 01/03/2002 → 01/12/2002
Number of participants: 1
Acronym: 304
Project ID: 30219
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 50,000.00 Danish Kroner
Project

Biodegradation of Complexed Cyanides
Department of Environmental Engineering
Period: 01/02/2002 → 12/07/2005
Number of participants: 6
Phd Student:
Larsen, Morten (Intern)
Supervisor:
Postma, Diederik Jan (Intern)
Main Supervisor:
Trapp, Stefan (Intern)
Examiner:
Kjeldsen, Peter (Intern)
Davis, Lawrence C. (Ekstern)
Mansfeldt, Tim (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Toxicity of volatile organic compounds in groundwater
The toxicity of volatile organic compounds found in gasoline contaminated groundwater is investigated through fractionation and pre-concentration techniques in combination with algal toxicity tests

Department of Environmental Engineering
Period: 01/02/2002 → 01/07/2002
Number of participants: 3
Acronym: 319
Project participant:
Bjerg, Poul Løgstrup (Intern)
Christensen, Anne Munch (Intern)

Project Manager, organisational:
Baun, Anders (Intern)

WWT&SYSENG. Getting systems engineering into regional wastewater treatment strategies.
Within the WWT & SYSENG project, we will investigate the fate of xenobiotic compounds (e.g. pesticides, pharmaceuticals) in the urban water system by means of mathematical modelling and model development. To achieve detailed knowledge about the different pathways of xenobiotics, we will first focus on their fate in biological treatment systems, which in a large extent mimic natural environments. We will then broaden the boundaries to include the influence of rainfall-runoff relationships on the distribution of xenobiotics and then the final destinations, i.e. the recipients. One project goal is to establish how detailed the various compartments should be described in order to formulate an integrated fate model that can be used for decision making and risk assessment. In wastewater treatment plants (WWTPs), xenobiotic compounds are affected by on the one hand physico-chemical processes such as sorption/desorption, volatilisation and stripping and on the other hand by biological degradation. Several attempts have been made to summarise these processes into predictive fate models but according to literature, the description of the biological degradation of the xenobiotics form a bottleneck while trying to improve them. We will aim at developing correct descriptions, which then can be incorporated into some of the well-established biological WWTP models of today.

Dynamic experiments will be carried out at the Lynetten WWTP (Copenhagen, Denmark), a facility treating municipal and industrial wastewater corresponding to some 1.1 million citizens. In connection with the full scale plant, a pilot plant has recently been erected at the site. The experimental procedure will involve addition of selected xenobiotic compounds to the influent wastewater of this pilot plant. The screening of xenobiotics is characterised by rather time consuming and expensive analyses of compounds present in the environment at low concentrations (ng/l-µg/l) and as a consequence, we will try to minimise the number of necessary samples and analyses. A reliable model of the treatment plant helps to design the experiments as it can be used to isolate relevant investigations from the less important ones. With this in mind, a plausible first step of the work will be to get hold of a reliable WWTP model over the pilot plant that describes standard wastewater parameters. For this, the Activated Sludge Model No. 1 (ASM1), will be used. The results will then motivate model extensions and/or reductions. Although the model will be helpful during the experimental procedure, a reliable model necessarily depends on the experimental results. Consequently, modelling and experimental work will be carried out simultaneously.

Department of Environmental Engineering
University of Strathclyde
Universidad Autonoma de Barcelona
University of Pavia
Lund University

Imperial College of Science, Technology and Medicine
Technical University of Crete
Period: 01/02/2002 → 31/01/2006
Number of participants: 5
Acronym: WWT&SYSENG
Project ID: 30221
Project participant:
Lindblom, Erik Ulfson (Intern)
Ahlman, Stefan (Intern)
**Pretreatment of source separated organic household waste prior to biogasification**


Department of Environmental Engineering  
Period: 16/01/2002 → 01/10/2002  
Number of participants: 1  
Acronym: 323  
Project ID: 30239  
Project Manager, organisational: Mikkelsen, Peter Steen (Intern)

**Financing sources**  
Source: Forsk. EU - Rammeprogram  
Name of research programme: Forsk. EU - Rammeprogram  
Amount: 1,124,950.00 Danish Kroner

**Sustainable Implementation of Sanitary Systems in Periurban Areas in Africa**

Department of Environmental Engineering  
Period: 15/01/2002 → 31/08/2005  
Number of participants: 3  
Phd Student: Bravo, Augusto (Intern)  
Supervisor: Bregnhøj, Henrik (Intern)  
Main Supervisor: Mikkelsen, Peter Steen (Intern)

**Financing sources**  
Source: Unknown  
Name of research programme: Ukendt  
Amount: 130,000.00 Danish Kroner

**Chemical oxidation of groundwater contaminants**

Chemical oxidation is a promising remediation technology for chlorinated aliphatic compounds in groundwater. Laboratory methods for prediction of oxidant demand are developed. The role of natural organic matter in the oxidation process is investigated. The research is related to on-going field application performed by Danish consulting companies. See project homepage for further details (in Danish)

Department of Environmental Engineering  
Fyns Amt  
NIARAS A/S  
Hedeselskabet  
COWI A/S  
Period: 01/01/2002 → 31/12/2005  
Number of participants: 6  
Acronym: 327  
Project participant:
Methane emissions from organic household waste biogasification.

Department of Environmental Engineering
Period: 01/01/2002 → 31/10/2002
Number of participants: 1
Project ID: 30216
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 404,000.00 Danish Kroner
Project

Miljøvurdering af organisk husholdningsaffald

Department of Environmental Engineering
Period: 01/01/2002 → 14/11/2005
Number of participants: 6
PhD Student:
Hansen, Trine Lund (Intern)
Supervisor:
Angelidaki, Irini (Intern)
Main Supervisor:
Christensen, Thomas Højlund (Intern)
Examiner:
Kjeldsen, Peter (Intern)
Magid, Jakob (Ekstern)
Stentiford, Edward I. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Nedbrydning af pesticider i grundvandsmagasiner og opskalering af nedbrydningsrater med fokus på "Processtudier af anaerob nedbrydning i grund-vandsmagasiner.


Department of Environmental Engineering
Transport and survival of human pathogenic microorganisms in groundwater and drinking water.

The main aims of this project are (i) to identify human pathogenic microorganisms in groundwater downstream of sewage infiltration (ii) to extrapolate our current knowledge of bacterial and viral transport (iii) to analyse factors that affect their surface properties (iv) to examine the influence of geochemistry on the transport, survival and potential ineffectivity of human microorganisms (v) to identify the factors that determine the retardation of microorganisms in waterworks filter and in distribution systems.

Department of Environmental Engineering
Period: 01/01/2002 → 01/12/2002
Number of participants: 1
Acronym: 305
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Uptake of organic chemicals into vegetables and fruits

Department of Environmental Engineering
Period: 01/01/2002 → 01/09/2002
Number of participants: 1
Acronym: 314
Project Manager, organisational:
Trapp, Stefan (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 140,000.00 Danish Kroner

Varetagelse og koordinering af prøveudtagning og analyser af en række kemiske og mikrobiologiske parametre på gråvands anlægget på Bo90.
Det overordnede formål med et specifikt måleprogram for gråt spildevand er at gennemføre en grundig fysisk, kemisk og mikrobiologisk karakterisering. Det afdækkes, hvad gråt spildevand består af og belyser den tidsmæssige variation i sammensætningen af gråt spildevand på døgn- og årsbasis, variationen mellem forskellige beboelser og mellem forskellige typer af gråt spildevand. På baggrund af resultater fra måleprogrammets trin 1 (beskrevet i "Måleprogram for karakterisering af gråt spildevand i relevante Tema 4 projekter") vurderes det om et mindre omfangsrigt, men mere specifikt måleprogram kan gennemføres for at gråvandsanlægget lever op til de krav, som vil blive stillet, for at det rensete vand kan bruges til toiletskylling.
NAME. Nitrate from aquifers and influences on carbon cycling in marine ecosystems. Contract no.: EVK3-CT-2001-00066-2003

Nitrate enters the sea with groundwater discharging through the shoreface at many locations along the European coast. The impact of this process on the state of eutrophication of the coastal marine environment is presently unknown. This project investigates the transport of nitrate through the shoreface by groundwater discharge and the biogeochemical processes that together determine the net flux of groundwater nitrate into the marine environment. The findings will be quantified in coupled groundwater and marine models that will facilitate integrated coastal zone management with respect to the interest of agriculture and the use of the coastal marine environment in terms of recreation and food production.

Department of Environmental Engineering
DHI Denmark
Max Planck Institute
Netherlands Institute of Ecology
Université de Lausanne
Ribe Amt
Period: 01/12/2001 → 28/02/2005
Number of participants: 7
Acronym: NAME
Project ID: 30185
Project participant:
Postma, Diederik Jan (Intern)
Andersen, Martin Søgaard (Intern)
Jakobsen, Rasmus (Intern)
Lange, Erik Rønn (Intern)
Hansen, Ellen Zimmer (Intern)
Skov, Henrik (Intern)
Jensen, Lene Kirstejn (Intern)

**Financing sources**

Source: Forsk. EU - Rammeprogram  
Name of research programme: Forsk. EU - Rammeprogram  
Amount: 3,563,730.00 Danish Kroner

**Project**

Regulation of xenobiotic compounds in separate rainwater discharges  
The contribution of E&R to this project deals with the application of biotests in the regulation of rainwater discharges

Department of Environmental Engineering  
Period: 01/12/2001 → 01/04/2002  
Number of participants: 2  
Acronym: 318

**Project participant:**  
Christensen, Anne Munch (Intern)

**Project Manager, organisational:**  
Baun, Anders (Intern)

**Project**

CORONA, Confidence in forecasting of natural attenuation as a risk-based groundwater remediation strategy.  
The overall goal of CORONA is to increase confidence in assessment and forecasting of natural attenuation (NA) of groundwater pollution. M&R DTU collaborates with several European partners (http://www.shef.ac.uk/corona/) and together we will carry out multi-disciplinary research on 6 varied field sites and in the laboratory and use numerical modeling. The activities done by M&R DTU are primarily connected to a field site where landfill leachate infiltrates to an underlying sandy aquifer. This creates a reduced plume, with manganese and nitrate reducing conditions close to the landfill. Different phenoxy acid herbicides are the main pollutants in the leachate. These compounds are recalcitrant in the anaerobic core of the plume, but the hypothesis is that a significant mass reduction (by microbial degradation) occurs at the fringe of the plume, where aerobic water from the surrounding aquifer mixes with the contaminated water. This hypothesis will be tested by field observations (mass fluxes through control planes as well as high resolution multi-level-samplers) and laboratory investigations (micro-scale variations in fringe sediment cores of phenoxy acid degradation potential, microbial numbers and redox chemistry). The experimental results will be incorporated in a reactive solute transport model for the site.

Department of Environmental Engineering  
Commonwealth Scientific and Industrial Research Organisation  
Ejlaskov Consult ApS  
County of Southern Jutland  
Period: 01/11/2001 → 31/12/2004  
Number of participants: 6  
Acronym: CORONA  
Project ID: 30202

**Project participant:**  
Tuxen, Nina (Intern)  
Skov, Bent Henning (Intern)  
Albrechtsen, Hans-Jørgen (Intern)  
Sørensen, Jens Schaarup (Intern)  
Refstrup, Mona (Intern)

**Project Manager, organisational:**  
Bjerg, Poul Legstrup (Intern)

**Financing sources**

Source: Forsk. EU - Rammeprogram  
Name of research programme: Forsk. EU - Rammeprogram  
Amount: 2,755,688.00 Danish Kroner

**Project**

Eftervækstpotentiale for polymere materialer i drikkevand  
Department of Environmental Engineering
Life cycle assessment of road construction and reuse of waste incineration residues
The project develops a life-cycle-assessment model for road construction with and without use of incineration residues. The model accounts for all uses and savings in resources and environmental emissions including savings in residue landfilling if the residue is used in road construction. A key issue is quantification of the leaching from the materials and test data and sub-models have been developed.

Department of Environmental Engineering
Danish Road Directorate

Reduction of xenobiotic compounds found in the sewage sludge by bioprocessing. START-programmet.
Reduction of xenobiotic compounds found in the sewage sludge by bioprocessing.

Department of Environmental Engineering
Period: 20/09/2001 → 01/02/2002
Number of participants: 2
Project ID: 30199
Project participant:
Angelidaki, Irini (Intern)
Project Manager, organisational:
Schmidt, Jens Ejbye (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 82,500.00 Danish Kroner

Arsenfjernelse fra drikkevand ved udfældning med naturligt forekommende jern

Department of Environmental Engineering
Period: 01/09/2001 → 22/05/2006
Number of participants: 7
Phd Student:
Sharma, Anitha Kumari (Intern)
Supervisor:
Mosbæk, Hans (Intern)
Postma, Diederik Jan (Intern)
Main Supervisor:
Tjell, Jens Christian (Intern)
Examiner:
Arvin, Erik (Intern)
Ahmed, M. Feroze (Ekster)
Østergaard, Peter Holm (Ekster)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Evaluation of the attenuation of non-methane-organic-compounds (NMOSes) in the top cover of a french landfill

The purpose of this project is to build on existing Danish and U.S. work to investigate both the mechanisms and rates of attenuation of NMOC’s in landfill cover material. This will be done through a combined field and laboratory investigation. The specific goals of this project are to evaluate both a) the potential for NMOC attenuation, as determined by laboratory batch studies; and b) the measured rates of NMOC emissions in the landfill cover material at a French landfill.

Department of Environmental Engineering
Period: 01/09/2001 → 30/11/2001
Number of participants: 1
Project ID: 30190
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 112,391.00 Danish Kroner
Project

Incertitude and its Implications for the Environmental Field

Department of Environmental Engineering
Period: 01/09/2001 → 10/02/2006
Number of participants: 5
Phd Student:
Krayer von Krauss, Martin Paul (Intern)
Main Supervisor:
Baun, Anders (Intern)
Examiner:
Mikkelsen, Peter Steen (Intern)
Pedersen, Stig Andur (Intern)
Stirling, Andrew Charles (Ekster)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD
Miljøvurdering af restprodukters genanvendelse

Department of Environmental Engineering  
Period: 01/09/2001 → 23/12/2005  
Number of participants: 6  
Phd Student:  
Birgisdottir, Harpa (Intern)  
Supervisor:  
Hauschild, Michael Zwicky (Intern)  
Main Supervisor:  
Christensen, Thomas Højlund (Intern)  
Examiner:  
Kjeldsen, Peter (Intern)  
Finnveden, Göran (Ekstern)  
Gardner, Kevin H. (Ekstern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: DTU-lønnnet stipendie  
Project: PhD

Support to capacity building at the water resources university, Hanoi  
Sub-components of the "National Capacity Building Component" under the Danida Water Sector Programme Support to Vietnam. The project support the Water Resources University in Hanoi and Ho Chi Minh City to improve teaching and capacity of teachers.

Department of Environmental Engineering  
Period: 01/09/2001 → 01/10/2006  
Number of participants: 2  
Project ID: 30203  
Project participant:  
Rosbjerg, Dan (Intern)  
Project Manager, organisational:  
Bregnørhøj, Henrik (Intern)

Financing sources  
Source: Sam.arb.aftaler, Private danske - Andre virksomheder  
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder  
Amount: 264,000.00 Danish Kroner  
Project

Nikkelfrigivelse ved pyritoxidation  
Miljøstyrelsen ønsker undersøgt hvilke faktorer, der har betydning for nikkelfrigivelse til grundvandet i kalkmagasinerne i typeområdet ved Køge Bugt. Undersøgelsesstrategi omfatter: Gastransport (barometerånding) i den umættede zone, effekt af hævning af vandspejlet på nikkelindholdet og vurdering af regionale aspekter.

Department of Environmental Engineering  
Period: 01/08/2001 → 31/12/2002  
Number of participants: 4  
Project ID: 30192  
Project participant:  
Jessen, Søren (Intern)  
Kjeller, Claus (Intern)  
Postma, Diederik Jan (Intern)  
Project Manager, organisational:  
Larsen, Flemming (Intern)

Financing sources  
Source: Forskningsprojekter - Miljø- og Energiministeriet  
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet  
Amount: 402,000.00 Danish Kroner
Improved monitoring and control of the anaerobic process. START-programmet

Department of Environmental Engineering
Period: 01/07/2001 → 31/03/2002
Number of participants: 1
Project ID: 30191
Project Manager, organisational: Angelidaki, Irini (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 89,512.00 Danish Kroner

Spreadsheet for estimation of CDS storms for short durations
In continuation of previous work with regionalisation of extreme rainfall data for urban runoff applications, a methodology for automated estimation of CDS design storms based on regional short-duration rain data is developed. This involves: 1. Analysis of short duration rain data (1, 2 and 5 minutes) corresponding to previous analyses, cf. the link below 2. Documentation of the new data analyses 3. Extention of spreadsheet-based CDS estimation tool 4. Documentation of the new spreadsheet version

Department of Environmental Engineering
DHI Denmark
Period: 01/07/2001 → 31/12/2002
Number of participants: 1
Acronym: svk26
Project Manager, organisational: Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Study on anaerobic treatment of sewage sludge for removal of linear alkylbenzene sulfonates (LAS).
We are aiming with this project to investigate anaerobic treatment of sludge with respect of eliminating/reducing LAS concentration. The influence of several parameters, such as temperature, hydraulic retention time, etc. on the removal efficiency will be investigated.

Department of Environmental Engineering
Period: 01/07/2001 → 30/06/2004
Number of participants: 4
Project ID: 30189
Project participant: Batstone, Damien J. (Intern)
Schmidt, Jens Ejbye (Intern)
Toräng, Lars (Intern)
Project Manager, organisational: Angelidaki, Irini (Intern)

Financing sources
Source: Samarb.aftaler - Udenlandske offentlige og private
Name of research programme: Samarb.aftaler - Udenlandske offentlige og private
Amount: 1,090,680.00 Danish Kroner

Denitrifikation med højt saltindhold.
Undersøgelse af denitrifikation i opløsnings med højt indhold af calciumklorid (10-12%), for at opbygge viden om denne proces med henblik på rensning af spildevand fra gødningsproduktion
Department of Environmental Engineering
Period: 15/06/2001 → 31/12/2001
Number of participants: 1
Project ID: 30195
Project Manager, organisational:
Henze, Mogens (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 158,600.00 Danish Kroner

Project

Removal of MTBE from water

Department of Environmental Engineering
Period: 01/06/2001 → 15/12/2002
Number of participants: 1
Project ID: 30186
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 399,480.00 Danish Kroner

Project

Center for Industriel Vandmiljøteknologi (CIV) / Øresundskontrakt
Purpose: to ensure competence building and technology development within concepts and technologies for the management of industrial water flows and environmental optimisation. Solutions developed shall aim at improving industrial pollution control through resources recovery in production processes, introduction of new technology, and integrated management of production and treatment facilities. And to inspire other enterprises to implement corresponding solutions in production and treatment facilities.

Department of Environmental Engineering
Period: 01/04/2001 → 31/03/2004
Number of participants: 2
Project ID: 30197
Project participant:
Eilersen, Ann Marie (Intern)
Project Manager, organisational:
Henze, Mogens (Intern)

Financing sources
Source: Sam.arb.aftaler - Statslige danske
Name of research programme: Sam.arb.aftaler - Statslige danske
Amount: 2,000,000.00 Danish Kroner

Project

Ecotoxicological effects of surface water and groundwater collected at waste dump site located near Harboøre Tange, Denmark
Projektet skal, primært gennem udførelse af et praktisk undersøgelsesprogram, belyse risikoen for uønskede biologiske effekter af toksiske stoffer i grund- og overfladevand udtaget fra formodede kraftigt forurenete områder på Harboøre Tange. Prøverne underkastes ekotoksikologiske tests for at undersøge den mulige akutte toksicitet og enkelte prøver vil også blive underkasted tests for langsigtede effekter i recipiencerne.

Department of Environmental Engineering
Period: 01/04/2001 → 31/12/2001
Number of participants: 4
Project ID: 30183
Project participant:
Bergstrøm, Jane Mette (Intern)
Kusk, Kresten Ole (Intern)
Kruse, Susanne (Intern)
Project Manager, organisational: Baun, Anders (Intern)

**Financing sources**
Source: Sam.arb.aftaler - Amter og kommuner
Name of research programme: Sam.arb.aftaler - Amter og kommuner
Amount: 60,000.00 Danish Kroner

Project

**Faglig sekretær for "Naturlig nedbrydning".**
Forlængelse af eksisterende kontrakt "Naturlig nedbrydning" af 13. nov. 1998

Department of Environmental Engineering
Period: 01/04/2001 → 31/12/2002
Number of participants: 1
Acronym: 307
Project ID: 30032
Project Manager, organisational: Bjerg, Poul Løgstrup (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 155,000.00 Danish Kroner

Project

**The use of x-ray micro-tomography and pore-scale modeling to evaluate dynamic and equilibrium pore-scale processes in porous media**

Department of Environmental Engineering
Period: 01/04/2001 → 08/09/2006
Number of participants: 5
Phd Student: Christensen, Britt Stenhøj Baun (Intern)
Main Supervisor: Jensen, Karsten Høgh (Intern)
Examiner: Binning, Philip John (Intern)
Jacobsen Hørbye, Ole (Ekstern)
Willson, Clinton S. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Biogasprogram
Sammenfatning af Biogasprogrammets aktiviteter og resultater til programmets slutrapportering.

Department of Environmental Engineering
Period: 01/03/2001 → 01/07/2001
Number of participants: 2
Project ID: 30207
Project participant: Pind, Peter Frode (Intern)
Project Manager, organisational: Angelidaki, Irini (Intern)

**Financing sources**
Source: Forskningsprojekter - Miljø- og Energiministeriet
**CPDW. Development of harmonized tests to be used in European approval scheme concerning construction products in contact with drinking water.**

S. Framework Programme (EESD)

Department of Environmental Engineering

KIWA, RC

WRC

OFICT

Thames Water Utilities Ltd

DVGW

Centre de Recherche D'Expertise et de Contrôle des Eaux de Paris

Period: 01/03/2001 to 31/05/2003

Number of participants: 2

Acronym: CPDW

Project ID: 30182

Project Participant:

Corfitzen, Charlotte B. (Intern)

Project Manager, Organisational:

Albrechtsen, Hans-Jørgen (Intern)

**Financing Sources**

Source: Forsk. EU - Rammeprogram

Name of research programme: Forsk. EU - Rammeprogram

Amount: 835,000.00 Danish Kroner

Project

**Environmental assessment of solid waste management system with a view to technological innovation**

Department of Environmental Engineering

Period: 01/03/2001 to 28/02/2003

Number of participants: 1

Project ID: 30159

Project Manager, Organisational:

Christensen, Thomas Højlund (Intern)

**Financing Sources**

Source: Samarb.aftaler, Private danske - Fonde

Name of research programme: Samarb.aftaler, Private danske - Fonde

Amount: 750,000.00 Danish Kroner

Project

**Algetoksicitet**

Formålet med dette Projekt er at frembringe et tilstrækkeligt datagrundlag til at definere en korrelation af tøksicitet med LogP (minimumstøksicitet). Der vil blive udført test på ca. 75 kemiske stoffer bredt dækkende det kemiske univers.

Department of Environmental Engineering

Period: 01/02/2001 to 15/12/2001

Number of participants: 1

Acronym: QSAR-II-B

Project ID: 30158

Project Manager, Organisational:

Kusk, Kresten Ole (Intern)

**Financing Sources**

Source: Forskningsprojekter - Miljø- og Energiministeriet

Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
**Alge-toksicitetsdata for toksiske organiske kemiske stoffer - Litteratur**

Formålet er at frembringe et tilstrækkeligt datagranulag til at foretage en analyse af sammenhængene mellem fysisk-kemiske egenskaber af organiske stoffer og deres toksiske effekt. I projektet vil der blive søgt data fra håndbøger og databaser, hvor de fundne data sæges underkastet en kvalitetsvurdering.

Department of Environmental Engineering  
Period: 01/02/2001 → 31/10/2001  
Number of participants: 1  
Acronym: QSAR-II-A  
Project ID: 30160  
Project Manager, organisational:  
Kusk, Kresten Ole (Intern)

**Financing sources**  
Source: Forskningsprojekter - Miljø- og Energiministeriet  
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet  
Amount: 295,000.00 Danish Kroner  
Project

A QSAR-based model for predicting of algal toxicity is developed based on multiple tests with compounds with selected molecular structures. About 400 chemicals are being tested. The purpose of this project is, by performance of multiple algal tests to create a data base for development of a noncongeneric universal computer model. We focus on the QSAR-related toxicity of chemicals with molecular structures which influence the toxicity, in a way that makes it possible to find a relationship between stuctures and specific toxicity towards algae - and based on this - to develop a noncongerisk universal computer model for prediction of algal toxicity of compounds which has not been tested.

Department of Environmental Engineering  
Danish Ministry of Environment and Energy  
Period: 01/02/2001 → 31/12/2003  
Number of participants: 2  
Project ID: 30181  
Project participant:  
Nyholm, Niels (Intern)  
Project Manager, organisational:  
Kusk, Kresten Ole (Intern)

**Financing sources**  
Source: Forskningsprojekter - Miljø- og Energiministeriet  
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet  
Amount: 295,000.00 Danish Kroner  
Project

Litteraturstudium og opstilling af måleprogram for overfladevand


Department of Environmental Engineering  
Period: 01/02/2001 → 30/06/2001  
Number of participants: 1  
Project ID: 30176  
Project Manager, organisational:  
Ledin, Anna (Intern)

**Financing sources**  
Source: Forskningsprojekter - Miljø- og Energiministeriet  
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Modeller til miljøvurdering af affaldssystemer

Department of Environmental Engineering
Period: 01/02/2001 → 18/05/2005
Number of participants: 6
Phd Student:
Kirkeby, Janus Søgaard (Intern)
Supervisor:
Hauschild, Michael Zwicky (Intern)
Main Supervisor:
Christensen, Thomas Højlund (Intern)
Examiner:
Mikkelsen, Peter Steen (Intern)
Bilitewski, Bernd (Ekstern)
Nielsen, Per Henning (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Biogasification of organic household waste: Waste composition, pretreatment and methane potentials
Projektet vil etablere basisdata for sammensætning og karakteristika af organisk husholdningsaffald i forhold til biogaspotentialt for fraktioner indsamlet separat efter forskellige sorteringskriterier. Projektet indeholder 3 faser: En kritisk gennemgang af det eksisterende datagrundlag Indsamling af nye pårævende data om sammensætningen af det organiske affald Måling af faktiske biogaspotentialer.

Department of Environmental Engineering
Lund University
Malmö Kommune/Sysav
Rambøll Danmark A/S
Period: 01/01/2001 → 30/11/2002
Number of participants: 2
Acronym: 240
Project ID: 30145
Project participant:
Hansen, Trine Lund (Intern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,440,000.00 Danish Kroner
Project

Chemical assessment of the environment
Many chemicals pollute our environment. The extent and severity of the situation are not always well known if hard facts are lacking. The environmental state of affairs depends very much on the industrial production modes, the consumer habits, the enforcement of environmental protection regulations, and the end-of-pipe installations to limit harmful emissions. In developing economies some of the limiting factors for environmental protection are not optimal. This may lead to excess exposure with harmful substances to flora and fauna, including humans. Universities can play an important role in raising public awareness on the local, regional, and national problems, as well as providing theoretical framework for better environmental protection. The universities may often help in providing basic knowledge and hard facts on environmental presence and fate of chemicals, toxicity and risk, and local/regional conditions. The universities may gain reputation for competent and independent counselling through participation in public life, and through publicising their findings. Objectives The objectives of the network are: •To increase impact of university research through focusing manpower and equipment on elucidation of pertinent local/regional contamination problems •To increase capacity and quality of chemical analysis •To improve methodology for assessing the chemical status of the environment •To improve
the basis for risk assessment in relation to chemicals in the environment • To increase inter-university collaboration on selected chemical contamination topics. Methods and approach: The base for a successful implementation to reach these objectives is the availability of well qualified staff capable of formulating and carrying through the concrete joint activities, and as well the presence of adequate and functioning physical possibilities for the practical research. Environmental assessment methodology in pollution research and chemical analytical capability of the involved researchers will be enhanced and strengthened through exchange of research staff (academics) and graduate students between universities for participation in topics of joint interest. This goes both ways, as studying at Danish universities should improve the analytical experience, while studying in DEA countries should strengthen undertaking of much needed fieldwork and improve laboratory analytical capacity and quality. The diversity of problems encountered in chemical assessment of the environment has called for creation of four sub-networks focusing on the joint practical collaboration. An additional approach is to support creation of “centres of excellence” at the involved universities. The remedies for this upgrading of existing activities are staff exchange and training at other LUCED universities, and exchange of experienced staff for help in solving problems of importance.

Department of Environmental Engineering

National University of Malaysia

Prince of Songkla University

Chiang Mai University

Period: 01/01/2001 → 31/12/2005
Number of participants: 5
Acronym: CHASE
Project participant:
Bregnhøj, Henrik (Intern)
Genc-Fuhrman, Hülya (Intern)
Sharma, Anitha Kumari (Intern)
Mosbæk, Hans (Intern)

Project Manager, organisational:
Tjell, Jens Christian (Intern)

Demonstrationsprojekt med genanvendelse af gråt spildevand fra større gråvandsproducent.


Department of Environmental Engineering

Miljøstyrelsen
Period: 01/01/2001 → 31/12/2002
Number of participants: 6
Acronym: 248
Project participant:
Eilersen, Ann Marie (Intern)
Ledin, Anna (Intern)
Eriksson, Eva (Intern)
Smith, Morten (Intern)
Mikkelsen, Peter Steen (Intern)

Project Manager, organisational:
Henze, Mogens (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Project
ENDEGRADE.Endophytic degrader bacteria for improving phytoremediation of organic xenobiotics.

Development of a model that can consider a woody compartment, the transport and fate of metabolites and the effect of dissociation on transport. Modelling of the effects of endophytic bacteria (both wild type and modified) on the fate of specific organic xenobiotics in plants.

Department of Environmental Engineering
Period: 01/01/2001 → 31/12/2003
Number of participants: 1
Acronym: Endegrade
Project ID: 30150
Project Manager, organisational:
Trapp, Stefan (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,296,300.00 Danish Kroner
Project

Etablering og drift af anlæg til opsamling, rensning og genanvendelse af gråvand ved boliger til toiletskyl og maskinvask af tøj.

Der er stigende interesse for at reducere vandforbruget særligt i områder, hvor vandforbruget overstiger den naturlige grundvandsproduktion. Erfaringerne med etablering og drift af gråvandsanlæg er dog endnu utilstrækkelig til at der kan udarbejdes regler desangående. Derfor iværksættes et projekt der har til formål at optimere driften i gråvandsrenseanlæg ved to boliger: Beboerforeningen Bo90, Nørrebro, københavn og beboerforeningen Afd. 47, Virklund, Silkeborg.

Department of Environmental Engineering

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Forsøg med kullfilterrensning af grundvand for pesticider

Formålet er at bestemme 3 kultypers kapacitet til at fjerne pesticiderne BAM og Atrazin fra tre forskellige danske grundvandstyper. Kapaciteten bestemmes ud fra gennembrudskurverne opnået med kolonneforsøg. Såfremt undersøgelsens resultater giver mulighed for det, skal de undersøgte kultypers egnetsid til at fjerne andre pesticider vurderes.

Department of Environmental Engineering

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project
Impact of DOM on the transport of organic contaminants in groundwater.

Dissolved organic matter (DOM) in groundwater is, in elevated concentrations, to be treated as a contaminant per se. Furthermore, it may act as a carrier for different types of contaminants. The degradation of DOM is generally slow in groundwater, but when degradation takes place the binding capacity for different types of organic contaminants may be changed. A better understanding of these changes in binding capacity will be of importance in order to be able to understand and predict the transport of contaminants from polluted soils, like old petrol stations and landfills, to receiving aquifers. Furthermore, the degradation processes, as well as other types of attenuation of organic matter in the groundwater, are poorly understood, especially in qualitative terms. In the proposed project we hypothesize that: - DOM in the landfill leachate polluted groundwater is degraded in such a way that it is not only reduced in quality, but is also qualitatively transformed by microbial degradation processes. - As a consequence of these qualitative changes of DOM, the binding capacity for organic contaminants is influenced. Furthermore we intend to elucidate the mechanisms behind observed changes in binding capacity of DOM due to degradation.

Processes in water supply systems affecting water quality.

Currently, physical flow in water supply systems is very well understood, as is reflected by the spectrum of models available on the world market, which includes two Danish systems. However, a consistent model that can also predict the evolution of drinking water quality from the time it leaves the water treatment facility until it runs out of the consumer's tap is lacking. The bottleneck to credible water quality models is not mathematical formulations for currently understood processes, but the lack of parameters to describe much of the biological and chemical processes that take place in water supply systems. Basic fundamental understanding must be developed and the new information transferred into mathematical terms before the situation can be improved. We propose an integrated project that unites the skills and expertise of a multidisciplinary team to develop new understanding of microbial and chemical processes and to provide an improved model for predicting water quality evolution. The four themes are: Advanced characterisation methods - development Biological processes in water works and distribution systems Chemical processes in distribution systems Integrated modelling of water supply systems.
Project participant:
Jakobsen, Rasmus (Intern)
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Støtte til udvikling af internetkurser
Støtte til udvikling af internetkurser
Department of Environmental Engineering
Period: 01/01/2001 → 31/12/2001
Number of participants: 2
Acronym: 285
Project ID: 30178
Project participant:

Warnaars, Eric (Intern)
Project Manager, organisational:
Harremoës, Poul (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 200,000.00 Danish Kroner
Project

The use of Sewater Neutralised Red-Mud (Bauxsol) to remove Arsenic from Groundwater
Department of Environmental Engineering
Period: 01/01/2001 → 26/05/2004
Number of participants: 7
Phd Student:
Genc-Fuhrman, Hülya (Intern)
Supervisor:
McConchie, David (Ekstern)
Schuiling, Olaf (Ekstern)
Main Supervisor:
Tjell, Jens Christian (Intern)
Examiner:
Ledin, Anna (Intern)
Ahmed, M. Feroze (Ekstern)
Østergaard, Peter Holm (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

DUCED - I&UA (Danish University Consortium for Environment and Development - Industry and Urban Areas) - Consolidation Phase 2000-2003
As described in "Letter of Grant, Annex 1"
Department of Environmental Science and Engineering
Department of Environmental Engineering
Period: 01/12/2000 → 31/12/2003
Number of participants: 6
Project participant:
DUCED - I&UA (Danish University Consortium for Environment and Development - Industry and Urban Areas) - Consolidation Phase 2000-2003
As described in "Letter of Grant, Annex 1" Project Managing Director: Niels Thygesen

Department of Environmental Engineering
Period: 01/12/2000 → 31/05/2004
Number of participants: 4
Acronym: 262
Project participant:
Warnaars, Eric (Intern)
Bregnhøj, Henrik (Intern)
Thygesen, Niels (Intern)
Thygesen, Niels (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt

The new waste chapter in the TGD is expected to provide guidance how to address the potential concerns specifically related to the "rend-of-service-life" waste stage of chemical substances. This means in particular Criteria in which cases a waste scenario should be carried out guidance how to identify the most relevant emission scenarios in these cases recommendations on how to make use of available emission models for certain waste operations and emission scenarios for certain product types guidance on how proceed if no realistic emission scenario is available examples how to formulate the standard conclusions with regard for more information based on waste related releases.

Department of Environmental Engineering
Miljøstyrelsen
Period: 01/12/2000 → 31/12/2000
Number of participants: 2
Acronym: 237
Project participant:
Baun, Anders (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 99,000.00 Danish Kroner

Effekter af bekæmpelsesmidler på akvatiske planter og dyr

Department of Environmental Engineering
Period: 01/11/2000 → 09/03/2003
Number of participants: 3
Environmental assessment of organic household waste management in the municipal of Copenhagen

Department of Environmental Engineering
Number of participants: 1
Acronym: 325
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Uksndt
Amount: 348,000.00 Danish Kroner

Rensning af MTBE forurenet grundvand i bioreaktor med MTBE som primært substrat.

Department of Environmental Engineering
Miljøstyrelsen
Period: 01/11/2000 → 01/07/2002
Number of participants: 1
Acronym: 239
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Unknown
Name of research programme: Uksndt
Amount: 960,000.00 Danish Kroner

Strømningsmønstre i opsprækket moræneler

Department of Environmental Engineering
Period: 01/11/2000 → 23/12/2005
Number of participants: 8
Phd Student:
Rosenbom, Annette Elisabeth (Intern)
Supervisor:
Ernstsen, Vibeke (Ekstern)
Jensen, Karsten Høgh (Intern)
Refsgaard, Jens Christian (Ekstern)
Main Supervisor:
Larsen, Flemming (Intern)
Examiner:
Jakobsen, Rasmus (Intern)
Hansen, Søren (Intern)
Jarvis, Nicholas John (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Kandidatstipendiat
Project: PhD

Udarbejdelse af måleprogram for komposteret fæces.
Måleprogrammet skal benytte til at vurdere reduktionen af smitstoffer i human afføring som har været behandlet enten centralt i efterkomposteringsbeholdere eller i forskellige kommercielt tilgængelige komposttoiletter.

Department of Environmental Engineering
Miljøstyrelsen
Number of participants: 1
Acronym: 242
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 19,780.00 Danish Kroner
Project

Data Assimilation in Hydrological Modelling
Department of Environmental Engineering
Period: 01/10/2000 → 20/08/2004
Number of participants: 6
Phd Student:
Drecourt, Jean-Philippe (Intern)
Supervisor:
Madsen, Henrik (Intern)
Main Supervisor:
Rosbjerg, Dan (Intern)
Examiner:
Binning, Philip John (Intern)
Dee, Dick (Ekstern)
Geer, Frans van (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Identifikation af gråvandsanlæg.
Identifikation af gråvandsanlæg.

Department of Environmental Engineering
Miljøstyrelsen
Period: 01/10/2000 → 01/03/2001
Number of participants: 3
Acronym: 246
Project participant:
Eriksson, Eva (Intern)
Smith, Morten (Intern)
**Financing sources**  
Source: Unknown  
Name of research programme: Ukendt  
Amount: 100,000.00 Danish Kroner  

**MARNURE research network**  
MARNURE: Management of Resources in Urban Areas and Industries, Focus on Nutrient Recycling is a LUCED-I&UA research network. The focus of the MARNURE research network is techniques and management systems, which can improve the handling of resources in urban areas and industries. Especially, the focus in most of MARNURE’s projects is on improving the recycling of nutrients and investigating the socioeconomic possibilities and constraints in the practical implementation of the techniques.

Department of Environmental Engineering  
Period: 01/10/2000 → 01/10/2006  
Number of participants: 3  
Acronym: MARNURE  
Project participant: Bregnø, Henrik (Intern)
Tjell, Jens Christian (Intern)

**Studieophold i Australien vedr. oprensningsteknikker i grundvand.**  
Der ansøges om tilskud til finansiering af 5 månedes studieophold primært i tilknytning til Greg Davis og hans gruppe, CSIRO, Land and Water, Perth, Australia. Gruppen har i en årrække gennemført internationalt anerkendt forskning indenfor dette område. Formålet er at udbygge min generelle forskningmæssige viden vedr. oprensningsteknologier jord og grundvand. Der vil desuden blive samarbejdet om konkrete forskningsprojekter under opholdet. Det er et område, hvor der sker en meget stærk udvikling og er et stort samfundsmæssigt behov, da eksisterende teknikker i mange tilfælde har vist sig at være mindre effekttive. Jeg har interesse i at udbygge min viden indenfor dette område med henblik på at hjemtage nye ideer og metoder og skabe gode internationale samarbejdsrelationer til gavn for fremtidig forskning.

Centre for Groundwater Studies  
Number of participants: 1  
Acronym: 245  
Project participant: Bjerg, Poul Løgstrup (Intern)

**Energy - Based Land - Surface Modelling: New Opportunities in Integrated Hydrological Modelling**  
Department of Environmental Engineering  
Period: 15/08/2000 → 28/09/2005  
Number of participants: 6  
Phd Student: Overgaard, Jesper (Intern)  
Supervisor: Butts, Michael Brian (Intern)  
Main Supervisor: Rosbjerg, Dan (Intern)  
Examiner:
Quantification of Natural Attenuation in Groundwater using Analytical-Chemical Tools

Department of Environmental Engineering
Period: 01/08/2000 → 10/06/2005
Number of participants: 6
Phd Student:
Reitzel, Lotte (Intern)
Supervisor:
Ledin, Anna (Intern)
Main Supervisor:
Bjerg, Poul Løgstrup (Intern)
Examiner:
Kjeldsen, Peter (Intern)
Hunkeler, Daniel (Ekstern)
Lauritsen, Frants Roager (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

The use of x-ray micro-tomography and pore-scale modeling to evaluate dynamic and equilibrium pore-scale processes in porous media

Department of Environmental Engineering
Period: 01/07/2000 → 01/01/2005
Number of participants: 1
Acronym: 324
Project ID: 30087
Project Manager, organisational:
Wildenschild, Dorthe (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Effekter af toksiske stoffer i regnbetingede udløb.
Projektet skal primært gennem udførelse af et praktisk undersøgelseresprogram belyse risikoen for uønskede biologiske effekter i recipienten af toksiske stoffer i regnbetingede udløb. Udløbsprøver fra udvalgte oplande undkastes ekotoksikologiske tests for at undersøge den mulige akutte toksicitet af regnbetingede udløb, mens risikoen for langsigtede effekter i recipienten forventes undersøgt ved testning af sedimenter ude og indstrøms et regnbetinget udløb.

Department of Environmental Engineering
COWI A/S
Period: 01/06/2000 → 31/12/2000
Number of participants: 2
Acronym: 236
Project participant:
Baun, Anders (Intern)
PEGASE. Part of EU project EVK1-CT-1999-00028.
Contract and direct costs transferred from University of Copenhagen, Faculty of Science, Department of Geology. Overført fra KU: 870.000 DKK 1/3-02

Department of Environmental Engineering
Period: 01/06/2000 → 30/11/2003
Number of participants: 3
Acronym: PEGASE
Project ID: 30217
Project participant:
Albrechtsen, Hans-Jørgen (Intern)
Clausen, Liselotte (Intern)

Project Manager, organisational:
Jørgensen, Peter Rene (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,526,500.00 Danish Kroner

PEGASE. Part of EU project EVK-CT-1999-00028
Contract and direct costs transferred from University of Copenhagen, Faculty of Science, Department of Geology. Overført fra KU: 870.000 DKK 1/3-02

Department of Environmental Science and Engineering
Department of Geology and Geotechnical Engineering
Department of Environmental Engineering
Period: 01/06/2000 → 30/11/2003
Number of participants: 4
Project participant:
Albrechtsen, Hans-Jørgen (Intern)
Clausen, Liselotte (Intern)
Jørgensen, Peter (Ekstern)

Project Manager, organisational:
Larsen, Nils Juul (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 152,500.00 Danish Kroner

PEGASE. Pesticides in european groundwaters.
The project is a detailed study of representative Aquifers and simulation of possible evolution scenarios to be carried out in the framework of the specific research and technological development programme Eenergy Environment and Sustainable Development (EESD).

Department of Environmental Engineering
University of Copenhagen
BRGM
Ecole Polytechnique Federale de Lausanne (EPFL)
Lund University
Research Centre Julich (FZJ)
Undersøgelse af udvalgte patogener, herunder campylobacter i udvalgte vandværker.


Department of Environmental Engineering
Miljøstyrelsen
Dansk Landbrugs Rådgivnings Center
Københavns Vand
Danske Vandværkers Forening
De private Vandværker
Period: 15/04/2000 → 15/12/2000
Number of participants: 1
Acronym: 229
Project ID: 30131
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 50,400.00 Danish Kroner
Project

Faglig sekretær for Teknologiudviklingsprogrammet I forhold til MTBE


Department of Environmental Engineering
Miljøstyrelsen
Period: 03/04/2000 → 31/12/2001
Number of participants: 1
Acronym: 230
Project ID: 30130
Project Manager, organisational:
Arvin, Erik (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 325,060.00 Danish Kroner
Project

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**Eksperimentelle og numeriske undersøgelser af forureningsoprensning ved dampinjektion**

Department of Environmental Engineering
Period: 01/04/2000 → 12/02/2004
Number of participants: 6
Phd Student:
Gudbjerg, Jacob (Intern)
Supervisor:
Jensen, Karsten Hegh (Intern)
Main Supervisor:
Sonnenborg, Torben Obel (Intern)
Examiner:
Binning, Philip John (Intern)
Heron, Gorm (Intern)
Sleep, Brent Edwin (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Blandet Finansiering
Project: PhD

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**Memorandum of understanding for twinning arrangement between Asian Institute of Technology and Technical University of Denmark.**
AIT and DTU have been successfully carrying out a twinning arrangement over the past 3 years on "Wastewater Nitrogen Removal. This arrangement aims to establish a continued scientific collaboration between Asian Institute of technology and DTU for promoting research and manpower development in the S.E. Asian region in "Industrial wastewater treatment for Reuse".

Department of Environmental Engineering
Asian Institute of Technology
Period: 01/04/2000 → 30/06/2004
Number of participants: 1
Acronym: 235
Project ID: 30251
Project Manager, organisational:
Harremoës, Poul (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 456,000.00 Danish Kroner
Project

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**Modelbaseret risikovurdering af integrerede spildevandssystemer**

Department of Environmental Engineering
Period: 01/04/2000 → 02/02/2006
Number of participants: 6
Phd Student:
Hauger, Mikkel Boye (Intern)
Supervisor:
Linde, Jens Jørgen (Intern)
Main Supervisor:
Mikkelsen, Peter Steen (Intern)
BASELINE. Natural baseline quality in European aquifers: a basis for aquifer management

The objective of the BASELINE project is to establish criteria for defining natural water quality baselines and develop a standardised Europe-wide approach for use in the emerging Water Framework Directive.

Department of Environmental Engineering
Period: 01/03/2000 → 31/07/2003
Number of participants: 4
Acronym: Baseline
Project ID: 30126
Project participant:
Kjøller, Claus (Intern)
Andersen, Martin Søgaard (Intern)
Iversen, Vibeke Margrethe Nyvang (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Displacement processes in fractured reservoir chalk

Department of Environmental Engineering
Section for Building Materials and Geotechnics
Department of Civil Engineering
Geotechnical Institute
De Nationale Geologiske Undersøgelser for Danmark og Grønland
COWI A/S
Period: 01/03/2000 → 31/12/2002
Number of participants: 2
Contact person:
Foged, Niels Nielsen (Intern)
Project Manager, organisational:
Christensen, Helle Foged (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Indtægtsdækket virksomhed UK 90
Amount: 800,000.00 Danish Kroner
Project

GRACOS- Groundwater risk assessment at contaminated sites.

Contaminated land in Europe poses a serious problem with respect to soil quality and the risk of spreading of pollutants into other compartments of the environment. The major concern at most contaminated sites is the risk of groundwater pollution by organic and inorganic compounds. Since, the remediation of all of the contaminated sites in Europe is economically not feasible, groundwater risk assessment procedures are needed for the ranking of sites, decision making on further use and remedial actions. In contrast to existing procedures this project concentrates on the development of
methodologies for the assessment of the mobile contaminant fraction in contaminated soil and waste material. (i.e. the contaminant fraction which would reach the aquifer). It will allow the determination of the long-term contaminant release rates and the overall emission of pollutants into the groundwater at contaminated sites. The most important innovations expected will be more harmonized and integrated guidelines for groundwater risk assessment in Europe and beyond. At DTU a well controlled field experiment has been carried out. The experiment comprises an emplaced source of a hydrocarbon mixture consisting of volatile to semi-volatile, (partly) biodegradable compounds. The experiment is finalized and preparation of journal papers is on-going.

Department of Environmental Engineering

Eberhard-Karls-Universität Tübingen
Period: 01/02/2000 → 31/03/2004
Number of participants: 5
Acronym: GRACOS
Project ID: 30054
Project participant:
Sørensen, Jens Schaarup (Intern)
Christophersen, Mette (Intern)
Broholm, Mette Martina (Intern)
Hansen, Rita Kallesøe (Intern)
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 4,276,114.00 Danish Kroner

"Study on Phytoremediation of soils from Søllerød Gasværk".

Department of Environmental Engineering
Period: 01/02/2000 → 15/05/2000
Number of participants: 1
Acronym: 212
Project Manager, organisational:
Trapp, Stefan (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 140,000.00 Danish Kroner

Uptake of cyanides into plants - risk or chance for phytoremediation?
Plants have detoxification systems for cyanides. Free cyanide is quickly taken up into plants, but low dosages are also quickly metabolised. The project investigates toxicity, uptake and fate of free and iron complexed cyanides from nutrient solution and soil. The results are needed to evaluate the probable success of the phytoremediation of gas work Holte, Søllerød

Department of Environmental Science and Engineering

Department of Environmental Engineering
Period: 01/02/2000 → 31/12/2004
Number of participants: 2
Project participant:
Larsen, Morten (Ekstern)
Project Manager, organisational:
Trapp, Stefan (Intern)

Uptake of cyanides into plants - risk or chance for phytoremediation?
Plants have detoxification systems for cyanides. Free cyanide is quickly taken up into plants, but low dosages are also quickly metabolised. The project investigates toxicity, uptake and fate of free and iron complexed cyanides from nutrient solution and soil. The results are needed to evaluate the probable success of the phytoremediation of gas work Holte,
Electrochemical removal of CCA from impregnated wood waste
Målet med projektet er at skabe et grundlag for etablering af fælles nordisk samarbejde med det sigte at udvikle metoden: elektrokemisk fjernelse af CCA fra imøprægetræ.

Chemical interactions between polymers and water

Enhanced bioremediation of groundwater contaminants
The use of microbial degradation processes as a remedy is attractive because contaminants are degraded to carbon dioxide, water and salts. The research activities focuses on on enhancement of microbial degradation by addition of electron, donors, nutrient or microbes. The target compounds are chlorinated aliphatic compounds actual contaminated sites. The activities are carried out in collaboration with the county of Funen, Copenhagen County and consulting companys in Denmark and North America. The work is supported by County of Funen and the Danish EPA.
Impact of colloidal carrier substances on the mobility of xenobiotic organic compounds in landfill leachates.
The objective of this project is to extend the knowledge on the behaviour of xenobiotic organic compounds in leachate water within landfills and their transport routes to recipients. It is expected that: a) sorption of organic pollutants to colloidal matter will occur in the landfill environments; b) this sorption is dependent on the content of organic matter in the colloids and the pH of the water; c) the sorption is expected to follow the order from hydrophilic to hydrophobic; d) the sorption will affect the availability of the organic pollutant to micro-organisms and thus their degradability. These hypotheses will be addressed by our field and laboratory investigations on phthalates, which are chosen as model compounds, since they cover a large variety of properties common among organic xenobiotics. The results of this study will be published in scientific papers and communicated to landfill owners and companies dealing with wastes as well as their organisations in written reports and open seminars. The research will also be presented on our University home for the interested public.
Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Koordinator for Aktionsplanens tema 4, samt rapportering af litteraturstudium for tema 4.
Projektets opgave er at sammenfatte en rapport for et litteraturstudium om gråvand, d.v.s. spildevand fra køkkenvask, håndvask, badefaciliteter og maskinvask. Litteraturstudiet skal anvendes i forbindelse med godkendelse af måleprogram for gråvandsanlæg i Sundhedssyrelsen og Miljøstyrelsen.

Department of Environmental Engineering
Miljøstyrelsen

Period: 01/01/2000 → 31/12/2001
Number of participants: 3
Acronym: 249
Project ID: 30134
Project participant:
Eilersen, Ann Marie (Intern)
Ledin, Anna (Intern)
Henze, Mogens (Intern)

Migration of organic compounds from plastic pipes into drinking water
A whole range of chemicals may migrate from polymers to water in contact with the polymer, for example stabilisers. This may affect the aesthetic quality the water and consumer's health. Some of the chemicals are substrate for bacteria and thus stimulates biological growth (aftergrowth). The research has focused on the identification and quantification of chemicals migrating from polyethylene pipes. Thereby, it has been possible to identify aromatic compounds with isobutyl substitutions which can be used as chemical markers for additives. The aim is to provide data that can be used in models describing water quality in distribution systems. In addition, pipe producers can use the information to optimise the hygienic quality their products.

Department of Environmental Engineering
The Food Research Department

Period: 01/01/2000 → 31/12/2008
Number of participants: 2
Acronym: 376
Project participant:
Mosbæk, Hans (Intern)
Arvin, Erik (Intern)

Regional scaling of groundwater recharge
This project is aimed at improving groundwater recharge estimates in a shallow coastal aquifer as part of a wider investigation of sustainable yield. Current techniques for measuring recharge provide estimates at various scales, both temporal and spatial. These scales may be different from those required for yield calculations. It is therefore necessary to provide methods that can both aggregate and disaggregate recharge measurements. Yield calculations do not adequately account for uncertainty in recharge estimates. The aggregation and disaggregation techniques provided in this thesis show how to estimate the uncertainty in recharge and provide indications of the data requirements of the methods. Finally it is shown that yield calculations require accurate determination of mass balance. For aquifers with shallow water tables,
this means that it is necessary to determine plant water use and its impact on recharge. Small spatial scale estimates of recharge have been made using the water table fluctuation method and the chloride mass balance method. A time series model has been developed for the water table fluctuation method of estimating recharge. The water table fluctuation method measures gross recharge, or the sum of all rainfall reaching the water table. The model uses a variable specific yield based upon the soil moisture retention curve, filters out the influence of the Lisse effect on the water table and is capable of detecting recharge even if the water table does not rise. It is shown that high temporal resolution water level data and a variable specific yield are essential for the accurate estimation of recharge. This study has shown that considerable amounts of data are required to minimize uncertainty in the chloride mass balance method. It is shown that a single observation of the chloride concentration of the groundwater can deviate as much as 50% from the average. If observations are averaged over 100 days the error reduces to 20% and after 10,000 days the error is expected to be less than 10%. The chloride mass balance measures long term net recharge, or the gross recharge remaining after accounting for evapotranspiration. A temporal disaggregation method based on a water balance is presented for determining the short term variability of recharge. In the aquifer under investigation, the average annual recharge volume is between a half and a third of the available storage. This means that the temporal variability of the recharge is extremely important in determining the sustainable yield of the aquifer. Annual recharge estimates were found to be well correlated with the annual rainfall, but the annual evapotranspiration sourced from the groundwater was found to be inversely related to the annual rainfall. In a drought period there is reduced recharge and increased discharge by phreatophytes. A simple model has been used to show how these observations can be incorporated into a probabilistic determination of the sustainable yield of the aquifer.

Department of Environmental Engineering

University of Newcastle
Period: 01/01/2000 → 01/01/2006
Number of participants: 1
Acronym: 365
Project Manager, organisational:
Binning, Philip John (Intern)

Removal of the pesticides BAM and Atrazine from drinking water by activated carbon

The Danish drinking water resource is increasingly polluted by pesticides, especially BAM and atrazine. Activated carbon filtration is an obvious technology that is used worldwide, but primarily for treatment of surface water, whereas Danish drinking water supply is based on groundwater. The purpose of the project has therefore been to investigate the opportunities for using activated carbon (AC) filtration to remove the pesticides BAM (2,6-Dichlorobenzamide) and atrazine from Danish groundwater. The main objective of the study was to determine the AC capacity, which is an expression for the amount of pesticide which can be bound to a certain amount of AC and maintain the outlet concentration below a certain, given value. The AC capacity was investigated for three different types of activated carbon (Chemviron Filtrasorb F400, Norit ROW 0.8, and Lurgi, Hydraffin CC 8 x 30). Experimentally three different approaches were used: Column experiments at bench-scale (near-realistic scale (one meter scale)), small-scale column test (centimetre scale) and adsorption isotherm test (batch test with suspended AC). In general this project showed that AC adsorption is a suitable method for removal of BAM from groundwater. Furthermore, the capacities for BAM unexpectedly were in the same order of magnitude as capacities for atrazine. It was expected that the adsorption of BAM onto activated carbon would be considerably lower compared to that of atrazine, because of the more polar structure of BAM (hydrophobicity). The capacity for BAM and atrazine did not vary significantly with the different types of activated carbon or groundwater investigated in this study. Modelling of break-through curves with the program AQUASIM of tracer experiments carried out in the bench-scale columns and of pesticide adsorption in bench-scale columns and small-scale columns has shown a potential for model-based scaling. It is possible to model sorption of BAM in both bench-scale columns and small-scale columns with isotherm data for BAM (Kd=1.15 m3/g AC). By modelling of the tracer experiments from the bench-scale columns, it is possible to estimate mass transfer parameters necessary for modelling the breakthrough profiles of BAM.

Department of Environmental Engineering
Period: 01/01/2000 → 31/12/2005
Number of participants: 5
Acronym: 377
Project participant:
Skov, Bent Henning (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Clausen, Liselotte (Intern)
Kagstrup, Tanja (Intern)
Project Manager, organisational:
Arvin, Erik (Intern)
Transport of arsenic and iron following mine induced oxidation of an aquifer

Iron and arsenic concentrations have been monitored in a water supply aquifer located in NSW Australia. The aquifer has been sandmined upstream of the water supply pump stations. The sandmining has oxidized the aquifer resulting in the release of trace metals including iron, arsenic and manganese into the aquifer. The project determined the geochemical processes controlling the downstream migration of contamination. These included ion exchange, gibbsite buffering, sulphate reduction, arsenic sorption and aquifer flushing.

Department of Environmental Engineering

University of South Australia
Period: 01/01/2000 → 01/01/2005
Number of participants: 2
Acronym: 367
Project participant:
Postma, Diederik Jan (Intern)
Project Manager, organisational:
Binning, Philip John (Intern)

Udvaskning af organiske kemikalier fra restprodukter

Department of Environmental Engineering
Period: 01/01/2000 → 31/12/2001
Number of participants: 2
Phd Student:
Tuchsen, Peter Lysholm (Intern)
Main Supervisor:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Centerfinansieret
Project: PhD

Weathering kinetics and processes

A major environmental problem facing many areas of the world is that of soil erosion. During erosion, the fine sediment is washed away leaving an armour comprised of larger particles on the soil surface. In the long term, erosion rates are therefore no longer transport limited, and instead are limited by the breakdown or weathering of larger sediment. Our ability to model soil erosion in the long term is seriously hindered by a lack of rock weathering kinetic data. In this study we aim, through laboratory and fieldwork, to study the rates of breakdown of various rock types undergoing weathering. The kinetic models that result and insights we gain into the interplay between the rock structure and the breakdown process will result in an enhanced ability to predict both soil erosion and development.

Department of Environmental Engineering

University of Newcastle

University of Leeds
Period: 01/01/2000 → 01/06/2005
Number of participants: 1
Acronym: 368
Project Manager, organisational:
Binning, Philip John (Intern)

Sjølund Losseplads. Samarbejdsaftale vedr. bidrag til videregående forureningsundersøgelse.

Kontraktforlængelse d. 21-10-2002 så projektet også omfatter naturlig afværge.

Department of Environmental Engineering

Ejlskov Consult ApS
Period: 01/12/1999 → 01/07/2006
Number of participants: 1
Acronym: 244
Project ID: 30143
Development of immunological assays for the analysis of pesticides and determination of their prevalence and fate in groundwater and water supply systems.

Immunological assays have turned out to be powerful means to detect pesticides and other environmental contaminants including some of their metabolites at the low concentrations (sub-ug/L) actually found in groundwater. A compound like BAM can be detected even at a concentration of 0.02 ug/L. The project aims at developing the methods in order to cover more pesticides, to improve sensitivity and specificity, and to immobilize the immunological agents on a microchip so that a whole spectrum of pesticides can be detected rapidly and cheaply. The specific role of E&R is to verify the applicability of the methods for groundwater analysis and analysis of water from water supply systems. Furthermore, E&R will use the immunological assays during studies of biodegradation processes in groundwater, water treatment plants, and water distribution systems.

Department of Environmental Engineering
Statens Serum Institut
Technical University of Denmark
Exiqon A/S
De Nationale Geologiske Undersøgelser for Danmark og Grønland

Groundwater contamination by MTBE from underground storage tanks.

The aim of the project has been to make a framework project proposal that outlines how future projects can identify whether methyl tert. butyl ether (MTBE) leaking from underground storage tanks is a significant threat to groundwater. It is suggested to: 1) Perform investigations in both sandy aquifers and in moraine clay and chalk aquifers to reflect Danish conditions, and 2) That the field investigations are supplemented by laboratory investigations under controlled conditions.

Department of Environmental Engineering
Miljøstyrelsen

Project Manager, organisational:
Bjerg, Poul Legstrup (Intern)

Project participant:
Albrechtsen, Hans-Jørgen (Intern)

Arvin, Erik (Intern)

Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 78,000.00 Danish Kroner
Project

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,523,232.00 Danish Kroner
Project

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 12,600.00 Danish Kroner
Project
Aquatic toxicity of mono- and diesters of o-phthalic esters
The toxicity of mono- and diesters of o-phthalic esters towards bacteria, algae, and crustaceans is studied through a series of standardized ecotoxicity tests

Department of Environmental Engineering
Period: 01/09/1999 → 01/09/2002
Number of participants: 1
Acronym: 320
Project Manager, organisational:
Baun, Anders (Intern)

BEIDS
BEIDS (Baltic Environmental Information Dissemination System) er et miljøprojekt for østersøregionen med vægten specielt lagt på Energi, transport og bæredygtig udvikling. 6 lande deltager i projektet, som via Internettet søger at forbedre udvekslingen af miljøinformationer i Østersøområdet.

Department of Geology and Geotechnical Engineering

Department of Environmental Engineering
Period: 01/09/1999 → 31/08/2001
Number of participants: 3
Project participant:
Villumsen, Arne (Intern)
Filho, Walter Leal (Ekstern)
Project Manager, organisational:
Christensen, Iben Vernegren (Intern)

Characterization and stabilization of municipal waste incineration residues.

Department of Environmental Engineering
Period: 01/09/1999 → 30/03/2003
Number of participants: 2
Acronym: 184
Project participant:
Kjeldsen, Peter (Intern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Characterization and stabilization of Residues.

Department of Environmental Science and Engineering
Department of Environmental Engineering
Period: 01/09/1999 → 30/08/2002
Number of participants: 3
Project participant:
Kjeldsen, Peter (Intern)
Hjelmar, Ole (Ekstern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)
Release of volatile trace gases from waste materials

Procedures and models for the diffusive release of trace gases (e.g. CFCs, HFCs, and others) from waste materials such as insulation foam, plastics etc. have been developed and applied to a range of materials found in household appliances. The fate of the released VOCs in landfills after disposal is also studied. The work is partly funded by Association of Home Appliance Manufacturers, Washington DC, USA

Department of Environmental Engineering

Association of Home Appliance Manufacturers
Period: 01/09/1999 → 01/01/2004
Number of participants: 2
Acronym: 371
Project participant:
Scheutz, Charlotte (Intern)
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Potentials and problems related to handling of grey wastewater from households

Department of Environmental Engineering
Period: 01/08/1999 → 17/01/2003
Number of participants: 6
Phd Student:
Eriksson, Eva (Intern)
Supervisor:
Henze, Mogens (Intern)
Main Supervisor:
Ledin, Anna (Intern)
Examiner:
Mosbæk, Hans (Intern)
Butler, David (Ekstern)
Halling-Sørensen, Bent (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Ecological handling of rainwater in Tingbjerg

The "Tingbjerg" study area is a relatively small (50 hectares) catchment which discharges combined sewerage during rain via overflows to an urban lake in the western suburbs of Copenhagen. Extensive renovation of the apartment blocks in the area can be foreseen during the next decade, and there is a unique opportunity for simultaneously retrofitting the combined sewer system. Solutions based on infiltrating stormwater locally are possible but need to be negotiated with the local residents' associations. Copenhagen Water is particularly interested in uncovering the potential for reducing the hydraulic load of wastewater treatment plants and solving surface water quality problems by implementing structural and non-structural best management practices for stormwater control. At the same time, we wish to assess the possible negative environmental effects (i.e. pollution of urban soils and groundwaters). The "Tingbjerg" study area is used as a model catchment for developing new procedures for stormwater control.

Department of Environmental Science and Engineering
Department of Environmental Engineering
Rambøll Danmark A/S
Copenhagen Water
Royal Veterinary and Agricultural University
Period: 01/07/1999 → 31/12/2000
Number of participants: 4
Project participant:
Markussen, Lars M. (Ekstern)
Hansen, Svend Krongaard (Ekstern)
Investigations of local handling of grey waste water
Physical-chemical characterisation, microbiological analyses, and toxicity tests are used to evaluate the characteristics of the grey wastewater in a building with 17 apartments, BO-90, situated in Copenhagen. The treatment efficiency of the on-site grey wastewater treatment plant will also be evaluated. The presence of xenobiotic organic compounds (XOC) will be evaluated through chemical analyses and an inventory of amounts and use patterns of the household chemicals and personal care products in the building. Furthermore, will activities producing grey wastewater be investigated and a sampling programme for grey wastewater developed.

Department of Environmental Engineering
Royal Veterinary and Agricultural University
Period: 24/06/1999 → 31/12/2005
Number of participants: 5
Acronym: 389
Project ID: 30040
Project participant:
Eilersen, Ann Marie (Intern)
Eriksson, Eva (Intern)
Henze, Mogens (Intern)
Mikkelsen, Peter Steen (Intern)
Project Manager, organisational:
Ledin, Anna (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 130,000.00 Danish Kroner

Grundvandsdannelse
Department of Environmental Engineering
Period: 01/06/1999 → 10/06/2005
Number of participants: 8
Phd Student:
Troldborg, Lars (Intern)
Supervisor:
Engesgaard, Peter Knudegaard (Intern)
Jensen, Karsten Høgh (Intern)
Refsgaard, Jens Christian (Ekstern)
Main Supervisor:
Larsen, Flemming (Intern)
Examiner:
Jakobsen, Rasmus (Intern)
Carrera, Jesús (Ekstern)
Kaluarachchi, Jagath J. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD
Modeling of soil-vegetation-atmosphere transfer processes
The aim of the project is to develop a micro-scale SVAT (Soil Vegetation Atmospheric Transfer) model using data from the Danish EUROFLUX site Sorø Lille Begeskov. Presently the data covers four growing seasons of measurements in a closed beech canopy. To understand how carbon dioxide and water vapour fluxes depend on other environmental variables is an important question when modelling the global climate. Micro-scale models provide useful information for larger scale models. Important steps in this project are to understand which parameters are most important to the canopy conductance and then to use the result to simplify an existing SVAT model.

Department of Hydrodynamics and Water Resources
Risø National Laboratory for Sustainable Energy

Department of Environmental Engineering
Period: 01/06/1999 → 31/05/2002
Number of participants: 2
Project participant:
Dellwik, Ebba (Intern)
Project Manager, organisational:
Jensen, Karsten Høgh (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,200,000.00 Danish Kroner
Project

Prediction of porosity and fluid in chalk from acoustic measurements
Department of Environmental Engineering
Period: 01/06/1999 → 28/03/2003
Number of participants: 5
Phd Student:
Gommesen, Lars (Intern)
Supervisor:
Pedersen, Jacob Mørch (Ekstern)
Main Supervisor:
Fabricius, Ida Lykke (Intern)
Examiner:
Smith, Brackin A. (Ekstern)
Vejbæk, Ole Valdemar (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samarbejdsaftalefinans
Project: PhD

Udvikling af SVAT-model
Department of Environmental Engineering
Period: 01/06/1999 → 12/02/2004
Number of participants: 7
Phd Student:
Dellwik, Ebba (Intern)
Supervisor:
Jensen, Niels Otto (Intern)
Jensen, Karsten Høgh (Intern)
Main Supervisor:
Sonnenborg, Torben Obel (Intern)
Examiner:
Rosbjerg, Dan (Intern)
Bernhofer, Christian (Ekstern)
Ecological handling of rain water in Tingbjerg

The "Tingbjerg" study area is a relatively small (50 hectares) catchment which discharges combined sewerage during rain via overflows to an urban lake in the western suburbs of Copenhagen. Extensive renovation of the apartment blocks in the area can be foreseen during the next decade, and there is a unique opportunity for simultaneously retrofitting the combined sewer system. Solutions based on infiltrating stormwater locally are possible but need to be negotiated with the local residents' associations. Copenhagen Water is particularly interested in uncovering the potential for reducing the hydraulic load of wastewater treatment plants and solving surface water quality problems by implementing structural and non-structural best management practices for stormwater control. At the same time, we wish to assess the possible negative environmental effects (i.e. pollution of urban soils and groundwaters). The "Tingbjerg" study area is used as a model catchment for developing new procedures for stormwater control.

Department of Environmental Engineering

Rambøll Danmark A/S

Period: 01/05/1999 → 31/12/2003
Number of participants: 2
Acronym: 193
Project ID: 30048
Project participant:
Sønderup, Henrik (Intern)
Project Manager, organisational:
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 130,000.00 Danish Kroner

High quality algal toxicity data for use in QSAR research

Department of Environmental Engineering

Period: 01/05/1999 → 01/12/1999
Number of participants: 2
Acronym: 195
Project participant:
Kusk, Kresten Ole (Intern)
Project Manager, organisational:
Nyholm, Niels (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Calibration of flow meters by LDA

A technique is developed to calibrate large flow meters used in district heating in site by Laser Doppler Anemometry.

Department of Energy Engineering
Department of Environmental Engineering
Danish Technological Institute
Dantec Measurement Technology A/S
Danish District Heating Suppliers
Danish Flowmeter Manufactures
Period: 01/04/1999 → 01/07/2001
Number of participants: 2
Project participant:
Ullum, Ulrik (Intern)
Project Manager, organisational:
Meyer, Knud Erik (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 1,000,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 450.00 Danish Kroner

**Saltwater intrusion**
Reactive transport in saltwater intrusion zones is investigated at a Danish field site and in the laboratory. A density-dependent flow and reactive transport simulator is developed and applied to simulate the field data. In collaboration with Dept. of Geology and Geotechnical Engineering, DTU. A Ph.D. study by Flemming D. Christensen, funded by the Groundwater Research Centre, DTU.

Department of Hydrodynamics and Water Resources
Department of Geology and Geotechnical Engineering
Department of Environmental Engineering
Period: 01/04/1999 → 31/03/2001
Number of participants: 3
Project participant:
Christensen, Flemming Damgaard (Intern)
Jakobsen, Rasmus (Intern)
Project Manager, organisational:
Engesgaard, Peter Knudegaard (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 1,200,000.00 Danish Kroner

**Sustainable Renewal of Owner-occupied Single Houses**
The aim of this project is to create the basis for dissemination of facts regarding sustainable renewal to the central actors in renewal of owner occupied single houses. Three themes has been chosen to test the possible strategy: Kitchen, Windows and Water. An in-depth analysis of the primary target group - the house owners - has been carried out.

Department of Planning
Department of Environmental Engineering
Department of Management Engineering
Ladings Tegnestue
The Danish Centre for Urban Ecology
Grøn Information
Period: 01/03/1999 → 31/07/2000
Number of participants: 3
Project participant:
Hoffmann, Birgitte (Intern)
Jessen, Astrid (Intern)
Treatment of residues from solid waste incineration: Pilotscale experiments.

Incineration is the most common waste treatment and disposal method for municipal and industrial solid waste in Denmark. Solid residues are generated in terms of bottom ash and APC (air pollution control) solids (fly ashes and acid flue gas cleaning products). The bottom ashes are primarily used for construction purposes while the APC solids are landfilled or temporarily stored until permanent landfills are approved. All the residues from incineration should be utilized or landfilled by sustainable methods without adverse impacts on the environment. One of the main environmental concerns is the short term (few years) as well as long term (centuries) leaching of salts and heavy metals from construction material containing residues or from waste residue landfills. The aim of this project is to develop technologies for bottom ashes as well as for APC products based on combinations of washing and chemical stabilization. Currently focus is on APC solids and washing followed by stabilization by ironoxides. This leads to a reduction in the leaching of salts by partial removal and a permanent binding of heavy metals in the treated solids.

Department of Environmental Engineering
I/S Amagerforbrænding
AV Miljø
AVM
Miljøstyrelsen
Period: 01/03/1999 → 31/12/2000
Number of participants: 3
Acronym: 151
Project participant:
Lundtorp, Kasper (Intern)
Sørensen, Mette Abildgaard (Intern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 775,000.00 Danish Kroner

Afværgeteknologier for grundvand forurenet med pesticider fra punktkilder

Department of Environmental Engineering
Period: 01/02/1999 → 02/10/2002
Number of participants: 6
Phd Student:
Tuxen, Nina (Intern)
Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Main Supervisor:
Bjerg, Poul Legstrup (Intern)
Examiner:
Arvin, Erik (Intern)
Helweg, Arne (Ekstern)
Schirmer, Mario (Ekstern)

Financing sources
Source: Internal funding (public)
Biodegradation of agricultural antibiotics in surface water
The project is a subproject of a larger collaborative joint research that aims at elucidationg the environmental problems associated with the use of antibiotics in agriculture and the release of these substances to the environment. Biodegradation studies are performed as far as possible following the principles of the ISO standard described in project B 1.

Department of Environmental Science and Engineering
Department of Environmental Engineering
Royal Danish School of Pharmacy

Flakkebjerg
Period: 01/01/1999 → 01/01/9999
Number of participants: 8
Project participant:
Ebert, Birthe (Intern)
Biodegradation of agricultural antibiotics in surface water.
The project is a subproject of a larger collaborative joint research that aims at elucidating the environmental problems associated with the use of antibiotics in agriculture and the release of these substances to the environment. Biodegradation studies are performed as far as possible following the principles of the ISO standard described in project B 1.

Department of Environmental Engineering
Period: 01/01/1999 → 31/08/2001
Number of participants: 4
Acronym: 62
Project participant:
Ebert, Birthe (Intern)
Toräng, Lars (Intern)
Qualmann, Signe (Intern)
Project Manager, organisational:
Nyholm, Niels (Intern)

Composition of landfill leachates
Department of Environmental Engineering
Period: 01/01/1999 → 01/01/2002
Number of participants: 1
Acronym: 372
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Ecological wastewater handling on Christiansø - a small island in the Baltic
Christiansø and Frederikse, two small rocky Danish islands, are inhabited by 100 residents. On top of this comes 1000 daily tourists during the summer period. Currently, the wastewater is discharged untreated into the Baltic sea. The bedrock underground, the distance to the mainland, the peaks in wastewater production and the relatively strict nature preservation regulations implies that conventional wastewater transport and treatment is expensive and not considered appropriate. Consequently, this project aimed at identifying alternative solutions based on source control and "green" treatment methods. A number of alternative systems solutions were drawn up and evaluated in a holistic manner.

Department of Environmental Engineering
Department of Civil Engineering
Period: 01/01/1999 → 30/06/2001
Number of participants: 4
Acronym: 221
Project participant:
Hauger, Mikkel Boye (Intern)
Smith, Morten (Intern)
Gabriel, Søren (Intern)
Permable reactive barriers using zerovalent iron
Groundwater polluted with chlorinated compounds and metals can be remediated by use of reactive material such as metallic iron. Research is carried out on permeable reactive barriers by use of laboratory experiments, and field investigations. Lately a study on the hydraulic properties and the in situ degradation rates has been carried out at the Vapokon site together with Irene Lo and Keith Lay from Hong Kong University of Science and Technology. The work continues in student projects.

Remediation of MTBE-contaminated groundwater
Methyl tert. butyl ether (MTBE) has been used in as an additive in gasoline since 1985 in order to increase the octane number. Since many underground storage tanks for oil products are not tight, there is a risk of groundwater contamination at many places. The pollution potential is particularly high if MTBE is present because of its biological persistance and poor sorption to the soil matrix. The project aims at identifying the most feasible methods of groundwater remediation following contamination with MTBE. The project has shown that several technologies are relevant, for example stripping methods. It is also likely that natural bioremediation works in some places. The is a considerable need for the development of methods for biological treatment of the off-gases from the stripping methods and treatment of contaminated water from the pumping operations.
Amternes Videncenter for jordforurening
Period: 30/11/1998 → 31/12/1999
Number of participants: 1
Acronym: 150
Project Manager, organisational:
Arvin, Erik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Assessment of sustainable wastewater handling in sewerless settlmen.
The purpose is to develop a method for comparative assessment of solutions for sustainable handling of wastewater in the open land. The perspective is transparency and a better agreement between different stakeholders' perception of what sustainable wastewater handling is. The assessment method will be incorporated in a generally accessible and practicable computer-based decision support system for use in planning and quality control of projects. The basic premise of the method is that no specific technologies are inherently sustainable, or ecological, but that the sustainability of the total system of technologies for a settlement in a given location must be assessed in a holistic and transparent manner. The method brings wastewater handling into focus, but related waste streams and stormwater is included in the assessments, when their handling are directly coupled with the handling of wastewater. Settlements without traditional sewer systems are covered, e.g. farm houses, summer cottages, garden allotments, villages and ecological settlements planned with specific reference to avoiding sewers. These types of settlements have very different natural and manmade preconditions and the method thus rests on site-analyses of local conditions. The project will involve external stakeholders through case-studies where solutions for existing or planned settlements are assessed to test and illustrate the assessment method.

Department of Environmental Science and Engineering
Department of Planning
Department of Environmental Engineering
Period: 01/10/1998 → 31/12/2000
Number of participants: 12
Project participant:
Mikkelsen, Peter Steen (Intern)
Eilersen, Ann Marie (Intern)
Gabriel, Søren (Intern)
Rauch, Wolfgang (Intern)
Tjell, Jens Christian (Intern)
Hauger, Mikkel Boye (Intern)
Christensen, Knud (Intern)
Elle, Morten (Intern)
Nielsen, Susanne Balslev (Intern)
Hoffmann, Birgitte (Intern)
Hauschild, Michael Zwicky (Intern)
Project Manager, organisational:
Henze, Mogens (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 2,312,000.00 Danish Kroner

Assessment of sustainable wastewater handling in sewerless settlements
The purpose is to develop a method for comparative assessment of solutions for sustainable handling of wastewater in the open land. The perspective is transparency and a better agreement between different stakeholders' perception of what sustainable wastewater handling is. The assessment method will be incorporated in a generally accessible and practicable computer-based decision support system for use in planning and quality control of projects. The basic premise of the method is that no specific technologies are inherently sustainable, or ecological, but that the sustainability of the total system of technologies for a settlement in a given location must be assessed in a holistic and transparent manner. The method brings wastewater handling into focus, but related waste streams and stormwater is included in the assessments,
when their handling are directly coupled with the handling of wastewater. Settlements without traditional sewer systems are covered, e.g. farm houses, summer cottages, garden allotments, villages and ecological settlements planned with specific reference to avoiding sewers. These types of settlements have very different natural and manmade preconditions and the method thus rests on site-analyses of local conditions. The project will involve external stakeholders through case-studies where solutions for existing or planned settlements are assessed to test and illustrate the assessment method.

Department of Environmental Engineering

Department of Civil Engineering
Period: 01/10/1998 → 30/06/2002
Number of participants: 6
Acronym: kloaklose
Project ID: 30027
Project participant:
Eilersen, Ann Marie (Intern)
Hauger, Mikkel Boye (Intern)
Henze, Mogens (Intern)
Smith, Morten (Intern)
Gabriel, Søren (Intern)

Project Manager, organisational:
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 2,312,000.00 Danish Kroner

Biotechnological procedures for sustainable water management.

Department of Environmental Science and Engineering

Department of Environmental Engineering
Period: 01/10/1998 → 01/10/2001
Number of participants: 6
Project participant:
Mosbæk, Hans (Intern)
Dircks, Klaus (Intern)
Schröder, H.C. (Ekstern)
Wanner, J. (Ekstern)
Sujbert, L. (Ekstern)

Project Manager, organisational:
Henze, Mogens (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 230,000.00 Danish Kroner

Biotechnological procedures for sustainable water management.

Urban, industrial and agricultural pollution of natural water resources and low quality of drinking water are currently major problems for human and animal health, especially in the countries of CCE/NIS. This multidisciplinary project concerns the application of modern biotechnological and molecular biological approaches, which will help to solve these problems and are based on existing knowledge in the participating countries of EU/CCE/NIS, thereby contributing to stabilization of RTD potential in the respective CCE/NIS. The topics of the proposed research are: A. Determination of phosphate pollution of wastewaters and the development of methods for phosphate removal with its consequent reuse (enhanced biological phosphorus removal). B. Determination of genotoxicity of by-products of water oxidation/disinfection and development of methods for its routine assessment.

Department of Environmental Engineering

Institute of Chemical Technology
Semmelweis University

Johannes Gutenberg-Universität
Period: 01/10/1998 → 01/10/2001
Number of participants: 3
Acronym: 144
Project participant:
Mosbæk, Hans (Intern)
Dircks, Klaus (Intern)
Project Manager, organisational:
Henze, Mogens (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 230,000.00 Danish Kroner
Project

Determination of microbial available growth in lab. investigations.
Department of Environmental Engineering
VKI Water Quality Institute
Danske Elværkers Forening
Københavns Vand
Miliøestyrelsen
Period: 01/10/1998 → 30/06/2001
Number of participants: 2
Acronym: 129
Project participant:
Arvin, Erik (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 749,080.00 Danish Kroner
Project

Determination of microbial available organic growth in lab. investigations.
Department of Environmental Science and Engineering
Department of Environmental Engineering
Period: 01/10/1998 → 30/06/1999
Number of participants: 7
Project participant:
Arvin, Erik (Intern)
Jørgensen, Claus (Ekstern)
Beck, Jørgen (Ekstern)
Lind, Søren (Ekstern)
Forslund, Jane (Ekstern)
Bagge, Linda (Ekstern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 749,080.00 Danish Kroner
Reliability of Foundation Analysis: Model uncertainty and uncertainties of design soil parameters
A reliability study of the performance of a foundation requires, among other factors, the specification of the uncertainties of
the design parameters and those of the adopted model. The first task is concerned with geological, experimental, and
statistical uncertainties, whereas the second task is basically a calibration work which demands a good, generally
accepted reference that normally does not exist. In this project both issues are addressed in the case of spread footings in
the following way: (i) large model tests performed under well-controlled conditions are analyzed numerically and semi-
empirically; (ii) the testing soils is investigated in the laboratory, utilizing different methods and setups. A reference model
will be created for quantifying the uncertainties inherent in different models.

Department of Geology and Geotechnical Engineering
Department of Environmental Engineering
Period: 01/10/1998 → 01/01/1999
Number of participants: 2
Project participant:
Hansbo, Sven (Ekstern)
Project Manager, organisational:
Du-Thinh, Kien (Intern)

The coupling between the dynamics and the biology in the North Sea
In stratified waters there may be a close connection between the dynamics and the biology of the water masses. Recent
research suggests that this circumstance is responsible for the fact that the North Sea is among the world’s most
important with respect to the production of fish. The project aims at studying this possible close connection by considering
the course of the thermal stratification in the North Sea and the abundance of cod larvae for the past 40 years.

Department of Hydrodynamics and Water Resources
National Institute of Aquatic Resources
Department of Environmental Engineering
Period: 01/10/1998 → 14/12/1999
Number of participants: 2
Project participant:
St. John, Michael (Intern)
Project Manager, organisational:
Nielsen, Morten Holtegaard (Intern)

Bioavailability and effects of chemicals on aquatic plants and animals under varied conditions.
Department of Environmental Engineering
Period: 01/09/1998 → 31/12/2001
Number of participants: 2
Acronym: 112
Project participant:
Ledin, Anna (Intern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Chromium reduction in soils and groundwater
Chromium(VI) (Cr(VI)) is a highly toxic and mobile pollutant. Cr(VI) is mainly found in connection to pollution from
tanneries, electroplating and wood preservating activities. Cr(VI) can be reduced to Cr(III) which is less toxic and mobile
by addition of reductants. The objectives of this project is to evaluate through laboratory experiments the possibility of 1) to
reduce Cr(VI) in pumped groundwater in on-site filters containing metallic iron. 2) to reduce the Cr(VI) in soils by adding
metallic iron or other reductant. In 1999 the experiments made for optimizing the on-site filters was finalized and reported.
Experiments with three different chromium polluted soils using zero-valent iron and ferro sulfate has been carried out. The experiments showed that the reduction of chromate in soils might be possible using ferro sulfate, but the use of zero-valent iron was not feasible. The reporting of the soil experiments was finalized as well.

Department of Environmental Engineering
Period: 01/09/1998 → 01/04/2000
Number of participants: 2
Acronym: 158
Project participant:
Locht, Thomas (Intern)
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 480,000.00 Danish Kroner
Project

Environmental risk assessment and algal ecotoxicology - basics, methodologies, safety factors and no-effect levels.
The project will explore basic phenomena and further develop a number of new concepts and methodologies in algal ecotoxicology with a special view to applications in regulatory risk assessments of chemicals, mixtures of chemicals and complex test materials, such as chemically contaminated water, wastewater, aquatic soil and groundwater.

Department of Environmental Engineering
Danmarks Farmaceutiske Højskole
Research Institute of Toxicology
Period: 01/09/1998 → 31/12/2004
Number of participants: 3
Acronym: 113
Project participant:
Kusk, Kresten Ole (Intern)
Hedberg, Camilla Berg (Intern)
Project Manager, organisational:
Nyholm, Niels (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,627,484.00 Danish Kroner
Project

Environmental risk assessment and Algal ecotoxicology - Basis, methodologies, safety ect.

Department of Environmental Engineering
Department of Environmental Science and Engineering
Period: 01/09/1998 → 01/09/2001
Number of participants: 4
Project participant:
Qualmann, Signe (Intern)
Halling-Sørensen, Bent (Ekstern)
Mayer, Philipp (Ekstern)
Project Manager, organisational:
Nyholm, Niels (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,627,484.00 Danish Kroner
Project
European team for new methods of education and training in urban water resources management.
This project responds to the SOCRATES objective of promoting ODL by establishing a European partnership in the field of Urban Water Resources Management. This partnership will integrate the new information and communication technologies offered by the World Wide Web and Internet to improve two existing university courses that have successfully run in a distance learning mode for 2 and 5 years respectively. The project will make use of the expertise of the partners in the field of Urban Water Resources Management to divide the load of interacting with the course participants to respond to exercises and discuss related topics. The project will involve private enterprise to help develop an educational product that has practical value in addition to academic. The project will also make use of partners’ experience with previous distance learning and multimedia projects to develop the technical aspects of establishing a web-based class room with a user-friendly interface. The project will seek to enable synchronous (chat room) and asynchronous (e-mail) communication on an individual or group level. Through using the web the project will maintain a platform independence and will present a (for most) familiar interface.

Department of Environmental Engineering

PH-Consult Aps.

Norwegian University of Science and Technology

Vrije Universiteit Brussel

TECHWARE
Period: 01/09/1998 → 01/08/2000
Number of participants: 4
Acronym: 111
Project participant:
Warnaars, Eric (Intern)
Loke, Egon (Intern)
Rauch, Wolfgang (Intern)
Project Manager, organisational:
Harremoës, Poul (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 532,800.00 Danish Kroner


Department of Environmental Engineering

Department of Environmental Science and Engineering
Period: 01/09/1998 → 01/08/2000
Number of participants: 9
Project participant:
Loke, Egon (Intern)
Rauch, Wolfgang (Intern)
Warnaars, Eric (Intern)
Schilling, Wolfgang (Ekstern)
Davis, John (Ekstern)
Bauwens, Willi (Ekstern)
van der Becken, Andre (Ekstern)
Linde, Jens Jørgen (Ekstern)
Project Manager, organisational:
Harremoës, Poul (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 532,800.00 Danish Kroner
European team for new methods of education and training in urban water resource management.

Department of Environmental Science and Engineering

Department of Environmental Engineering
Period: 01/09/1998 → 01/08/2000
Number of participants: 8
Project participant:
Rauch, Wolfgang (Intern)
Loke, Egon (Intern)
Warnaars, Eric (Intern)
Schilling, Wolfgang (Ekstern)
John Davis (Ekstern)
Bauwens, Willi (Ekstern)
Jens Jørgen Linde (Ekstern)
Project Manager, organisational:
Harremoës, Poul (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukekndt
Amount: 532,800.00 Danish Kroner
Project

Investigation of the properties of dredged limestone fill
Dredged limestone from the Øresund fixed link has been used for reclamation purposes and Peberholm and Kastrup. The IGG study - carried out partly as a Mid-term project for two student - utilises a number of geophysical and geotechnical investigation techniques, supplemented by laboratory testing. At the Kastrup reclamation site DSB is developing a maintenance centre. The Danish Geotechnical Institute has carried out geotechnical investigations and studied the fill properties using dynamic compaction and plate loading test. The resistivity contouring by IGG showed local variability in the 5 m thick fill layer which was confirmed by electrical soundings but not seen in the boreholes. The surface wave technique was able effectively to characterise deformation properties of the coarse granular material (dmax=200mm). It was concluded that the limestone fill could be divided in three main categories: (1) coarse well graded granular material with low fines content having good engineering properties when compacted, (2) loose layered silty fine sand prone to liquefaction, (3) very soft normally consolidated clayey silt with very low shear strength. The forward modelling of the continuous surface wave method was applied and the results compared very well with the plate loading test taking into account that SASW works at very small strain. The study showed that geophysical methods were applicable and very cost effective to more traditional geotechnical methods.

Department of Geology and Geotechnical Engineering
Department of Environmental Engineering
University of Surrey
Geotechnical Institute
Øresundskonsortiet
DSB Jernbanestyrelsen
Period: 01/09/1998 → 01/01/9999
Number of participants: 5
Project participant:
Gordon, Anne (Ekstern)
Hansen, H. Kryger (Ekstern)
Anderse, Kim Smedegaard (Ekstern)
Larsen, Ole Scheller (Ekstern)
Project Manager, organisational:
Foged, Niels Nielsen (Intern)
Project
**Proceskinetik og mekanismer for bionedbrydning af kemikalier i naturlige systemer ved miljørelevante koncentrationer**

Department of Environmental Engineering  
Period: 01/09/1998 → 26/03/2004  
Number of participants: 6  
Phd Student:  
Toräng, Lars (Intern)  
Supervisor:  
Albrechtsen, Hans-Jørgen (Intern)  
Main Supervisor:  
Nyholm, Niels (Intern)  
Examiner:  
Bjerg, Poul Løgstrup (Intern)  
Boethling, Robert (Ekstern)  
Madsen, Torben Ole (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

**Recirkulering af næringsstoffer i affald fra byer i det sydlige Thailand**

Department of Environmental Engineering  
Number of participants: 6  
Phd Student:  
Schouw, Nanette L.. (Intern)  
Supervisor:  
Tjell, Jens Christian (Intern)  
Main Supervisor:  
Mosbæk, Hans (Intern)  
Examiner:  
Mikkelsen, Peter Steen (Intern)  
Polprasert, Chongrak (Ekstern)  
Østergaard, Peter Holm (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Ansat eksternt  
Project: PhD

**Stability and creep of gas caverns in rocksalt**

DONG A/S and IGG/DTU have initiated an industrial PhD-project for Mikkel Kristian Dahl on developing robust models for creep and stability modelling og gas caverns in rocksalt. The study involves advanced laboratory testing of creep under actual field stress and temperature conditions. During the project period of 3 years MKD should develop the necessary software to be used on DONG's EDP-facilities for modelling of gas caverns under operational conditions. A verification is done based on measurements of cavern deformations under more than 10 years operation. It is the major research and development goal to establish a Danish expertise in this field of gas storage.

Department of Geology and Geotechnical Engineering  
Department of Environmental Engineering  

**Financing sources**
Pollution concentrations in wet weather discharges from combined sewer systems

Annual loads of organic matter, nitrogen and phosphorus to Danish receiving waters have been calculated every year for more than a decade. All receiving waters from small streams to lakes and seas are evaluated and allowable loads are assessed. The pollution sources are mainly rural runoff from intensely cultivated land, atmospheric deposition and urban sewage. There is an increased focus on urban runoff during rain. This is due to mainly two reasons: 1) loads from other sources are decreasing due to human intervention, and 2) an intensified national measurement campaign has shown significantly higher concentrations than what has previously been observed. The national authorities recommend three levels of complexity in the calculations of urban runoff loads from CSO structures during rain. The methods range from unit loads to long-term simulation with the SAMBA module in the MOUSE software package. Common for all these methods are the concept of event mean concentrations (EMC), i.e. that the pollutant concentrations in the runoff are assumed to be independent of the size and distribution of the rain volume and also independent of characteristics of the catchment such as size, slope, storage capacity, maintenance etc. All variation of measured pollutant concentrations is assumed to be random. On this basis the national authorities recommend EMC-values for calculating annual pollution loads. Recent data question the present concept. During two summer periods runoff from six catchments have been measured. The
Preliminary analysis shows significant systematic differences between the hydrograph and the pollutograph, possibly caused by flushing of the sewer systems. More troublesome is the fact that the calculated event mean concentrations are significantly higher than what has previously been observed. The present work elaborates the data more closely and evaluates the results in light of the many data sets that are available now throughout the world. The aim is to identify a few parameters that can describe pollution runoff from urban areas with sufficient accuracy. At present three parameters are used, i.e. an initial losses, a hydrological reduction factor and an event mean concentration. Detailed models that incorporate pollutant washout are most often extremely complex and use a vast number of parameters. It will be attempted to reach a better description then currently by using one or two extra parameters and perhaps re-parameterising the present runoff model. The findings are meant to improve the basis for estimating pollution loads from combined sewer systems in the future.

Department of Environmental Engineering
Aalborg University
COWI Consultants A/S
Miljøstyrelsen
PH-Consult Aps.

Financing sources
Source: Unknown
Name of research programme: Unknown
Amount: 175,000.00 Danish Kroner
Project

Pollution concentrations in wet weather discharges from combined sewer systems.
The national authorities recommend three levels of complexity in the calculations of urban runoff loads from CSO structures during rain. The methods range from unit loads to long-term simulation with the SAMBA module in the MOUSE software package. Common for all these methods are the concept of event mean concentrations (EMC), i.e. that the pollutant concentrations in the runoff are assumed to be independent of the size and distribution of the rain volume and also independent of characteristics of the catchment such as size, slope, storage capacity, maintenance etc. All variation of measured pollutant concentrations is assumed to be random. On this basis the national authorities recommend EMC-values for calculating annual pollution loads. Recent data question the present concept. During two summer periods runoff from six catchments have been measured. The preliminary analysis shows significant systematic differences between the hydrograph and the pollutograph, possibly caused by flushing of the sewer systems. More troublesome is the fact that the calculated event mean concentrations are significantly higher than what has previously been observed. The present work elaborates the data more closely and evaluates the results in light of the many data sets that are available now throughout the world. The aim is to identify a few parameters that can describe pollution runoff from urban areas with sufficient accuracy. At present three parameters are used, i.e. an initial losses, a hydrological reduction factor and an event mean concentration. Detailed models that incorporate pollutant washout are most often extremely complex and use a vast number of parameters. It will be attempted to reach a better description then currently by using one or two extra parameters and perhaps re-parameterising the present runoff model. The findings are meant to improve the basis for estimating pollution loads from combined sewer systems in the future.

Department of Environmental Science and Engineering
Aalborg University
COWI A/S
PH-Consult Aps.
Miljøstyrelsen

Period: 01/07/1998 → 31/03/1999
Number of participants: 3
Acronym: 147
Project participant:
Harremoës, Poul (Intern)
Rauch, Wolfgang (Intern)
Project Manager, organisational:
Mikkelsen, Peter Steen (Intern)
Rock mechanical properties of Jurassic underburden at Valdemar
The pore pressure generation due to conversion of clay minerals under the Danish oil and gas reservoir Valdemar is studied. The structural change from smectite to illite under high temperature and stresses implying collapse and release of inter-layer water seems to be of great importance to oil migration from a potential source rock. The structural development may be caused by volume-constant flow of the clay shale under very low effective pressure. And the release of gas and oil to be caused by internal hydraulic fracturing during this process. The research project intends to intergrate the knowledge in a number of geosciences to the benifit of understanding very important reservoir mechanisms. Rock mechanics, structural geology, clay mineralogy and -chemistry, and geotechnical modelling of porepressure development seem to be key points for the oil maturing and migration from Jurassic clay shales, which then is contained in the Lower Cretaceous reservoir at Valdemar. Preliminary results were presented at the Fifth Nordic Symposium on Petrophysics, August 19-20th 1999, Copenhagen, DK. The study is presumed to be finalised in March 2000 and the results will be published as part of the on-going Energy Research Programme PRIORITY.

Department of Geology and Geotechnical Engineering
Department of Environmental Engineering
De Nationale Geologiske Undersøgelser for Danmark og Grønland

Geotechnical Institute
Period: 22/04/1998 → 01/01/9999
Number of participants: 5
Project participant:
Jacobsen, Finn (Ekstern)
Lindgren, Holger (Ekstern)
Springer, Niels (Ekstern)
Christensen, Helle F. (Ekstern)

Project Manager, organisational:
Foged, Niels Nielsen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 175,000.00 Danish Kroner

Redox Processes at the Seawater/Freshwater Interface in an Anaerobic Aquifer

Department of Environmental Engineering
Period: 01/04/1998 → 15/10/2003
Number of participants: 5
Phd Student:
Iversen, Vibeke Margrethe Nyvang (Intern)
Main Supervisor:
Jakobsen, Rasmus (Intern)
Algal toxicity tests with coloured substances

Toxicity testing of coloured substances in algal growth inhibition tests gives problems because light absorption by the test material may reduce the rate of algal growth and thus interfere with the toxicity measurement. A separation of the toxic effect and the light absorption effect is necessary for the proper interpretation of test results, not only because information of toxicity per se (inherent toxicity) is needed but also because the overall response to the factors combined is highly specific to the test setup and therefore can only be generalized and used with great difficulty. In order to assess the inherent toxicity or toxicity potential of a coloured substance towards algae in a growth inhibition test, the influence of light absorption should be eliminated or if not possible minimized and corrected for. The final goal of this project and subsequent projects is the adoption of a consensus protocol for testing coloured substances in algal growth inhibition tests based upon the principles of eliminating the influence of light absorption.

Department of Environmental Engineering

Recycling of nutrients.

Department of Environmental Engineering

Department of Environmental Science and Engineering
Recycling of nutrients.
The object of the project is to evaluate the potential of recycling nutrients from the cities to agriculture.

Department of Environmental Engineering
Royal Veterinary and Agricultural University
Period: 01/03/1998 → 14/05/1998
Number of participants: 2
Acronym: 152
Project participant:
Eilersen, Ann Marie (Intern)
Project Manager, organisational:
Henze, Mogens (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 75,000.00 Danish Kroner
Project

Sammenhænge mellem mikrotekstur, reservoiregenskaber og lithitype for kalk fra Nordsøen
Department of Environmental Engineering
Period: 01/03/1998 → 17/01/2003
Number of participants: 5
Phd Student:
Røgen, Birte (Intern)
Main Supervisor:
Fabricius, Ida Lykke (Intern)
Examiner:
Krogsbøll, Anette (Intern)
Holt, Rune M. (Ekstern)
Tirsgaard, Henrik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Blandet Finansiering
Project: PhD

Degradation of persistent toxic organic chemicals by cometabolism in a biofilm system
Department of Environmental Engineering
Period: 01/02/1998 → 14/12/2001
Number of participants: 5
Phd Student:
Rivas, Isabelle Marie (Intern)
Main Supervisor:
Arvin, Erik (Intern)
Examiner:
Baun, Anders (Intern)
Fedorak, Phil (Ekstern)
Svensmark, Bo (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Optimering af design og udnyttelse af overfladevands reservoirer i bæredygtigt perspektiv
Department of Environmental Engineering
Period: 01/02/1998 → 28/01/2002
Number of participants: 6
Phd Student:
Kjeldsen, Thomas Rødding (Intern)
Supervisor:
Knudsen, Jesper (Ekstern)
Main Supervisor:
Rosbjerg, Dan (Intern)
Examiner:
Mikkelsen, Peter Steen (Intern)
Højbye, Jan (Ekstern)
Kundzewicz, Zbigniew W. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Saltvandsintrusion
Department of Environmental Engineering
Period: 01/02/1998 → 22/01/2002
Number of participants: 5
Phd Student:
Andersen, Martin Søgaard (Intern)
Main Supervisor:
Postma, Diederik Jan (Intern)
Examiner:
Engesgaard, Peter Knudgaard (Intern)
Appelo, C. A. J. (Ekstern)
Edmunds, W. M. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Biofilm modelling for real time control.
Department of Environmental Science and Engineering
Department of Environmental Engineering
Period: 01/01/1998 → 01/06/1999
Number of participants: 3
Project participant:
Nielsen, Marinus K. (Ekstern)
Madsen, Henrik (Ekstern)
Project Manager, organisational:
Harremoës, Poul (Intern)

**Financing sources**
Source: Unknown  
Name of research programme: *Ukendt*  
Amount: 300,000.00 Danish Kroner  
Project

**Chalk Heterogeneity Catalogue**  
Confidential  
Department of Geology and Geotechnical Engineering  
Department of Environmental Engineering  
Period: 01/01/1998 → 31/12/1999  
Number of participants: 2  
Project participant:  
Frykman, Peter (Ekstern)  
Project Manager, organisational:  
Fabricius, Ida Lykke (Intern)

**Financing sources**
Source: Unknown  
Name of research programme: *Ukendt*  
Amount: 50,000.00 Danish Kroner  
Project

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**Reactive barriers for the remediation of fluoride contamination in groundwater**

This project will build the first pilot scale calcite permeable reactive barrier for the remediation of fluoride contamination in groundwater at VAW aluminium, an aluminium smelter located in NSW Australia. At VAW, fluoride has contaminated groundwater at concentrations up to 3000mg/L, levels far higher than the drinking water guideline value of 1.5mg/L. The barrier design will be based on laboratory work which has shown that calcite can remove 99% of fluoride contamination from water. The project will prove the technology at the field scale and provide the basis for its application to other contaminants.

Department of Environmental Engineering  
University of Newcastle  
University of Copenhagen  
Period: 01/01/1998 → 01/01/2006  
Number of participants: 1  
Acronym: 366  
Project Manager, organisational:  
Binning, Philip John (Intern)  
Project

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**Removal of Cadmium from Straw and Wood Combustion Flyashes**

Investigation on the use of electric fields to remove cadmium from fly ashes from wood and straw combustion. Project done in co-operation with dk-TEKNIK under a project financed by Energistyrelsen.

Department of Geology and Geotechnical Engineering  
Department of Environmental Engineering  
dk-TEKNIK ENERGI & MILJØ  
Period: 01/01/1998 → 31/12/1999  
Number of participants: 4  
Project participant:  
Ottosen, Lisbeth M. (Intern)  
Dame, Anne Juul (Intern)  
Villumsen, Arne (Intern)  
Project Manager, organisational:  
Hansen, Henrik K. (Intern)
**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 290,000.00 Danish Kroner
Project

**Rock Physics of Chalk**
Accoustic properties of North Sea chalk is upscaled from plug to reservoir-scale. Plug data are interpreted from microtexture

Department of Environmental Engineering
Department of Geology and Geotechnical Engineering
Period: 01/01/1998 → 01/09/2000
Number of participants: 7
Project participant:
Regen, Birte (Intern)
Borre, Mai Kirstine (Intern)
Peter Japsen (Ekstern)
Nielsen, Erik (Ekstern)
Pedersen, Jakob Mørch (Ekstern)
Mavko, Gary (Ekstern)

**Project Manager, organisational:**
Fabricius, Ida Lykke (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 810,000.00 Danish Kroner
Project

**Subcontract.Existing biofilm theory incorporated into stochastic models.**
Existing biofilm theory is examined with the aim of selecting a suitable level of complexity for incorporation into stochastic models. This is done primarily with the aim of later application to model predictive real time control. Although this project focuses on modelling for control at biofilter level, the major benefits of this grey-box modelling approach are expected on application at a treatment plant and a catchment level. The project will involve much PC work using data collected from earlier IMT laboratory work and from pilot/full scale plants outside IMT. The project is a sub-project of the EFS-CINTEM project co-ordinated from VKI.

Department of Environmental Engineering
Technical University of Denmark
Krüger A/S
Period: 01/01/1998 → 01/06/1999
Number of participants: 2
Acronym: EFS-CINTEM
Project participant:
Grum, Morten (Intern)

**Project Manager, organisational:**
Harremoës, Poul (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 300,000.00 Danish Kroner
Project

**Sustainable water and sanitation systems in developing countries**
Research and education in appropriate methods and barriers for establishment of affordable and sustainable solutions in water and sanitation management in developing countries.

Department of Environmental Engineering
Næringsstofbalancer for små landbrug i det sydlige Thailand

Department of Environmental Engineering
Period: 01/12/1997 → 30/09/2001
Number of participants: 2
PhD Student:
Christensen, Lena (Intern)
Main Supervisor:
Tjell, Jens Christian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Permeable reactive barriers for groundwater remediation. Scientific coordinator for demonstration programme.

Groundwater polluted with chlorinated compounds and metals can be remediated by use of reactive material such as metallic iron. The Danish EPA has started a demonstration programme where reactive walls are to be used. Under this programme IMT (PK) serves as a scientific coordinator working together with Danish EPA, counties and consulting companies. Besides research is carried out on reactive walls by use of laboratory experiments, especially looking at chromate reduction and simultaneous removal of chlorinated solvents. The demonstration programme is closed and the final summary report about to be published.

Department of Environmental Engineering
Danish Ministry of the Environment
Period: 01/12/1997 → 31/12/2003
Number of participants: 1
Acronym: 157
Project ID: 30014
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Financing sources
Source: Unknown
Name of research programme: Unknown
Amount: 482,298.00 Danish Kroner
Project

Præferentiel transport af pesticider til grundvand

Department of Environmental Engineering
Treatment of residues from solid waste incineration

Incineration is the most common waste treatment and disposal method for municipal and industrial solid waste in Denmark. Solid residues are generated in terms of bottom ash and APC (air pollution control) solids (fly ashes and acid flue gas cleaning products). The bottom ashes are primarily used for construction purposes while the APC solids are landfilled or temporarily stored until permanent landfills are approved. All the residues from incineration should be utilized or landfilled by sustainable methods without adverse impacts on the environment. One of the main environmental concerns is the short term (few years) as well as long term (centuries) leaching of salts and heavy metals from construction material containing residues or from waste residue landfills. The aim of this project is to develop technologies for bottom ashes as well as for APC products based on combinations of washing and chemical stabilization. Currently focus is on APC solids and washing followed by stabilization by ironoxides. This leads to a reduction in the leaching of salts by partial removal and a permanent binding of heavy metals in the treated solids. Utilization by incorporation into ceramics is currently being considered.

Fate of particulate organic in biofilm reactors

The project is part of a network that aims at obtaining advancements in the biological removal of nitrogen from industrial and municipal wastewaters, focusing on the use of biofilm technology. The ultimate goals of the network are: the development of efficient and compact biofilm reactors; the scientific training of young researchers; the exchange of knowledge between the research teams involved. Correlations will be established between biofilm structure and activity, on one side, and the bioreactor operating conditions, on the other side, in order to obtain an optimized design of the nitrogen conversion processes. Main topics of research are: a) Biofilm structure and activity: characterization of microbial aggregates as a function of the physico-chemical and hydrodynamic environment; b) Bioprocess modeling: predictive biofilm models and process simulation; c) Bioreactor design, operation and control: guide-lines for the efficient design and control of nitrifying/denitrifying biofilm reactors. The specific focus of the work at IMT will be to perform laboratory scale experiments and mathematical simulations to evaluate the fate of particulate organic matter in biofilm reactors treating wastewater.

Department of Environmental Engineering
Microbial growth in drinking water distribution systems
The project concerns changes in water quality due to microbial growth during the transport of drinking water from waterworks to the consumer. The major part of the biomass in drinking water system is attached to the inner surfaces of the waterpipes as a ‘biofilm’. The project focuses on the factors controlling the growth of this biofilm, primarily the concentration of microbial available nutrients and the flow velocity in the pipes. The kinetics of the growth will be investigated, with respect to determining the effect of the hydraulic retention time in the water distribution system. These factors will be investigated in a constructed model pipe system. The goal of the project is to provide an useful tool for assessing the microbial growth potential of various types of water in different drinking water distribution systems.
Corfitzen, Charlotte B. (Intern)
Arvin, Erik (Intern)
Boe-Hansen, Rasmus (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

**Mikrobiel vækst i drikkevandsdistributionssystemer**
Department of Environmental Engineering
Period: 01/10/1997 → …
Number of participants: 7
Phd Student:
Boe-Hansen, Rasmus (Intern)
Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Jørgensen, Claus (Ekstern)
Main Supervisor:
Arvin, Erik (Intern)
Examiner:
Henze, Mogens (Intern)
Block, Jean-Claude (Ekstern)
Gruttner, Henrik (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen

**Mobilization of Nickel in Aquifers in response to Afforestation**
Department of Environmental Engineering
Period: 01/10/1997 → 30/11/2001
Number of participants: 5
Phd Student:
Kjøller, Claus (Intern)
Main Supervisor:
Postma, Diederik Jan (Intern)
Examiner:
Christensen, Thomas Højlund (Intern)
Hansen, Hans Chr. B. (Ekstern)
Kinniburgh, David G. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment

**Stabilisering af restprodukter fra affaldsforbrænding**
Department of Environmental Engineering
Period: 01/10/1997 → …
Number of participants: 7
Phd Student:
Lundtorp, Kasper (Intern)
Supervisor:
Jensen, Dorthe Lærke (Intern)
Mogensen, Erhardt (Ekstern)
Main Supervisor:
Christensen, Thomas Højlund (Intern)
Examiner:
Kjeldsen, Peter (Intern)
Hjelmar, Ole (Ekstern)
Johnson, Carola Annette (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Behandling af restprodukter fra affaldsforbrænding med henblik på genanvendelse og/eller bæredygtig deponering

Department of Environmental Engineering
Period: 01/09/1997 → 26/09/2001
Number of participants: 6
Phd Student:
Sørensen, Mette Abildgaard (Intern)
Supervisor:
Koch, Christian Bender (Ekstern)
Main Supervisor:
Christensen, Thomas Højlund (Intern)
Examiner:
Postma, Diederik Jan (Intern)
Hansen, Hans Chr. B. (Ekstern)
Johnson, Carola Annette (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Geotechnical and hydraulic properties of fissured clay till
The project is a multi-disciplinary study of field and laboratory methods connecting engineering geology, geotechnical and environmental engineering related to fissured clay till. It forms the basis for a number of parallel courses carried out by students (Mid-course projects and MSc. courses). It is carried out in co-operation with the Danish Geotechnical Institute, the Geological Institute at the University of Copenhagen and the Geological Survey of Denmark and Greenland. Using the modified "intact block"-method large test specimens of fissured clay till have been collected at field site and studied in an isotropically loaded permeameter as well as in a triaxial cell. The objectives are to characterise the spatial distribution, orientation, apertures and coating of fissures, and to study and evaluate fracture permeability, and to determine strength and deformation properties of fissured clay till.

Department of Geology and Geotechnical Engineering
Department of Environmental Engineering
Geotechnical Institute
University of Copenhagen
Geological Survey of Denmark and Greenland
Period: 01/09/1997 → 01/01/9999
Number of participants: 4
Project participant:
Baumann, Jens (Ekstern)
Jørgensen, Peter (Ekstern)
Klint, Knud Erik (Ekstern)
Project Manager, organisational:
Foged, Niels Nielsen (Intern)
Model based optimization of integrated drainage systems
The research project is focusing on the overall perspectives of optimization of urban drainage systems. The idea is to analyze the system performance by means of mathematical models, to question the basic concepts and to outline the benefit that is gained by the application of integrated modeling and optimization concepts as compared to the more traditional engineering approaches.

Department of Environmental Engineering
Period: 01/09/1997 → 31/08/2001
Number of participants: 3
Acronym: 148
Project participant:
Mikkelsen, Peter Steen (Intern)
Rauch, Wolfgang (Intern)

Project Manager, organisational:
Harremoës, Poul (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,092,000.00 Danish Kroner

Treatment of residues from solid waste incineration
Incineration is the most common waste treatment and disposal method for municipal and industrial solid waste in Denmark. Solid residues are generated in terms of bottom ash and APC (air pollution control) solids (fly ashes and acid flue gas cleaning products). The bottom ashes are primarily used for construction purposes while the APC solids are landfilled or temporarily stored until permanent landfills are approved. All the residues from incineration should be utilized or landfilled by sustainable methods without adverse impacts on the environment. One of the main environmental concerns is the short term (few years) as well as long term (centuries) leaching of salts and heavy metals from construction material containing residues or from waste residue landfills. The aim of this project is to develop technologies for bottom ashes as well as for APC products based on combinations of washing and chemical stabilization. Currently focus is on APC solids and washing followed by stabilization by ironoxides. This leads to a reduction in the leaching of salts by partial removal and a permanent binding of heavy metals in the treated solids. Extensive laboratory studies are being carried out and currently a pilot-plant is being constructed.

Department of Environmental Science and Engineering
Department of Environmental Engineering
Ansaldo Vølund A/S
University of Copenhagen
Royal Veterinary and Agricultural University
University of Washington
Period: 01/09/1997 → 30/08/2000
Number of participants: 11
Project participant:
Jensen, Dorthe Lærke (Intern)
Serensen, Mette Abildgaard (Intern)
Lundtorp, Kasper (Intern)
Duhring, Pernille Bayard (Intern)
Skov, Bent Henning (Intern)
Mogensen, Erhardt (Ekstern)
Stipp, Susan (Ekstern)
Koch, Christian Bender (Ekstern)
Bordia, Raj (Ekstern)
Benjamin, Mark (Ekstern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)
Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,512,000.00 Danish Kroner
Project

Agrohydrologisk modellering på stor geografisk skala
Department of Environmental Engineering
Period: 01/08/1997 → 21/09/2001
Number of participants: 6
Phd Student:
Andersen, Jens Asger (Intern)
Supervisor:
Refsgaard, Jens Christian (Ekstern)
Main Supervisor:
Jensen, Karsten Høgh (Intern)
Examiner:
Rosbjerg, Dan (Intern)
Dolman, Han (Ekstern)
Thomsen, Anton (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Argillaceous carbonate rocks
Petrophysical data bases for argillaceous limestone from Estonia and from the Caribbean Sea are analysed in order to identify the influence of clay on petrophysical data, especially sonic velocities.
Department of Geology and Geotechnical Engineering
Department of Environmental Engineering
EE
Period: 01/08/1997 → 01/01/9999
Number of participants: 2
Project participant:
Shogenova, Alla (Ekstern)
Project Manager, organisational:
Fabricius, Ida Lykke (Intern)

Occurrence and environmental properties of antibiotics in organic waste. Effects and bioaccumulation in Crustaceans
Medical substances such as antibiotics have been used intensively in agriculture and exposed to the environment with very little attention. In this project an environmental risk assessment is performed involving analyses of 10 different antibiotics and their metabolites in organic wastes; investigations of degradation is soil and water, transport in the environment including leaching and effect and accumulation analysis on algae and daphnids. As test objects are selected 10 different antibiotics representing different groups of action. Besides they represent the groups used in the highest quantities in Danish farming. In the present part of the project is focused on effects and bioaccumulation in the freshwater crustacean Daphnia magna. Acute (immobilisation) tests and reproduction tests are performed and accumulation studies are planned.
Department of Environmental Science and Engineering
Department of Environmental Engineering
Period: 15/07/1997 → 31/12/2000
Number of participants: 3
Project participant:
Wollenberger, Leah (Intern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)
Occurrence and environmental properties of antibiotics in organic waste. Effects and bioaccumulation in Crustaceans

Medical substances such as antibiotics have been used intensively in agriculture and exposed to the environment with very little attention. In this project an environmental risk assessment is performed involving analyses of 10 different antibiotics and their metabolites in organic wastes; investigations of degradation in soil and water, transport in the environment including leaching and effect and accumulation analysis on algae and daphnids. As test objects are selected 10 different antibiotics representing different groups of action. Besides they represent the groups used in the highest quantities in Danish farming. In the present part of the project is focused on effects and bioaccumulation in the freshwater crustacean Daphnia magna. Acute (immobilisation) tests and reproduction tests are performed and accumulation studies are planned. Primary

Department of Environmental Engineering
Period: 15/07/1997 → 31/12/2000
Number of participants: 2
Acronym: 106
Project participant:
Wollenberger, Leah (Intern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 171,600.00 Danish Kroner

Frost susceptibility of limestone fill

Frost susceptibility of hydraulic fill from dredged limestone used for an artificial island at the Øresund Link has been studied and evaluated. The fill acts as bearing layer for a combined rail and motor way. Due to removal of fines in the dredging operations the material has no significant heave caused by frost. It could be classified as not susceptible to frost under the used conditions at the construction site.

Department of Geology and Geotechnical Engineering
Department of Environmental Engineering
Period: 20/06/1997 → 12/09/1997
Number of participants: 5
Project participant:
Lemme, Finn (Ekstern)
Fuglsang, Leif D. (Ekstern)
Michailoff, Boris (Ekstern)
Thygesen, Ejvind (Ekstern)
Project Manager, organisational:
Foged, Niels Nielsen (Intern)

Transport og nedbrydning af pesticider i injektionsforsøg

Department of Environmental Engineering
Period: 01/04/1997 → 18/09/2001
Number of participants: 6
Phd Student:
Højberg, Anker Lajer (Intern)
Supervisor:
Bjerg, Poul Løgstrup (Intern)
Main Supervisor:
Engesgaard, Peter Knudegaard (Intern)
Examiner:
Schirma, Mario (Ekstern)
Jensen, Karsten Høgh (Intern)
Refsgaard, Jens Christian (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Sektorministerium, Stip-SU
Project: PhD

**Effects of redox conditions on pesticide degradation in groundwater**
Department of Environmental Engineering
Period: 01/03/1997 → 30/03/2001
Number of participants: 4
Phd Student:
Pedersen, Philip Grinder (Intern)
Supervisor:
Albrechtsen, Hans-Jørgen (Intern)
Main Supervisor:
Mosbæk, Hans (Intern)
Examiner:
Christensen, Thomas Højlund (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Sektorministerium, Stip-SU
Project: PhD

**ECO-CAMPUS, Energy Environment network of European universities and research centers**
The project is carried out by an international network between universities in France, Denmark, Finland, Greece, Poland, Portugal and Romania. The aim is to investigate the energy and environment situation at the universities themselves, realizing the importance of these institutions being examples for the rest of societies, especially the students. Studies from various campuses are analysed and compared.

Department of Buildings and Energy
Department of Environmental Science and Engineering
Department of Civil Engineering
Department of Environmental Engineering

Department of Environmental Engineering
Period: 15/02/1997 → 01/01/1999
Number of participants: 8
Project participant:
Gabriel, Søren (Intern)
Roturier, Jacques (Ekstern)
Laine, T. (Ekstern)
Apostolidou, E. (Ekstern)
Gula, A. (Ekstern)
Almeida, A. de (Ekstern)
Berbecaru, D. (Ekstern)
Project Manager, organisational:
Nørgaard, Jørgen (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 73,500.00 Danish Kroner
Project
Behavior of iron-cyanides in soil and groundwater at gaswork sites

Department of Environmental Engineering
Period: 01/02/1997 → 31/12/1999
Number of participants: 2
Acronym: 104
Project participant:
Mosbæk, Hans (Intern)
Project Manager, organisational:
Kjeldsen, Peter (Intern)

Evaluering af anvendeligheden af netværksmodeller til den specielle kerneanalyse

Department of Environmental Engineering
Period: 01/02/1997 → 30/07/2001
Number of participants: 6
Phd Student:
Larsen, Jens Kjell (Intern)
Supervisor:
Winter, Anatol (Ekstern)
Main Supervisor:
Fabricius, Ida Lykke (Intern)
Examiner:
Foged, Niels Tækker (Intern)
Engstrøm, Finn (Ekstern)
Payatakes, Alkiviades C (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Mikrobiel respiration ...

Department of Environmental Engineering
Period: 01/02/1997 → 26/03/2000
Number of participants: 2
Phd Student:
Dircks, Klaus (Intern)
Main Supervisor:
Henze, Mogens (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Network models and special core analysis

The purpose of this project is to evaluate the applicability of physical and mathematical network models in the interpretation of special core analysis data, e.g. capillary pressure and relative permeability. The possibility of including microscopic phenomena in macroscopic reservoir models will be addressed.

Department of Geology and Geotechnical Engineering
Department of Environmental Engineering
Period: 01/02/1997 → 31/01/2000
Number of participants: 3
Project participant:
Larsen, Jens Kjell (Intern)
**Reactive walls for groundwater remediation.**

Groundwater polluted with chlorinated compounds and metals can be remediated by use of reactive material such as metallic iron. The Danish EPA has started a demonstration programme where reactive walls are to be used. Under this programme IMT (PK) serves as a scientific coordinator working together with Danish EPA, counties and consulting companies. Besides research is carried out on reactive walls by use of laboratory experiments, especially looking at chromate reduction and simultaneous removal of chlorinated solvents.

Department of Environmental Science and Engineering

**Financing sources**

Source: Unknown
Name of research programme: Ukendt
Amount: 400,000.00 Danish Kroner

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**Activated carbon filtration of water**

Contamination of ground water reservoirs by organic chemical pollutants (solvents and pesticides) is becoming common in Denmark. As a consequence, many wells have been closed and the loss of water resources has been compensated by savings of water. However, this strategy may lead to a shortage of water, and therefore treatment of the water for the organic chemicals may be required in the future. The purpose of the project is to: 1) Determine the capacity of activated carbon to remove atrazine and other pesticides at realistic very low concentrations (0.01-1 ug/l) in groundwaters with different contents of natural organic matter (NOM), and 2) To develop the laboratory and modeling methodologies to predict actual full scale sorption capacities.

Department of Environmental Engineering

**Financing sources**

Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment

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**Areal distribueret ....**

Department of Environmental Engineering
Bioenergetics of microbiologically mediated water rock interactions
Microbiologically mediated sulfate reduction and methanogenesis is closely linked to the in-situ energy available for the processes, to what extent this is the case for the suboxic processes modified is not well described, but pursued here. The processes may occur when a threshold energy level is superseded. There are different threshold values for different processes and different systems, and the factors controlling this are to be studied.

Department of Environmental Engineering
Period: 01/01/1997 → 01/01/2008
Number of participants: 2
Acronym: Geoen
Project participant:
Heimann, Axel Colin (Intern)

Biological phosphorus removal

Department of Environmental Engineering
Period: 01/01/1997 → 31/12/2000
Number of participants: 1
Acronym: 165
Project Manager, organisational:
Henze, Mogens (Intern)

Combined anaerobic and aerobic biodegradation of perchloroethylene
Highly chlorinated compounds are easily dechlorinated under anaerobic conditions and the dechlorinated compounds may be completely mineralized in a subsequent aerobic step. This process was investigated with perchloroethyeno as a model substrate. The anaerobic process was performed in an UASB reactor with the dechlorinating organism Dehalospirillum multivorans inoculated in the granulars. The subsequent aerobic degradation was done in a biofilm reactor with methanotropic organisms. The fate of the metabolites and the kinetic behavior of the reactors has been studied.

Department of Environmental Science and Engineering
Department of Environmental Engineering
Period: 01/01/1997 → 01/01/9999
Number of participants: 6
Project participant:
Combined anaerobic and aerobic biodegradation of perchloroethylene
Highly chlorinated compounds are easily dechlorinated under anaerobic conditions and the dechlorinated compounds may be completely mineralized in a subsequent aerobic step. This process was investigated with perchloroethylene as a model substrate. The anaerobic process was performed in an UASB reactor with the dechlorinating organism Dehalospirillum multivorans inoculated in the granulars. The subsequent aerobic degradation was done in a biofilm reactor with methanotrophic organisms. The fate of the metabolites and the kinetic behavior of the reactors has been studied.

Primary Focus Area: Environmental engineering

Department of Environmental Engineering
Period: 01/01/1997 → 31/12/1999
Number of participants: 2
Acronym: 96
Project participant:
Christensen, Nina (Intern)
Project Manager, organisational:
Arvin, Erik (Intern)

Concrete, hardened: Self desiccation
The scope is to describe and verify a test method for control of self desiccation for hardened concrete. The test method covers the determination of internal relative humidity (RH) in hardened concrete and cement mortar using RH instruments. The determination of RH is done on crushed samples of concrete or cement mortar. The test method is only for measuring equipment which gives off or takes up humidity to a limited extent, so that a stable RH value can be obtained within 24 hours.

Department of Environmental Science and Engineering
Lund University
Period: 01/01/1997 → 31/12/1998
Number of participants: 3
Project participant:
Hansen, Ernst Jan De Place (Intern)
Persson, Bertil (Ekstern)
Project Manager, organisational:
Hansen, Kurt Kielsgaard (Intern)

Field investigations of transport and fate of pesticides in a sandy aquifer
The behaviour of selected pesticides will be studied in the field e.g. migration, sorption, and degradation. A continuous injection experiment has been conducted for ambient flow gradients in an aerobic sandy aquifer. Hydrological and geochemical characteristics of the aquifer are already known. The microbiological and sorption characteristics of the aquifer will be characterized. Selected pesticides and conservative tracer will continuously be injected for a period of 0.5-1 year. Multilevel samplers installed downstream of the injection will be monitored frequently during a period of about two years. The experiment will be evaluated based on: (1) breakthrough curves at sampling points downstream of the injection and (2) reactive solute transport simulation of the pesticide plume using a model developed and evaluated in this project. From the breakthrough data, dilution, sorption, and degradation can be determined and field degradation rates calculated. The spatial distribution of the pesticide plume will be determined by synoptic sampling at all monitoring points (2-3 times). The field investigation will be planned in detail autumn 1997. The project is made in collaboration with GEUS and Department of Hydrodynamics and Water resources (ISVA). The project is funded by The Danish Environmental Research Programme. The project period is 1997-1999.

Department of Environmental Science and Engineering
Field investigations of transport and fate of pesticides in a sandy aquifer

The behaviour of selected pesticides will be studied in the field e.g. migration, sorption, and degradation. A continuous injection experiment will be conducted for ambient flow gradients in an aerobic sandy aquifer. Hydrological and geochemical characteristics of the aquifer are already known. The microbiological and sorption characteristics of the aquifer will be characterized. Selected pesticides and conservative tracer will continuously be injected for a period of 0.5-1 year. Multilevel samplers installed downstream of the injection will be monitored frequently during a period of about two years. The experiment will be evaluated based on: (1) breakthrough curves at sampling points downstream of the injection and (2) reactive solute transport simulation of the pesticide plume using a model developed and evaluated in this project. From the breakthrough data, dilution, sorption, and degradation can be determined and field degradation rates calculated. The spatial distribution of the pesticide plume will be determined by synoptic sampling at all monitoring points (2-3 times). The field investigation will be planned in detail autumn 1997. The project is made in collaboration with GEUS and Department of ..., (ISVA), and is fundes by The Danish Environmental Research Programme. The project period is 1997-1999.
Inorganic fluxes in watersheds hosting old landfills
Natural attenuation by degradation may be substantial for organic pollutants in leachate plumes, but most inorganic species will be subject to only minor attenuation in the aquifer. However inorganic species as chloride, sodium, potassium, calcium, magnesium, sulfate etc. enter the groundwater also from other sources than the landfill. This be precipitation, soil weathering, use of fertilizer and use of road deicing chemicals. The significance of these other sources is being mapped by monitoring of groundwater quality just below different land uses within two watersheds also containing unlined landfills. The contributions from the landfills are also being assessed. The results indicate that deicing chemicals and agriculture contribute significantly to the load of inorganic species on the groundwater.

Department of Environmental Engineering
Period: 01/01/1997 → 31/12/2004
Number of participants: 3
Acronym: 98
Project participant:
Skov, Bent Henning (Intern)
Christensen, Thomas Højlund (Intern)

Kinetics of degradation of chlorinated aliphatics and domestic compounds in biofilm reactors.
The purpose of the research was to determine kinetic parameters for the biodegradation of organic contaminants at the very low concentrations which are often found in practice (µg/l range). Since several important compounds are degraded by cometabolism, this phenomenon was studied intensively. Experiments have being conducted in a "biodrum" reactor where biofilm samples can be removed easily and the thickness of the biofilm can be determined non-destructively by microscopy. Substrate removal and the simultaneous biofilm growth is modelled by the computer programme Aquasim from EAWAG in Zürich. The modelling takes into account the main processes affecting the different species of the biofilm (growth, decay, hydrolysis, polymer production, attachment, and detachment).

Department of Environmental Engineering
Period: 01/01/1997 → 31/12/1999
Number of participants: 1
Acronym: 95
Project Manager, organisational:
Arvin, Erik (Intern)

Long-lived radioisotopes (Sr, Nd and U-Th) as tracers for exogene geochemical processes.
The objective of this project in to improve the understanding of element transport from the continents to the oceans by using radioisotopes of Sr and Nd. Suspended particles, colloidal size fractions and truly dissolved material in oxic and anoxic brackish water, comprising a vertical profile in the central baltic Sea will be samples in 1997. Colloid concentration and size distribution will be measured by photon correlation spectroscopy. The separation og colloida in different size classes will be done by ultrafiltration. The brackish water data, compared with freshwater data, will be used to model the importance of particles and colloids for in freshwater-estuarian systems for element transport in general, and for the element transport in the Baltic Sea in particular. The project is financed by the Swedish Natural Research Council and the grants are administrated by Per Andersson at the Swedish Museum of Natural History, Stockholm, Sweden

Department of Environmental Engineering
Swedish Museum of Natural History
Stockholm University
Period: 01/01/1997 → 31/12/2001
Number of participants: 1
Acronym: 105
Project Manager, organisational:
Ledin, Anna (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Long-lived radioisotopes (Sr, Nd and U-Th) as tracers for exogene geochemical processes: The importance of particles, colloids and dissolved components for element transport in fresh and brackish water.

The objective of this project is to improve the understanding of element transport from the continents to the oceans by using radioisotopes of Sr and Nd. Suspended particles, colloidal size fractions and truly dissolved material in oxic and anoxic brackish water, comprising a vertical profile in the central Baltic Sea will be samples in 1997. Colloid concentration and size distribution will be measured by photon correlation spectroscopy. The separation of colloids in different size classes will be done by ultrafiltration. The brackish water data, compared with freshwater data, will be used to model the importance of particles and colloids for in freshwater-estuarine systems for element transport in general, and for the element transport in the Baltic Sea in particular. The project is financed by the Swedish Natural Research Council and the grants are administrated by Per Andersson at the Swedish Museum of Natural History, Stockholm, Sweden.

Department of Environmental Science and Engineering
Swedish Museum of Natural History
Lulea University of Technology
Dow Chemical Company

Natural attenuation as remediation of landfill leachate plumes.

Natural attenuation as a remediation technology is being considered for landfill leachate plumes. The demonstration of mass removal of target pollutants by natural remediation and the evaluation of residual risk is somewhat more complicated than the approaches and protocols used in the context of petroleum hydrocarbons and chlorinated aliphatic compounds. The difference relates to the size of the source term and its influence on local hydrogeology, the mixture of pollutants and general organic matter and the often unidentified toxicity of the leachate. Based on the extensive research results described under "landfills" a conceptual model for natural attenuation at landfills is being developed.

Department of Environmental Engineering
Period: 01/01/1997 → 31/12/2000
Number of participants: 9
Acronym: 93
Project participant:
Foverskov, Anja (Intern)
Baun, Anders (Intern)
Troelsen, Lena Birgit Dalskov (Intern)
Nyholm, Niels (Intern)
Bjerg, Poul Legstrup (Intern)
Kruse, Susanne (Intern)
Nilsson, Torben (Intern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 2,215,200.00 Danish Kroner
Project

Natural attenuation of landfill leachate plumes

Natural attenuation as a remediation technology is being considered for landfill leachate plumes. The demonstration of mass removal of target pollutants by natural remediation and the evaluation of residual risk is somewhat more complicated...
than the approaches and protocols used in the context of petroleum hydrocarbons and chlorinated aliphatic compounds. The difference relates to the size of the source term and its influence on local hydrogeology, the mixture of pollutants and general organic matter and the often unidentified toxicity of the leachate. Based on the extensive research results described under "landfills" a conceptual model for natural attenuation at landfills is being developed.

Department of Environmental Science and Engineering
Department of Environmental Engineering
Amternes Videncenter for jordforurening
Ejlskov Consult ApS
Sønderjylland Amt
Period: 01/01/1997 → 31/12/2000
Number of participants: 6
Project participant:
Bjerg, Poul Løgstrup (Intern)
Kjeldsen, Peter (Intern)
Rokkjær, Arne (Ekstern)
Ejlskov, Palle (Ekstern)
Züricho, Henrik (Ekstern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)
Project

Natural attenuation of xenobiotic organic compounds in groundwater.
Natural attenuation has gained more and more interest as a remediation strategy for groundwater contaminated by petroleum hydrocarbons and chlorinated solvents. The current project focus on the actual potential for natural attenuation as a remedy. The dependency on the conditions with respect to geology, redox and type of contaminants are investigated and the estimation of mass removal by different methods is evaluated. As a part of the project Poul L. Bjerg acts as technical advisor for the Danish EPA.

Department of Environmental Science and Engineering
Department of Environmental Engineering
Hedeselskabet
NIRAS A/S
Oliebranchens Miljøpulje
Danish Ministry of the Environment
Amternes Videncenter for jordforurening
Period: 01/01/1997 → 01/01/9999
Number of participants: 10
Project participant:
Arvin, Erik (Intern)
Mossing, Christian (Ekstern)
Larsen, Lars Chr. (Ekstern)
Anders G. Christensen (Ekstern)
Ris, Charlotte E. (Ekstern)
Lassen, Ernst (Ekstern)
Asp-Fuglsang, Inger (Ekstern)
Dahlstrøm, Kim (Ekstern)
Kaalund, Lars (Ekstern)
Project Manager, organisational:
Bjerg, Poul Løgstrup (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 300,000.00 Danish Kroner
Project
**Pesticide & Grundvand 2.3**, Kinetics of pesticide degradation

Kinetic investigations of pesticide degradation in groundwater at realistic low concentrations and with special emphasis on threshold concentrations and their dependence on primary substrates. Furthermore, adaptations are studied. The absolute rates are compared with rate estimates obtained in other subprojects during field experiments/modeling.

Department of Environmental Engineering
Period: 01/01/1997 → 31/12/1997
Number of participants: 2
Acronym: 3
Project participant:
Albrechtsen, Hans-Jørgen (Intern)

**Threshold concentrations for biodegradation of pesticides in groundwater**

The project is a subproject of project no. 2.2 of the pesticide and groundwater strategic environmental research programme. Methods and theory are used as established in the above STVF funded project on general biodegradation kinetics, except that tests are being conducted at even lower concentrations (pg/L levels).

Department of Environmental Science and Engineering

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**Effects of redox conditions and geology on pesticide degradation**

Degradation of pesticides in aquifers will be investigated by aseptically collecting sediment and water samples from various redox environments (e.g., aerobic, denitrifying, sulfate- and iron-reducing and methanogenic). Samples will be
obtained from different aquifers representing typical geological settings in Denmark. Sediment and groundwater amended with low concentrations of pesticides (typically below 10 mg/l) will be incubated in the laboratory at field redox conditions and temperatures. The removal of pesticides and the accumulation of metabolites in the sediment-groundwater will be analyzed using HPLC and GC-MS. Complete mineralization will be assessed by addition of 14C-labelled pesticides and measurement of 14CO2 evolution. The degradation observed will be compared to the biomass and activity of dominant bacterial groups (i.e., aerobic, denitrifying, Fe(III)/Mn(IV)-reducing, sulfate-reducing and methanogenic) as well as to geochemical conditions in the aquifer. Finally, the degradation of pesticides in the field will be investigated at selected sites using in situ microcosms. These field investigations will facilitate the comparison and transfer of laboratory results to field conditions.

Department of Environmental Science and Engineering

Department of Environmental Engineering

De Nationale Geologiske Undersøgelser for Danmark og Grønland
Period: 01/10/1996 → 31/12/2000
Number of participants: 4
Project participant:
Mosbæk, Hans (Intern)
Refstrup, Mona (Intern)
Pedersen, Philip Grinder (Intern)
Project Manager, organisational:
Albrechtsen, Hans-Jørgen (Intern)

Financing sources
Source: Unknown
Name of research programme: Uukendt
Amount: 2,200,000.00 Danish Kroner
Project

Effects of Xenohormones on Crustaceans

The project is to develop a fast and easy method to identify chemicals, which act as hormones or as hormone disrupters in humans and wild life. The ecologically important copepod Acartia tonsa is used as a test organism and different chemicals suspected to interfere with hormone systems are used as positive controls. The increasing incidence of some cancer types, damage to reproductive systems and developmental problems of this system of humans and wildlife has caused concern about some industrial compounds used in high quantities, which can mimic the natural hormones and acts as such or in other ways interfere with the functions of the natural hormones. Crustaceans posses some of the same hormones as many other animal groups - oestrogen, testosterone and progesterone - among others have been identified, and it seems likely that the hormones act in much the same way in Crustaceans as in mammals. In this project is used the small (1 mm) copepod, Acartia tonsa, as a test animal. It is a very common planktonic organism in European and American coastal waters and as such of great ecological importance. It’s easily cultured and handled in the laboratory. Suspected oestrogens such as alkylphenoles, alkylphenole ethoxylates, bisphenol A and plastic softeners has been investigated together with the positive controls (oestrogen, testosterone) and some negative controls to find parameters which will show or at least indicate if the compounds act as hormones. Life cycle tests with Acartia is performed, and focus is directed against different parts of the lifecycle.

Department of Environmental Science and Engineering

Royal Danish School of Pharmacy
Period: 01/10/1996 → 31/12/1999
Number of participants: 3
Project participant:
Bergstrøm, Jane Mette (Intern)
Halling-Sørensen, Bent (Ekstern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Financing sources
Source: Unknown
Name of research programme: Uukendt
Amount: 1,090,000.00 Danish Kroner
Project
Effects of Xenohormones on Crustaceans
The aim of the project is to develop a fast and easy method to identify chemicals, which act as hormones in humans and wild life. The increasing incidence of some cancer types, damage to reproductive systems and developmental problems of this system of humans and wildlife has caused concern about some industrial compounds used in high quantities, which can mimic the natural hormones and act as such. Crustaceans possess the same hormones as many other animal groups - oestrogen, testosterone and progesterone - among others have been identified, and it seems likely that the hormones act in the same way in Crustaceans as in mammals. In this project is used the small (1 mm) copepod, Acartia tonsa, as a test animal. It is a very common planktonic organism in European coastal waters and as such of great ecological importance. It is easily cultured and handled in the laboratory. Suspected oestrogen such as alkylphenoles, alkylphenole ethoxylates, bisphenol A and plastic softeners has been investigated together with the positive control oestrogen and some negative controls to find parameters which will show or at least indicate if the compounds act as hormones. Life cycle tests with Acartia is performed, and focus is directed against different parts of the lifecycle.

Department of Environmental Engineering
Danmarks Farmaceutiske Højskole
Period: 01/10/1996 → 31/12/2000
Number of participants: 2
Acronym: 43
Project participant:
Bergstrom, Jane Mette (Intern)
Project Manager, organisational:
Kusk, Kresten Ole (Intern)

Estimation Problems in Hydrology: Unsaturated Flow and Reactive Transport
Department of Environmental Engineering
Period: 01/09/1996 → …
Number of participants: 3
Phd Student:
Hollenbeck, Karl-Josef (Intern)
Main Supervisor:
Jensen, Karsten Høgh (Intern)
Examiner:
Engesaard, Peter Knudsgaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Blandet Finansiering-SU
Project: PhD

Monitoring and Interpretation of H2 as a redox indicator in an anaerobic leachate plume
Concentrations of hydrogen (H2) was measured in 52 sampling points in the leachate pollution plume at the Grindsted Landfill. The H2 concentrations indicate that the redox level of the main part of the strongly anaerobic plume is iron-reducing. Calculation of Gibb’s free energy for various redox processes at the actual groundwater temperature of 8 degrees C suggests that sulfate-reduction may also take place, but that methanogenesis must take place in microniches or by fermentation since the free energy and the H2 levels are not favorable for carbon dioxide reduction. These results are in accordance with the microbial studies performed in the plume. Prior to the study, testing of well construction and materials was performed to allow for correct measurements to be made.

Department of Environmental Engineering
Technical University of Denmark
Period: 01/09/1996 → 30/09/1997
Number of participants: 4
Acronym: 6
Project participant:
Skov, Bent Henning (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Bjerg, Poul Legstrup (Intern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)
Monitoring and interpretation of H2 as a redox indicator in an anaerobic leachate plume

Concentrations of hydrogen (H2) was measured in 52 sampling points in the leachate pollution plume at the Grindsted Landfill. The H2 concentrations indicate that the redox level of the main part of the strongly anaerobic plume is iron-reducing. Calculation of Gibb’s free energy for various redox processes at the actual groundwater temperature of 8 degrees C suggests that sulfate-reduction may also take place, but that methanogenesis must take place in microniches or by fermentation since the free energy and the H2 levels are not favorable for carbon dioxide reduction. These results are in accordance with the microbial studies performed in the plume. Prior to the study, testing of well construction and materials was performed to allow for correct measurements to be made.

Department of Environmental Science and Engineering
Department of Geology and Geotechnical Engineering

Geographical variation of extreme point rainfall

In 1979 the institute initiated a nationwide rain gauge system suitable for monitoring short, intense rain events. The system consists of approximately 50 measuring stations separated by one to 300 km, and covering a total of 43,000 square kilometres. At the present time the longest records include 16 years of data. Statistical analysis of the new data reveals a remarkable geographical variation which can be explained only partially by correlation with regional climatological variables that describe differences in physiography and microclimate. In addition to sampling errors originating from use of limited samples for estimation at individual sites, there is a significant statistical residual that cannot be explained by a regional model. Consequently, the engineering application of rainfall data for design and analysis are being revised. The project aims at establishing guidelines for use of rain data in modelling of urban drainage systems.

Department of Environmental Science and Engineering
Geographical variation of extreme point rainfall

In 1979 the institute initiated a nationwide rain gauge system suitable for monitoring short, intense rain events. The system consists of approximately 70 measuring stations separated by one to 300 km, and covering a total of 43,000 square kilometres. At the present time the longest records include 16 years of data. Statistical analysis of the new data reveals a remarkable geographical variation which can be explained only partially by correlation with regional climatological variables that describe differences in physiography and microclimate. In addition to sampling errors originating from use of limited samples for estimation at individual sites, there is a significant statistical residual that cannot be explained by a regional model. Consequently, the engineering application of rainfall data for design and analysis are being revised. Part of the conclusions have recently been published in a new guide from the Danish Water Pollution Control Committee.
**Toxic effects by cadmium on growth and phosphate uptake by P-deficient algae**

The project is a continuation of research performed by Niels Nyholm under a sabbatical leave in 1982 to the states. Inhibition of the ecologically relevant parameter phosphate uptake may perhaps be more sensitive than inhibition of growth, and as there is no direct relation between the growth of algae and their uptake of nutrients, phosphate uptake must be studied in short term spiking experiments. Perturbations of natural communities as a result of toxic exposure could potentially take place with no detection possible in normal growth tests, if nutrient uptake was inhibited at a more sensitive level than seem equally sensitive, if selected mathematically consistent and distinguishing organism response from system (reactor) response.

**Department of Environmental Engineering**
- **Period:** 01/08/1996 → 01/02/1998
- **Number of participants:** 2
- **Acronym:** 59
- **Project participant:**
  - Ebert, Birthe (Intern)
  - Nyholm, Niels (Intern)

**Sorption of pesticides in aquifers**

Sorption of pesticides are studied in batch experiments on mineral powders and on aquifer sediment samples. The results from the experiments are interpreted with the basis on pore surface mineralogy of the sediments.

**Department of Geology and Geotechnical Engineering**

**De Nationale Geologiske Undersøgelser for Danmark og Grønland**
- **Period:** 01/07/1996 → 01/01/9999
- **Number of participants:** 5
- **Project participant:**
  - Madsen, Lene (Intern)
  - Carlsen, Kirsten Suzanne Hvid (Intern)
  - Clausen, Liselotte (Intern)
  - Lindhardt, Bo (Ekstern)
  - Fabricius, Ida Lykke (Intern)

**Financing sources**
- **Source:** Unknown
- **Name of research programme:** Ukendt
- **Amount:** 732,000.00 Danish Kroner

**Joule Heating**

**Department of Environmental Engineering**
- **Period:** 01/06/1996 → 30/12/1998
- **Number of participants:** 2
- **Acronym:** 108
- **Project participant:**
  - Heron, Gorm (Intern)
  - Christensen, Thomas Højlund (Intern)

**Rain as a water resource in households.**

The water resource, energy and economy aspects of rainwater collection are assessed to evaluate rainfall collection as an alternative option for sustainable water supply in Denmark. A maximum of 229 million m³/year of rainwater can be collected from Danish roofs, provided that all possible surfaces are used and all rain falling on the surfaces is collected. This is equivalent to 24% of the total present production of drinking water, which is mainly based on groundwater. From household roofs 64.5 million m³/year can be collected if used for toilet flushing and washing of clothes. This is 68% of the
actual demand for toilet flushing and washing of clothes in households, but only 7% of the total present drinking water production in丹麦. From the society point of view there is neither an environmental nor an economic reason to systematically promote rainfall collection.

**Department of Environmental Engineering**

*Period: 01/05/1996 → 31/12/1997*

*Number of participants: 3*

*Acronym: 23*

*Project participant:*

Henze, Mogens (Intern)

Mikkelsen, Peter Steen (Intern)

Albrechtsen, Hans-Jørgen (Intern)

**Substitution of drinking water by rainwater or gray water for flushing of toilets in households**

The reduction of the groundwater resources, and maybe also the increasing drinking water prizes, have increased the interest for collecting rainwater for use in toilet flushing or laundry. However, there is little knowledge of the hygienic quality of the collected and stored rainwater and of the hygienic consequences of this use. Therefore several rainwater collection systems and gray water reuse systems for use in toilet flushing established in different parts of Denmark are investigated with respect to occurrence of a range of microorganisms: bacteria, fungi and protozoans.

**Department of Environmental Engineering**

*Period: 01/05/1996 → 31/12/1998*

*Number of participants: 1*

*Acronym: 17*

*Project Manager, organisational:*

Albrechtsen, Hans-Jørgen (Intern)

**Neural networks in environmental engineering**

The purpose of this phd-study is to identify the features of neural networks with respect to application in the field of urban wastewater problems. The features of neural networks will be compared to other approaches to the problems.

**Department of Environmental Engineering**

*Period: 01/04/1996 → 31/12/1999*

*Number of participants: 2*

*Acronym: 101*

*Project participant:*

Loke, Egon (Intern)

Albrechtsen, Hans-Jørgen (Intern)

**Strømning og redoxforhold i grundvand forurenet med lossepladsperkolat**

**Department of Environmental Engineering**

*Period: 01/04/1996 → 07/01/2000*

*Number of participants: 5*

*Phd Student:*

Juul Petersen, Michael (Intern)

**Supervisor:**

Bjerg, Poul Løgstrup (Intern)

Røsterg, Dan (Intern)

**Main Supervisor:**

Engesgaard, Peter Knudegaard (Intern)

**Examiner:**

Brun, Adam (Intern)

**Financing sources**

*Source: Internal funding (public)*

*Name of research programme: Forskningsrådsstip.-SU, Eksp*
Artificial recharge of groundwater
Artificial recharge is a method to increase the capacity to extract groundwater by augmenting the natural infiltration of surface water. At the same time the top soil is utilized as a reactor for treatment of surface water. A wide spectrum of research challenges need to be addressed to fully benefit from the technique. In the project IMT focuses on physical, chemical and biological processes occurring during clogging of laboratory columns simulating the sand bed of artificial recharge basins. Methods for characterization of the water input and the clogging materials (particles, algae and biomass) found in artificial recharge systems are tested. Furthermore, experiments are conducted to measure the development of redox zones during progress of biological growth and clogging. The project is part of the European research project Artificial recharge of groundwater (1996-98) which is funded partly by the European Committee through the 4th framework programme Environment and Climate. This project involves nine different European partners and includes six work packages, (1) clogging and heterogeneity, (2) organic compounds and biodegradation, (3) redox dynamics, (4) water-aquifer material interaction, (5) fate of pathogens and (6) integration of knowledge from all work packages.

Department of Environmental Science and Engineering

Department of Environmental Engineering

Water Quality Institute, Denmark, Science Park Aarhus
Period: 01/02/1996 → 31/01/1999
Number of participants: 7
Project participant:
Albrechtsen, Hans-Jørgen (Intern)
Henze, Mogens (Intern)
Boe-Hansen, Rasmus (Intern)
Hansen, Karin (Intern)
Engelsen, Peter Christian (Intern)
Jensen, Bjørn K. (Ekstern)
Project Manager, organisational:
Mikkelsen, Peter Steen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 650,000.00 Danish Kroner

Artificial recharge of groundwater
Artificial recharge is a method to increase the capacity to extract groundwater by augmenting the natural infiltration of surface water and at the same time utilize the top soil as a reactor for treatment of surface water. Artificial recharge has a wide spectrum of research challenges that need to be addressed to fully benefit from the technique. In the near future IMT will focus on physical, chemical and biological processes occurring during biological clogging of sand filters and soils. Methods for characterization of the water input and the clogging materials (biomass) found in artificial recharge systems will be tested. Furthermore, laboratory column experiments will be conducted to measure the development of redox zones during progress of biological growth and clogging. The project is part of the European research project Artificial recharge of groundwater (1996-98) which is funded partly by the European Committee through the 4th framework programme Environment and Climate. This project involves nine different European partners, including the Water Quality Institute (VKI), and includes six work packages, (1) clogging and heterogeneity, (2) organic compounds and biodegradation, (3) redox dynamics, (4) water-aquifer material interaction, (5) fate of pathogens and (6) integration of knowledge from all work packages.

Department of Environmental Engineering
Period: 01/02/1996 → 31/01/1999
Number of participants: 5
Acronym: 51
Project participant:
Albrechtsen, Hans-Jørgen (Intern)
Henze, Mogens (Intern)
Engelsen, Peter Christian (Intern)
Boe-Hansen, Rasmus (Intern)
Project Manager, organisational:
Mikkelsen, Peter Steen (Intern)
Mass-transfer and degradation of organic compounds from coal-tar in dual porosity geologic media

Department of Environmental Engineering
Period: 01/02/1996 → 24/06/1998
Number of participants: 3
Phd Student:
Broholm, Mette Martina (Intern)
Main Supervisor:
Arvin, Erik (Intern)
Examiner:
Helweg, Arne (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Kandidatstipendium ansat på DT
Project: PhD

Simultaneous removal of nitrogen and Phophorus in biofilters
Biological removal of Phosphorus is inherently a cyclic mode of operation, where bacteria with the ability to store P intracellularly are selected for by the cyclic operation of the wastewater plant. In biofilm reactors this has the special effect that the diffusion of substrates into and products out of the biofilm changes rapidly during a cycle of operation. The aim of the project is to elucidate the diffusional phenomena and to identify the significance of diffusional resistance to the performance of the process. The phenomena has been clearly identified experimentally.

Department of Environmental Engineering
Period: 01/02/1996 → 17/09/2001
Number of participants: 7
Phd Student:
Falkentoft, Christina Maria (Intern)
Mosbæk, Hans (Intern)
Henze, Mogens (Intern)
Supervisor:
Harremoës, Poul (Intern)
Project Manager, organisational:
Project

Simultanfjernelse af kvælstof og forfor i biofiltre

Department of Environmental Engineering
Period: 01/02/1996 → 17/09/2001
Number of participants: 7
Phd Student:
Falkentoft, Christina Maria (Intern)
Mosbæk, Hans (Intern)
Henze, Mogens (Intern)
Supervisor:
Harremoës, Poul (Intern)
Examiner:
La Cour Jansen, Jes (Intern)
Nielsen, Per Halkjær (Ekstern)
von Loosdrecht, Mark (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD
Characterisation of wastewater and biomass
Detailed characterisation of wastewater and biomass is important in relation to modelling of wastewater treatment processes. A key element in municipal wastewater is the type of organic material present. Research is done on the uptake of organics and the influence of stabilised substrate on the processes.

Department of Environmental Engineering
Period: 01/01/1996 → 31/12/2000
Number of participants: 1
Acronym: 35
Project Manager, organisational: Henze, Mogens (Intern)

Leaching of heavy metals from soils.
Quality criteria for soils with respect to heavy metals have traditionally focused on the environmental issues related to the land use (ingestion of soil, skin contact, etc.) and very little attention has been given to protection of the groundwater. The complex form of heavy metals in polluted soils makes prediction of leachability difficult and leaching experiments or leaching test are usually the only way to assess the amount of metal to leach from the soil. Model scenarios are being developed to evaluate heavy metal leaching in the context of groundwater protection and allow for simplified methods to account for groundwater quality criteria, depth and location of polluted soil, reduction in infiltration and leachable amounts determined in leaching test. Experimental studies have been performed at actual sites and leaching experiments are conducted in the laboratory.

Department of Environmental Engineering
Period: 01/01/1996 → 31/12/1998
Number of participants: 5
Acronym: 10
Project participant: Foverskov, Anja (Intern)
Jensen, Dorthe Lærke (Intern)
Kjeldsen, Peter (Intern)
Astrup, Thomas Fruergaard (Intern)
Project Manager, organisational: Christensen, Thomas Højlund (Intern)

Modelling of biological wastewater processes
Development of models for removal of organic matter, nitrogen and phosphorus from wastewater.

Department of Environmental Engineering
University of Zurich
Period: 01/01/1996 → 31/12/2001
Number of participants: 1
Acronym: 103
Project Manager, organisational: Henze, Mogens (Intern)

Scientific Co-operation with Phuket Marine Biological Station, Thailand
The overall aim of the Danida co-sponsored programme is science and technology transfer through co-operative research with the local Thai scientists. The first phase of the present project was a screening study of the occurrence of pesticides in surface water and of the risk for the adjacent marine environment as a result of the pesticide runoff. The scientific focus was a practical evaluation of a monitoring method using bioassays with algae and daphnia on XAD concentrated water samples. The method proved useful and revealed severe pesticide contamination of stream water but toxic impact on the marine environment was concluded to be unlikely because of a large dilution factor caused by tidal action. The subsequent project activities have dealt with development and uses of marine algal toxicity tests with tropical algae. Temperature control was here a critical factor in addition to factors determining metal speciation. It has been found that metals toxicity increases with decreasing cell size. Initial studies of the heavy metals pollution in the Phuket area revealed no severe problems.

Department of Environmental Engineering
Scientific Co-operation with Phuket Marine Biological Station, Thailand
The overall aim of the Danida co-sponsored programme is science and technology transfer through co-operative research with the local Thai scientists. The first phase of the present project was a screening study of the occurrence of pesticides in surface water and of the risk for the adjacent marine environment as a result of the pesticide runoff. The scientific focus was a practical evaluation of a monitoring method using bioassays with algae and daphnia on XAD concentrated water samples. The method proved useful and revealed severe pesticide contamination of stream water but toxic impact on the marine environment was concluded to be unlikely because of a large dilution factor caused by tidal action. The subsequent project activities have dealt with development and uses of marine algal toxicity tests with tropical algae. Temperature control was here a critical factor in addition to factors determining metal speciation. It has been found that metals toxicity increases with decreasing cell size. Initial studies of the heavy metals pollution in the Phuket area revealed no severe problems.

Department of Environmental Science and Engineering

PMBC
Period: 01/01/1996 → 01/01/2000
Number of participants: 6
Project participant:
Baun, Anders (Intern)
Jensen, Susanne Dal (Intern)
Prawin, E. (Ekstern)
Bussarivit, N. (Ekstern)
Panutrakul, S. (Ekstern)
Project Manager, organisational:
Nyholm, Niels (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 906,000.00 Danish Kroner
Project

Transformation processes in water treatment plants
A wide range of biotic and abiotic transformation processes are going on in treatment plants for groundwater. It is of particular interest whether organic chemical pollutants in trace concentrations (ug/l) can be degraded. Experiments with aromatic hydrocarbons in a pilot water works have shown very high treatment efficiencies resulting in residual concentrations of benzene, toluene, and naphthalene below 1 microg/l. This has to be further verified in larger scale, and a possible negative effect of iron precipitation has to be investigated. Studies of MTBE degradation in a full-scale water works has been conducted. MTBE was degraded efficiently from 10-50 ug/L to a few ug/L. It is planned to include a broader range of organic contaminants in the studies, including chlorinated aliphatic hydrocarbons and pesticides. Biological transformation of some of the "traditional" pollutants is still an interesting research topic (nitrification, iron and managnes removal, etc.), in particular interactions between the specific groups of organisms involved. Modelling of the organic and inorganic substrate removal and the simultaneous microbial growth and precipitation reactions is also considered as important. The better understanding of the processes will improve the chances of success of the modelling.

Department of Environmental Engineering
Period: 01/01/1996 → 30/11/2003
Number of participants: 3
Urban ecological engineering
Technologies for handling urban wastes is studied. The purpose is to design waste composition that is optimal for further handling and treatment, either in the cities or on agricultural land.

Period: 01/01/1996 → 31/12/1999
Number of participants: 2

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,150,000.00 Danish Kroner

Enzymatic synthesis and modification of carbohydrates.

Period: 01/10/1995 → 31/12/1999
Number of participants: 6

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 4,000,000.00 Danish Kroner
Microbial degradation of PAHs: Mechanisms for surfactant enhanced bioavailability
Department of Environmental Engineering
Period: 01/10/1995 → 02/09/1998
Number of participants: 4
Phd Student:
Willumsen, Pia Arentsen (Intern)
Main Supervisor:
Arvin, Erik (Intern)
Examiner:
Helweg, Arne (Ekstern)
Struwe, Sten (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Sammenhængen mellem porøsitet og akustisk hastighed i kalk
Department of Environmental Engineering
Period: 01/10/1995 → 16/09/1999
Number of participants: 3
Phd Student:
Borre, Mai Kirstine (Intern)
Main Supervisor:
Fabricius, Ida Lykke (Intern)
Examiner:
Japsen, Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden Programfinansiering-SU
Project: PhD

Biotechnological research
Department of Environmental Science and Engineering
Department of Biotechnology
Department of Microbiology
Department of Environmental Engineering
Department of Systems Biology
Period: 01/09/1995 → 31/12/1999
Number of participants: 8
Project participant:
Mathrani, Indra Madan (Intern)
Fischer, Lene (Intern)
Huusom, Elisabeth (Intern)
Schmidt, Jens Ejbye (Intern)
Christensen, Nina (Intern)
Villadsen, John (Intern)
Molin, Søren (Intern)
Project Manager, organisational:
Ahring, Birgitte Kiær (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 4,500,000.00 Danish Kroner

Real Time Control of urban storm drainage
The project is deals with the real time control of the integrated urban drainage system: The sewer system, the treatment plant and the receiving water, interpreted as one unit. Different procedures for optimised control has been developed, including genetic algorithm.

Department of Environmental Engineering
Period: 01/08/1995 → 31/12/1998
Number of participants: 2
Acronym: 32
Project participant:
Rauch, Wolfgang (Intern)
Project Manager, organisational:
Harremoës, Poul (Intern)

Simulation of the integrated urban wastewater system
A deterministic model for the integrated system: The sewer system, the treatment plant and the receiving water, interpreted as one unit, has been developed. The problems associated with the accumulation of nutrients leading to eutrophication has been investigated. Simulationshave shown that the usual design procedures less than optimal with respect to minimisation of the pollution.

Department of Environmental Engineering
Period: 01/08/1995 → 31/08/2001
Number of participants: 3
Acronym: 31
Project participant:
Mikkelsen, Peter Steen (Intern)
Rauch, Wolfgang (Intern)
Project Manager, organisational:
Harremoës, Poul (Intern)

Complexation of Cd, Ni, Zn, Pb and Cu by dissolved organic carbon from landfills
The complexation of heavy metals by dissolved organic carbon from a leachate plume has been measured by means of ion exchange resin techniques. The dissolved organic carbon was studied in its original matrix in order to avoid artifacts by purification and loss of non-purifiable carbon (in some cases up to 30% is lost). Conditional stability constants have been estimated showing much higher complexation for Cu and Pb than for Cd, Ni and Zn. Experiments using aquifer material instead of resin gave comparable results but showed that even in the presence of the dissolved organic carbon, the distribution coefficients for the metal sorption onto the aquifer material still were high indicating limited mobility also in the presence of dissolved organic carbon. Traditional purification of the dissolved organic carbon showed that 60% was fulvic-acid-like, 10% was humic-acid-like and 30% belonged to a hydrophilic group somewhat related to fulvic acids. The characteristics of the separated fractions are being studied and complexation modeled by Model V/WHAM and NICA-Donnan/Ecosat.

Department of Environmental Science and Engineering
Department of Environmental Engineering
RISØ
Verein für Wasser-, Boden- und Lufthygiene e.V.
Fresh Water Institute
British Geological Survey
Period: 01/06/1995 → 28/02/1999
Number of participants: 6
Project participant:
Hansen, Jette Bjerre (Intern)
Grøn, C. (Ekstern)
Filip, Z. (Ekstern)
The complexation of heavy metals by dissolved organic carbon from a leachate plume has been measured by means of ion exchange resin techniques. The dissolved organic carbon was studied in its original matrix in order to avoid artifacts by purification and loss of non-purifyable carbon (in some cases up to 30% is lost). Conditional stability constants have been estimated showing much higher complexation for Cu and Pb than for Cd, Ni and Zn. Experiments using aquifer material instead of resin gave comparable results but showed that even in the presence of dissolved organic carbon, the distribution coefficients for the metal sorption onto the aquifer material still was high indicating limited mobility also in the presence of dissolved organic carbon. Traditional purification of the dissolved organic carbon showed that 60% was fulvic-acid-like, 10% was humic-acid-like and 30% belonged to a hydrophilic group somewhat related to fulvic acids. The characteristics of the separated fractions are being studied and complexation modeled by Model V/WHAM and NICA-Donnan/ECOSAT.

Department of Environmental Science and Engineering
Risø National Laboratory for Sustainable Energy
Department of Environmental Engineering
Fresh Water Institute
British Geological Survey
Period: 01/06/1995 → 28/02/1999
Number of participants: 6
Project participant:
Hansen, Jette Bjerre (Intern)
Grøn, Christian (Intern)
Tipping, E. (Ekstern)
Kinninburgh, D. (Ekstern)
Wabolu, Dr. Z. Filip (Ekstern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 400,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project

Hydrologic behaviour of stormwater infiltration systems
The hydrological behaviour of stormwater infiltration structures needs to be understood to ensure safe design and long life-time. Mathematical models may be used to assess the behaviour and sub-models are needed as part of the general urban drainage simulation models. Field measurements are established in newly constructed facilities and by comparing measured and simulated data the significant model parameters may be estimated. In collaboration with the Department of Inner City Renovation of Copenhagen Municipality two infiltration trenches are constructed in a densely built-up part of central Copenhagen. The trenches are equipped with on-line sensors measuring rain, runoff flow from the connected surfaces and water level in the trenches. Two infiltration trenches were constructed in a densely built-up area in central Copenhagen and equipped with on-line sensors measuring rain, runoff flow from the connected surfaces and water level in the trenches. Although the two trenches are placed close to each other they function rather differently, corresponding to

Department of Environmental Science and Engineering
Risø National Laboratory for Sustainable Energy
Department of Environmental Engineering
Fresh Water Institute
British Geological Survey
Period: 01/06/1995 → 28/02/1999
Number of participants: 6
Project participant:
Hansen, Jette Bjerre (Intern)
Grøn, Christian (Intern)
Tipping, E. (Ekstern)
Kinninburgh, D. (Ekstern)
Wabolu, Dr. Z. Filip (Ekstern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 400,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project
effective soil permeabilities of $2 \times 10^{-6}$ m/s in one trench and a factor 10 smaller in the other. During 2½ years of measuring 89 events were recorded, of which 7 cause overflow. Analyses of falling water tables after rain indicated slight clogging, but this effect is less important than the general lack of knowledge about soil permeability for normal design situations. The results indicate that the stormwater infiltration in central urban areas with compressed soils and backfill is more feasible than previously anticipated. The project started in October 1994, and the first measuring campaign lasted until June 1997. The intention is to resume the measurements twice, after 5 and 10 years respectively, to investigate possible long-term changes in the hydrologic performance of the infiltration changes. A list of publications (html) related to this project and a slide show (pdf, 2,058KB) summarising the results is available on-line.

**Department of Environmental Engineering**

**Period:** 05/05/1995 → 31/12/2001  
**Number of participants:** 2  
**Acronym:** 49  
**Project participant:**  
**Warnaars, Eric (Intern)**  
**Project Manager, organisational:**  
**Mikkelsen, Peter Steen (Intern)**

**Financing sources**

**Source:** Unknown  
**Name of research programme:** Ukendt  
**Amount:** 96,000.00 Danish Kroner  
**Project**

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**Controlling contaminants affecting use and reuse of water sewage and sludge in Jordan and Syria**

To increase knowledge of and scientific methods for monitoring and evaluating the presence of contaminants in the water cycle, and to develop measures to assure and promote safe use of drinking water, reuse of treated sewage for irrigation and to utilise sewage sludge as fertilizer. To gain long term benefits of establishing links and technology transfer with partner institutions.

**Department of Environmental Engineering**

**Period:** 01/05/1995 → 01/05/1999  
**Number of participants:** 3  
**Acronym:** 53  
**Project participant:**  
**Gundersen, Anders Torp (Intern)**  
**Sørensen, Jens Schaarup (Intern)**  
**Project Manager, organisational:**  
**Mosbæk, Hans (Intern)**

**Financing sources**

**Source:** Unknown  
**Name of research programme:** Ukendt  
**Amount:** 500,000.00 Danish Kroner  
**Project**

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**Heavy metal species in solid waste leachates.**

The complexation of heavy metals by dissolved organic carbon from a leachate plume has been measured by means of ion exchange resin techniques. The dissolved organic carbon was studied in its original matrix in order to avoid artifacts by purification and loss of non-purifiable carbon (in some cases up to 30% is lost). Conditional stability constants have been estimated showing much higher complexation for Cu and Pb than for Cd, Ni and Zn. Experiments using aquifer material instead of resin gave comparable results but showed that even in the presence of dissolved organic carbon, the distribution coefficients for the metal sorption onto the aquifer material still was high indicating limited mobility also in the presence of dissolved organic carbon. Traditional purification of the dissolved organic carbon showed that 60% was fulvic-acid-like, 10% was humic-acid-like and 30% belonged to a hydrophilic group somewhat related to fulvic acids. The characteristics of the separated fractions are eing studied and complexation modeled by Model V/WHAM and NICA-Donnan/Ecosat.

**Department of Environmental Engineering**

**Period:** 01/05/1995 → 31/12/1997  
**Number of participants:** 2  
**Acronym:** 92  
**Project participant:**  
**Hansen, Jette Bjerre (Intern)**
**In Situ heat treatment of polluted clayish soils**

Laboratory experiments have been performed determining the effects of elevated temperatures on the physico-chemical constants of TCE forming the basis for heating soils as a mean of remediation.

Department of Environmental Science and Engineering

Department of Environmental Engineering

US.EPA Research Laboratory,

TNO-Research

Period: 01/05/1995 → 01/01/1999

Number of participants: 4

Project participant:

Heron, Gorm (Intern)

Enfield, Ada C. (Ekstern)

Zupthen, Macus van (Ekstern)

Project Manager, organisational:

Christensen, Thomas Højlund (Intern)

**Financing sources**

Source: Unknown

Name of research programme: Ukendt

Amount: 0.00 Danish Kroner

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**Anvendelse af biotests i forbindelse med karakterisering og risikovurdering af kemikalieforurenet grundvand**

Department of Environmental Engineering

PhD Student:

Baun, Anders (Intern)

Supervisor:

Bjerg, Poul Løgstrup (Intern)

Main Supervisor:

Nyholm, Niels (Intern)

Examiner:

Kristensen, Preben (Ekstern)

**Financing sources**

Source: Internal funding (public)

Name of research programme: Forskningsrådsstip.-SU, Eksp

Project: PhD

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**Densitetspåvirket strømning og opblanding i grundvand**

Department of Environmental Engineering

Period: 01/04/1995 → 15/09/1999

Number of participants: 3

PhD Student:
Holm, Jesper (Intern)
Main Supervisor:
Engesgaard, Peter Knudegaard (Intern)
Examiner:
Postma, Diederik Jan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Acoustic properties of chalk from the Ontong Java Plateau and from the North Sea
We wish to establish a model for the relationship between porosity, texture, and acoustic velocity of chalk. Chalk from the Ontong Java Plateau (OJP) has a wide range of porosities as a consequence of the progressive burial diagenesis of chalk. P-wave velocity data and textural data obtained by electron microscopy for OJP material form the basis for a model, which will be applied to chalk from North Sea reservoirs.

Department of Geology and Geotechnical Engineering
Risø National Laboratory for Sustainable Energy
Department of Environmental Engineering

Period: 01/03/1995 → ...
Number of participants: 3
Project participant:
Borre, Mai Kirstine (Intern)
Ølgaard, Povl Lebeck (Intern)

Fabricius, Ida Lykke (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 122,600.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 592,963.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 100,000.00 Danish Kroner

Chemical fate models for environmental assessment
The project has been carried out as a DTU funded Ph.D. study and terminated half way through, because the student quit engineering and resumed studies in philosophy. Nevertheless 2 papers in CHEMOSPHERE have emerged - one on a regional chemical fate model for Denmark developed in cooperation with the DMU while the other sub project was a study on the importance of including terrestrial vegetation in such chemical fate models this study was performed while Morten Severinsen was visiting the RIVM, The Netherlands.

Department of Environmental Engineering
Period: 01/02/1995 → 22/08/1997
Number of participants: 1
Acronym: 60
Project Manager, organisational:
Nyholt, Niels (Intern)

Jernoxiders omsætning i grundvandsmagasiner
Department of Environmental Engineering
Period: 01/02/1995 → 28/08/1998
Number of participants: 3
Phd Student:
Larsen, Lars Ole (Intern)
Main Supervisor:
Postma, Diederik Jan (Intern)
Examiner:
Villumsen, Arne (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Landfill Remediation via Decision Analysis
Department of Environmental Engineering
Period: 01/02/1995 → …
Number of participants: 2
Phd Student:
Krom, Thomas Donald (Intern)
Main Supervisor:
Rosbjerg, Dan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Matematisk modellering af kemikaliers skæbne i det ydre miljø
Department of Environmental Engineering
Period: 01/02/1995 → 01/03/1997
Number of participants: 2
Phd Student:
Severinsen, Morten (Intern)
Main Supervisor:
Nyholm, Niels (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Planters optag af partikulære luftforurening
Department of Environmental Engineering
Period: 01/02/1995 → 22/04/1999
Number of participants: 4
Phd Student:
Fauser, Patrik (Intern)
Supervisor:
Bjerg, Poul Legstrup (Intern)
Main Supervisor:
Tjell, Jens Christian (Intern)
Examiner:
Bohgard, Mats (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Reservoirgeologisk model for bryozokalkstenen i Faxe kalkbrud, sydsjælland
Department of Environmental Engineering
The role of particulates in biofilm reactors
The kinetics of degradation of particulates in biofilms is complicated and is still not well described. We have chosen to make unsteady experiments, such that the sequence of variations of loading is designed to reveal important features of particulate adsorption and degradation in the biofilter. The experiments include mass balances on the basis of Total Carbon (TOC and TIC). Experiments in lab. scale and pilot scale have shown that only a small fraction of the particulates are degraded in the period between backwash, to the benefit of digestion and gas production in the treatment plant; but to the detriment of the availability of organic matter for denitrification in the biofilters.

Algal bioassays for metal mining wastes
The project is a Danish contribution to a larger Canadian project funded by Environment Canada. The overall objective is to develop scientifically based algal bioassays that can reveal the presence and toxicity of bioavailable metal forms in complex wastewaters from the Canadian metal mining industry and in leachates from Danish deposits of combustion residues. The main effort has been the optimization and interpretation of algal toxicity tests of heavy metals which are complicated by interactions between algal growth and medium factors on the one hand and by the influence of these factors on metal speciation. The main emphasis of the TUD project part has been to study iron-chelator interactions and to develop an optimized medium for heavy metal toxicity testing. It has further been found that the commonly used chelator EDTA photodecomposes under the test conditions and therefore an alternative chelator should be selected, for instance citrate. The work has been considered (and used in part) by the ISO.
Algal bioassays for metal mining wastes
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Distribution coefficients for metals in soils and aquifer materials
Distribution coefficients are useful parameters to describe trace metal distribution between solid phase and solute phase at low trace metal concentration provided that sorption is the controlling process. The database on distribution coefficient determined at low environmentally relevant concentration levels is still very limited and few regression equations are available for predicting distribution coefficients from soil and aquifer characteristics. We conduct Batch experiments to measure distribution coefficients on soils and aquifer materials. Most studies are done on samples from our library of soil and aquifer material. In general the distribution coefficients are lower in aquifer materials than in soil, but for both materials pH seems to be the dominating parameter for all the metals studied.
The phase systems Fe-Re-S and Fe-Os-S
In connection with the growing geochemical importance of the Re-Os pair, the phase systems Fe-Re-S and Fe-Os-S have been studied at temperatures between 800 and 1200°C.

Department of Geology and Geotechnical Engineering

Department of Environmental Engineering
Period: 01/01/1995 → 01/01/9999
Number of participants: 2
Project participant:
Makovicky, Emil (Ekstern)
Project Manager, organisational:
Karup-Møller, Sven (Intern)

Fluoride in Magadi Salts
High Fluoride intakes via water is common in dry or volcanic regions in Africa. This calamity is aggravated with the use of Magadi (sodium hydrogen carbonate) with high Fluoride concentrations. The Ph.D. project covers the occurrence of contaminated Magadi, the crystallization processes in the alkaline lakes, and the technical possibilities for purifying Magadi for human consumption.

Department of Environmental Engineering

Department of Chemistry
Period: 01/09/1994 → 31/01/1997
Number of participants: 1
Acronym: 64
Project Manager, organisational:
Tjell, Jens Christian (Intern)

Kinetisk Grundlag for Projektering af Biofiltrer til Spildevandsrensning

Department of Environmental Engineering
Number of participants: 2
Phd Student:
Janning, Kenneth F. (Intern)
Main Supervisor:
Harremoës, Poul (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Koloidbåren transport af forureningstoffer i porøse medier

Department of Environmental Engineering
Number of participants: 2
Phd Student:
Ullum, Marlene (Intern)
Main Supervisor:
Jensen, Karsten Høgh (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Oprindelse og kemisk sammensætning af fluorid-kontamineret magade fra alkaliske sær og jordoverflader i Tanzania

Department of Environmental Engineering
Anaerobic field injection experiment with organic chemicals in a leachate plume
Eighteen organic chemicals at trace level were injected for at six month period into the strongly anaerobic part of the leachate plume downgradient from the Grindsted Landfill. The immigration and fate of the compounds were monitored for nearly three years. Sorption was insignificant in the coarse sandy aquifer, but many of the organic chemicals degraded: Toluene, o-xylene, several nitrobenzenes and maybe naphthalene. Benzene was recalcitrant. The degradation rates were low and in many cases long adaptation periods were observed making short term laboratory degradation studies unsuited for studying degradation of organic chemicals in leachate plumes. However, long term batch degradation experiments and in situ microcosms installed in the plume gave results generally comparable to the observations in the plume. The plume was dominated by iron reduction, but locally methanogenesis and sulfate reduction also took place.

Bioaccumulation and toxicity of lipophilic chemical in algae, crustaceans and fish
Lipophilic Organic Chemicals, LOC's constitute an important group of concern pollutants. LOC's may bioconcentrate and even bioaccumulate via food webs (mostly in terrestrial systems). The compounds may be toxic not only to directly exposed populations of organisms but also cause indirect poisoning of man and other predators at the top of the food chain. While well studied with respect to toxicity and accumulation in fish, surprisingly little information has hitherto been available for other types of organisms, and the sorptive behaviour in surface waters, where algae may constitute a significant particulate phase, is generally not known. Information on sorption is important, nevertheless, not only for assessing the exposure of aquatic organisms to bioavailable toxicants, but also for the purpose of assessing the general chemical fate of LOC's. Sedimentation mediated by sinking algae is here an important transport process moving the LOC's from the water column to the sediments which may act as an ultimate sink and concern compartment since with no or slow biodegradation under the prevailing anaerobic conditions, lrge LOC concentrations may build up in time. The project aimed at contributing to fill the knowledge gabs on ecotoxicity to other organisms than fish, and further to investigate in detail the mechanisms involved in sorption and toxicity to phytoplankton algae including looking at the basic dose concept. According to current practice in aquatic ecotoxicology, concentration (total or dissolved) is used as a dose surrogate, while the real dose defining toxic exposure may either be the sorbed or bioaccumulated amount per unit of biomass or be the bioavailable concentration in partitioning equilibrium with this internal dose or biomass burden.
Bioaccumulation and toxicity of lipophilic chemical in algae, crustaceans and fish

Lipophilic Organic Chemicals, LOC’s constitute an important group of concern pollutants. LOC’s may bioconcentrate and even bioaccumulate via food webs (mostly in terrestrial systems). The compounds may be toxic not only to directly exposed populations of organisms but also cause indirect poisoning of man and other predators at the top of the food chain. While well studied with respect to toxicity and accumulation in fish, surprisingly little information has hitherto been available for other types of organisms, and the sorptive behaviour in surface waters, where algae may constitute a significant particulate phase, is generally not known. Information on sorption is important, nevertheless, not only for assessing the exposure of aquatic organisms to bioavailable toxicants, but also for the purpose of assessing the general chemical fate of LOC’s. Sedimentation mediated by sinking algae is here an important transport process moving the LOC’s from the water column to the sediments which may act as an ultimate sink and concern compartment since with no or slow biodegradation under the prevailing anaerobic conditions, large LOC concentrations may build up in time. The project aimed at contributing to fill the knowledge gaps on ecotoxicity to other organisms than fish, and further to investigate in detail the mechanisms involved in sorption and toxicity to phytoplankton algae including looking at the basic dose concept.

According to current practice in aquatic ecotoxicology, concentration (total or dissolved) is used as a dose surrogate, while the real dose defining toxic exposure may either be the sorbed or bioaccumulated amount per unit of biomass or be the bioavailable concentration in partitioning equilibrium with this internal dose or biomass burden.
Impact of colloidal and particulate carrier substances on the transport of organic carbon in aquatic systems

Several studies with focus on redistribution processes of trace elements in natural waters, as a function of the general hydrochemistry, have illustrated the impact of colloidal carrier substances. These studies have also indicated the importance of organic matter on both adsorption and stability (size distribution and surface charge) of colloidal matter. However, limited attention has been paid to investigations of the interactions between colloidal material and organic matter in natural waters. The objectives of this project are:

- In field studies examine changes in the colloidal and organic matter in a slowly changing salt gradient over the year. Particular attention is given against interactions between the materials and the impact of organic carbon on the stability of colloidal matter.
- The mechanisms behind the distribution of organic carbon between dissolved, colloidal and particulate forms is studied in well-defined laboratory experiments by changing the hydrochemistry within the natural ranges discovered in the field study. The project is financed from the Swedish Natural Research Council and the grants are administrated by Department of Water and Environmental Studies, Linköping university, Sweden.

Department of Environmental Science and Engineering

Department of Environmental Engineering

Linköping University

Period: 01/07/1994 → 31/12/1998
Number of participants: 2
Project participant:
Düker, Anders (Ekstern)

Project Manager, organisational:
Impact of colloidal and particulate carrier substances on the transport of organic carbon in aquatic systems

Several studies with focus on redistribution processes of trace elements in natural waters, as a function of the general hydrochemistry, have illustrated the impact of colloidal carrier substances. These studies have also indicated the importance of organic matter on both adsorption and stability (size distribution and surface charge) of colloidal matter. However, limited attention has been paid to investigations of the interactions between colloidal material and organic matter in natural waters. The objectives of this project are: - In field studies examine changes in the colloidal and organic matter in a slowly changing salt gradient over the year. Particular attention is given against interactions between the materials and the impact of organic carbon on the stability of colloidal matter. - The mechanisms behind the distribution of organic carbon between dissolved, colloidal and particulate forms is studied in well-defined laboratory experiments by changing the hydrochemistry within the natural ranges discovered in the field study. The project is financed from the Swedish Natural Research Council and the grants are administrated by Department of Water and Environmental Studies, Linköping University, Sweden.

Department of Environmental Engineering

Linköping University

Period: 01/07/1994 → 31/12/1998

Number of participants: 1

Acronym: 44

Project Manager, organisational:

Ledin, Anna (Intern)

Activities:

Uvildige Ekspertpanel Deponering af radioaktivt affald i DK (External organisation)

Period: 2017 → …

Steffen Foss Hansen (Chairman)

Department of Environmental Engineering

Environmental Chemistry

Description

Member of the independent expert panel on deposit of radioactive waste in Denmark

Degree of recognition: National

Links:

http://ufm.dk/aktuelt/temaer/deponering-af-radioaktivt-affald-i-dk/det-uvildige-ekspertpanel-1/det-uvildige-ekspertpanel#cookieoptin

Related external organisation

Uvildige Ekspertpanel Deponering af radioaktivt affald i DK

Uddannelses- og Forskningsministeriet, Børgade 4, 2135, København K, Denmark

Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

The value of DCIP geophysical surveys for contaminated site investigations

Period: 13 Dec 2017

Nicola Balbarini (Guest lecturer)

Vinni Kampman Rønde (Guest lecturer)

Pradip Kumar Maurya (Guest lecturer)

Ingelise Møller (Guest lecturer)

Ursula S. McKnight (Guest lecturer)
Attenuation of a discharging chlorinated ethene (CE) plume: use of streambed point velocity probes (SBPVP), streambed passive flux meters (SBPFM) and contaminant mass discharge (CMD)

Period: 11 Dec 2017

Vinni Kampman Rønde (Guest lecturer)
Ursula S. McKnight (Guest lecturer)
Michael Annable (Guest lecturer)
J.F. Devlin (Guest lecturer)
Mackenzie Cremeans (Guest lecturer)
Anne Thobo Sonne (Guest lecturer)
Poul Løgstrup Bjerg (Guest lecturer)

Department of Environmental Engineering
Water Resources Engineering

Description
Chlorinated ethenes (CE) are abundant groundwater contaminants and pose risk to both groundwater and surface water bodies, as plumes can migrate through aquifers to streams. After release to the environment, CE may undergo attenuation. The hyporheic zone is believed to enhance CE attenuation, however studies contradicting this have also been reported. Since dilution commonly reduces contaminant concentrations in streams to below quantification limits, use of mass balances along the pathway from groundwater to stream is unusual.

Our study is conducted at the low-land Grindsted stream, Denmark, which is impacted by a contaminant plume. CE have been observed in the stream water; hence our study site provides an unusual opportunity to study attenuation processes in a CE plume as it migrates through the groundwater at the stream bank, through the stream bed and further to the point of fully mixed conditions in the stream.

The study undertook the determination of redox conditions and CE distribution from bank to stream; streambed contaminant flux estimation using streambed Passive Flux Meters (SBPFM); and quantification of streambed water fluxes using streambed Point Velocity Probes (SBPVP). The advantage of the sPFM is that it directly measures the contaminant flux without the need for water samples, while the advantage of the SBPVP is its ability to measure the vertical seepage velocity without the need for additional geological parameters. Finally, a mass balance assessment along the plume pathway was conducted to account for any losses or accumulations.

The results show consistencies between contaminant mass discharge estimates at the bank, through the streambed and in the stream channel. Furthermore, parent-metabolite compound ratios indicate limited degradation between the bank and the point of fully mixed stream water, leaving the dominant attenuation process to be mixing in the stream channel. Since the plume at the bank mainly consists of cis-DCE and vinyl chloride, this implies high and persistent stream water concentrations of these compounds. Finally, this study demonstrates the usefulness and complementary nature of SBPFM and SBPVP measurements for assessing the attenuation processes through mass balance calculations.

Degree of recognition: International
Documents:
2017-11-30 AGU_poster_vinni
New Orleans, United States
Activity: Talks and presentations › Conference presentations

**DTU Sustain 2017**
Period: 6 Dec 2017
Steffen Foss Hansen (Organizer)
Kristian Mølhave (Organizer)
Department of Environmental Engineering
Environmental Chemistry
Department of Micro- and Nanotechnology
Molecular Windows

**Description**
Steering group member of DTU Sustain 2017
Degree of recognition: National

**Links:**
http://www.sustain.dtu.dk (Conference website)

**Related event**

**DTU Sustain 2017**
06/12/2017 → 06/12/2017
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

**DTU Sustain 2017**
Period: 6 Dec 2017
Stig Irving Olsen (Organizer)
Katrine Nielsen (Organizer)
Berit Godskesen (Organizer)
Viggo Aaberg Kærn (Organizer)
Department of Environmental Engineering
Urban Water Systems
Office for Innovation & Sector Services
Department of Management Engineering
Quantitative Sustainability Assessment
Degree of recognition: International

**Related event**

**DTU Sustain 2017**
06/12/2017 → 06/12/2017
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference
Office for Innovation & Sector Services
Department of Management Engineering
Quantitative Sustainability Assessment
Degree of recognition: International

Related event
DTU Sustain 2017
06/12/2017 → 06/12/2017
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

DTU Sustain 2017
Period: 6 Dec 2017
Marlene Mark Jensen (Organizer)
Department of Environmental Engineering
Water Technologies
Degree of recognition: National

Related event
DTU Sustain 2017
06/12/2017 → 06/12/2017
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The WISE project
Period: 6 Dec 2017
Katrine Nielsen (Speaker)
Department of Environmental Engineering
Urban Water Systems
Degree of recognition: International

Related event
DTU Sustain 2017
06/12/2017 → 06/12/2017
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Period: 30 Nov 2017 → 3 Dec 2017
Liguan Li (Participant)
Department of Environmental Engineering
Water Technologies
Degree of recognition: International

Related event
30/11/2017 → 03/12/2017
Shenzhen, China
Activity: Attending an event › Participating in or organising a conference

Tracking and understanding AMR dynamics across European urban water systems
Period: 30 Nov 2017 → 3 Dec 2017
Related event

30/11/2017 → 03/12/2017
Shenzhen, China
Activity: Talks and presentations › Conference presentations

Partiklers indflydelse på vandkvaliteten
Period: 16 Nov 2017
Katrine Nielsen (Invited speaker)
Department of Environmental Engineering
Urban Water Systems
Degree of recognition: National

Related event

Vand i Byer stormøde November 2017: Vandkvalitet
16/11/2017 → 16/11/2017
Taastrup, Denmark
Activity: Talks and presentations › Conference presentations

Vand i Byer stormøde November 2017
Period: 16 Nov 2017
Katrine Nielsen (Organizer)
Peter Steen Mikkelsen (Organizer)
Department of Environmental Engineering
Urban Water Systems
Degree of recognition: National

Related event

Vand i Byer stormøde November 2017: Vandkvalitet
16/11/2017 → 16/11/2017
Taastrup, Denmark
Activity: Attending an event › Participating in or organising a conference

Controls of N2O production pathways in nitritation-anammox biomass
Period: 13 Nov 2017
Marlene Mark Jensen (Invited speaker)
Department of Environmental Engineering
Water Technologies
DNA and RNA SIP reveal ammonium and nitrite oxidizers in groundwater fed biofilters

Period: 13 Nov 2017 → 15 Nov 2017

Arda Gülay (Speaker)
Barth F. Smets (Other)
Jane Fowler (Other)
Hans-Jørgen Albrechtsen (Other)
Karolina Tatari (Other)

Department of Environmental Engineering
Water Technologies

DNA and RNA SIP reveal nitrifiers in groundwater fed biofilters

Period: 13 Nov 2017

Arda Gülay (Other)
Jane Fowler (Other)
Barth F. Smets (Other)
Hans-Jørgen Albrechtsen (Other)

Department of Environmental Engineering
Water Technologies

Permissiveness of Microbial Community from Wastewater Treatment Plant towards IncP-1 Plasmid

Period: 13 Nov 2017

Liguan Li (Other)
Arnaud Dechesne (Other)
Barth F. Smets (Other)
Jonas Stenløkke Madsen (Other)
Søren J. Sørensen (Other)

Department of Environmental Engineering
Water Technologies
Integrated characterization of perchloroethene plume natural attenuation after thermal source zone remediation - molecular biology tools and dual isotope analysis

Period: 7 Nov 2017

Alexandra Marie Murray (Speaker)
Lærke Brabæk (Other)
Inge Lise Kristensen (Other)
Julien Maillard (Other)
Anders Johansen (Other)
Daniel Hunkeler (Other)
Mette Broholm (Other)

Department of Environmental Engineering
Water Resources Engineering

Organohalide-respiring bacteria community competition dynamics: Experiments and model-based interpretations

Period: 7 Nov 2017

Alexandra Marie Murray (Speaker)
Massimo Rolle (Other)
Biao Jin (Other)
Julien Maillard (Other)
Mette Broholm (Other)
Christof Holliger (Other)

Department of Environmental Engineering
Water Resources Engineering

Modelling Illicit Drug Fate in Sewers for Wastewater-Based Epidemiology

Period: 26 Oct 2017 → 27 Oct 2017
Related organisation

**Modelling Illicit Drug Fate in Sewers for Wastewater-Based Epidemiology**
Ramin, P. (Speaker), Mikkelsen, P. S. (Guest lecturer), Plósz, B. G. (Guest lecturer)
26 Oct 2017 → 27 Oct 2017
Activity: Talks and presentations › Conference presentations

**Advances in Remote Sensing for Water Monitoring**
Period: 23 Oct 2017
Peter Bauer-Gottwein (Guest lecturer)
Department of Environmental Engineering
Water Resources Engineering

*Description*
Invited lecture at G-STIC, https://www.gstic.org/
Documents:
GSTIC_pbau

**Related event**

**G-STIC**
23/10/2017 → …
Activity: Talks and presentations › Conference presentations

**Ozonation of recirculating aquaculture system based on system’s demand**
Aikaterini Spiliotopoulou (Speaker)
Richard Martin (Other)
Lars-Flemming Pedersen (Other)
Henrik Rasmus Andersen (Other)
Department of Environmental Engineering
National Institute of Aquatic Resources
Section for Aquaculture
Water Technologies

**Related event**

**Aquaculture Europe 2017**
17/10/2017 → 20/10/2017
Dubrovnik, Croatia
Activity: Talks and presentations › Conference presentations

**4'th Nordic RAS workshop and field trip**
Period: 12 Oct 2017 → 14 Oct 2017
Erik Arvin (Participant)
Department of Environmental Engineering
Degree of recognition: International

Related event

4'th Nordic RAS workshop and field trip
12/10/2017 → 14/10/2017
Aalborg
Activity: Attending an event › Participating in or organising a conference

Sustainability assessment of stormwater management systems and the importance of pollutants in runoff
Period: 11 Oct 2017
Sarah Brudler (Guest lecturer)
Karsten Ambjerg-Nielsen (Other)
Christian Ammitsøe (Other)
Michael Zwicky Hauschild (Guest lecturer)
Martin Rygaard (Guest lecturer)
Department of Environmental Engineering
Urban Water Systems
Degree of recognition: International

Related event

NORDIWA Nordic Wastewater Conference 2017
10/10/2017 → 12/10/2017
Aarhus, Denmark
Activity: Talks and presentations › Conference presentations

Conceptualization of contamination using depth-discrete monitoring of dynamic PCE concentration changes during pumping
Period: 3 Oct 2017
Mette Martina Broholm (Speaker)
Annika Sidelmann Fjordbøge (Other)
Klaus Mosthaf (Speaker)
Bentje Brauns (Other)
Philip John Binning (Other)
Poul Legstrup Bjerg (Other)
Department of Environmental Engineering
Forced-gradient tracer tests in a fractured limestone aquifer designed and interpreted by modeling

Period: 2 Oct 2017

Klaus Mosthaf (Speaker)
Bentje Brauns (Other)
Mette Martina Broholm (Other)
Annika Sidelmann Fjordbøge (Other)
Poul Legstrup Bjerg (Other)
Magnus Rohde (Other)
Henriette Kern-Jespersen (Other)
Philip John Binning (Other)

Department of Environmental Engineering
Water Resources Engineering

Description

The importance of fracture flow and transport in a fractured limestone was investigated with a hydraulic pumping test combined with 6 tracer tests. The pumping test was conducted in a PCE-contaminated fractured limestone aquifer over several weeks, with head observations being collected at a set of observation wells at several depth intervals in the aquifer. The pumping test was combined with six tracer tests. Fluorescent and ionic tracers were used for injections through the screens of the observation wells and monitored at the pumping well. Before the pumping test, the geology was carefully mapped using borehole cores, flow logs, geophysics etc. 3D modeling guided with the test design and helped with the interpretation of the of the pumping and tracer test results.

The pumping test and the geologic investigations showed that the limestone aquifer was highly permeable, with fracture flow dominating the hydraulic response. Most tracer tests resulted in a very fast tracer arrival, indicating a very good connectivity between wells at a similar depth as the pumping well. Strong diffusive interaction between fractures and matrix was revealed by significant tailing in the tracer breakthrough curves. In one tracer test, tracers were injected before starting to pump to allow the tracers to diffuse more into the matrix. This resulted in lower breakthrough concentrations and longer tailing, representing mainly the back-diffusion from the matrix. Deeper wells and crushed upper layers have less connectivity to the pumping well and show slower tracer breakthroughs.

The breakthrough curves from the tracer tests were used to test different model concepts. A discrete-fracture model could be fitted best to the observed breakthrough curves. It demonstrated the importance of including fracture flow and transport in the modeling of fractured limestone sites. The calibrated model was used to analyze the spreading behavior of the contaminant plume.

Degree of recognition: International

Related event

2017 NGWA Conference on Fractured Rock and Groundwater
02/10/2017 → 03/10/2017
Burlington, United States
Activity: Talks and presentations › Conference presentations

DRIP Annual seminar 2017
Period: 28 Sep 2017 → 29 Sep 2017
Berit Godskesen (Guest lecturer)
Hans-Jørgen Albrechtsen (Guest lecturer)

Department of Environmental Engineering
Urban Water Systems

Description
Annual seminar in the DRIP project (Danish Partnership for Resource and Water efficient industrial food production)
Degree of recognition: National

Related organisation

DRIP Annual seminar 2017
Godskesen, B. (Guest lecturer), Albrechtsen, H. (Guest lecturer)
28 Sep 2017 → 29 Sep 2017
Activity: Talks and presentations › Conference presentations

Innovation workshop on lake restoration for project Vand i Mølleåen.
Period: 21 Sep 2017
Erik Arvin (Panel member)
Department of Environmental Engineering
Degree of recognition: National

Related event

Innovation workshop on lake restoration for project Vand i Mølleåen.
21/09/2017 → 21/09/2017
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

A local freshwater impact – proposing the groundwater indicator AGWaRe
Period: 12 Sep 2017
Ryle Nørskov Gejl (Guest lecturer)
Martin Rygaard (Guest lecturer)
Poul Løgstrup Bjerg (Guest lecturer)
Jens Rasmussen (Guest lecturer)
Department of Environmental Engineering
Urban Water Systems
Water Resources Engineering

Related event

4th Water Research Conference: The Role of Water Technology Innovation in the Blue Economy
10/09/2017 → 13/09/2017
Waterloo, Ontario, Canada
Activity: Talks and presentations › Conference presentations

Nye - Assessing the environmental and economic sustainability
Period: 12 Sep 2017
Maria Faragò (Speaker)
Sarah Brudler (Other)
Martin Rygaard (Other)
Department of Environmental Engineering
Urban Water Systems

Related event

ATV Jord og Grundvand møde: Vand på tværs - alternativ vandhåndtering og helhedstænkning
12/09/2017 → 12/09/2017
Aarhus, Denmark
Activity: Talks and presentations › Conference presentations
Particle-enhanced transportation of metal and PAH pollution reduces stormwater treatment efficiency based on settling and filtration
Period: 10 Sep 2017 → 15 Sep 2017
Katrine Nielsen (Speaker)
Department of Environmental Engineering
Urban Water Systems
Degree of recognition: International

The microbiome of potable water producing biofilters: taxonomic insights and anomalies, metabolic potentials, biotechnological opportunities?
Period: 7 Sep 2017 → 8 Sep 2017
Barth F. Smets (Keynote speaker)
Department of Environmental Engineering
Water Technologies
Degree of recognition: International

International workshop on marine geomicrobiology - A matter of energy
Period: 28 Aug 2017 → 1 Sep 2017
Marlene Mark Jensen (Participant)
Department of Environmental Engineering
Water Technologies
Degree of recognition: International

International workshop on marine geomicrobiology - A matter of energy
Period: 28 Aug 2017 → 1 Sep 2017
Sønderborg, Denmark
Sustainable solutions for risky problems in urban water management
Period: 22 Aug 2017
Hjalte Jomo Danielsen Sørup (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related organisation
Sustainable solutions for risky problems in urban water management
Sørup, H. J. D. (Speaker)
22 Aug 2017
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

University of California Berkeley, Department of Civil and Environmental Engineering
Period: 15 Aug 2017 → 28 Feb 2018
Martin Rygaard (Visiting researcher)
Department of Environmental Engineering
Urban Water Systems

Description
Sabbatical
Degree of recognition: International
Activity: Visiting an external institution › Visiting another research institution

Plasmid Host Range (Permissiveness) in Microbial Communities across Urban Water Systems
Period: 13 Aug 2017 → 17 Aug 2017
Barth F. Smets (Invited speaker)
Arnaud Dechesne (Other)
Liguan Li (Other)
Søren Johannes Sørensen (Other)
Jonas S. Madsen (Other)
Department of Environmental Engineering
Water Technologies
Degree of recognition: International
Documents:
EDAR2017_BFSM

Related event
4th International Symposium on the Environmental Dimension of Antibiotic Resistance
13/08/2017 → 17/08/2017
Lansing, MI, United States
Activity: Talks and presentations › Conference presentations

ICoN5: 5th International Conference on Nitrification
Period: 23 Jul 2017 → 27 Jul 2017
Carlos Domingo-Felez (Participant)
Department of Environmental Engineering
Water Technologies

Related event
ICoN5: 5th International Conference on Nitrification
23/07/2017 → 27/07/2017
Vienna, Austria
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

N2O dynamics of N-transforming microbial communities: from mechanistic insights to full-scale process control
Period: 23 Jul 2017 → 27 Jul 2017
Barth F. Smets (Invited speaker)
Department of Environmental Engineering
Water Technologies
Degree of recognition: International
Links:
https://icon5.univie.ac.at/welcome/

Related event
ICoN5: 5th International Conference on Nitrification
23/07/2017 → 27/07/2017
Vienna, Austria
Activity: Talks and presentations › Conference presentations

Diversity, structure, and novel physiologies in microbial communities in rapid sand filters
Period: 9 Jul 2017 → 13 Jul 2017
Barth F. Smets (Invited speaker)
Arda Gülay (Other)
Alejandro Palomo (Other)
Jane Fowler (Other)
Thomas Sicheritz-Pontén (Other)
Department of Environmental Engineering
Water Technologies
Department of Bio and Health Informatics
Metagenomics
Degree of recognition: International
Documents:
fems 2

Related event
The Federation of European Microbiological Societies
09/07/2017 → 13/07/2017
Valencia, Spain
Activity: Talks and presentations › Conference presentations

A local freshwater impact – proposing a groundwater indicator AGWaRe
Period: 27 Jun 2017
Ryle Nørskov Gejl (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related event
ISIE 2017: Science for Sustainable and Resilient Communities
25/06/2017 → 29/06/2017
Chicago, United States
Activity: Talks and presentations › Conference presentations

Essential Societal Service Functions and Planetary Boundaries: The Case of Sustainable Urban Water Management
Period: 26 Jun 2017
The industrial dynamics of water innovation: A comparison of China and Europe
Period: 26 Jun 2017
Mariú Abritta Moro (Speaker)
Department of Environmental Engineering
Water Technologies
Department of Management Engineering
Technology and Innovation Management
Degree of recognition: International

Related event
International Conference on Innovation Studies
26/06/2017 → 27/06/2017
Beijing, China
Activity: Talks and presentations › Conference presentations

Adsorption of microplastics to the edible Fucus vesiculosus and possible wash off before food application
Period: 22 Jun 2017
Nanna B. Hartmann (Speaker)
Clara G. Villaro (Speaker)
Ida D.W. Koch (Speaker)
Kasper B. Sundbæk (Speaker)
Niclas S. Rasmussen (Speaker)
Susan Løvstad Holdt (Speaker)
National Food Institute
Research Group for Bioactives – Analysis and Application
Department of Environmental Engineering
Environmental Chemistry

Description
The growing demand for food accessibility, due to rapidly growing population of the world, has raised the interest of macroalgae as a food source also in the Western world. However, this combined with increased food awareness trigger a concern that accumulated microplastics in the oceans might pollute the seaweed and influence food safety and thereby applicability. One of the most common types of seaweed in Denmark is bladder wrack, Fucus vesiculosus (FC), and this specimen is also popular for the use in e.g. pesto and flour in Denmark. This study investigated if fluorescent polystyrene (PS) microplastic particles (diameter: 20 μm) adsorb to the macroalga FC and if they can be washed off afterwards with filtered seawater.

Degree of recognition: International
Documents:
ISAP_2017_abstract_Hartmann et al-Microplastic on Fucus

Related external organisation
University of Nantes
New applications for fluorescence spectroscopy for monitoring drinking water disinfection and distribution
Period: 17 Jun 2017
Erik Arvin (External examiner)
Department of Environmental Engineering

Description
Discussion leader for Licentiate defense
Degree of recognition: International
Activity: Examinations and supervision › External examination

A Stochastic Method to Manage Delay and Missing Values for In-Situ Sensors in an Alternating Activated Sludge Process
Period: 13 Jun 2017
Peter Alexander Stentoft (Speaker)
Jan Kloppenborg Møller (Other)
Henrik Madsen (Other)
Peter Steen Mikkelsen (Other)
Thomas Munk-Nielsen (Other)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Department of Environmental Engineering
Urban Water Systems

Description
Oral Presentation
Degree of recognition: International

Related event
12th IWA Specialized Conference on Instrumentation, Control and Automation
11/06/2017 → 14/06/2017
Quebec, Canada
Activity: Talks and presentations › Conference presentations

A Critical and in-depth analysis of the environmental aspect of the OECD SP dossiers
Period: 1 Jun 2017
Steffen Foss Hansen (Speaker)
Anders Baun (Other)
Rune Hjorth (Other)
Lars Michael Skjolding (Other)
Department of Environmental Engineering
Environmental Chemistry

Description
Degree of recognition: International

Related external organisation
National Research Center for Working Environment
Denmark
Activity: Talks and presentations › Conference presentations
WISE project - Experiences & Funding Bazar
Period: 24 May 2017
Katrine Nielsen (Organizer)
Birgitte Neergaard (Organizer)
Berit Godskesen (Organizer)
Viggo Aaberg Kærn (Organizer)
Lærke Philipsen (Organizer)
Peter Steen Mikkelsen (Organizer)
Camilla Bitsch (Organizer)
Department of Environmental Engineering
Urban Water Systems
Office for Innovation & Sector Services

Related event
WISE project - Experiences & Funding Bazar
24/05/2017 → 24/05/2017
Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

WISE-project - Societal needs to be solved & Professional mingling
Period: 24 May 2017
Katrine Nielsen (Organizer)
Berit Godskesen (Organizer)
Lærke Philipsen (Organizer)
Birgitte Neergaard (Organizer)
Viggo Aaberg Kærn (Organizer)
Peter Steen Mikkelsen (Organizer)
Camilla Bitsch (Organizer)
Department of Environmental Engineering
Urban Water Systems
Office for Innovation & Sector Services
Degree of recognition: National

Related event
WISE-project - Societal needs to be solved & Professional mingling
24/05/2017 → 24/05/2017
Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

3th Water DTU Partner Seminar
Period: 23 May 2017 → 24 May 2017
Peter Steen Mikkelsen (Organizer)
Katrine Nielsen (Organizer)
Berit Godskesen (Organizer)
Birgitte Neergaard (Organizer)
Camilla Bitsch (Organizer)
Viggo Aaberg Kærn (Organizer)
Lærke Philipsen (Organizer)
Department of Environmental Engineering
Urban Water Systems
Office for Innovation & Sector Services
Related event

3th Water DTU Partner Seminar
23/05/2017 → 24/05/2017
Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

Frontiers International Conference on Wastewater Treatment (FICWTM2017)
Period: 21 May 2017 → 24 May 2017
Carlos Domingo-Felez (Participant)
Department of Environmental Engineering
Water Technologies

Related event

Frontiers International Conference on Wastewater Treatment (FICWTM2017): FICWTM 2017
21/05/2017 → 24/05/2017
Palermo, Italy
Activity: Attending an event › Participating in or organising a conference

Low nitrous oxide production in intermittent-feed high performance nitritating reactors
Period: 21 May 2017 → 24 May 2017
Qingxian Su (Keynote speaker)
Department of Environmental Engineering
Water Technologies

Description
Flash presentation
Degree of recognition: International

Related event

Frontiers International Conference on Wastewater Treatment (FICWTM2017): FICWTM 2017
21/05/2017 → 24/05/2017
Palermo, Italy
Activity: Talks and presentations › Conference presentations

Oversvømmelsessimuering vs. detaljegrad i 1D modeller
Period: 11 May 2017
Roland Löwe (Speaker)
Department of Environmental Engineering
Urban Water Systems

Description
Invited speech on EVA temadag
Degree of recognition: National

Related event

Er modellerne for tynde: EVA temadag
11/05/2017 → 11/05/2017
Nyborg, Denmark
Activity: Talks and presentations › Conference presentations

water in urban area
Period: 11 May 2017
Berit Godskesen (Organizer)
Karsten Arnbjerg-Nielsen (Organizer)
Department of Environmental Engineering
Urban Water Systems

**Description**
Water in urban areas, meeting (stormøde), May 11th, Odense, Denmark - Bæredygtighed, Vand og Klimatilpasning
Degree of recognition: National
Links:

**Related event**

**water in urban area: Sustainability, Water and Climate adaptation**
11/05/2017 → 11/05/2017
Odense, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Applying LCA in decision making-the need and the future perspective**
Period: 10 May 2017
Yan Dong (Speaker)
Simona Miraglia (Other)
Stefano Manzo (Other)
Stylianos Georgiadis (Other)
Hjalte Jomo Danielsen Sørup (Other)
Elena Boriani (Other)
Tine Hald (Other)
Sebastian Thøns (Other)
Michael Zwicky Hauschild (Other)
Department of Management Engineering
Quantitative Sustainability Assessment
Centre for oil and gas – DTU
Transport DTU
Transport Modelling
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Department of Environmental Engineering
Urban Water Systems
National Food Institute
Research Group for Genomic Epidemiology
Department of Civil Engineering
Section for Structural Engineering
Documents:
AbstrApplying LCA in policy deciison making_Final
Links:
https://brussels.setac.org/welcome/

**Related event**

**SETAC Europe: 27th Annual Meeting – Environmental Quality Through Transdisciplinary Collaboration**
07/05/2017 → 13/07/2017
Brussels, Belgium
Activity: Talks and presentations › Conference presentations
Intermittent aeration regimes are effective tools to manage size of bio-granules and microbial communities in PN/A SBRs.

Period: 10 May 2017
Jan-Michael Blum (Speaker)
Department of Environmental Engineering
Water Technologies

Description
The presentation was given at the 10th International Conference on Biofilm Reactors at University College Dublin, Ireland.
Degree of recognition: International

Related event
10th International Conference on Biofilm Reactors
09/05/2017 → 12/05/2017
Dublin, Ireland
Activity: Talks and presentations › Conference presentations

Balancing complexity and uncertainty in model-based estimation of micropollutant fluxes in integrated urban drainage-wastewater systems
Period: 9 May 2017
Luca Vezzaro (Invited speaker)
Department of Environmental Engineering
Urban Water Systems

Description
Presentation held at the SETAC 2017 conference (special session on "Looking across organizational boundaries: exchanging ideas on mechanistic modelling between SETAC and the International Water Association (IWA)")
Degree of recognition: International
Documents:
20170509_MPmodelComplexity_SETAC_LUVE

Related event
SETAC Europe: 27th Annual Meeting – Environmental Quality Through Transdisciplinary Collaboration
07/05/2017 → 13/07/2017
Brussels, Belgium
Activity: Talks and presentations › Conference presentations

Developments in Integrated Urban Drainage
Period: 9 May 2017
Luca Vezzaro (Invited speaker)
Lorenzo Benedetti (Other)
Wolfgang Rauch (Other)
Peter M. Bach (Other)
Department of Environmental Engineering
Urban Water Systems

Description
Presentation held at the SETAC 2017 conference (special session on "Looking across organizational boundaries: exchanging ideas on mechanistic modelling between SETAC and the International Water Association (IWA)")
Degree of recognition: International
Documents:
20170509_integratedModels_SETAC_LUVE

Related event
SETAC Europe: 27th Annual Meeting – Environmental Quality Through Transdisciplinary Collaboration
Differential adhesion and the spatial positioning effect on early stage microbial aggregation  
Period: 9 May 2017 → 12 May 2017  
Bastiaan Cockx (Other)  
Jan-Ulrich Kreft (Other)  
Barth F. Smets (Other)  
Department of Environmental Engineering  
Water Technologies  
Degree of recognition: International  

Related event  
10th International Conference on Biofilm Reactors  
09/05/2017 → 12/05/2017  
Dublin, Ireland  
Activity: Talks and presentations › Conference presentations  

Feasibility-test of a complete autotrophic nitrogen removal process treating the effluent of an industrial anaerobic digester  
Period: 9 May 2017 → 12 May 2017  
Hannah Feldman (Other)  
Xavier Flores Alsina (Other)  
Kasper Kjellberg (Other)  
Jan-Michael Blum (Other)  
Borja Valverde Pérez (Other)  
Gürkan Sin (Other)  
Barth F. Smets (Other)  
Krist V. Gernaey (Other)  
Department of Chemical and Biochemical Engineering  
PROSYS - Process and Systems Engineering Centre  
Department of Environmental Engineering  
Degree of recognition: International  

Related event  
10th International Conference on Biofilm Reactors  
09/05/2017 → 12/05/2017  
Dublin, Ireland  
Activity: Talks and presentations › Conference presentations  

Biodegradation of hydrophobic chemicals in mixtures at low concentrations - Covering the chemical space of petroleum hydrocarbons  
Period: 8 May 2017  
Heidi Birch (Speaker)  
Department of Environmental Engineering  
Environmental Chemistry  
Degree of recognition: International  

Related event  
SETAC Europe: 27th Annual Meeting – Environmental Quality Through Transdisciplinary Collaboration  
07/05/2017 → 13/07/2017  
Brussels, Belgium  
Activity: Talks and presentations › Conference presentations
Applying LCA in decision making - the need and the future perspective

Period: 7 May 2017 → 11 May 2017

Yan Dong (Guest lecturer)
Simona Miraglia (Guest lecturer)
Stefano Manzo (Guest lecturer)
Stylianos Georgiadis (Guest lecturer)
Hjalte Jomo Danielsen Sarup (Guest lecturer)
Elena Boriani (Guest lecturer)
Tine Hald (Guest lecturer)
Sebastian Thöns (Guest lecturer)
Michael Zwicky Hauschild (Guest lecturer)

Department of Management Engineering
Quantitative Sustainability Assessment
Department of Civil Engineering
Transport DTU
Transport Modelling
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Department of Environmental Engineering
Urban Water Systems
National Food Institute
Research Group for Genomic Epidemiology
Section for Structural Engineering

Description
There is nowadays a need of including sustainable considerations in the policy and decision making. Sound decision making requires evidence-based support, i.e. decision analysis to help decision makers in identifying the best alternative based on the associated impacts. Decision analysis includes four steps: 1) structure decision problem; 2) assess possible impacts associated with alternatives; 3) determine stakeholder preferences and 4) evaluate alternatives. Decision analysis can be performed applying different tools, such as cost-benefit analysis (CBA), risk assessment, and life cycle assessment (LCA).

LCA is a decision analysis tool that focuses on environmental impacts. One limit is that LCA is based on defined impact categories and therefore does not provide information for those impacts and consequences out of the LCA scope. However, the LCA framework closely follows the decision analysis scheme and has the potential to be integrated with other decision analysis tools to enhance their assessment of environmental impacts.

To understand why LCA is needed in the policy decision context, we looked into the decision support for policy in several disciplines. Taking sustainable transport policy as an example, the traditional decision analysis tool for choosing the best alternative is CBA. CBA mainly analyses socio-economic impacts, such as travel time savings and costs, while only some environmental impacts are considered; i.e. the damage costs of greenhouse gas emissions, particulate matters, SOx, NOx and noise. Therefore, current transport policy making rarely reflect a full environmental profile of the suggested alternatives. Making decisions based on incomplete information may lead to sub-optimal solutions, especially where the environment is a major concern. There is a growing attention of conducting LCA in transport. Some identified environmental hotspots, such as consumer and household behavior, which may be the focus for future policies. Others assess the environmental impacts associated with building infrastructures and vehicle use. These studies verify that LCA can successfully quantify the environmental profile of alternatives in transport policy, if the relevant physical changes, e.g. vehicle travel distance and new infrastructures, are well-defined. However, before integrating LCA with other decision analysis methods for decision support, the study system, objectives, scopes, evaluation metrics and uncertainty handling need to be aligned.

Degree of recognition: International

Links:
https://brussels.setac.org/

Related event
**2017 GEMS Spring Meeting**  
Period: 2 May 2017  
Steffen Foss Hansen (Participant)  
Department of Environmental Engineering  
Environmental Chemistry  
Degree of recognition: International  
Documents:  
Nanomaterial consumer products in a consolidated database wb comments

**Related event**

**2017 GEMS Spring Meeting: Nanomaterials and Consumer Product Safety**  
02/05/2017 → 02/05/2017  
Durham, United States  
Activity: Attending an event › Participating in or organising a conference

**7th International Conference**  
Period: 2 May 2017 → 5 May 2017  
Kamilla Marie Speht Kaarsholm (Participant)  
Henrik Rasmus Andersen (Chairman)  
Traek Manasfi (Participant)  
Jean-Luc Boudenne (Participant)  
Department of Environmental Engineering  
Water Technologies  
**Description**  
Effect of UV treatment on DBPs formation in chlorinated seawater swimming pools- a laboratory study  
The study aim was to investigate the effect of UV treatment followed by chlorination on DBP formation was studied using laboratory experiments. Three groups of DBPs were investigated including THMs, HANs and HAAs. DBP level measured after post-UV chlorination was compared to dark control sample which was not subjected to UV exposure. Bromine substitution was investigated to analyse its effects on the formation of DBPs. Finally, overall cytotoxicity and genotoxicity were estimated for the toxic potency of compounds before and after treatment.  
Degree of recognition: International  
Documents:  
UV for seawater pools

**Related event**

**7th International Conference : Swimming Pool and Spa**  
02/05/2017 → 05/05/2017  
Kos, Greece  
Activity: Attending an event › Participating in or organising a conference

**7th International Conference**  
Period: 2 May 2017 → 5 May 2017  
Kamilla Marie Speht Kaarsholm (Participant)  
Henrik Rasmus Andersen (Chairman)  
Department of Environmental Engineering  
Water Technologies  
**Description**  
Destruction of DBPs and their precursors in swimming pool water by combined UV-treatment and ozonation
The study aim was to investigate the effect of a combined treatment system on DBP formation. As both ozone and chlorine preferably react with electrophilic groups in compounds, we hypothesise that reactivity to chlorine, created by the UV treatment of dissolved organic matter in pool water, might also mean that there is increased reactivity to ozone and that ozonation might remove the chlorine reactivity created by UV treatment. Therefore, we first performed an experiment to range-find the effect of swimming pool water UV activation on chlorine reactivity. Secondly, an experiment was carried out to characterise the effect of adding various doses of ozone to pool water, with or without UV pre-treatment, before chlorination to study the effect on chlorine reactivity and the formation of chlorination by-products. Finally, the possible effect on chlorination by-product formation was investigated by a repeated, combined UV-ozone treatment interchanged with chlorination (repeated cycles of UV followed by ozone with subsequent chlorination). Toxicity estimation was used to evaluate water quality.

Degree of recognition: International
Documents:
combined UV and ozone treatment for swimming pool water

Related event

7th International Conference: Swimming Pool and Spa
02/05/2017 → 05/05/2017
Kos, Greece
Activity: Attending an event › Participating in or organising a conference

Effect of UV treatment on DBPs formation in chlorinated seawater swimming pools - a laboratory study
Period: 2 May 2017 → 5 May 2017
Waqas Akram Cheema (Speaker)
Department of Environmental Engineering
Water Technologies
Description
The study aim was to investigate the effect of UV treatment followed by chlorination on DBP formation was studied using laboratory experiments. Three groups of DBPs were investigated including THMs, HANs and HAAs. DBP level measured after post-UV chlorination was compared to dark control sample which was not subjected to UV exposure. Bromine substitution was investigated to analyse its effects on the formation of DBPs. Finally, overall cytotoxicity and genotoxicity were estimated for the toxic potency of compounds before and after treatment.

Degree of recognition: International
Documents:
combined UV and ozone treatment for swimming pool water

Related event

7th International Conference: Swimming Pool and Spa
02/05/2017 → 05/05/2017
Kos, Greece
Activity: Talks and presentations › Conference presentations
Degree of recognition: International

Related event

7th International Conference : Swimming Pool and Spa
02/05/2017 → 05/05/2017
Kos, Greece
Activity: Talks and presentations › Conference presentations

EGU General Assembly 2017
Period: 27 Apr 2017
Teis Nørgaard Mikkelsen (Speaker)
Department of Environmental Engineering
Atmospheric Environment

Description
N2O emission from plant surfaces – light stimulated and a global phenomenon PICO Presentation. Teis N. Mikkelsen, Dan Bruhn, Kim Pilegaard & Per Ambus
Degree of recognition: International
Documents:
PICO presentation EGU 2017

Related event

EGU General Assembly 2017: European GEosciences Union 2017
24/04/2017 → 28/04/2017
Vienna, Austria
Activity: Talks and presentations › Conference presentations

Seminar on climate adaptation for politicians and water company board members
Period: 27 Apr 2017
Erik Arvin (Participant)
Department of Environmental Engineering
Degree of recognition: Local

Related event

Seminar on climate adaptation for politicians and water company board members
27/04/2017 → 27/04/2017
Roskilde, Denmark
Activity: Attending an event › Participating in or organising a conference

Forskning og projekter inden for klimatilpasning
Period: 26 Apr 2017
Hjalte Jomo Danielsen Sørup (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related external organisation

The Danish Society of Engineers, IDA
Kalvebod Brygge 31-33, DK-1780, Copenhagen V, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Klimatilpasning af vandinfrastruktur
Period: 5 Apr 2017
Hjalte Jomo Danielsen Sørup (Speaker)
Department of Environmental Engineering

Urban Water Systems

Related organisation

Klimatilpasning af vandinfrastruktur
Sørup, H. J. D. (Speaker)
5 Apr 2017
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Nanoworld Conference
Period: 4 Apr 2017
Steffen Foss Hansen (Chairman)
Department of Environmental Engineering
Environmental Chemistry

Related event

Nanoworld Conference
03/04/2017 → 05/04/2017
Newton, United States
Activity: Attending an event › Participating in or organising a conference

Nanoworld Conference
Period: 4 Apr 2017
Steffen Foss Hansen (Speaker)
Department of Environmental Engineering
Environmental Chemistry
Links:

Related event

Nanoworld Conference
03/04/2017 → 05/04/2017
Newton, United States
Activity: Talks and presentations › Conference presentations

Member of Panel on Work Environment at DTU Environment (External organisation)
Period: 1 Apr 2017
Steffen Foss Hansen (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
Member of Panel on Work Environment at DTU Environment
Degree of recognition: Local

Related external organisation

Member of Panel on Work Environment at DTU Environment
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Konstruktion og test af kunstige regnserier
Period: 29 Mar 2017
Hjalte Jomo Danielsen Sørup (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related external organisation

The Danish Society of Engineers, IDA
Kalvebod Brygge 31-33, DK-1780, Copenhagen V, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Release and control of chemicals from plastic pipes in water supply
Period: 27 Mar 2017
Erik Arvin (Invited speaker)
Department of Environmental Engineering
Degree of recognition: National
Documents:
Erik Arvin_VandCenterSyd møde_27 marts 2017

Related event

Workshop on release and control of chemicals from plastic pipes in water supply
27/03/2017 → 27/03/2017
Odense, Denmark
Activity: Talks and presentations › Conference presentations

Kinetic considerations of two Sulfurospirillum spp. competing for tetrachloroethene
Period: 26 Mar 2017 → 29 Mar 2017
Geraldine Buttet (Other)
Alexandra Marie Murray (Other)
Melissa Burion (Other)
C. Holliger (Other)
J Maillard (Speaker)
Department of Environmental Engineering
Water Resources Engineering
Degree of recognition: International
Documents:
Maillard_abstract_final (1)

Related event

DehalocoII: A Conference on Anaerobic Reductive Dehalogenation
26/03/2017 → 29/03/2017
Leipzig, Germany
Activity: Talks and presentations › Conference presentations

Forsyning 2020: Fremtid og forandring i forsyningssektoren
Period: 9 Mar 2017
Martin Rygaard (Invited speaker)
Department of Environmental Engineering
Urban Water Systems
Degree of recognition: National

Related event

Forsyning 2020: Fremtid og forandring i forsyningssektoren
09/03/2017 → 09/03/2017
Kolding, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities
**Microbial processes in rapid sandfilters - removal of ammonium and organic micropollutants (pesticides)**  
*Period: 8 Mar 2017*  
Hans-Jørgen Albrechtsen (Invited speaker)  
Department of Environmental Engineering  
Urban Water Systems  
Degree of recognition: International

**Related event**

**New Technologies and Innovative Solutions in the Danish Water Sector**  
*07/03/2017 → 08/03/2017*  
Tallinn, Estonia  
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

**Integration of geological, geophysical and contaminant monitoring technologies for contaminated site investigation**  
*Period: 7 Mar 2017*  
Nicola Balbarini (Guest lecturer)  
Pradip Kumar Maurya (Other)  
Vinni Kampman Rønde (Other)  
Anders Vest Christiansen (Other)  
Knud Erik Klint (Other)  
Poul Løgstrup Bjerg (Other)  
Philip John Binning (Other)  
Department of Environmental Engineering  
Water Resources Engineering  
Office for Study Programmes and Student Affairs

**Related event**

**ATV jord og grundvand 2017: vintermøde**  
*07/03/2017 → 08/03/2017*  
Vejle, Denmark  
Activity: Talks and presentations › Conference presentations

**SRA Policy Forum: Risk Governance for Key Enabling Technologies**  
*Period: 2 Mar 2017*  
Steffen Foss Hansen (Organizer)  
Department of Environmental Engineering  
Environmental Chemistry

**Description**  
Chairman. Synthetic Biology Applications and State of Science. Risk Governance of Key Emerging Technologies. Venice, Italy, 1-3 March 2017  
Degree of recognition: International

**Related event**

**SRA Policy Forum: Risk Governance for Key Enabling Technologies**  
*01/03/2017 → 03/03/2017*  
Venice, Italy  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**A pumping and tracer test in limestone with modeling interpretation – experiences and results**  
*Period: 1 Mar 2017*  
Klaus Mosthaf (Speaker)
Related event

**Fagmøde: Forurening af kalkmagasiner: Konceptuelle modeller, transport, spredningsprocesser og modellering**

01/03/2017 → 01/03/2017

København, Denmark

Activity: Talks and presentations › Conference presentations

Related event

**Formidling af "kalkprojektet" & Introduction of the Limestone Wiki**

Period: 1 Mar 2017

Klaus Mosthaf (Speaker)
Poul Løgstrup Bjerg (Speaker)

Department of Environmental Engineering

Water Resources Engineering

Degree of recognition: National

Related event
Fagmøde: Forurening af kalkmagasiner: Konceptuelle modeller, transport, spredningsprocesser og modellering  
01/03/2017 → 01/03/2017  
København, Denmark  
Activity: Talks and presentations › Conference presentations

Hvor finder man forureningen ved Akacievej?  
Period: 1 Mar 2017  
Annika Sidelmann Fjordbøge (Speaker)  
Klaus Mosthaf (Other)  
Bentje Brauns (Other)  
Poul Løgstrup Bjerg (Other)  
Philip John Binning (Other)  
Mette Martina Broholm (Other)  
Henriette Kerrn-Jespersen (Other)  
Anna Toft (Other)  

Department of Environmental Engineering  
Water Resources Engineering  
Degree of recognition: National

Related event

Fagmøde: Forurening af kalkmagasiner: Konceptuelle modeller, transport, spredningsprocesser og modellering  
01/03/2017 → 01/03/2017  
København, Denmark  
Activity: Talks and presentations › Conference presentations

Kalkgeologi og transportprocesser samt intro til Akacievej  
Period: 1 Mar 2017  
Mette Martina Broholm (Speaker)  
Annika Sidelmann Fjordbøge (Other)  
Klaus Mosthaf (Other)  
Poul Løgstrup Bjerg (Other)  
Peter Roll Jakobsen (Other)  
Rasmus Jakobsen (Other)  
Jens Galsgaard (Other)  
Magnus Marius Rohde (Other)  
Henriette Kern-Jespersen (Other)  
Anna Toft (Other)  

Department of Environmental Engineering  
Water Resources Engineering  
Degree of recognition: National

Related event

Fagmøde: Forurening af kalkmagasiner: Konceptuelle modeller, transport, spredningsprocesser og modellering  
01/03/2017 → 01/03/2017  
København, Denmark  
Activity: Talks and presentations › Conference presentations

Modeller til strømning og stoftransport i kalk  
Period: 1 Mar 2017  
Poul Løgstrup Bjerg (Speaker)  
Klaus Mosthaf (Other)  
Annika Sidelmann Fjordbøge (Other)  
Mette Martina Broholm (Other)
Which data is most useful for the assessment of a contaminated limestone site? How can it be obtained?

Period: 1 Mar 2017

Klaus Mosthaf (Speaker)
Bentje Brauns (Other)
Annika Sidelmann Fjordbøge (Other)
Jens Schaarup Sørensen (Other)
Bent Henning Skov (Other)
Flemming Møller (Other)
Mette Martina Broholm (Other)
Poul Løgstrup Bjerg (Other)
Philip John Binning (Other)
Niels D. Overheu (Other)
Anna Toft (Other)
Henriette Kerrn-Jespersen (Other)
Magnus Marius Rohde (Other)
Christian Helweg (Other)
John U. Bastrup (Other)

Department of Environmental Engineering
Water Resources Engineering
Degree of recognition: National
2017 IUVA Americas Conference
Period: 5 Feb 2017 → 8 Feb 2017
Waqas Akram Cheema (Speaker)
Department of Environmental Engineering
Water Technologies
Description
presented topic "Effect of UV treatment on formation of disinfection by-products in chlorinated seawater swimming pools"
Degree of recognition: International

Related event
2017 IUVA Americas Conference
05/02/2017 → 08/02/2017
Austin, United States
Activity: Talks and presentations › Conference presentations

Miljøteknisk Topmøde
Period: 2 Feb 2017
Hans-Jørgen Albrechtsen (Participant)
Department of Environmental Engineering
Description
Miljøteknisk Topmøde

Related event
Miljøteknisk Topmøde: Vintermøde (Brancheforeningen Dansk Miljøteknologi)
02/02/2017 → 02/02/2017
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Miljøteknisk Topmøde
Period: 2 Feb 2017
Hans-Jørgen Albrechtsen (Participant)
Department of Environmental Engineering
Urban Water Systems
Description
Drikkevand - er den danske holdning til vandbehandling tidssvarende?

Related event
Miljøteknisk Topmøde: Vintermøde (Brancheforeningen Dansk Miljøteknologi)
02/02/2017 → 02/02/2017
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

11th annual Danish Water Forum (DWF) 2017
Period: 30 Jan 2017
Camilla Tang (Speaker)
Department of Environmental Engineering
Urban Water Systems
Related event
11th annual Danish Water Forum (DWF) 2017
30/01/2017 → 30/01/2017
Frederiksberg, Denmark
Activity: Talks and presentations › Conference presentations

Science for Environment Policy, Issue 480: A service from the European Commission (Journal)
Period: 12 Jan 2017
Ursula S. McKnight (Reviewer)
Department of Environmental Engineering
Water Resources Engineering
Documents:
Banned pesticides continue to affect toxicity in streams

Related journal
Science for Environment Policy, Issue 480: A service from the European Commission
Local database
Activity: Research › Journal editor

National Research Council of Italy
Period: 9 Jan 2017 → 9 Mar 2017
Raphael Schneider (Visiting researcher)
Department of Environmental Engineering
Water Resources Engineering
Description
external research stay during PhD studies
External stay at the Hydrology Research Group of CNR IRPI in Perugia, Italy: http://hydrology.irpi.cnr.it/
Activity: Visiting an external institution › Visiting another research institution

Birkerød Water Supply (External organisation)
Period: 1 Jan 2017 → 31 Dec 2017
Erik Arvin (Member)
Department of Environmental Engineering
Description
Board member
Degree of recognition: Local
Related external organisation
Birkerød Water Supply
Biskop Svanes vej, 3460, Birkerød, Denmark
Activity: Membership › Board duties in companies, associations, or public organisations

Rudersdal Supply (External organisation)
Period: 1 Jan 2017 → 31 Dec 2017
Erik Arvin (Member)
Department of Environmental Engineering
Description
Board member
Degree of recognition: Local
Related external organisation
Rudersdal Supply
Activity: Membership › Board duties in companies, associations, or public organisations

**Chemical Processes and Materials (Journal)**
Period: 2016 → …
Steffen Foss Hansen (Reviewer)
Department of Environmental Engineering
Environmental Chemistry

**Description**
Associate Editor
Degree of recognition: International
Links:
http://chempm.org/ (Homepage of Chemical Processes and Materials)

**Related journal**
**Chemical Processes and Materials**
Local database
Activity: Research › Journal editor

**Continuing education coordinator at DTU Environment**
Period: 2016 → …
Steffen Foss Hansen (Lecturer)
Department of Environmental Engineering
Environmental Chemistry
Degree of recognition: Local
Links:
http://www.env.dtu.dk/english/Teaching/Continuing-Education (DTU Environment's Continuing education website)
Activity: Other

**NanoImpact (Journal)**
Period: 2016 → …
Steffen Foss Hansen (Reviewer)
Department of Environmental Engineering
Environmental Chemistry

**Description**
Associate Editor
Degree of recognition: International
Links:
https://www.journals.elsevier.com/nanoimpact (Homepage of NanoImpact)

**Related journal**
**NanoImpact**
2452-0748
Web of Science (2017): Indexed yes
Central database
Activity: Research › Journal editor

**Pedagogical teaching coordinator at DTU Environment**
Period: 2016 → …
Steffen Foss Hansen (Other)
Department of Environmental Engineering
Environmental Chemistry
Steering group member of the project "Plastfri Roskilde Fjord" (Event)
Period: 2016 → 2018
Steffen Foss Hansen (Chairman)
Department of Environmental Engineering
Environmental Chemistry
Degree of recognition: National
Links:
http://plasticchange.dk/vores-loesninger/plastfri-roskilde-fjord/

Related event
Steering group member of the project "Plastfri Roskilde Fjord"
01/09/2016 → …
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Potentialer og udfordringer med målerdata i vandforsyningen
Period: 16 Dec 2016
Jonas Kjeld Kirstein (Speaker)
Department of Environmental Engineering
Urban Water Systems

Description
Presentation given at DTU challenge "Water supply" with 3Vand (VCS, HOFOR and Aarhus Vand)
Participation and presentation at DTU Challenge "Water Supply"

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

American Geophysical Union Fall meeting
Period: 12 Dec 2016 → 16 Dec 2016
Teis Nørgaard Mikkelsen (Participant)
Department of Environmental Engineering
Atmospheric Environment

Description
Abstract ID and Title: 177175: Solar UV irradiation-induced production of N2O from plant surfaces - low emissions rates but all over the world. Final Paper Number: B11E-0509 Presentation Type: Poster Session Date and Time: Monday, 12 December 2016; 08:00 - 12:20 Session Number and Title: B11E: Global Nitrous Oxide Budget: Magnitude, Sources, and Drivers I Posters Location: Moscone South; Poster Hall
American Geophysical Union Fall meeting

Related event
American Geophysical Union Fall meeting
12/12/2016 → 16/12/2016
San Francisco, United States
Activity: Attending an event › Participating in or organising a conference

9th International membrane science and technology conference (IMSTEC)
Period: 5 Dec 2016 → 8 Dec 2016
Agata Zarebska (Speaker)
Department of Environmental Engineering
Water Technologies

Description
Influence of mechanical wastewater pretreatment on membrane fouling during municipal wastewater treatment by forward osmosis

Oral presentation

Related event

9th International Membrane Science & Technology Conference
05/12/2016 → 08/12/2016
Adelaide, Australia
Activity: Talks and presentations › Conference presentations

DTU Sustain 2016
Period: 30 Nov 2016
Steffen Foss Hansen (Organizer)
Kristian Mølhave (Organizer)
Department of Environmental Engineering
Environmental Chemistry
Department of Micro- and Nanotechnology
Molecular Windows
Documents:
SustainAbstracts2016-20161130-1
Links:
http://www.sustain.dtu.dk/

Related event

DTU Sustain 2016
30/11/2016 → …
Activity: Attending an event › Participating in or organising a conference

What does it take to practice sustainable flood risk management?
Period: 30 Nov 2016
Hjalte Jomo Danielsen Sørup (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related event

DTU Sustain 2016
30/11/2016 → …
Activity: Talks and presentations › Conference presentations

Danske Vandværker, Temalørdag, Hotel Falster, Nykøbing F
Period: 26 Nov 2016
Hans-Jørgen Albrechtsen (Participant)
Department of Environmental Engineering
Urban Water Systems

Related event

Danske Vandværker, Temalørdag, Hotel Falster, Nykøbing F
Danske Vandværker, Temalørdag, Roskilde
Period: 12 Nov 2016
Hans-Jørgen Albrechtsen (Invited speaker)
Department of Environmental Engineering
Urban Water Systems

Description
Fordele og ulemper ved forskellige blødgøringsteknologier på vandværket

Related event
Danske Vandværker, Temalørdag, Roskilde
Roskilde, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Dansk Vand Konference
Period: 9 Nov 2016
Jonas Kjeld Kirstein (Speaker)
Department of Environmental Engineering
Urban Water Systems

Description
Fra big data til smart data – driftsoptimering med højoppløste sektionsdata i vandforsyningen
Links:
http://www.danva.dk/Admin/Public/DWSDownload.aspx?File=%2fFiles%2fFiler%2fArrangementer%2f2016%2fDVK+2016+pr%c3%a6sentationer%2f11.1+Fra+big+data+til+smart+data.pdf (Link to presentation)

Related event
Dansk Vand Konference
08/11/2016 → 09/11/2016
Århus, Denmark
Activity: Talks and presentations › Conference presentations

Kortlægning af den bakterielle lattergasproduktion i aktivt slam ved hjælp af stabile isotoper
Period: 9 Nov 2016
Marlene Mark Jensen (Speaker)
Department of Environmental Engineering
Water Technologies

Related event
Dansk Vand Konference
08/11/2016 → 09/11/2016
Århus, Denmark
Activity: Talks and presentations › Conference presentations

Modificering af regnserier så de reflekterer et ændret klima
Period: 9 Nov 2016
Hjalte Jomo Danielsen Sarup (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related event

Dansk Vand Konference 2016
08/11/2016 → 09/11/2016
Aarhus, Denmark
Activity: Talks and presentations › Conference presentations

SOMmic – Microbial Contribution and Impact on Soil Organic Matter, Structure and Genesis
Period: 9 Nov 2016 → 11 Nov 2016
Stefan Trapp (Speaker)
Department of Environmental Engineering
Environmental Chemistry
Documents:
Proceedings_SOMmic_Workshop_2016-11

Related event

SOMmic – Microbial Contribution and Impact on Soil Organic Matter, Structure and Genesis
Leipzig, Germany
Activity: Talks and presentations › Conference presentations

Integrering af ferskvandspåvirkning i livscyclusvurdering af tre vandteknologier
Period: 8 Nov 2016
Ryle Nørskov Gejl (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related event

Phytotechnologies
Period: 8 Nov 2016
Lauge Peter Westergaard Clausen (Invited speaker)
Department of Environmental Engineering
Environmental Chemistry

Description
Presentation of the applications of phytotechnologies

Related event

Workshop vedr. grønne løsninger/Refshaleøen
08/11/2016 → 08/11/2016
Søborg, Denmark
Activity: Talks and presentations › Conference presentations

7th SETAC World Congress
Period: 6 Nov 2016 → 10 Nov 2016
Philipp Mayer (Participant)
Department of Environmental Engineering
7th SETAC World Congress
Period: 6 Nov 2016 → 10 Nov 2016
Philipp Mayer (Invited speaker)
Department of Environmental Engineering
Environmental Chemistry
Documents:
SETAC-Orlando-Abstract-Book

Related event
7th SETAC World Congress: SETAC North America 37th Annual Meeting
06/11/2016 → 10/11/2016
Orlando, United States
Activity: Talks and presentations › Conference presentations

Developing a strategy to improve the environmental risk assessment of difficult to test multi-component substances
Period: 2 Nov 2016 → 4 Nov 2016
Philipp Mayer (Invited speaker)
Department of Environmental Engineering
Environmental Chemistry
Documents:
RIFM ECETOC WS RA of Multiconsituent Substances

Related event
RIFM/ECETOC Workshop
02/11/2016 → 04/11/2016
Kissimmee, United States
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Environmental Protection and Urban Water Systems
Hans-Jørgen Albrechtsen (Invited speaker)
Department of Environmental Engineering
Urban Water Systems

Related event
Chinese Mayors Training Programme
31/10/2016 → 04/11/2016
Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

DRIP Workshop
Hans-Jørgen Albrechtsen (Speaker)
Department of Environmental Engineering
Urban Water Systems
Description
Feasibility of Direct Potable Reuse in California
Documents:
DRIP Direct Potable Reuse in California – 21061025

Related event
DRIP Workshop
Sustainability assessment - eco-efficiency
Martin Rygaard (Invited speaker)
Department of Environmental Engineering
Urban Water Systems

Related event

DRIP Workshop
25/10/2016 → 26/10/2016
Fredericia, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Supersites for Superior Forest Science: Launching Supersites for Superior Forest Science - Novelty, Needs and Networking
Period: 24 Oct 2016 → Oct 2017
Teis Nørgaard Mikkelsen (Other)
Department of Environmental Engineering
Atmospheric Environment

Description
Presentation by Rainer Matyssek at the IUFRO Task Force on Climate Change and Forest Health, Beijing, China. IUFRO regional Asia Oceania congres.
Documents:
IUFRO_China_Matyssek_Oct_2016

Related event

IUFRO regional Asia Oceania congress
24/10/2016 → 27/10/2016
Beijing, China
Activity: Talks and presentations › Conference presentations

C-accounting and the role of LCA in waste management
Thomas Hejlund Christensen (Keynote speaker)
Department of Environmental Engineering
Atmospheric Environment
Water Technologies
Documents:
16 ICWMT Beijing T H Christensen

Related event

The 11th International Conference on Waste Management and Technology
21/10/2016 → 24/10/2016
Beijing, China
Activity: Talks and presentations › Conference presentations

IWA World Water Congress & Exhibition
Period: 11 Oct 2016
Martin Rygaard (Speaker)
Department of Environmental Engineering
Urban Water Systems

Description
Life Cycle Assessment Of Cloudburst Management Plans In Adaptation To Climate Change In Copenhagen, Denmark

Related event
IWA World Water Congress & Exhibition: Shaping Our Water Future
09/10/2016 → 14/10/2016
Brisbane, Australia
Activity: Talks and presentations › Conference presentations

Referee panel member (External organisation)
Teis Nørgaard Mikkelsen (Member)
Department of Environmental Engineering
Atmospheric Environment

Description
Assessment of proposals submitted to the call "NOK 40 million for climate research projects within an open thematic framework"

Member of panel for assessment terrestrial ecosystems

Body type: The Research Council of Norway
Degree of recognition: International

Related external organisation
Referee panel member
Activity: Membership › Membership in review committee

Soil and Plant Contamination - Modelling and Simulation of Processes
Stefan Trapp (Invited speaker)
Department of Environmental Engineering
Environmental Chemistry
Documents:
program_04102016_mk_rja

Related event
International Symposium on Persistent Toxic Substances - ISPTS
11/10/2016 → 14/10/2016
Leipzig, Germany
Activity: Talks and presentations › Conference presentations

IWA World Water Congress & Exhibition
Period: 10 Oct 2016
Martin Rygaard (Speaker)
Department of Environmental Engineering
Urban Water Systems

Description
GISMOWA - GIS Assisted Monitoring Of Drinking Water Quality

Related event
IWA World Water Congress & Exhibition: Shaping Our Water Future
09/10/2016 → 14/10/2016
Brisbane, Australia
Activity: Talks and presentations › Conference presentations

International Society of Exposure Science
Philipp Mayer (Invited speaker)
Department of Environmental Engineering
Environmental Chemistry

Related event
International Society of Exposure Science 2016: 26th Annual Meeting: Interdisciplinary Approaches to Health and the Environment
09/10/2016 → 13/10/2016
Utrecht, Netherlands
Activity: Talks and presentations › Conference presentations

International Society of Exposure Science 26th Annual Meeting - ISES2016
Philipp Mayer (Invited speaker)
Department of Environmental Engineering
Environmental Chemistry

Related event
International Society of Exposure Science 26th Annual Meeting - ISES2016
09/10/2016 → 13/10/2016
Utrecht, Netherlands
Activity: Talks and presentations › Conference presentations

IWA World Water Congress & Exhibition
Hans-Jørgen Albrechtsen (Speaker)
Department of Environmental Engineering
Urban Water Systems

Description
Optimizing nitrification in biological rapid sand filters for drinking water production

Related event
IWA World Water Congress & Exhibition: Shaping Our Water Future
09/10/2016 → 14/10/2016
Brisbane, Australia
Activity: Talks and presentations › Conference presentations

IWA World Water Congress & Exhibition
Hans-Jørgen Albrechtsen (Speaker)
Department of Environmental Engineering
Urban Water Systems

Description
Towards the development of an automated ATP measuring platform to monitor microbial quality of drinking water
Related event

IWA World Water Congress & Exhibition: Shaping Our Water Future
09/10/2016 → 14/10/2016
Brisbane, Australia
Activity: Talks and presentations › Conference presentations

International Conference of Phytotechnologies
Period: 28 Sep 2016
Lauge Peter Westergaard Clausen (Speaker)
Department of Environmental Engineering
Environmental Chemistry
Description
Oral presentation
Toxicity testing with the willow tree transpiration test
- 15 years of results

Related event

International Conference of Phytotechnologies: Toxicity testing with the willow tree transpiration test - 15 years of results
26/09/2016 → 29/09/2016
Hangzhou, China
Activity: Talks and presentations › Conference presentations

LCA – Life-Cycle-Assessment - modeling with an industrial waste example
Period: 27 Sep 2016 → 30 Sep 2016
Thomas Hejlund Christensen (Invited speaker)
Department of Environmental Engineering
Atmospheric Environment
Water Technologies
Documents:
16 Crete Thomas Christensen Invited lecture

Related event

5th International Conference on Industrial and Hazardous waste management
27/09/2016 → 30/09/2016
Crete, Greece
Activity: Talks and presentations › Conference presentations

When is it produced, why is it produced and how to prevent nitrous oxide emissions? Main findings from a large nitrous oxide project in Denmark
Period: 27 Sep 2016
Marlene Mark Jensen (Invited speaker)
Department of Environmental Engineering
Water Technologies

Related event

Swedish Water & Waterwater Fair 2016: Leading Edge Wastewater Treatment
27/09/2016 → 27/10/2016
Jönköping, Sweden
Activity: Talks and presentations › Conference presentations

Advances in FACE and manipulation technique
Period: 26 Sep 2016 → 29 Sep 2016
Teis Nørgaard Mikkelsen (Speaker)
Department of Environmental Engineering
Atmospheric Environment

**Related event**

**FACEing the future : food production and ecosystems under a changing climate**  
26/09/2016 → 29/09/2016  
Giessen, Germany  
Activity: Talks and presentations › Conference presentations

**FACEing the future**  
Period: 26 Sep 2016 → 29 Sep 2016  
Teis Nørgaard Mikkelsen (Chairman)
Department of Environmental Engineering
Atmospheric Environment

**Description**  
Yields, food quality and phenotypes

**Related event**

**FACEing the future : food production and ecosystems under a changing climate**  
26/09/2016 → 29/09/2016  
Giessen, Germany  
Activity: Attending an event › Participating in or organising a conference

**Integration of freshwater impact in lifecycle assessment of three water supply technologies**  
Period: 21 Sep 2016  
Ryle Nørskov Gejl (Speaker)
Department of Environmental Engineering
Urban Water Systems

**Related event**

**22nd SETAC Europe LCA Case Study Symposium**  
20/09/2016 → 22/09/2016  
Montpellier, France  
Activity: Talks and presentations › Conference presentations

**N2O Expert Meeting and Workshop**  
Period: 21 Sep 2016 → 22 Sep 2016  
Carlos Domingo-Felez (Participant)
Department of Environmental Engineering
Water Technologies

**Description**  
10 minutes presentation about current research on DTU-Miljø

N2O expert meeting and workshop held at the Ruhr-Universität Bochum on Setpember 2016. Two days of presentations and discussions about analytical methods, full-scale measurement campaigns and modelling of biological N2O turnover

**Related event**

**N2O Expert Meeting and Workshop**  
21/09/2016 → 22/09/2016
Bochum, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Chinese Academy of Sciences**
Period: 5 Sep 2016 → 15 Dec 2016
Grith Martinsen (Visiting researcher)
Department of Environmental Engineering
Water Resources Engineering

**Description**
External SDC stay: External stay at Institute of Geography and Natural Resources Research at Chinese Academy of Sciences in Beijing, China

Teaching, field work, data collection and collaboration
Activity: Visiting an external institution › Visiting another research institution

**Hydrology: SDC master course**
Period: 5 Sep 2016 → 23 Sep 2016
Grith Martinsen (Lecturer)
Department of Environmental Engineering
Water Resources Engineering

**Description**
At the SDC master degree Water & Environment

Teaching assistant
Degree of recognition: Local

**Related event**

**Hydrology: SDC master course**
05/09/2016 → 23/09/2016
Denmark
Activity: Talks and presentations › Conference presentations

**MEWE and biofilms IWA specialist conference**
Period: 4 Sep 2016 → 7 Sep 2016
Jane Fowler (Organizer)
Department of Environmental Engineering
Water Technologies

**Description**
Vice chairperson

**Related event**

**MEWE and biofilms IWA specialist conference**
04/09/2016 → 07/09/2016
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising a conference

**EuroTech Postdoc seminar**
Period: 31 Aug 2016 → 2 Sep 2016
Agata Zarebska (Participant)
Department of Environmental Engineering
Water Technologies
Description
Intensive, highly interactive, and fun crash course in the soft skills underlying professional success for postdoctoral researchers from EuroTech Universities: - Selling your science and yourself! by Jen Rolfe (UK) - Global mindset and intercultural competence! by Christine McCarthy (DE) - Networking and career planning - how to use your network for your next career step! by Barbara Wagner (DE)

Participant

Related event

EuroTech Postdoc seminar
31/08/2016 → 02/09/2016
Munich, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

High-resolution rainfall time series for future climate
Period: 30 Aug 2016
Hjalte Jomo Danielsen Sørup (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related event

4th Nordic Conference on Climate Change Adaptation: From Research to Actions and Transformation
29/08/2016 → 31/08/2016
Bergen, Norway
Activity: Talks and presentations › Conference presentations

Environmental impacts of flood control measures in climate change adaptation strategies
Period: 29 Aug 2016
Sarah Brudler (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related event

4th Nordic Conference on Climate Change Adaptation: From Research to Actions and Transformation
29/08/2016 → 31/08/2016
Bergen, Norway
Activity: Talks and presentations › Conference presentations

IOA-PAG International Conference
Waqas Akram Cheema (Speaker)
Department of Environmental Engineering
Water Technologies

Description
presented topic "Treatment of Swimming Pool Water with UV Followed by Ozone"
Degree of recognition: International

Related event

International Ozone Association Pan American Group: 2016 Annual Conference
28/08/2016 → 31/08/2016
Las Vegas, United States
Activity: Talks and presentations › Conference presentations
16th Nordic Filtration Symposium - Filtration for Circular Economy
Agata Zarebska (Speaker)
Department of Environmental Engineering
Water Technologies

Description
Oral presentation

Related event

16th Nordic Filtration Symposium - Filtration for Circular Economy
24/08/2016 → 26/08/2016
Lappeenranta, Finland
Activity: Talks and presentations › Conference presentations

ESA Earth Observation Summer School
Period: 1 Aug 2016 → 12 Aug 2016
Raphael Schneider (Participant)
Department of Environmental Engineering
Water Resources Engineering

Related event

ESA Earth Observation Summer School
01/08/2016 → 12/08/2016
Frascati, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Estimating mass discharge of contaminant plumes downstream of landfills: Benefits of geophysics
Period: 26 Jul 2016
Nicola Balbarini (Guest lecturer)
Pradip Kumar Maurya (Guest lecturer)
Vinni Kampman Rønde (Guest lecturer)
Anders Vest Christiansen (Guest lecturer)
Poul Legstrup Bjerg (Guest lecturer)
Knud Erik Klint (Guest lecturer)
Philip John Binning (Guest lecturer)
Department of Environmental Engineering
Water Resources Engineering
Office for Study Programmes and Student Affairs

Related event

Groundwater Quality Conference (GQ16)
24/07/2016 → 28/07/2016
Shenzhen Kylin Villa, China
Activity: Talks and presentations › Conference presentations

Groundwater Quality Conference (GQ16)
Ursula S. McKnight (Participant)
Department of Environmental Engineering
Water Resources Engineering
Mette Martina Broholm (Participant)
Department of Environmental Engineering
Water Resources Engineering
Documents:
Integrated characterization of the development in natural attenuation

Related event
The 9th IAHS Conference on Groundwater Quality: Safeguarding Groundwater Quality in a Changing World
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Klaus Mosthaf (Participant)
Department of Environmental Engineering
Water Resources Engineering
Documents:
Modeling contaminant plumes in fractured limestone aquifers

Related event
The 9th IAHS Conference on Groundwater Quality: Safeguarding Groundwater Quality in a Changing World
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Biao Jin (Participant)
Department of Environmental Engineering
Water Resources Engineering
Documents:
Modeling position-specific isotope fractionation of organic

Related event
The 9th IAHS Conference on Groundwater Quality: Safeguarding Groundwater Quality in a Changing World
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Ursula S. McKnight (Participant)
Department of Environmental Engineering
Water Resources Engineering
Documents:
Re-thinking stressor interactions - the role of groundwater

Related event
The 9th IAHS Conference on Groundwater Quality: Safeguarding Groundwater Quality in a Changing World
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
The 9th IAHS Conference on Groundwater Quality
Poul Løgstrup Bjerg (Invited speaker)
Department of Environmental Engineering
Water Resources Engineering

Related event
The 9th IAHS Conference on Groundwater Quality: Safeguarding Groundwater Quality in a Changing World
24/07/2016 → 28/07/2016
Shenzhen, China
Activity: Talks and presentations › Conference presentations

Who are the water innovators?
Period: 7 Jul 2016
Mariú Abritta Moro (Speaker)
Department of Environmental Engineering
Water Technologies
Department of Management Engineering
Technology and Innovation Management
Degree of recognition: International

Related event
16th International Schumpeter Society Conference
06/07/2016 → 08/07/2016
Montreal, Canada
Activity: Talks and presentations › Conference presentations

Accounting for multiple functions in environmental life cycle assessment of storm water management solutions
Period: 29 Jun 2016
Sarah Brudler (Speaker)
Department of Environmental Engineering
Urban Water Systems

Description
Oral presentation

Related event
9th International Conference on Planning and Technologies for Sustainable Urban Water Management (NOVATECH)
28/06/2016 → 01/07/2016
Lyon, France
Activity: Talks and presentations › Conference presentations

Developing Fast and Reliable Flood Models
Period: 29 Jun 2016
Cecilie Thrysøe (Lecturer)
Department of Environmental Engineering
Urban Water Systems

Related event
9th International Conference on Planning and Technologies for Sustainable Urban Water Management (NOVATECH)
28/06/2016 → 01/07/2016
Sustainable flood risk management – What is sustainable?
Period: 29 Jun 2016
Hjalte Jomo Danielsen Sørup (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related event

9th International Conference on Planning and Technologies for Sustainable Urban Water Management (NOVATECH)
28/06/2016 → 01/07/2016
Lyon, France
Activity: Talks and presentations › Conference presentations

An International Conference Linking Science and Policy
Poul Løgstrup Bjerg (Participant)
Department of Environmental Engineering
Water Resources Engineering
Documents:
Abstract for SanFransisco2016-pesticide

Related event

An International Conference Linking Science and Policy: Toward Sustainable Groundwater in Agriculture
28/06/2016 → 30/06/2016
San Francisco, United States
Activity: Attending an event › Participating in or organising a conference

8th INTERNATIONAL WATER & HEALTH SEMINAR
Kai Tang (Participant)
Department of Environmental Engineering
Water Technologies

Description
Polishing of pharmaceuticals in conventionally treated wastewater with intermittently fed Moving Bed Biofilm Reactors (MBBR)
Documents:
International water and health seminar (kaitang DTU)

Related event

8th INTERNATIONAL WATER & HEALTH SEMINAR
27/06/2016 → 29/06/2016
Cannes, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

European Conference on Plastics in Freshwater Environments
Sinja Rist (Participant)
Department of Environmental Engineering
Environmental Chemistry
Related event

European Conference on Plastics in Freshwater Environments
21/06/2016 → 22/06/2016
Berlin, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Advanced Applications of Spectrophotometry and Surface Analysis
Period: 16 Jun 2016
Agata Zarebska (Participant)
Department of Environmental Engineering
Water Technologies

Related event

Advanced Applications of Spectrophotometry and Surface Analysis
16/06/2016 → 16/06/2016
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

University Consortium for Field-Focused Groundwater Contamination Research
Poul Løgstrup Bjerg (Participant)
Department of Environmental Engineering
Water Resources Engineering

Description

Related event

University Consortium for Field-Focused Groundwater Contamination Research: University of Guelph,
13/06/2016 → 15/06/2016
Ontario, , Canada
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

natur & miljø 2016
Period: 8 Jun 2016
Poul Løgstrup Bjerg (Speaker)
Department of Environmental Engineering
Water Resources Engineering
Links:
http://www.naturogmiljo2016.dk

Related event

natur & miljø 2016: Den store nationale konference for natur- og miljøområdet
08/06/2016 → 09/06/2016
Nyborg, Denmark
Activity: Talks and presentations › Conference presentations

12th International Conference on Renewable Resources and Biorefineries
Period: 30 May 2016 → 1 Jun 2016
Martina D'Este (Speaker)
Department of Environmental Engineering
Residual Resource Engineering

Related event

12th International Conference on Renewable Resources and Biorefineries
30/05/2016 → 01/06/2016
Ghent, Belgium
Activity: Talks and presentations › Conference presentations

Congressi Stefano Franscini
Period: 29 May 2016 → 3 Jun 2016
Philipp Mayer (Participant)
Department of Environmental Engineering
Environmental Chemistry
Documents: Sjoholm

Related event

Congressi Stefano Franscini
29/05/2016 → 03/06/2016
Ascona, Switzerland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC Europe 26th Annual Meeting
Period: 22 May 2016 → 26 May 2016
Nanna B. Hartmann (Participant)
Department of Environmental Engineering
Environmental Chemistry
Documents: SETAC_nanoplastics_FINAL_online

Related event

SETAC Europe 26th Annual Meeting
22/05/2016 → 26/05/2016
France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC Europe 26th Annual Meeting
Period: 22 May 2016 → 26 May 2016
Nanna B. Hartmann (Participant)
Department of Environmental Engineering
Environmental Chemistry
Documents: SETAC_Nantes_nanoplastics_final_clean

Related event

SETAC Europe 26th Annual Meeting
22/05/2016 → 26/05/2016
France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC Europe 26th Annual Meeting
Period: 22 May 2016 → 26 May 2016
Philipp Mayer (Participant)
Department of Environmental Engineering
Environmental Chemistry

Related event
SETAC Europe 26th Annual Meeting: Environmental contaminants from land to sea: continuities and interface in environmental toxicology and chemistry
22/05/2016 → 26/05/2016
Nantes, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC Europe 26th Annual Meeting
Period: 22 May 2016 → 26 May 2016
Philipp Mayer (Participant)
Department of Environmental Engineering
Environmental Chemistry

Related event
SETAC Europe 26th Annual Meeting: Environmental contaminants from land to sea: continuities and interface in environmental toxicology and chemistry
22/05/2016 → 26/05/2016
Nantes, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC Europe 26th Annual Meeting
Period: 22 May 2016 → 26 May 2016
Anders Baun (Participant)
Department of Environmental Engineering
Environmental Chemistry

Related event
SETAC Europe 26th Annual Meeting: Environmental contaminants from land to sea: continuities and interface in environmental toxicology and chemistry
22/05/2016 → 26/05/2016
Nantes, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC Europe 26th Annual Meeting
Period: 22 May 2016 → 26 May 2016
Anders Baun (Participant)
Department of Environmental Engineering
Environmental Chemistry

Related event
SETAC Europe 26th Annual Meeting: Environmental contaminants from land to sea: continuities and interface in environmental toxicology and chemistry
22/05/2016 → 26/05/2016
Nantes, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC Europe 26th Annual Meeting
Period: 22 May 2016 → 26 May 2016
Lars Michael Skjolding (Participant)
Related event

SETAC Europe 26th Annual Meeting: Environmental contaminants from land to sea: continuities and interface in environmental toxicology and chemistry
Period: 22 May 2016 → 26 May 2016
Nantes, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Anders Baun (Participant)
Department of Environmental Engineering
Environmental Chemistry

Related event

SETAC Europe 26th Annual Meeting
Period: 22 May 2016 → 26 May 2016
Ursula S. McKnight (Participant)
Department of Environmental Engineering
Water Resources Engineering
Documents:
McKnight_Setac2016-abstract

Related event

SETAC Europe 26th Annual Meeting: Environmental contaminants from land to sea: continuities and interface in environmental toxicology and chemistry
Period: 22 May 2016 → 26 May 2016
Nantes, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Stefan Trapp (Speaker)
Department of Environmental Engineering
Environmental Chemistry
Documents:
SETAC abstract book, Nantes, France 2016

Related event

SETAC Europe 26th Annual Meeting: Environmental contaminants from land to sea: continuities and interface in environmental toxicology and chemistry
Period: 22 May 2016 → 26 May 2016
Nantes, France
Activity: Talks and presentations › Conference presentations
SETAC Europe 26th Annual Meeting
Period: 22 May 2016 → 26 May 2016
Sara Nørgaard Sørensen (Speaker)
Department of Environmental Engineering
Environmental Chemistry

Related event
SETAC Europe 26th Annual Meeting: Environmental contaminants from land to sea: continuities and interface in environmental toxicology and chemistry
22/05/2016 → 26/05/2016
Nantes, France
Activity: Talks and presentations › Conference presentations

7th International Water Resources Management Conference of ICWRS
Period: 18 May 2016 → 20 May 2016
Grith Martinsen (Participant)
Department of Environmental Engineering
Water Resources Engineering

Description
Presented my poster at the poster session
Participated in IAHS conference in Bochum, Germany

Related event
7th International Water Resources Management Conference of ICWRS: The spatial dimensions of water management - Redistribution of benefits and risks
18/05/2016 → 20/05/2016
bochum, Germany
Activity: Attending an event › Participating in or organising a conference

ESA Living Planet Symposium 2016
Period: 12 May 2016
Raphael Schneider (Speaker)
Department of Environmental Engineering
Water Resources Engineering

Description
Presenting the abstract "Combining Envisat and CryoSat-2 altimetry to inform hydrodynamic models" submitted to that conference

Related event
ESA Living Planet Symposium 2016
09/05/2016 → 13/05/2016
Prague, Czech Republic
Activity: Talks and presentations › Conference presentations

EU Climate Cafe meeting in Roskilde
Period: 11 May 2016 → 13 May 2016
Teis Nørgaard Mikkelsen (Organizer)
Department of Environmental Engineering
Atmospheric Environment
**Description**
Climate-CAFE is the acronym for "Climate Change Adaptability of cropping and Farming systems for Europe". The project Climate-CAFE aims at assessing the « adaptive capacity » to climate change of Europeans arable cropping and farming systems, through the modelling and simulation of innovative strategies co-designed with actors. Started the 4th of February 2015, this project brings together under the coordination of Eric Justes (INRA Toulouse, UMR AGIR), 12 European research teams who met in Toulouse for the kick-off then. The second meeting is organized by Roskilde University, Denmark. The meeting is an opportunity to share and coordinate work in progress and to enforce work relations across the country teams during two and a half days of face to face contact and interaction.

**EU Climate Cafe meeting in Roskilde**

**Related event**

**EU Climate Cafe meeting in Roskilde: Climate-CAFÉ 2nd meeting Roskilde**
11/05/2016 → 13/05/2016
Roskilde, Denmark
Activity: Attending an event › Participating in or organising a conference

**EGU General Assembly 2016**
Period: 21 Apr 2016
Poul Legstrup Bjerg (Speaker)
Department of Environmental Engineering
Water Resources Engineering
Documents:
EGU2016-7174

**Related event**

**EGU General Assembly 2016**
17/04/2016 → 22/04/2016
Vienna, Austria
Activity: Talks and presentations › Conference presentations

**EGU General Assembly 2016**
Period: 21 Apr 2016
Antonio Delre (Speaker)
Department of Environmental Engineering
Residual Resource Engineering

**Description**
Oral presentation about greenhouse gas emission quantification from wastewater treatment plant

Participation at European Geosciences Union - General Assembly - Vienna 17-22 April, 2016 with an oral presentation and a poster presentation

Documents:
Delre_EGU2016-ERE3.7

Links:

**Related event**

**EGU General Assembly 2016**
17/04/2016 → 22/04/2016
Vienna, Austria
Activity: Talks and presentations › Conference presentations

**Perturbing high-resolution precipitation time series to represent future climates**
Period: 18 Apr 2016
Hjalte Jomo Danielsen Sørup (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related event

**EGU General Assembly 2016**
Period: 17/04/2016 → 22/04/2016
Vienna, Austria
Activity: Talks and presentations › Conference presentations

**European Geosciences Union General Assembly 2016**
Period: 17 Apr 2016 → 22 Apr 2016
Ursula S. McKnight (Participant)
Department of Environmental Engineering
Water Resources Engineering
Documents:
EGU2016-11980

Related event

**European Geosciences Union General Assembly 2016: European Geosciences Union General Assembly 2016**
Period: 17/04/2016 → 22/04/2016
Vienna, Austria
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**ARTEK Event 2016 - International Conference**
Period: 12 Apr 2016 → 14 Apr 2016
Steffen Davidsen (Speaker)
Department of Environmental Engineering
ARTEK, Section for Arctic Engineering and Sustainable Solutions

Related event

**ARTEK Event 2016 – International Conference: Sanitation in Cold Climate Regions**
Period: 12/04/2016 → 14/04/2016
Sisimiut, Greenland
Activity: Talks and presentations › Conference presentations

Where to direct modelling efforts for a faster road towards resource recovery?
Period: 31 Mar 2016
Borja Valverde Pérez (Invited speaker)
Department of Environmental Engineering
Water Technologies

Related event

**5 th IWA/WEF Wastewater Treatment Modelling Seminar 2016: Where to direct modelling efforts for a faster road towards resource recovery?**
Period: 02/04/2016 → 06/04/2016
Annecy, France
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Advanced Materials Characterization
Period: 30 Mar 2016
Agata Zarebska (Participant)
Related event

Advanced Materials Characterization
30/03/2016 → 30/03/2016
Brøndby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

2nd Young Water Professionals Denmark Conference and Workshop
Period: 10 Mar 2016
Kai Tang (Participant)
Department of Environmental Engineering
Water Technologies

Description
Influence of dissolved organic carbon on biodegradation of pharmaceuticals by suspended biofilms in wastewater

Documents:
YWPDK_2nd_conf_abstract (kaitang DTU)
Links:
http://ywp.dk/?page_id=784

Related event

2nd Young Water Professionals Denmark Conference and Workshop
10/03/2016 → 11/03/2016
Aarhus, Denmark
Activity: Attending an event › Participating in or organising a conference

DWF Gå-hjem-møde: Aktuelle forsknings- of innovationsinitiativer og calls på vandområdet
Period: 10 Mar 2016
Hans-Jørgen Albrechtsen (Speaker)
Department of Environmental Engineering
Urban Water Systems

Description
Opening speaker and chairman

Related event

DWF Gå-hjem-møde: Aktuelle forsknings- of innovationsinitiativer og calls på vandområdet
10/03/2016 → 10/03/2016
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

MIKE POWERED BY DHI SEMINAR 2016
Period: 10 Mar 2016
Morten Borup (Invited speaker)
Department of Environmental Engineering
Urban Water Systems

Related event

MIKE POWERED BY DHI SEMINAR 2016
10/03/2016 → ...
Hørsholm, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities
Konstruktion og test af kunstige regnserier: hvad er godt og godt nok?
Period: 29 Feb 2016
Hjalte Jomo Danielsen Sarup (Speaker)
Ida Bülow Gregersen (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related external organisation
The Danish Society of Engineers, IDA
Kalvebod Brygge 31-33, DK-1780, Copenhagen V, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Reviewer for Grant Proposals, Bio-Based Industries Joint Undertaking (EU Horizon 2020) (External organisation)
Period: 22 Feb 2016 → 26 Feb 2016
Dimitar Borisov Karakashev (Participant)
Department of Environmental Engineering
Residual Resource Engineering
Degree of recognition: International

Related external organisation
Reviewer for Grant Proposals, Bio-Based Industries Joint Undertaking (EU Horizon 2020) Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

2016 IUVA World Congress
Period: 31 Jan 2016 → 3 Feb 2016
Waqas Akram Cheema (Speaker)
Department of Environmental Engineering
Water Technologies

Description
presented topic "Destruction of disinfection by products and their precursors in swimming pool water by combined UV treatment and ozonation"
Degree of recognition: International

Related event
2016 IUVA World Congress
31/01/2016 → 03/02/2016
vancouver, Canada
Activity: Talks and presentations › Conference presentations

Member of the Environmental, health and safety network at the Technical University of Denmark (Event)
Period: 2015 → ...
Steffen Foss Hansen (Chairman)
Department of Environmental Engineering
Environmental Chemistry
Degree of recognition: Local

Related event
Member of the Environmental, health and safety network at the Technical University of Denmark
05/01/2015 → ...
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar
DTU Sustain 2015
Period: 17 Dec 2015
Steffen Foss Hansen (Organizer)
Department of Environmental Engineering
Environmental Chemistry
Documents:
sustain2015abstracts
Links:
hp://www.sustain.dtu.dk/

Related event

DTU Sustain 2015
17/12/2015 → …
Activity: Attending an event › Participating in or organising a conference

DTU Sustain Conference 2015
Period: 17 Dec 2015
Martina D'Este (Participant)
Department of Environmental Engineering
Residual Resource Engineering

Description
Poster presentation

Related event

DTU Sustain Conference 2015
17/12/2015 → 17/12/2015
Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DTU Sustain Conference 2015
Period: 17 Dec 2015
Valentina Bisinella (Speaker)
Department of Environmental Engineering
Residual Resource Engineering
Documents:
Bisinella_Sustain2015_abstract

Related event

DTU Sustain Conference 2015
17/12/2015 → 17/12/2015
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

The freshwater impact of Water Utilities
Period: 17 Dec 2015
Ryle Nørskov Gejl (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related event
Application of microbial communities in environmental biotechnology: from wastewater treatment to resource recovery
Period: 1 Dec 2015
Marlene Mark Jensen (Invited speaker)
Department of Environmental Engineering

Related event
Application of microbial communities in environmental biotechnology: from wastewater treatment to resource recovery
01/12/2015 → 01/12/2015
Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Frem mod det energineutrale vandselskab
Period: 30 Nov 2015
Marlene Mark Jensen (Invited speaker)
Department of Environmental Engineering

Description
Frem mod det energineutrale vandselskab. Workshop arrangeret af Dansk Miljøteknologi, DANVA og Dansk Industri

Related event
Frem mod det energineutrale vandselskab
30/11/2015 → 30/11/2015
Skanderborg, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Micropol & Ecohazard 2015
Period: 25 Nov 2015
Fabio Polesel (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Oral presentation
Documents:
PLOSZ_WWTP_Removal_assessment_FINAL_FINAL

Related event
9th IWA Specialist Conference on Assessment and Control of Micropollutants and Hazardous Substances in Water
22/11/2015 → 25/12/2015
Singapore, Singapore
Activity: Talks and presentations › Conference presentations

Micropol & Ecohazard 2015
Period: 25 Nov 2015
Fabio Polesel (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Oral presentation
Documents:
MPOL-170-POLESEL_TORRESI_Abstract_Revised

Related event

9th IWA Specialist Conference on Assessment and Control of Micropolutants and Hazardous Substances in Water
22/11/2015 → 25/12/2015
Singapore, Singapore
Activity: Talks and presentations › Conference presentations

Micropol & Ecohazard 2015
Fabio Polesel (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Poster presentation
Documents:
MPOL165_Plant_uptake_Poster_A1_portrait_FINAL

Related event

9th IWA Specialist Conference on Assessment and Control of Micropolutants and Hazardous Substances in Water
22/11/2015 → 25/12/2015
Singapore, Singapore
Activity: Talks and presentations › Conference presentations

Drikkevandssediment i rør og tanke - en kilde til bekymring
Period: 17 Nov 2015
Sarah Christine Boesgaard Christensen (Speaker)
Department of Environmental Engineering
Urban Water Engineering
Documents:
Sarah_C_B_Christensen_Præsentation_DANSKVAND UPLOAD_WEB

Related event

Dansk Vand Konference 2015
17/11/2015 → 18/11/2015
Aarhus, Denmark
Activity: Talks and presentations › Conference presentations

Tilsætning af spormetalier stimulerer nitrifikation i sandfiltre
Period: 17 Nov 2015
Hans-Jørgen Albrechtsen (Keynote speaker)
Department of Environmental Engineering

Related event

Dansk Vand Konference 2015
17/11/2015 → 18/11/2015
Aarhus, Denmark
Activity: Talks and presentations › Conference presentations

The freshwater impact of Water Utilities
Period: 8 Nov 2015
Ryle Nørskov Gejl (Speaker)
Department of Environmental Engineering
Urban Water Systems

**Related event**

**Dansk Vand Konference 2015**  
17/11/2015 → 18/11/2015  
Aarhus, Denmark  
Activity: Talks and presentations › Conference presentations

**ATV Jord og Grundvand: Vandindvindingens påvirkning af ferskvandsressourcen - Water Footprint, vandbalance og miljøindikatorer**  
Period: 5 Nov 2015  
Martin Rygaard (Organizer)  
Department of Environmental Engineering  
Urban Water Engineering

**Description**  
Organizing ATV Jord og Grundvand seminar

**Related event**

**ATV Jord og Grundvand: Vandindvindingens påvirkning af ferskvandsressourcen - Water Footprint, vandbalance og miljøindikatorer**  
05/11/2015 → 05/11/2015  
Copenhagen, Denmark  
Activity: Attending an event › Participating in or organising a conference

**ATV Jord og Grundvand: Vandindvindingens påvirkning af ferskvandsressourcen - Water Footprint, vandbalance og miljøindikatorer**  
Period: 5 Nov 2015  
Martin Rygaard (Speaker)  
Department of Environmental Engineering  
Urban Water Engineering

**Description**  
Water Footprint. Hvad er det? Hvordan kan det bruges i vandforsyningen?

**Related event**

**Amsterdam International Water Week 2015**  
Period: 4 Nov 2015  
Martin Rygaard (Participant)  
Department of Environmental Engineering  
Urban Water Engineering

**Description**  
Participant in expert panel

**Related event**

**Amsterdam International Water Week 2015: Remineralization Workshop**
Optimal drinking water quality in a Danish context
Period: 4 Nov 2015
Martin Rygaard (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

Related event
Amsterdam International Water Week 2015: Remineralization Workshop
04/11/2015 → 04/11/2015
Amsterdam, Netherlands
Activity: Talks and presentations › Conference presentations

SETAC
Period: 1 Nov 2015 → 5 Nov 2015
Philipp Mayer (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
173 Equilibrium sampling for a thermodynamic assessment of contaminated sediments
Documents:
173 Equilibrium sampling for a thermodynamic assessment of contaminated sediments
SETAC-SLC-Abstract-Book

Related event
SETAC: Society of Environmental Toxicology and Chemistry North America 36th Annual Meeting
01/11/2015 → 05/11/2015
Salt Lake City, Utah, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC
Period: 1 Nov 2015 → 5 Nov 2015
Philipp Mayer (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
WP139 Sorptive capacities of lipids determined by passive dosing of non-polar organic chemicals
Documents:
WP139 Sorptive capacities of lipids determined by passive dosing of non-polar organic chemicals
SETAC-SLC-Abstract-Book

Related event
SETAC: Society of Environmental Toxicology and Chemistry North America 36th Annual Meeting
01/11/2015 → 05/11/2015
Salt Lake City, Utah, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
Stine Nørgaard Schmidt (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
WP195 Effect of narcotics on membrane-bound mitochondrial processes in fish
Documents:
WP195 Effect of narcotics on membrane-bound mitochondrial processes in fish
SETAC-SLC-Abstract-Book

Related event
SETAC: Society of Environmental Toxicology and Chemistry North America 36th Annual Meeting
01/11/2015 → 05/11/2015
Salt Lake City, Utah, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC
Period: 1 Nov 2015 → 5 Nov 2015
Stine Nørgaard Schmidt (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
WP135 Linking algal growth inhibition to chemical activity
Documents:
WP135 Linking algal growth inhibition to chemical activity
SETAC-SLC-Abstract-Book

Related event
SETAC: Society of Environmental Toxicology and Chemistry North America 36th Annual Meeting
01/11/2015 → 05/11/2015
Salt Lake City, Utah, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC
Period: 1 Nov 2015 → 5 Nov 2015
Stefan Trapp (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
84 The Role of Dissipation Processes in Plants for Modeling Bioaccumulation
Documents:
84 The Role of Dissipation Processes in Plants for Modeling Bioaccumulation
SETAC-SLC-Abstract-Book

Related event
SETAC: Society of Environmental Toxicology and Chemistry North America 36th Annual Meeting
01/11/2015 → 05/11/2015
Salt Lake City, Utah, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC
Period: 1 Nov 2015 → 5 Nov 2015
Nanna B. Hartmann (Participant)
Hydrophobic organic contaminants (HOCs) reaching the aquatic environment are largely stored in sediments. The risk of contaminated sediments is challenging to assess since traditional exhaustive extraction methods yield total HOC concentrations, whereas freely dissolved concentrations (Cfree) govern diffusive uptake and partitioning. Equilibrium sampling of sediment was introduced 15 years ago to measure Cfree, and it has since developed into a straightforward, precise and sensitive approach for determining Cfree and other exposure parameters that allow for thermodynamic assessment of polluted sediments. Glass jars with µm-thin silicone coatings on the inner walls can be used for ex situ equilibration while a device housing several silicone-coated fibers can be used for in situ equilibration. In both cases, parallel sampling with varying silicone thicknesses can be applied to confirm valid equilibrium sampling (method incorporated QA/QC). The measured equilibrium concentrations in silicone (CSil) can then be divided by silicone/water partition ratios to yield Cfree. CSil can also be compared to CSil from silicone equilibrated with biota in order to determine the equilibrium status of the biota relative to the sediment. Furthermore, concentrations in lipid at thermodynamic equilibrium with sediment (Clip?Sed) can be calculated via lipid/silicone partition ratios CSil × KLip:Sil, which has been done in studies with limnic, river and marine sediments. The data can then be compared to lipid-normalized concentrations
in aquatic organisms or to regulatory thresholds. Finally, CSil can also be converted into chemical activities (a), which express the energetic level of the chemicals, drive several spontaneous processes and are well linked to the potential for baseline (mixture) toxicity. This overview lecture will focus at the latest developments in equilibrium sampling concepts and methods. Further, we will explain how these approaches can provide a new basis for a thermodynamic assessment of polluted sediments.

Links:

Related event
SETAC: Society of Environmental Toxicology and Chemistry North America 36th Annual Meeting
01/11/2015 → 05/11/2015
Salt Lake City, Utah, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC
Period: 1 Nov 2015 → 5 Nov 2015
Philipp Mayer (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
and Stine Nørgaard Schmidt

Poster
Authors: Lucia Vergauwen, Stine Schmidt, Ellen Michiels, Evelyn Stinckens, Walid Maho, Ronny Blust, Adrian Covaci, Philipp Mayer, Dries Knapen
Titel: Effect of narcotics on membrane-bound mitochondrial processes in fish

Around 70% of industrial chemicals are hydrophobic compounds which are assumed to elicit toxicity through narcosis by accumulating in membranes and disrupting membrane integrity and function. Although narcosis has been recognized as an important toxicity mechanism for decades, ecotoxicological research has been mostly limited to the development of quantitative structure activity relations (QSARs) to predict toxicity, resulting in insufficient understanding of the exact mechanisms involved. In this study we investigate specific aspects of the mechanism of narcosis in fish using both alternative in vivo (zebrafish embryo) and in vitro tests. We applied a passive dosing method to expose zebrafish embryos up to 5 days post fertilization to linear dilution series of a set of non-polar narcotics (phenanthrene and three chlorobenzene structure analogues). In addition to increasing mortality, we observed decreasing growth, heart rate and motility with increasing exposure concentration of all narcotics, consistent with the general assumption of reduced cardiorespiratory function. At the cellular level, the cell membrane is expected to be the first target of narcotics. Since the mitochondrial and endoplasmic reticulum membrane are known to closely interact with the cell membrane, we hypothesize that narcotics can be further partitioned into these organelle membranes where they can disrupt essential membrane-bound processes. The electron transport chain (ETC) is an example of a crucial mitochondrial membrane-bound process and is therefore a potential target. We found that in zebrafish embryos ETC activity was increased at low exposure concentrations, suggesting a compensatory response, while it decreased when exposure concentrations reached levels causing reduced motility, heart rate and eventually mortality. The effect of narcotic compounds on ETC activity was confirmed in vitro: we observed inhibition of the ETC after adding the compounds directly to a homogenate of control embryos. To further investigate effects on the energy production system, and to characterize the observed compensatory response, we are currently measuring the effect of narcotics on ATP synthase activity both in vivo and directly in vitro. Although narcosis is considered a non-specific mechanism of toxicity acting by membrane disruption in general, we illustrate how we can increase our understanding of narcosis by focussing on specific membrane types and membrane-bound processes.

Related event
SETAC: Society of Environmental Toxicology and Chemistry North America 36th Annual Meeting
01/11/2015 → 05/11/2015
Salt Lake City, Utah, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

SETAC
Period: 1 Nov 2015 → 5 Nov 2015
Philipp Mayer (Participant)
Unitless chemical activity, expressing the energetic level of a compound relative to its energetic level in pure liquid [0-1], has proven useful to quantify the effective exposure to hydrophobic organic compounds through both aerial and aqueous media. Several studies have linked toxicity to chemical activity, as opposed to e.g. the total concentration. Baseline toxicity (narcosis) for neutral hydrophobic organic compounds has been shown to initiate in the narrow chemical activity range of 0.01 to 0.1. This presentation focuses on linking algal growth inhibition to chemical activity with the aims to (1) further challenge the current chemical activity range for baseline toxicity, and (2) extend the utilisation of the chemical activity concept across compounds and species. The first part of the presentation focuses on results from a recently published study, in which toxicity data for 39 non-polar liquids were applied to challenge the chemical activity range for baseline toxicity. For each compound, the effective activity (Ea50) was estimated as the ratio of the effective concentration (EC50) and water solubility. Of these ratios, 90% were within the expected chemical activity range of 0.01 to 0.1 for baseline toxicity, and none of the ratios were significantly below 0.01. On a practical level, these findings suggest EC50 values for baseline toxicity to be at or above 1% of water solubility. On an environmental risk assessment level, predicted no-effect concentrations (PNECs) for baseline toxicity could even be set as a percentage of saturation, and this approach can easily be extended to baseline toxicity of mixtures. However, EC50 values well below 1% of saturation can still occur and indicate the potential for excess toxicity through a specific or reactive mode of action. The second part of the presentation focuses on extending the utilisation of the chemical activity concept. More specifically, the chemical activity concept is applied to a much larger range of algal toxicity data, including a wide range of solids and liquids, covering several expected modes of action and also several algal species. High-quality toxicity data are carefully selected from peer-reviewed scientific literature and QSAR databases. This presentation shows how the chemical activity concept can be used to compare and combine toxicity data across compounds and species in order to characterize toxicity – and further how the concept can be used in environmental risk assessment.

Links:
https://www.researchgate.net/publication/264980441_Linking_algal_growth_inhibition_to_chemical_activity_Baseline_toxicity_required_1_of_saturation

Related event
SETAC: Society of Environmental Toxicology and Chemistry North America 36th Annual Meeting
01/11/2015 → 05/11/2015
Salt Lake City, Utah, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
olive oil controls at different time points; iv) purge-and-trap extraction of the model chemicals onto ENV+ SPE cartridges, elution and GC/MS analysis; v) characterization of the lipid composition in all samples via NMR. Our experiments demonstrate that the sorptive capacities of the EOM samples do not differ significantly from the olive oil controls if the EOM consists of neutral lipids only. However, the EOM samples show small but statistically significant differences in their sorptive capacities for the (semi)volatile model chemicals if other components such as phosphatidylcholine (PC) and cholesterol are present in quantifiable amounts. Based on the lipid composition quantified by NMR and literature data for the chemicals' partition ratios between PC/water and storage lipid/water, we modeled the chemicals' partitioning into the EOM and compared the model results to the measured concentrations. The study provides a new basis for unravelling biomagnification, since an increase in concentration with trophic level can be divided into a sorption capacity effect and an increase in chemical activity.

Links:
https://www.researchgate.net/publication/279204513_Differences_between_Lipids_Extracted_from_Five_Species_Are_Not_Sufficient_To_ Explain_Biomagnification_of_Nonpolar_Organic_Chemicals

Related event
SETAC: Society of Environmental Toxicology and Chemistry North America 36th Annual Meeting
01/11/2015 → 05/11/2015
Salt Lake City, Utah, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Foundational aspects of the concept of chemical activity
Philipp Mayer (Lecturer)
Department of Environmental Engineering
Environmental Chemistry
Documents:
2015 Foundational aspects of the concept of chemical activity
Final Workshop Programme. Snowbird, Utah 29-30 October 2015

Related event
ECETOC: Defining the role of chemical activity in environmental risk assessment within the context of mode of action: Practical guidance and advice
29/10/2015 → 30/10/2015
Snowbird Resort, Utah, United States
Activity: Talks and presentations › Conference presentations

Workshop on sensor technologies
Period: 29 Oct 2015
Sarah Christine Boesgaard Christensen (Speaker)
Department of Environmental Engineering

Related event
1st Water DTU Seminar
28/10/2015 → 29/10/2015
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

EFSA Food Focal Point
Period: 27 Oct 2015
Sarah Christine Boesgaard Christensen (Participant)
Department of Environmental Engineering
Urban Water Engineering
Description
Expert correspondent on drinking water quality
Related external organisation

European Food Safety Authority
Denmark
Activity: Other

The 60th Annual Midwest Groundwater Conference
Vinni Kampman Rønde (Participant)
Department of Environmental Engineering
Water Resources Engineering

Description
Devlin, J.F., Cremeans, M., Osorno, T., Rønde, V.K., McKnight, U.S., Bjerg, P. 2015
Point Measurements to Quantify Groundwater Discharge to a Stream, Grindsted, Denmark

Related event

The 60th Annual Midwest Groundwater Conference
13/10/2015 → 15/10/2015
Bentonville, Arkansas, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Raphael M. G. Flavigny (External organisation)
Period: 12 Oct 2015
Henrik Rasmus Andersen (Participant)
Department of Environmental Engineering
Urban Water Engineering

Description
A Novel Aerobic Process for Carbon and Nitrogen Removal from Wastewater using a Biofilm with Passive Aeration

PhD committee for Raphael M. G. Flavigny at Murdoch University
Degree of recognition: International

Related external organisation

Raphael M. G. Flavigny
Murdoch University, Australia
Activity: Membership › Membership in review committee

Risikofaktorer i spildevand og sygdomsrisiko ved oversvømmelser
Period: 5 Oct 2015
Hans-Jørgen Albrechtsen (Invited speaker)
Department of Environmental Engineering

Related event

sygdomsrisiko ved oversvømmelser og skybrudssikring
05/10/2015 → 05/10/2015
København, Denmark
Activity: Talks and presentations › Conference presentations

Sardinia 2015 - 15th International Waste Management and Landfill Symposium
Valentina Bisinella (Speaker)
Department of Environmental Engineering
Residual Resource Engineering

Related event

Sardinia 2015 - 15th International Waste Management and Landfill Symposium
05/10/2015 → 09/10/2015
Cagliari, Italy
Activity: Talks and presentations › Conference presentations

Biological rapid sand filters - optimizing nitrification
Period: 30 Sep 2015
Hans-Jørgen Albrechtsen (Keynote speaker)
Department of Environmental Engineering
Urban Water Engineering

Related event

3rd NordicRAS Workshop on Recirculating Aquaculture Systems
30/09/2015 → 01/10/2015
Molde, Norway
Activity: Talks and presentations › Conference presentations

Aerobic TCE degradation of willows and four strains of the root colonizing bacteria B. cepacia
Period: 29 Sep 2015
Lauge Peter Westergaard Clausen (Speaker)
Department of Environmental Engineering
Environmental Chemistry

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Dialogmøde om disruptive teknologiers indflydelse på infrastrukturen
Period: 23 Sep 2015
Hans-Jørgen Albrechtsen (Panel member)
Department of Environmental Engineering
Urban Water Engineering

Related event

ATV Dialogmøde om disruptive teknologiers indflydelse på infrastrukturen
23/09/2015 → 23/09/2015
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

International Congress on Education, Innovation and Learning Technologies
Period: 21 Sep 2015 → 23 Sep 2015
Steffen Foss Hansen (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
Oral presentation on New rooms for blended learning
Documents:
programa provisional ICEILT2015
Related event

International Congress on Education, Innovation and Learning Technologies
21/09/2015 → 23/09/2015
Granada, Spain, Spain
Activity: Attending an event › Participating in or organising a conference

Lauge Peter Westergaard Clausen (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
Oral presentation on New rooms for blended learning
Documents:
programa provisional ICEILT2015

Related event

International Congress on Education, Innovation and Learning Technologies
Period: 21 Sep 2015 → 23 Sep 2015
Granada, Spain, Spain
Activity: Attending an event › Participating in or organising a conference

Steffen Foss Hansen (Speaker)
Department of Environmental Engineering
Environmental Chemistry
Documents:
01-09-2015 Hansen and Clausen 2015 Educating Future Environmental Engineers - Granada - SFH

Related event

International Congress on Education, Innovation and Learning Technologies
Period: 21 Sep 2015 → 23 Sep 2015
Granada, Spain, Spain
Activity: Talks and presentations › Conference presentations

Robust on-line operation of integrated urban wastewater system – combining measurements, models and forecasts
Period: 20 Sep 2015 → 23 Sep 2015
Luca Vezzaro (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Keynote presentation at the 10th international conference on Urban Drainage Modelling (10UDM), Mont-Sainte-Anne, Quebec, Canada, 20-23 September 2015

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Panel Debate: Sustainable Urban Transformation
Period: 11 Sep 2015
Hans-Jørgen Albrechtsen (Panel member)
Related event

Chinese Mayors Training Programme
07/09/2015 → 11/09/2015
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Environmental Protection and Urban Water Systems
Period: 10 Sep 2015
Hans-Jørgen Albrechtsen (Invited speaker)
Department of Environmental Engineering

Related event

Chinese Mayors Training Programme
07/09/2015 → 11/09/2015
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

14th International Conference on Environmental Science and Technology
Period: 3 Sep 2015 → 5 Sep 2015
Ravi Kumar Chhetri (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Combined Sewer Overflow Pretreatment with Chemical Coagulation and a Particle Settler for Improved Peracetic Acid Disinfection
Documents:
CEST2015_fullpaper_00921
Links:
http://cest.gnest.org/node/1

Related event

14th International Conference on Environmental Science and Technology: CEST2015
03/09/2015 → 05/09/2015
Rhodes, Greece
Activity: Talks and presentations › Conference presentations

Development of Global Biodiversity Indicators (Group On Earth Observations Biodiversity Observation Network) GEO-BON (External organisation)
Period: 1 Sep 2015 → 1 Sep 2017
Monica Garcia (Participant)
Department of Environmental Engineering
Water Resources Engineering

Description
Development of a global indicator of the restoration level of degraded ecosystems, to comply with the Target 15 of the Aichi Biodiversity targets from the Convention for Biological Diversity.

Body type: GEO-BON
Degree of recognition: International
Documents:
GBCI_Version1.2_low_Biodiversity_Index

Related external organisation
International Conference on Emerging Water Desalination Technologies in Municipal and Industrial Applications
Agata Zarebska (Speaker)
Department of Environmental Engineering
Urban Water Engineering
Description
Fouling characterization of FO biomimetic aquaporin membranes used for water recovery from municipal wastewater
Oral presentation
Links:
Related event
International Conference on Emerging Water Desalination Technologies in Municipal and Industrial Applications
28/08/2015 → 29/08/2015
San Diego, United States
Activity: Talks and presentations › Conference presentations

150 year jubilee for Environmental Engineering at DTU
Period: 27 Aug 2015
Vinni Kampman Rønde (Participant)
Department of Environmental Engineering
Water Resources Engineering
Description
Ursula S. McKnight Anne T. Sonne John F. Devlin Poul L. Bjerg
Documents:
2015-08-27 150 year jubilee_Vinni
Related event
150 year jubilee for Environmental Engineering at DTU
27/08/2015 → 27/08/2015
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

150 year jubilee for Environmental Engineering at DTU
Period: 27 Aug 2015
Mette Martina Broholm (Participant)
Department of Environmental Engineering
Water Resources Engineering
Documents:
Broholm DTU Env jubilee
Related event
150 year jubilee for Environmental Engineering at DTU
27/08/2015 → 27/08/2015
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
**Description**
LCA as development and decision support tool to implement wastewater resource recovery

**Related event**
**150 year jubilee for Environmental Engineering at DTU**
Period: 27 Aug 2015
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

**Description**
Optimal drinking water quality - considerations of health, environment and aesthetics

**Related event**
**150 year jubilee for Environmental Engineering at DTU**
Period: 27 Aug 2015
Kgs. Lyngby, Denmark
Activity: Other

**Description**
Water in the City: Water Fit for Purpose: Seminar 7

**Related event**
**150 year jubilee for Environmental Engineering at DTU**
Period: 27 Aug 2015
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Description**
Urban Water Systems: Safe and optimal water supply – Going beyond the adequate

**Related event**
Invertebrates in Water distribution systems
Period: 27 Aug 2015
Sarah Christine Boesgaard Christensen (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering
Description
Oral presentation

Related event
150 year jubilee for Environmental Engineering at DTU
27/08/2015 → 27/08/2015
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

What is the right water quality for the given purpose?
Period: 27 Aug 2015
Hans-Jørgen Albrechtsen (Keynote speaker)
Department of Environmental Engineering

Related event
150 year jubilee for Environmental Engineering at DTU
27/08/2015 → 27/08/2015
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

IWA Specialized Conference: Biofilms in Drinking Water Systems: from Treatment to Tap
Period: 26 Aug 2015
Hans-Jørgen Albrechtsen (Organizer)
Department of Environmental Engineering
Description
Biological rapid sand filtration in drinking water treatment: Insights, controls, potentials, limitations: Roundtable discussion
As moderator giving a summary of the discussion.

Related event
IWA Specialized Conference: Biofilms in Drinking Water Systems: from Treatment to Tap
23/08/2015 → 26/08/2015
Arosa, Switzerland
Activity: Attending an event › Participating in or organising a conference
IWA Specialized Conference: Biofilms in Drinking Water Systems: from Treatment to Tap
23/08/2015 → 26/08/2015
Arosa, Switzerland
Activity: Attending an event › Participating in or organising a conference

Measuring and enhancing process kinetics of rapid gravity filters
Period: 24 Aug 2015
Florian Benedikt Wagner (Invited speaker)
Department of Environmental Engineering
Urban Water Systems

Description
Contribution to seminar "Biological rapid sand filtration for drinking water treatment: Update on insights, control, potentials, and limitations"

Related event
IWA Specialized Conference: Biofilms in Drinking Water Systems: from Treatment to Tap
23/08/2015 → 26/08/2015
Arosa, Switzerland
Activity: Talks and presentations › Conference presentations

Equilibrium Sampling of Hydrophobic Organic Contaminants in Sediment
Philipp Mayer (Lecturer)
Department of Environmental Engineering
Environmental Chemistry
Documents:
Short intro guide on How to use the VidyoRoom Video Conference System at ENV

Related event
250th American Chemical Society National Meeting
16/08/2015 → 20/08/2015
Boston, United States
Activity: Talks and presentations › Conference presentations

4th Summer School on Data Assimilation
Period: 20 Jul 2015 → 31 Jul 2015
Raphael Schneider (Participant)
Department of Environmental Engineering
Water Resources Engineering

Related event
4th Summer School on Data Assimilation: Summer School on Data Assimilation and its applications in Oceanography, Hydrology, Risk & Safety and Reservoir Engineering
20/07/2015 → 31/07/2015
Brasov, Romania
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

8th Conference of the International Society for Industrial Ecology
Period: 10 Jul 2015
Martin Rygaard (Speaker)
Department of Environmental Engineering
Urban Water Engineering
Life cycle assessment as decision support tool in early stage development of a new technology for wastewater resource recovery

8th Conference of the International Society for Industrial Ecology
07/07/2015 → 10/07/2015
Guildford, United Kingdom
Activity: Talks and presentations › Conference presentations

Spatial heterogeneity & spatial dynamic of soil bacteria: what importance?

Seminar
Period: 10 Jul 2015
Arnaud Dechesne (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

8th Conference of the International Society for Industrial Ecology
Period: 7 Jul 2015 → 10 Jul 2015
Karslruhe, Germany
Activity: Talks and presentations › Conference presentations

The role of biochar in achieving carbon neutral bioenergy systems
Period: 7 Jul 2015 → 10 Jul 2015
Koldo Saez de Bikuna Salinas (Lecturer)
Department of Environmental Engineering
Atmospheric Environment

In dedicated bioenergy systems, indirect land use changes may put in risk the sustainability of these renewable energy sources. Gasification can play a key role in bringing carbon neutrality through permanent C sequestration of stable biochar when this is use as soil amendment in the fields where the energy crops are cultivated. The importance of considering the background system development over time is highlighted, since it will affect the substituted energy sources. This should be an additional aspect to consider when performing life cycle assessments of dedicated bioenergy systems.

Documents:
The role of biochar in achieving carbon neutral bioenergy systems.ISIE_final
Review of proposal for Czech Science Foundation. (External organisation)
Period: 4 Jul 2015
Henrik Rasmus Andersen (Member)
Urban Water Engineering
Department of Environmental Engineering
Degree of recognition: International

Related external organisation
Review of proposal for Czech Science Foundation.
Activity: Membership › Membership in review committee

22nd IOA World Congress and Exhibition
Period: 1 Jul 2015
Kamilla Marie Speht Kaarsholm (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Ozonation for degradation of pharmaceutical in hospital wastewater

Related event
22nd IOA World Congress and Exhibition : Ozone and Advanced Oxidation: Leading-edge science and technologies
28/06/2015 → 03/07/2015
Barcelona, Spain
Activity: Talks and presentations › Conference presentations

22nd IOA World Congress and Exhibition
Period: 29 Jun 2015
Kamilla Marie Speht Kaarsholm (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Effect of ozonation on THM formation in swimming pool water – laboratory study

Related event
22nd IOA World Congress and Exhibition : Ozone and Advanced Oxidation: Leading-edge science and technologies
28/06/2015 → 03/07/2015
Barcelona, Spain
Activity: Talks and presentations › Conference presentations

Health Risks, Precaution and Innovation
Period: 24 Jun 2015
Steffen Foss Hansen (Speaker)
Department of Environmental Engineering
Environmental Chemistry
Documents:
ANSES 2015
Related event

Health Risks, Precaution and Innovation
24/06/2015 → 24/06/2015
Paris, France
Activity: Talks and presentations › Conference presentations

member of the "Environment and Global Changes" Panel, Fundação para a Ciência e a Tecnologia, I.P. (FCT), the Portuguese public funding agency for R&D (External organisation)
Period: 24 Jun 2015 → 26 Jun 2015
Dimitar Borisov Karakashev (Participant)
Department of Environmental Engineering
Residual Resource Engineering

Description

Degree of recognition: International

Related external organisation

member of the "Environment and Global Changes" Panel, Fundação para a Ciência e a Tecnologia, I.P. (FCT), the Portuguese public funding agency for R&D (External organisation)
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Tekboost sparringsdag
Period: 24 Jun 2015
Henrik Rasmus Andersen (Consultant)
Department of Environmental Engineering

Description
Deltager som match til firmaet O3Nordic
Deltager som match til firmaet O3Nordic

Related external organisation

Væksthus Hovedstadsregionen
Fruebjergvej 3, 2100, København Ø, Denmark
Activity: Public and private sector consultancy › Consultancy

Regeneration of brownfield mega sites
Period: 10 Jun 2015
Lauge Peter Westergaard Clausen (Other)
Department of Environmental Engineering
Environmental Chemistry

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Assessing the risks posed by multiple stressors to water resources
Period: 9 Jun 2015
Poul Løgstrup Bjerg (Invited speaker)
Department of Environmental Engineering
Water Resources Engineering
Related event

13th International UFZ-Deltares Conference on Sustainable Use and Management of Soil, Sediment and Water Resources
09/06/2015 → 12/06/2015
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Assessing the risks posed by multiple stressors to water resources
Period: 9 Jun 2015 → 12 Jun 2015
Poul Løgstrup Bjerg (Keynote speaker)
Department of Environmental Engineering
Water Resources Engineering
Documents:
Book of abstract - AquaConSoil conference

Related event

13th International UFZ-Deltares Conference on Sustainable Use and Management of Soil, Sediment and Water Resources
09/06/2015 → 12/06/2015
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Seaweed Symposium for Growth in the Blue Bio-economy
Period: 5 May 2015 → 7 May 2015
Martina D'Este (Participant)
Department of Environmental Engineering
Residual Resource Engineering

Related event

Seaweed Symposium for Growth in the Blue Bio-economy
05/05/2015 → 07/05/2015
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Campylobacter - findes andre steder end i kyllinger. Urbant vand.
Period: 27 Apr 2015
Hans-Jørgen Albrechtsen (Invited speaker)
Department of Environmental Engineering

Related event

One Health Forum: Tvaerministerielt Forum
27/04/2015 → 27/04/2015
2860 Søborg, DTU FOOD, Denmark
Activity: Talks and presentations › Conference presentations

WP 4.2: Qualitative and quantitative methods for exposure assessment for nanomaterials
Period: 22 Apr 2015 → 23 Apr 2015
Biase Liguori (Speaker)
Department of Environmental Engineering
Environmental Chemistry
Description
Annual Meeting Danish Centre for Nanosafety

Sensitivity Analysis of NanoSafer: Assess the Relative Weight of the Determinant Factors for Exposure Assessment

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

ATV Jord og grundvand
Period: 14 Apr 2015
Martin Rygaard (Organizer)
Department of Environmental Engineering
Urban Water Engineering

Related event
ATV Jord og grundvand: Kvaliteten af grund- og drikkevand i forhold til sundhed og økonomi
14/04/2015 → …
Gentofte, Denmark
Activity: Attending an event › Participating in or organising a conference

ATV Jord og grundvand
Period: 14 Apr 2015
Martin Rygaard (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering
Documents:
Martin Rygaard ATV JG 150414

Related event
ATV Jord og grundvand: Kvaliteten af grund- og drikkevand i forhold til sundhed og økonomi
14/04/2015 → …
Gentofte, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

European Geosciences Union General Assembly 2015
Period: 14 Apr 2015
Raphael Schneider (Speaker)
Water Resources Engineering
Department of Environmental Engineering

Description
Oral presentation at EGU 2015, session HS6.3: Integrating flood and surface water remote sensing with hydrodynamic modelling: from local to global scales

Related event
European Geosciences Union General Assembly 2015
12/04/2015 → 17/04/2015
Vienna, Austria
Activity: Talks and presentations › Conference presentations
Drones and Hydraulics
Period: 8 Apr 2015 → 9 Apr 2015
Filippo Bandini (Speaker)
Department of Environmental Engineering
Water Resources Engineering

Description
Poster presentation

Evaluation of different water surface ranging technologies for lightweight UAVs

Related event

Drones and Hydraulics: At the Service of Water Professionals
08/04/2015 → 09/04/2015
Paris, France
Activity: Talks and presentations › Conference presentations

Theoretical aspects of ensemble data assimilation for the Earth system
Period: 5 Apr 2015 → 10 Apr 2015
Morten Borup (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
5 days of presentations and discussions regarding ensemble data assimilation.

Les Houches workshop: "Theoretical aspects of ensemble data assimilation for the Earth system".

Related event

Theoretical aspects of ensemble data assimilation for the Earth system
05/04/2015 → 10/04/2015
Les Houches, France
Activity: Talks and presentations › Conference presentations

6th International Conference Swimming Pool & Spa
Henrik Rasmus Andersen (Participant)
Department of Environmental Engineering
Urban Water Engineering

Description
Scientific committee

Related event

6th International Conference Swimming Pool & Spa
17/03/2015 → 20/03/2015
Amsterdam, Netherlands
Activity: Attending an event › Participating in or organising a conference

6th International Conference Swimming Pool & Spa
Kamilla Marie Speht Kaarsholm (Speaker)
Department of Environmental Engineering
Urban Water Engineering
Description
Laboratory studies on the effect of ozonation on THM formation in swimming pool water

Documents:
Hansen - ozonation 150318 final - pool&spa conference Amsterdam 2015

Links:
http://iwcconferences.com/swimming-pool-spa-conference/ (conference home page)

Related event

6th International Conference Swimming Pool & Spa
17/03/2015 → 20/03/2015
Amsterdam, Netherlands
Activity: Talks and presentations › Conference presentations

Qatar National Research Fund (External organisation)
Period: 27 Feb 2015
Henrik Rasmus Andersen (Member)
Urban Water Engineering
Department of Environmental Engineering

Description
Proposal review for National Priorities Research Program (NPRP).
Degree of recognition: International

Related external organisation
Qatar National Research Fund
Activity: Membership › Membership in review committee

Miljøministeriets Vandtopmøde: Globale Udfordringer
Period: 25 Feb 2015
Hans-Jørgen Albrechtsen (Invited speaker)
Department of Environmental Engineering

Related event
Miljøministeriets Vandtopmøde
25/02/2015 → 25/02/2015
Industriens Hus, København V, Denmark
Activity: Talks and presentations › Conference presentations

Alternatives to groundwater based water supply: what are the challenges and opportunities?
Period: 29 Jan 2015
Martin Rygaard (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

Related event
9th Annual Danish Water Research Meeting 2015
29/01/2015 → 29/01/2015
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Phosphorus addition can increase nitrification in biological rapid sand filters for drinking water treatment
Period: 29 Jan 2015
Florian Benedikt Wagner (Speaker)
Department of Environmental Engineering
Urban Water Systems

Related event

9th Annual Danish Water Research Meeting 2015
29/01/2015 → 29/01/2015
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

15th International Symposium on Microbial Ecology
Period: 2014
Uli Klümper (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Deep sequencing of soil transconjugal pools reveals unexpected phylogenetic diversity of bacteria receiving broad host range plasmids.

Oral presentation

Related event

15th International Symposium on Microbial Ecology
24/08/2014 → 29/08/2014
Seoul, Korea, Republic of
Activity: Talks and presentations › Conference presentations

ESOF Marie Skłodowska-Curie actions Conference
Period: 2014
Alejandro Palomo (Participant)
Department of Environmental Engineering
Urban Water Engineering

Related event

ESOF Marie Skłodowska-Curie actions Conference
19/06/2014 → 20/06/2014
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Examiner, Environmental Regulation and History, International Master of Science in Environmental Risk, Roskilde University
Period: 2014 → ...
Steffen Foss Hansen (External examiner)
Department of Environmental Engineering
Environmental Chemistry
Degree of recognition: Regional
Activity: Examinations and supervision › External examination

Journal of Applied Phycology (Journal)
Period: 2014 → ...
Jonathan Myerson van Wagenen (Reviewer)
Department of Environmental Engineering
Residual Resource Engineering
Description
Journal of Applied Phycology

Related journal
Journal of Applied Phycology
0921-8971

Central database
Activity: Research › Peer review of manuscripts

Nordic Environmental NUcleotide Network
Period: 2014
Alejandro Palomo (Participant)
Department of Environmental Engineering
Urban Water Engineering

Description
Functional gene approach to study nitrifier diversity

Related event
Nordic Environmental NUcleotide Network
12/12/2014 → 14/12/2014
Helsinki, Finland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Steering group member of the Joint Nanotechnology Project CIEL, ECOS andd Öko Institut (External organisation)
Steffen Foss Hansen (Chairman)
Department of Environmental Engineering
Environmental Chemistry
Degree of recognition: International
Links:

Related external organisation
Steering group member of the Joint Nanotechnology Project CIEL, ECOS andd Öko Institut
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

DTU Sustain 2014
Period: 17 Dec 2014
Steffen Foss Hansen (Organizer)
Kristian Mølhave (Organizer)
Department of Environmental Engineering
Environmental Chemistry
Department of Micro- and Nanotechnology
Molecular Windows
Documents:
SustainDTUabstractBook2014-small

Related event
DTU Sustain 2014
17/12/2014 → …
Activity: Attending an event › Participating in or organising a conference
Alternative water supply and advanced water treatment
Period: 11 Dec 2014
Martin Rygaard (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

Related event
Årligt evalueringsmøde om tilsynsaftale med drikkevand
11/12/2014 → …
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

International Water Association Young Water Professionals Denmark General Assembly
Period: 11 Dec 2014
Martin Rygaard (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Alternative water supply options - it's not about history, it's about quality

Related event
International Water Association Young Water Professionals Denmark General Assembly
11/12/2014 → …
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Controlling factors for nitrification in biological drinking water rapid sand filters: Nitrification and nutrients
Period: 2 Dec 2014
Florian Benedikt Wagner (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Oral contribution at Krüger A/S Water Supply Department - workshop on biological treatment

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Workshop Evaluation Meeting Committee
Period: 1 Dec 2014
Monica Garcia (Invited speaker)
Department of Environmental Engineering
Water Resources Engineering

Description
Technical implications of adopting different methods of estimating evapotranspiration for index insurance purposes.


Related event
Workshop Evaluation Meeting Committee: Weather Risk Management in West Africa. Drought insurance with remote sensing
01/12/2014 → 02/12/2014
Rome, Italy
Activity: Talks and presentations › Conference presentations

SETAC Europe 20th LCA Case Study Symposium
Period: 26 Nov 2014
Martin Rygaard (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Platform presentation

Related event
SETAC Europe 20th LCA Case Study Symposium
24/11/2014 → 26/11/2014
Novi Sad, Serbia
Activity: Talks and presentations › Conference presentations

Conference on Energy and Environment for the Future
Period: 25 Nov 2014
Pernille Aabye Marker (Participant)
Department of Environmental Engineering
Water Resources Engineering

Description
Poster presentation
Documents:
24nov2014_InnoFond_A1_portrait_v2

Related event
Conference on Energy and Environment for the Future: Sustainable energy for a fossil free society and environmentally friendly technologies
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising a conference

Microbial water quality in clean water tanks following inspection and cleaning
Period: 24 Nov 2014
Florian Benedikt Wagner (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Oral presentation of poster at conference

Related event
2014 IWA World Water Congress & Exhibition
21/09/2014 → 26/09/2014
Lisbon, Portugal
Activity: Talks and presentations › Conference presentations
Optimering af vandforsyningens moniteringsstrategi ved hjælp af GIS-analyse

Phosphorus limitations of nitrification in biological sand filters for drinking water treatment – A study at 3 different scales

Rensning af hospitalsspildevand.: Driftsresultater af første års drift med fixed-film teknologi

Treatment of worm infested rapid sand filters
Related event

**Dansk Vand Konference 2014**
18/11/2014 → 19/11/2014
Århus, Denmark
Activity: Talks and presentations › Conference presentations

**HyGEM Workshop**
Period: 17 Nov 2014
Pernille Aabye Marker (Speaker)
Department of Environmental Engineering
Water Resources Engineering
Documents:
HyGEM_workshop_17nov2014

Related event

**HyGEM Workshop**
17/11/2014 → …
Højbjerg, Denmark
Activity: Talks and presentations › Conference presentations

**IP06 DesiCSO - Desinfektion af "Combined Sewer Overflow", CSO**
Period: 11 Nov 2014
Henrik Rasmus Andersen (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Teaser on the project content.

Related event

**Fremtidens klimarobuste by**
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

**The Danish Microbiological Society Annual Congress 2014**
Period: 10 Nov 2014
Lasse Pedersen (Participant)
Department of Environmental Engineering

Description
Poster: Reducing diffusion limitation shifts the dominant nitrate reduction metabolism from incomplete denitrification to dissimilatory nitrate reduction to ammonium
Documents:
Abstract

Related event

**The Danish Microbiological Society Annual Congress 2014**
10/11/2014 → …
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising a conference
New Marselisborg Wastewater Treatment Plant  
Period: 30 Oct 2014  
Martin Rygaard (Invited speaker)  
Department of Environmental Engineering  
Urban Water Engineering  

Description  
Presentation on "Water Symbiosis" in relation to future wastewater treatment in Denmark  
Documents:  
Martin Rygaard Vandsymbiose

Related event

New Marselisborg Wastewater Treatment Plant  
30/10/2014 → …  
Aarhus, Denmark  
Activity: Talks and presentations › Conference presentations

Expert panel for Research Council of Norway (External organisation)  
Teis Nørgaard Mikkelsen (Participant)  
Department of Environmental Engineering  
Atmospheric Environment  

Description  
Panel member Research Council of Norway (Projects on ecosystem effects )  
Degree of recognition: International

Related external organisation

Expert panel for Research Council of Norway  
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

IARU Sustainability Science Congress  
Koldo Saez de Bikuna Salinas (Participant)  
Department of Environmental Engineering  
Atmospheric Environment  

Description  
Biotic Stocks Potential: an improved indicator for Land Use impact assessment? In line with the Performance Economy thinking, a focus shift from managing and measuring environmental flows to stocks is suggested for the case of Biotic Production Potential (BPP) within Land Use Impact assessment in LCA. The difference between BPP and Biotic Stocks Potential is illustrated with a study case, where the bias taken when looking at flows can be seen. The focus of most impact indicators within LCA on environmental flows is put into question here, opening a debate for a possible thinking shift from flows to environmental stocks management.  
Documents:  
Poster_IARU_final

Related event

IARU Sustainability Science Congress  
22/10/2014 → 24/10/2014  
Copenhagen, Denmark  
Activity: Attending an event › Participating in or organising a conference
8th Intercontinental Landfill Research Symposium
Anders Damgaard (Participant)
Department of Environmental Engineering
Residual Resource Engineering
Description
ICLRS conference, Crystal River, Florida, USA
Documents:
Damgaard_ICLRS_Abstract_2014

Related event
8th Intercontinental Landfill Research Symposium
19/10/2014 → 22/10/2014
Crystal River, Florida, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

University of the Aegean
Henrik Rasmus Andersen (Visiting researcher)
Urban Water Engineering
Department of Environmental Engineering
Description
Research visit to University of the Aegean: WATERMICROPOL project
Visit to University of the Aegean with the purpose to co-supervise PhD projects, develop analytical methods and experimental methods for investigating degradation of micropolutants in wastewater treatment anaerobic digestors and participate in the WATERMICROPOL project. Planning new projects.
University of the Aegean is the project leader on the WATERMICROPOL project. DTU-ENV exchange students and PhD candidates.
Activity: Visiting an external institution › Visiting another research institution

Optimise Workshop
Monica Garcia (Participant)
Department of Environmental Engineering
Water Resources Engineering
Description
Participation as a representative of Denmark (Member) in the workshop related to Cost action

Related event
Optimise Workshop
07/10/2014 → 10/10/2014
Milano, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Biogeochemical Interfaces in Soil
Lasse Pedersen (Speaker)
Department of Environmental Engineering
Description
Oral presentation: Reducing diffusion limitation shifts the dominant nitrate reduction metabolism from incomplete denitrification to dissimilatory nitrate reduction to ammonium
Documents:
Abstract
Abstract

Related event

Biogeochemical Interfaces in Soil
06/10/2014 → 10/12/2014
Leipzig, Germany
Activity: Talks and presentations › Conference presentations

International Workshop On Urban Pluvial Flood Modelling
Period: 6 Oct 2014
Morten Borup (Participant)
Department of Environmental Engineering
Urban Water Engineering

Related event

International Workshop On Urban Pluvial Flood Modelling
06/10/2014 → ...
Exeter, United Kingdom
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Phytotoxicity of Sodium Fluoride and Uptake of Fluoride in Willow Trees
Period: 2 Oct 2014
Lauge Peter Westergaard Clausen (Speaker)
Department of Environmental Engineering
Environmental Chemistry

Related event

International Conference of Phytoremediation
30/09/2014 → 02/10/2014
Haraklion, Greece
Activity: Talks and presentations › Conference presentations

Phosphorus Limitations in Rapid Sand Filters Studied with Different Packed Column Assays
Period: 24 Sep 2014
Florian Benedikt Wagner (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Oral presentation of poster at conference.

Related event

2014 IWA World Water Congress & Exhibition
21/09/2014 → 26/09/2014
Lisbon, Portugal
Activity: Talks and presentations › Conference presentations

Design of Chemical Disinfection of Combined Sewer Overflows (CSO) by Peracetic Acid & Performic Acids
Period: 23 Sep 2014
Henrik Rasmus Andersen (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
We investigated the possibility of applying performic acid (PFA) and peracetic acid (PAA) for disinfection of combined sewer overflow (CSO) in existing CSO management infrastructures. The disinfection power of PFA and PAA towards Escherichia coli (E. coli) and Enterococcus were studied in batch-scale and pre-field experiments. In the batch-scale experiment, 2.5 mg•L⁻¹ PAA removed approximately 4 log unit of E. coli and Enterococcus from CSO with a 360 min contact time. The removal of E. coli and Enterococcus from CSO was always around or above 3 log units using 2–4 mg•L⁻¹ PFA; with a 20 min contact time in both batch-scale and pre-field experiments. There were no toxicological effect measured by Vibrio fischeri when CSO was disinfected with PFA, a slight toxic effect was observed on CSO disinfected with PAA.

Related event

2014 IWA World Water Congress & Exhibition
21/09/2014 → 26/09/2014
Lisbon, Portugal
Activity: Talks and presentations › Conference presentations

Workshop om anvendelse af sekundavand
Period: 23 Sep 2014
Martin Rygaard (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
Presenting outcomes of the Water in Cities project "Sekundavand i Nordhavn"

Workshop on secondary water supplies (Sekundavand)
Documents:
2014 Rygaard Nordhavn Sekundavandsworkshop 140923

Related event

Workshop om anvendelse af sekundavand
23/09/2014 → …
Valby, Denmark
Activity: Talks and presentations › Conference presentations

Teaching in the course Hydrology at the Sino-Danish Center (SDC)
Period: 20 Sep 2014 → 22 Oct 2014
Claus Davidsen (Lecturer)
Department of Environmental Engineering
Water Resources Engineering

Description
Hjælpeleærer og underviser i hydrologikurset, 1. semester på M.Sc. i Vand og Miljø-programmet sammen med Professor Dan Rosbjerg, DTU Miljø

Related external organisation

Sino-Danish Center (SDC) at the Chinese Academy of Sciences (CAS)
Beijing, China
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Konference Fremtidens Drikkevand
Period: 11 Sep 2014
Mathilde Jørgensen Hedegaard (Participant)
Department of Environmental Engineering
IBBA Methane emission workshop
Period: 4 Sep 2014
Antonio Delre (Speaker)
Department of Environmental Engineering
Residual Resource Engineering

Description
Presentation about "Full-scale quantification of methane (CH4) emission from wastewater treatment plants and biogas facilities" Presentation and Abstract can be found in "Links" section.

Inter Baltic Biogas Arena (IBBA) - Methane emission workshop
The biogas technology pursues the objective to produce methane as a renewable energy source. but it also has a strong effect on the climate change due to its global warming potential of 25. In this regard, the reliable measurement of stationary and diffuse emission sources are important. In the past years, numerous efforts were made to estimate methane emissions from biogas plants. It is however important that results from different countries are comparable to be able to combine the data from the different countries and give a European description of the situation.

Links:
http://conference.sgc.se/?pg=1445795 (Workshop Program)
http://conference.sgc.se/ckfinder/userfiles/files/DelreDTU.pdf (Abstract of "Full-scale quantification of CH4 emissions from wastewater treatment plants and biogas facilities".)

Water pricing and sustainable water management in Northern China
Period: 29 Aug 2014
Claus Davidsen (Invited speaker)
Department of Environmental Engineering
Water Resources Engineering

Description
Presentation for a Chinese delegation lead by Vice Minister Zhang Ye from the Office of South-to-North Water Diversion Project Commission of the State Council. The presentation was given at the Ministry of Environment, Copenhagen and was organized by the China-EU Water Platform.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

2nd International Conference on Algal Biorefinery
Martina D'Este (Speaker)
Department of Environmental Engineering
Residual Resource Engineering

Related event

2nd International Conference on Algal Biorefinery: A potential source of food, feed, biochemicals, biofuels and biofertilizers
27/08/2014 → 29/08/2014
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Mixotrophy or Cyclic Autotrophy/heterotrophy for Microalgal Cultivation on Media Containing Organic Carbon
Jonathan Myerson van Wagenen (Lecturer)
Department of Environmental Engineering
Residual Resource Engineering

Related event

2nd International Conference on Algal Biorefinery: A potential source of food, feed, biochemicals, biofuels and biofertilizers
27/08/2014 → 29/08/2014
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Aberdeen Catchment Science Summer School
Raphael Schneider (Participant)
Department of Environmental Engineering
Water Resources Engineering

Related event

Aberdeen Catchment Science Summer School
17/08/2014 → 22/08/2014
Aberdeen, United Kingdom
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

International Conference of Phytoremediation of Polluted Soils
Lauge Peter Westegaard Clausen (Speaker)
Department of Environmental Engineering
Environmental Chemistry

Description
Oral presentation
Phytotoxicity of Sodium Fluoride and Uptake of Fluoride in Willow Trees
Documents:
Presentation_Toxicity of NaF and uptake of F to willows

Related event

International Conference of Phytoremediation of Polluted Soils
29/07/2014 → 30/07/2014
Vigo, Spain
Activity: Talks and presentations › Conference presentations
International Conference of Phytoremediation of Polluted Soils
Stefan Trapp (Speaker)
Department of Environmental Engineering
Environmental Chemistry

Description
Oral presentation
Phytotoxicity of Sodium Fluoride and Uptake of Fluoride in Willow Trees
Documents:
Presentation_Toxicity of NaF and uptake of F to willows

Related event
International Conference of Phytoremediation of Polluted Soils
29/07/2014 → 30/07/2014
Vigo, Spain
Activity: Talks and presentations › Conference presentations

Global Energy and Carbon Cycles
Monica Garcia (Participant)
Department of Environmental Engineering
Water Resources Engineering
Links:
http://gewex.org/2014conf/info.html

Related event
Global Energy and Carbon Cycles
14/07/2014 → 17/07/2014
Den Haage, Netherlands
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

IASC-ERS Summer School on Compositional Data Analysis
Period: 7 Jul 2014
Maklawe Essonanawe Edjabou (Participant)
Department of Environmental Engineering
Residual Resource Engineering
Links:
http://ima.udg.edu/Recerca/EIO/pages/AnunciCoDACourse2014_IASC.pdf

Related event
IASC-ERS Summer School on Compositional Data Analysis
07/07/2014 → 11/07/2014
Girona, Spain
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

2014 AGU Fall Meeting
Klaus Mosthaf (Participant)
Department of Environmental Engineering
Water Resources Engineering


**Description**
Comparison of different modeling approaches to simulate contaminant transport in a fractured limestone aquifer

**Related event**

**2014 AGU Fall Meeting**
15/12/2014 → 19/12/2014
San Francisco, CA, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Estimating household food waste in Denmark: Case study of single family households**
Period: 26 Jun 2014
Maklawe Essonanawe Edjabou (Speaker)
Department of Environmental Engineering
Residual Resource Engineering
Links:
http://orbit2014.com/?mod=mainpage&cla=mainpage&fun=access&temp=startpage

**Related event**

**9th International Conference ORBIT 2014: New Challenges, New Responses in 21st Century**
26/06/2014 → 28/06/2014
Gödöllő, Hungary
Activity: Talks and presentations › Conference presentations

**Mixotrophy or Cyclic Autotrophy/Heterotrophy for Microalgal Cultivation on Media Containing Organic Carbon?**
Period: 23 Jun 2014
Jonathan Myerson van Wagenen (Lecturer)
Department of Environmental Engineering
Residual Resource Engineering

**Related event**

**5th Congress of the International Society for Applied Phycology**
22/06/2014 → 27/06/2014
Sydney, Australia
Activity: Talks and presentations › Conference presentations

**Euroscience Open Forum 2014**
Period: 21 Jun 2014 → 24 Jun 2014
Denisa Cupi (Speaker)
Department of Environmental Engineering
Environmental Chemistry

**Description**
EURODOC: the views of a young scientist, what are the challenges? What does EURODOC offer?

Life after a PhD: How professional career advisers support researchers in Europe.

**Related event**

**Euroscience Open Forum 2014**
21/06/2014 → 26/06/2014
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

**ESOF Marie Skłodowska-Curie actions Conference**
Period: 19 Jun 2014
Vaibhav Diwan (Speaker)
Urban Water Engineering
Department of Environmental Engineering

Description
Poster presentation of the PhD projects under the MERMAID-ITN at DTU.

Related event
ESOF Marie Skłodowska-Curie actions Conference
19/06/2014 → 20/06/2014
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

ICCA-LRI and JRC Workshop 2014
Period: 17 Jun 2014
Philipp Mayer (Invited speaker)
Department of Environmental Engineering
Environmental Chemistry

Description
Assessing toxicity with partitioning based methods and chemical activity.
Philipp Mayer.

Related event
ICCA-LRI and JRC Workshop 2014
17/06/2014 → 18/06/2014
Lugano, Switzerland
Activity: Talks and presentations › Conference presentations

Using stochastic dynamic programming to optimize use of surface water and groundwater in China
Period: 11 Jun 2014
Claus Davidsen (Invited speaker)
Department of Environmental Engineering
Water Resources Engineering

Description
Oral presentation of PhD project at COWI, division on "Economics, Management and Planning".

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Bologna IAHS 2014
Period: 4 Jun 2014
Claus Davidsen (Speaker)
Department of Environmental Engineering
Water Resources Engineering

Related event
04/06/2014 → 06/06/2014
Bologna, Italy
Functional gene approach to study nitrifier diversity
Period: 13 May 2014
Vaibhav Diwan (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Description
The talk consisted of past, present and future work in relation to using the functional gene approach to study nitrifier diversity.

Co-authors: Sanin Musovic (PostDoc) and Alejandro Palomo González (PhD student)

Related event
Nordic Environmental NUcleotide Network
12/12/2014 → 14/12/2014
Helsinki, Finland

SETAC Europe 24th Annual Meeting
Period: 11 May 2014 → 15 May 2014
Koldo Saez de Bikuna Salinas (Participant)
Department of Environmental Engineering
Atmospheric Environment

Description
Given that land is a limited resource, the possibility of establishing an absolute scale is suggested as normalization in Land Use impact assessments in LCA. The case of Biotic Production Potential and bioenergy is taken to illustrate the existence of a “Land Use Optimal Point”. It is hypothesized that the problem of available land for bioenergy production can be solved through linear programming, by finding the perfect compromise between the fossil fuel displacement potential (through e.g. business-as-usual yield maximization) and carbon stock maximization (through e.g. forestry systems or reforestation programs). As a result, high yielding bioenergy crops (e.g. short rotation coppices) that displace carbon intensive energy sources (e.g. coal) may make sense from a land use perspective in a transitioning energy system. On ther other hand, low performing bioenergy crops (e.g. rapeseed) substituting other energy sources may fall beyond the Land Use optimality frontier, meaning that a more efficient way of mitigating Global Warming would be reforestation for latter cases.

Documents:
Poster_SETAC_final

Related event
SETAC Europe 24th Annual Meeting
11/05/2014 → 15/05/2014
Basel, Switzerland

European Geosciences Union General Assembly 2014
Period: 30 Apr 2014
Claus Davidsen (Speaker)
Department of Environmental Engineering
Water Resources Engineering

Related event
European Geosciences Union General Assembly 2014
27/04/2014 → 02/05/2014
Vienna, Austria
**Kan den miljøteknologiske sektor levere?**

**Period:** 29 Apr 2014  
**Henrik Rasmus Andersen (Participant)**  
Department of Environmental Engineering  
Urban Water Engineering

**Description**
Participation in InnoMT yearly meeting. InnoMT is a registered participant in the project. www.innoMT.dk.

Inno-MTs annual meeting.

**Related event**

**Kan den miljøteknologiske sektor levere?: Inno-MTs årskonference 2014**
29/04/2014 → 29/04/2014  
Munkebo, Denmark  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Swiss LCA Discussion Forum**

**Period:** 11 Apr 2014  
**Jakob Thaysen Rørbech (Invited speaker)**  
Department of Environmental Engineering  
Residual Resource Engineering

**Related event**

**Swiss LCA Discussion Forum: Abiotic resources – New impact assessment approaches in view of resource efficiency and resource criticality**
11/04/2014 → …  
Zürich, Switzerland  
Activity: Talks and presentations › Conference presentations

**Den kemiske strategi for et godt badevand**

**Period:** 10 Apr 2014  
**Kamilla Marie Speht Kaarsholm (Invited speaker)**  
Department of Environmental Engineering  
Urban Water Engineering

**Related event**

**Dansk Svømmebadsteknisk Forening - Årsmøde 2014**
09/04/2014 → 10/04/2014  
Denmark  
Activity: Talks and presentations › Conference presentations

**Site characterization and in-situ remediation in fractured geologic media contaminated by chlorinated solvents**

**Period:** 28 Mar 2014  
**Mette Martina Broholm (Invited speaker)**  
Department of Environmental Engineering  
Water Resources Engineering
Documents:
Site characterization and in-situ remediation in fractured geologic media contaminated by chlorinated solvents

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Informationsmøde: Rammerne for MUDP 2014
Period: 27 Mar 2014
Henrik Rasmus Andersen (Participant)
Department of Environmental Engineering
Urban Water Engineering

Related event

Informationsmøde: Rammerne for MUDP 2014
27/03/2014 → 27/03/2014
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

53rd Annual Meeting of Society of Toxicology and ToxExpo
Period: 24 Mar 2014 → 27 Mar 2014
Denisa Cupi (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
Poster presentation
Documents:
Cupi Baun 2014 THE INFLUENCE OF UV LIGHT ON THE GENOTOXICITY OF ENGINEERED NANOPARTICLES

Related event

53rd Annual Meeting of Society of Toxicology and ToxExpo
24/03/2014 → 27/03/2014
Phoenix, AZ, United States
Activity: Attending an event › Participating in or organising a conference

University of the Aegean
Henrik Rasmus Andersen (Visiting researcher)
Urban Water Engineering
Department of Environmental Engineering

Description
Visit to University of the Aegean with the purpose to co-supervise PhD projects and participate in the WATERMICROPOL project. Planning new projects.

University of the Aegean is the project leader on the WATERMICROPOL project. DTU-ENV exchange students and PhD candidates.
Activity: Visiting an external institution › Visiting another research institution

Effekt af pH på dannelsen af biprodukter ved desinfektion i svømmebade
Period: 5 Mar 2014
Kamilla Marie Speht Kaarsholm (Invited speaker)
Department of Environmental Engineering
Related event

**Svømmehallkompetanse 2014**
05/03/2014 → 06/03/2014
Hamar, Norway
Activity: Talks and presentations › Conference presentations

**Klimatilpasning i offentligt privat samarbejde**
Period: 5 Mar 2014
Martin Rygaard (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

Related event

**Klimatilpasning i offentligt privat samarbejde: Forum for Offentligt Privat Samarbejde**
05/03/2014 → 05/03/2014
Hellerup, Denmark
Activity: Talks and presentations › Conference presentations

**Ozonbehandling til fjernelse af mikroforureningsstoffer i udløb fra renseanlæg**
Period: 5 Mar 2014
Henrik Rasmus Andersen (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering
Documents:
Andersen_Ozon

Related event

**Miljøfremmede stoffer og næste generations spildevandsrensning: Innovationsnetværk for Miljøteknologi**
05/03/2014 → 05/03/2014
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

**Pollution of water ressources**
Period: 2 Mar 2014
Mathilde Jørgensen Hedegaard (Lecturer)
Department of Environmental Engineering
Urban Water Engineering

Related event

**Water water everywhere and not a drop to drink**
01/03/2014 → 02/03/2014
Helsingør, Denmark
Activity: Talks and presentations › Conference presentations

**Water water everywhere and not a drop to drink**
Period: 1 Mar 2014
Martin Rygaard (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering
**Description**  
Scientific and technological challenges and solutions.

**Related event**  
*Water water everywhere and not a drop to drink*  
01/03/2014 → 02/03/2014  
Helsingør, Denmark  
Activity: Talks and presentations › Conference presentations

*International Seminar "Dynamic processes in capillary fringes"*  
Arnaud Dechesne (Invited speaker)  
Department of Environmental Engineering  
Urban Water Engineering  

**Description**  
Microbial motion in the vadose zone.  
Documents:  
Flyer & schedule for the international DyCap meeting in Karlsruhe, Feb.2014

**Related event**  
*International Seminar "Dynamic processes in capillary fringes"*  
24/02/2014 → 25/02/2014  
Karlsruhe, Germany  
Activity: Talks and presentations › Conference presentations

*Elsevier (Publisher)*  
Period: 22 Feb 2014  
Henrik Rasmus Andersen (Reviewer)  
Department of Environmental Engineering  
Urban Water Engineering  

**Description**  
Chemosphere  
Review of manuscript.

**Related Publisher**  
Elsevier  
Netherlands  
Local database  
Activity: Research › Peer review of manuscripts

*8th Annual Meeting of the Danish Water Research and Innovation Platform*  
Period: 30 Jan 2014  
Luca Locatelli (Speaker)  
Department of Environmental Engineering  
Urban Water Engineering  

**Description**  
Oral presentation  
Abstract submission and oral presentation  
Documents:  
Modelling the impact of implementing Water Sensitive Urban Design on at a catchment scale_template_modifiedVer1
Related event

8th Annual Meeting of the Danish Water Research and Innovation Platform  
30/01/2014 → 30/01/2014  
Copenhagen, Denmark  
Activity: Talks and presentations › Conference presentations

Pesticidnedbrydning  
Period: 22 Jan 2014  
Mathilde Jørgensen Hedegaard (Lecturer)  
Department of Environmental Engineering  
Urban Water Engineering  

Description  
Oplæg om fjernelse af pesticider i sandfiltre  
Documents:  
DANVA temadag om biologiske sandfiltre

Related event

DANVA: Temadag om biologiske sandfiltre til drikkevandsbehandling  
22/01/2014 → …  
Skanderborg, Denmark  
Activity: Talks and presentations › Conference presentations

Phosphorus limitations when ammonium removal is incomplete  
Period: 22 Jan 2014  
Florian Benedikt Wagner (Speaker)  
Department of Environmental Engineering  
Urban Water Engineering  

Related event

DANVA: Temadag om biologiske sandfiltre til drikkevandsbehandling  
22/01/2014 → …  
Skanderborg, Denmark  
Activity: Talks and presentations › Conference presentations

Water resources management in Northern China  
Period: 7 Jan 2014  
Claus Davidsen (Lecturer)  
Department of Environmental Engineering  
Water Resources Engineering  

Description  
Oral presentation at ETH, Institute of Environmental Engineering, Zürich

Related external organisation

Unknown external organisation  
Activity: Talks and presentations › Conference presentations

Rudersdal Supply (External organisation)  
Period: 1 Jan 2014 → 31 Dec 2017  
Erik Arvin (Participant)  
Department of Environmental Engineering
**Description**
Rudersdal Supply manage water supply and wastewater for Rudersdal municipality

**Body type:** Limited company

**Related external organisation**

**Rudersdal Supply**
*Activity: Membership › Board duties in companies, associations, or public organisations*

**Research Council Norway (External organisation)**
*Period: 2013 → 2014*
*Steffen Foss Hansen (Chairman)*

**Department of Environmental Engineering**

**Description**
Assessor of Grant Applications related to NANO2021 Innovasjonsprosjekter i næringslivet innen nanoteknologi og avanserte materialer

**Degree of recognition:** International

**Related external organisation**

**Research Council Norway**
*Norway*
*Activity: Membership › Membership in review committee*

**Water quality and water treatment**
*Period: 4 Dec 2013*
*Martin Rygaard (Invited speaker)*

**Department of Environmental Engineering**

**Urban Water Engineering**

**Related event**

**HOFOR Temadag**
*04/12/2013 → 04/12/2013*
*Copenhagen, Denmark*
*Activity: Talks and presentations › Conference presentations*

**Microbial growth in clean water tanks**
*Period: 20 Nov 2013*
*Sarah Christine Boesgaard Christensen (Speaker)*

**Department of Environmental Engineering**

**Urban Water Engineering**

**Related event**

**Dansk Vand Konference 2013**
*19/11/2013 → 20/11/2013*
*Aarhus, Denmark*
*Activity: Talks and presentations › Conference presentations*

**Assessing the permissiveness of complex bacterial communities towards conjugal plasmids – A novel method**
*Period: 18 Nov 2013*
*Uli Klümper (Speaker)*

**Department of Environmental Engineering**
Urban Water Engineering

Related event

2013 Congress of The Danish Microbiological Society
18/11/2013 → 18/11/2013
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

SETAC North America 34th annual meeting
Period: 17 Nov 2013 → 21 Nov 2013
Sara Nørgaard Sørensen (Participant)
Department of Environmental Engineering
Environmental Chemistry
Description
Co-author of poster
Documents:
Poster

Related event

SETAC North America 34th annual meeting
17/11/2013 → 21/11/2013
Nashville, TN, United States
Activity: Attending an event › Participating in or organising a conference

SETAC North America 34th annual meeting
Period: 17 Nov 2013 → 21 Nov 2013
Aiga Mackevica (Participant)
Department of Environmental Engineering
National Food Institute
Environmental Chemistry

Related event

SETAC North America 34th annual meeting
17/11/2013 → 21/11/2013
Nashville, TN, United States
Activity: Attending an event › Participating in or organising a conference

Bioresource Technology (Journal)
Period: 13 Nov 2013
Dimitar Borisov Karakashev (Reviewer)
Department of Environmental Engineering
Residual Resource Engineering

Related journal

Bioresource Technology
0960-8524
Central database
Activity: Communication › Peer review of manuscripts
Bioresource Technology (Journal)
Period: 13 Nov 2013
Dimitar Borisov Karakashev (Reviewer)
Department of Environmental Engineering
Residual Resource Engineering

Related journal
Bioresource Technology
0960-8524
Central database
Activity: Research › Peer review of manuscripts

Tang og multitrofisk produktion
Period: 6 Nov 2013
Susan Løvstad Holdt (Invited speaker)
National Institute of Aquatic Resources
Department of Environmental Engineering
National Food Institute
Residual Resource Engineering

Related event
ATV Temamøde Marin akvakultur : Perspektiver og potentialer
06/11/2013 → 06/11/2013
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Influence of the water louse, Asellus aquaticus, on bacterial survival in drinking water systems
Period: 5 Nov 2013
Sarah Christine Boesgaard Christensen (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Related event
AWWA Water Quality Technology Conference
03/11/2013 → 07/11/2013
Long Beach, CA, United States
Activity: Talks and presentations › Conference presentations

Nutrient limitations in drinking water rapid sand filters with incomplete ammonium removal
Period: 23 Oct 2013
Florian Benedikt Wagner (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Related event
DWBiofilters Workshop Berlin
23/10/2013 → 24/10/2013
Berlin, Germany
Activity: Talks and presentations › Conference presentations
IDA: Pesticidforskning - nyt om miljø, sundhed og regulering
Period: 30 Sep 2013
Mathilde Jørgensen Hedegaard (Participant)
Department of Environmental Engineering
Urban Water Engineering
Documents:
Pesticidforskning - nyt om miljø, sundhed og regulering _ IDA

Related event
IDA: Pesticidforskning - nyt om miljø, sundhed og regulering
30/09/2013 → …
Odense, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Timbre Workshop and Field Sampling
Period: 17 Sep 2013 → 18 Sep 2013
Lauge Peter Westergaard Clausen (Speaker)
Department of Environmental Engineering

Description
Oral presentation.
Phytoremediation of the former Soviet air-base at Szprotawa.
Documents:
Workshop__presentation

Related event
Timbre Workshop and Field Sampling
17/09/2013 → 18/09/2013
Szprotawa, Poland
Activity: Talks and presentations › Conference presentations

Timbre Workshop and Field Sampling
Period: 17 Sep 2013 → 18 Sep 2013
Stefan Trapp (Speaker)
Department of Environmental Engineering
Environmental Chemistry

Description
Oral presentation. Phytoremediation - possibilities and perspectives
Phytoremediation of the former Soviet air-base at Szprotawa
Documents:
Workshop__presentation

Related event
Timbre Workshop and Field Sampling
17/09/2013 → 18/09/2013
Szprotawa, Poland
Activity: Talks and presentations › Conference presentations

Timbre Workshop and Field Sampling
Period: 17 Sep 2013 → 18 Sep 2013
Mette Algreen Nielsen (Speaker)
Department of Environmental Engineering
Environmental Chemistry
Water Resources Engineering

Description
Oral presentation. Phytoremediation - possibilities and perspectives
Phytoremediation of the former Soviet air-base at Szprotawa
Documents:
Workshop__presentation

Related event
Timbre Workshop and Field Sampling
17/09/2013 → 18/09/2013
Szprotawa, Poland
Activity: Talks and presentations › Conference presentations

Innovations konference
Period: 12 Sep 2013
Susan Løvstad Holdt (Invited speaker)
National Institute of Aquatic Resources
Department of Environmental Engineering
National Food Institute
Residual Resource Engineering

Description
Presented: Tang som ressource - mulighed for udvikling og produktion af ingredienser.
Fødevareingredienser ‐ et dansk væksteventyr
Sundhed, Fødevareforsyning, Bæredygtighed, Fødevaresikkerhed

Related event
Innovations konference: Fødevareingredienser- et dansk væksteventyr
12/09/2013 → 12/09/2013
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Teaching in the course Hydrology at the Sino-Danish Center (SDC)
Period: 8 Sep 2013 → 3 Oct 2013
Claus Davidsen (Lecturer)
Department of Environmental Engineering
Water Resources Engineering

Description
Teaching assistant and lecturer in the hydrology course, 1st semester at the M.Sc. in Water and Environment.

Related external organisation
Sino-Danish Center (SDC) at the Chinese Academy of Sciences (CAS)
Beijing, China
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Goldschmidt 2013
Anne Graham Uldahl (Participant)
Environmental Chemistry
Department of Environmental Engineering

Related event

Goldschmidt 2013
25/08/2013 → 30/08/2013
Florence, Italy
Activity: Attending an event › Participating in or organising a conference

Period: 4 Jul 2013
Panagiotis Kougias (Speaker)
Department of Environmental Engineering
Residual Resource Engineering

Description

Related event

03/07/2013 → 05/07/2013
Billund, Denmark
Activity: Talks and presentations › Conference presentations

Period: 3 Jul 2013
Panagiotis Kougias (Chairman)
Department of Environmental Engineering
Residual Resource Engineering

Description

Related event

03/07/2013 → 05/07/2013
Billund, Denmark
Activity: Attending an event › Participating in or organising a conference

8th International Conference on the Environmental Effects of Nanoparticles and Nanomaterials
Period: 3 Jul 2013 → 5 Jul 2013
Sara Nørgaard Sørensen (Speaker)
Department of Environmental Engineering
Environmental Chemistry

Documents:
ICEENN Abstract Sara Soerensen

Related event
Oral presentation at the Copenhagen Resource Institute: Using stochastic dynamic programming to support catchment-scale water resources management in China
Period: 27 Jun 2013
Claus Davidsen (Lecturer)
Department of Environmental Engineering
Water Resources Engineering

Related external organisation
Unknown external organisation

13th World Congress on Anaerobic Digestion
Period: 25 Jun 2013 → 28 Jun 2013
Panagiotis Kougias (Speaker)
Department of Environmental Engineering
Residual Resource Engineering

Description
Anaerobic digestion foaming in Danish full-scale biogas plants: a survey on causes and solutions

Related event
13th World Congress on Anaerobic Digestion
25/06/2013 → 28/06/2013
Santiago De Compostela, Spain
Activity: Talks and presentations › Conference presentations

Investigating the use of stochastic forecast for RTC of urban drainage systems
Period: 25 Jun 2013
Roland Löwe (Lecturer)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Urban Water Engineering

Related event
8th International Conference on Planning and Technologies for Sustainable Urban Water Management
23/06/2013 → 27/06/2013
Lyon, France
Activity: Talks and presentations › Conference presentations

Ph.D. research and challenges for foreign researchers doing research in China.
Period: 16 May 2013
Claus Davidsen (Invited speaker)
Department of Environmental Engineering
Water Resources Engineering

Description
Invited speaker and expert board member.

Related event
23rd Annual Meeting of the Society of Environmental Toxicology and Chemistry Europe 2013
Period: 12 May 2013 → 16 May 2013
Denisa Cupi (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
Considerations and Recommendations to Standard Testing with Daphnia magna
Documents:
SETAC Glasgow Poster Final

Related event
23rd Annual Meeting of the Society of Environmental Toxicology and Chemistry Europe 2013
12/05/2013 → 16/05/2013
Glasgow, United Kingdom
Activity: Attending an event › Participating in or organising a conference

23rd Annual Meeting of the Society of Environmental Toxicology and Chemistry Europe 2013
Period: 12 May 2013 → 16 May 2013
Sara Nørgaard Sørensen (Participant)
Department of Environmental Engineering
Environmental Chemistry
Documents:
Poster SETAC SANS

Related event
23rd Annual Meeting of the Society of Environmental Toxicology and Chemistry Europe 2013
12/05/2013 → 16/05/2013
Glasgow, United Kingdom
Activity: Attending an event › Participating in or organising a conference

A Tool to Support Optimal Industrial Wastewater Treatment Design and Analysis
Period: 24 Apr 2013 → 26 Apr 2013
Gürkan Sin (Lecturer)
Department of Chemical and Biochemical Engineering
Computer Aided Process Engineering Center
Department of Environmental Engineering

Description

Related event
Asset management for enhancing energy efficiency in water and wastewater systems
24/04/2013 → 26/04/2013
Marbella, Spain
Activity: Talks and presentations › Conference presentations
Design of future municipal wastewater treatment plants: A mathematical approach to manage complexity and identify optimal solutions
Period: 24 Apr 2013 → 26 Apr 2013
Krist V. Gernaey (Lecturer)
Department of Chemical and Biochemical Engineering
Computer Aided Process Engineering Center
Department of Environmental Engineering
Center for Process Engineering and Technology

Description

Related event
Asset management for enhancing energy efficiency in water and wastewater systems
24/04/2013 → 26/04/2013
Marbella, Spain
Activity: Talks and presentations › Conference presentations

Design of future municipal wastewater treatment plants: A mathematical approach to manage complexity and identify optimal solutions
Period: 24 Apr 2013 → 26 Apr 2013
Gürkan Sin (Lecturer)
Department of Chemical and Biochemical Engineering
Computer Aided Process Engineering Center
Department of Environmental Engineering

Description

Related event
Asset management for enhancing energy efficiency in water and wastewater systems
24/04/2013 → 26/04/2013
Marbella, Spain
Activity: Talks and presentations › Conference presentations

Computer-aided modeling framework: a generic template as a modeling tool
Period: 20 Apr 2013 → 25 Apr 2013
Gürkan Sin (Speaker)
Department of Chemical and Biochemical Engineering
Computer Aided Process Engineering Center
Department of Environmental Engineering

Description

Related event
9th European Congress of Chemical Engineering
21/04/2013 → 25/04/2013
The Hague, Netherlands
Activity: Talks and presentations › Conference presentations
Efficient Information and Data Management in Synthesis and Design of Processing Networks
Period: 20 Apr 2013 → 25 Apr 2013
Gürkan Sin (Lecturer)
Department of Chemical and Biochemical Engineering
Computer Aided Process Engineering Center
Department of Environmental Engineering

Description

Related event
9th European Congress of Chemical Engineering
21/04/2013 → 25/04/2013
The Hague, Netherlands
Activity: Talks and presentations › Conference presentations

Efficient Information and Data Management in Synthesis and Design of Processing Networks
Period: 20 Apr 2013 → 25 Apr 2013
Rafiqul Gani (Lecturer)
Department of Chemical and Biochemical Engineering
Computer Aided Process Engineering Center
Department of Environmental Engineering

Description

Related event
9th European Congress of Chemical Engineering
21/04/2013 → 25/04/2013
The Hague, Netherlands
Activity: Talks and presentations › Conference presentations

Effect of pH on DBP formation
Period: 10 Apr 2013
Henrik Rasmus Andersen (Lecturer)
Department of Environmental Engineering
Urban Water Engineering

Related event
5th International Conference Swimming Pool & Spa
09/04/2013 → 12/04/2013
Rome, Italy
Activity: Talks and presentations › Conference presentations

European Geosciences Union General Assembly 2013
Period: 10 Apr 2013
Claus Davidsen (Speaker)
Department of Environmental Engineering
Water Resources Engineering

Description
Oral presentation with the title "Using stochastic dynamic programming to support catchment-scale water resources management in China" in session HS5.3, Advances in Modeling of Coupled Hydrologic-Socioeconomic Systems.
Oral presentation at EGU 2013, session HS5.3, Advances in Modeling of Coupled Hydrologic-Socioeconomic Systems.

Links:

Related event

European Geosciences Union General Assembly 2013
07/04/2013 → 12/04/2013
Vienna, Austria
Activity: Talks and presentations › Conference presentations

Ude af øje, ude af sind, ude af kontrol: - er det sådan vores afløbssystemer skal fungere?
Period: 13 Mar 2013
Roland Löwe (Lecturer)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Urban Water Engineering

Related event

Ude af øje, ude af sind, ude af kontrol: - er det sådan vores afløbssystemer skal fungere?
13/03/2013 → …
Aalborg, Denmark
Activity: Talks and presentations › Conference presentations

Stochastic runoff forecasting and real time control of urban drainage systems
Period: 11 Mar 2013
Roland Löwe (Lecturer)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Urban Water Engineering

Related event

Ude af øje, ude af sind, ude af kontrol: - er det sådan vores afløbssystemer skal fungere?
11/03/2013 → …
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Environmental Health 2013
Period: 6 Mar 2013
Steffen Foss Hansen (Chairman)
Department of Environmental Engineering
Environmental Chemistry

Description
Session on Research
Chair on session on Research
Documents:
Conference programme

Related event

Environmental Health 2013 : Science and Policy to Protect Future Generations
03/03/2013 → 06/03/2013
Environmental Health 2013
Period: 3 Mar 2013 → 6 Mar 2013
Steffen Foss Hansen (Organizer)
Department of Environmental Engineering
Environmental Chemistry

Description
Chairman
Degree of recognition: International

Related event
Environmental Health 2013 : Science and Policy to Protect Future Generations
03/03/2013 → 06/03/2013
Boston, United States
Activity: Attending an event › Participating in or organising a conference

Armax and Greybox Modeling in Water Systems
Period: 1 Mar 2013
Roland Löwe (Lecturer)
Dynamical Systems
Department of Applied Mathematics and Computer Science
Department of Environmental Engineering

Description
Lecture in Armax and Greybox Modeling as part of course 12342
Activity: Other

Stochastic runoff forecasting and real time control of urban drainage systems
Period: 31 Jan 2013
Roland Löwe (Lecturer)
Department of Informatics and Mathematical Modeling
Mathematical Statistics
Department of Mathematics
Urban Water Engineering
Department of Environmental Engineering
Links:
http://www.forskningsplatformen-vand.dk/Documents/Annual%20meeting%202013/index.html

Related event
7th Annual Meeting of the Danish Water Research and Innovation Platform
31/01/2013 → 31/01/2013
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Concept for a secondary water supply in Nordhavn
Period: 28 Jan 2013
Martin Rygaard (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

Related event

Konference om Sekundavand: En storm i et glas vand eller kilden til innovation, vækst og eksport
28/01/2013 → 28/01/2013
Odense, Denmark
Activity: Talks and presentations › Conference presentations

Reviewer of Grant applications under EU research framework programme call FP7-SME-2013 (External organisation)
Period: 21 Jan 2013 → 24 Jan 2013
Dimitar Borisov Karakashev (Participant)
Department of Environmental Engineering
Residual Resource Engineering
Degree of recognition: International

Related external organisation

Reviewer of Grant applications under EU research framework programme call FP7-SME-2013
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

International Conference on Algal Biorefinery
Period: 10 Jan 2013
Susan Løvstad Holdt (Participant)
Department of Environmental Engineering

Description
ICAB 2013
International Conference on Algal Biorefinery: A Potential Source of Food, Feed, Biochemicals, Biofuels and Biofertilizers
Links:
http://www.icab2012bt.iitkgp.ernet.in/icab/

Related event

International Conference on Algal Biorefinery: A Potential Source of Food, Feed, Biochemicals, Biofuels and Biofertilizers
10/01/2013 → 12/01/2013
Kharagpur, India
Activity: Attending an event › Participating in or organising a conference

Reviewer for Grant Proposals at the Italian Ministry for Education University and Research (MIUR) (External organisation)
Period: 2012 → 2015
Dimitar Borisov Karakashev (Participant)
Department of Environmental Engineering
Residual Resource Engineering
Degree of recognition: International

Related external organisation

Reviewer for Grant Proposals at the Italian Ministry for Education University and Research (MIUR)
Activity: Membership › Membership in review committee

Nanotechnology and human health
Period: 10 Dec 2012
Steffen Foss Hansen (Invited speaker)
Department of Environmental Engineering
Environmental Chemistry
In order to understand how companies identify and handle emerging risks related to nanomaterials, we completed more than 15 in-depth interviews with occupational health and safety (OHS) representatives in various Danish organisations. Companies varied not only greatly in regard to number of employees, overall R & D capacity and health and safety personnel, but also in regard to level of which, they already use/produce products that contain nanomaterials. Surprisingly, very little research has been done on how companies become alert to emerging issues although this initial identification of emerging risks is a prerequisite for any subsequent risk management. Key unanswered questions evolve around how companies: 1) Initially identify potentially emerging risks; 2) Collect and analyze data on these risks; 3) how they communicate results of their analysis internally and externally; 4) how they complete their analysis of management options and subsequently implementation of these management options and finally, 5) what the implications of action taken are or has been. Through our interviews we found that the level of awareness about the potential occupational risk associated with nanomaterials varied greatly and range from “having just heard about potential risks and planning to look into it” to “having initiated an internal full risk assessment currently under external peer-review”. Employees noting “that something might not be right” as well as media rumors turned out to be the two main sources of identification of emerging risks, whereas ad hoc personal and non-formal networks and meetings with academics and health care officials also played a role in larger organisations. Various sources were used to obtain more factual information including: Google; Newsletters from the National Research Centre for the Working Environment in Denmark; chemistry databases and scientific articles, but the information gathering process itself was somewhat unsystematic and seems to be completed ad hoc over time. Internal data analysis was performed by occupational health personal within the companies in constant consideration of resources available, priorities, possible management options, etc. unless individual OHS representative "felt like it" putting far more effort into it. Very often independent external experts were consulted in order to learn more and get outside confirmation of key internal findings and interpretations of the available literature. The selection of management options often involved a pro et con analysis of various options considering various technical and operational barriers whereas implementations often followed a process of: 1) Double-checking that company is in compliance with existing legislation and guidelines - often non-NM specific; 2) Initial mapping of NM R & D within the company; 3) Initiation of a capacity building process; 4) Mapping of NM exposure (sometimes very extensive); 5) Mapping of health effects among employees (again sometimes very extensive) and 6) Mapping and implementation of possible management
options. Overall, very few options had been implemented about mostly "easy", "low-hanging fruit" - PE-options and administrative controls. Limited or no implementation of more thorough process-related options or engineering controls was identified primarily explained by the continued uncertainty related to health effects of nanomaterials as well as uncertainty about legislation and best practices. Results were mostly communicated internally via intranets or internal workshops with health representatives. Externally communications included publication of scientific papers, posting of information on company websites, but surprisingly involved no or very limited dialogue with authorities. This was considered irrelevant at best and potentially a source of additional confusion and bureaucracy. Overall, implications of action taken within the companies have had little impacts, but in general company representatives noted that they had gotten an improved knowledge about NM risks; that there was a general alertness regarding risks related to airborne NPs and – in some companies - that there was an increased dialogue between workers and leadership.

Horizon-scanning and Identification of Emerging Risk among Nanotech-companies
Documents:
NanoSafe 2012 Book of Abstracts

Related event
NanoSafe 2012: International Conference on Safe production and use of nanomaterials
13/11/2012 → 15/11/2012
Grenoble, France
Activity: Talks and presentations › Conference presentations

EU-US Environmental Biotechnology Working Group Workshop
Period: 6 Nov 2012
Barth F. Smets (Invited speaker)
Department of Environmental Engineering

Description
Spatially structured autotrophic nitrogen removing communities: Competition and cooperation
Documents:
PDF

Related event
EU-US Environmental Biotechnology Working Group Workshop
04/11/2012 → 07/11/2012
St. Louis, United States
Activity: Talks and presentations › Conference presentations

Training on Human Health and Environmental aspects of Nanomaterials
Period: 5 Nov 2012 → 7 Nov 2012
Steffen Foss Hansen (Organizer)
Department of Environmental Engineering
Environmental Chemistry

Description
Organizer, course lecturer, coordinator

Environmental exposure of Nanomaterials

Related event
Training on Human Health and Environmental aspects of Nanomaterials
05/11/2012 → 07/11/2012
Helsinki, Finland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

New Uses and Possibilities for Seaweed
Period: 26 Sep 2012 → 27 Sep 2012
Susan Løvstad Holdt (Invited speaker)
**7th International Conference on the Environmental Effects of Nanoparticles and Nanomaterials**

*Period: 10 Sep 2012*

Denisa Cupi (Participant)

Department of Environmental Engineering

Environmental Chemistry

**Description**

Third Author

Documents:

- DOCX
- PDF

**Related event**

7th International Conference on the Environmental Effects of Nanoparticles and Nanomaterials

*Period: 10 Sep 2012*

Sara Nørgaard Sørensen (Participant)

Department of Environmental Engineering

Environmental Chemistry

**Description**

Co-author of poster

Documents:

- Toxicity of silver nanoparticles to green algae - towards a biotic ligand understanding

**Related event**

7th International Conference on the Environmental Effects of Nanoparticles and Nanomaterials

*Period: 10 Sep 2012*

Ana Faria Tomás (Participant)

Department of Environmental Engineering

Residual Resource Engineering

**Description**
Participated with a poster entitled "Use of a newly isolated extreme thermophile for the production of 2nd generation bio-ethanol"

Links:
http://www.isme-microbes.org/isme14 (Conference website)

**Related event**

**14th International Symposium on Microbial Ecology: The Power of the Small**
19/08/2012 → 24/08/2012
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising a conference

**Euroscience Open Forum 2012**
Denisa Cupi (Participant)
Department of Environmental Engineering
Environmental Chemistry

**Related event**

**Euroscience Open Forum 2012**
11/07/2012 → 15/07/2012
Dublin, Ireland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**SRA Europe 2012**
Steffen Foss Hansen (Organizer)
Department of Environmental Engineering
Environmental Chemistry

**Description**
Chairman
Degree of recognition: International
Links:

**Related event**

**SRA Europe 2012: 21th Annual conference**
18/06/2012 → 20/06/2012
Zurich, Switzerland
Activity: Attending an event › Participating in or organising a conference

**SRA-Europe 21st Annual Conference**
Period: 18 Jun 2012
Steffen Foss Hansen (Chairman)
Department of Environmental Engineering
Environmental Chemistry

**Description**
New approaches in risk assessment
Documents:
SRA Europe 2012 Book of abstracts
Links:
http://www.sraeurope.org/filehandler.ashx?file=10312

**Related event**
SRA-Europe 21st Annual Conference
18/06/2012 → 20/06/2012
Zurich, Switzerland
Activity: Attending an event › Participating in or organising a conference

2nd International Workshop of Microbial Life under Extreme Energy Limitations
Anne Graham Uldahl (Participant)
Department of Environmental Engineering

Description
Microenergy 2012 workshop

Related event
2nd International Workshop of Microbial Life under Extreme Energy Limitations
06/05/2012 → 09/05/2012
Aarhus, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

6th SETAC World Congress 2012
Period: 23 May 2012
Sara Nørgaard Sørensen (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
Participating in conference

Related event
6th SETAC World Congress 2012: SETAC Europe 22nd Annual Meeting
20/05/2012 → 24/05/2012
Berlin, Germany
Activity: Attending an event › Participating in or organising a conference

6th SETAC World Congress 2012
Period: 23 May 2012
Denisa Cupi (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
Attended lectures and poster presentations

Related event
6th SETAC World Congress 2012: SETAC Europe 22nd Annual Meeting
20/05/2012 → 24/05/2012
Berlin, Germany
Activity: Attending an event › Participating in or organising a conference

1st International Workshop on Swimming Pool Research
Period: 3 May 2012 → 4 May 2012
Kamilla Marie Speht Kaarsholm (Speaker)
Department of Environmental Engineering
Urban Water Engineering
Related event

1st International Workshop on Swimming Pool Research
03/05/2012 → 04/05/2012
Delft, Netherlands
Activity: Talks and presentations › Conference presentations

SOT Annual Meeting and ToxExpo
Denisa Cupi (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
First Author
Poster Presentation
Documents:
PDF

Related event

SOT Annual Meeting and ToxExpo
11/03/2012 → 15/03/2012
San Francisco, United States
Activity: Attending an event › Participating in or organising a conference

Course: Advanced Urban Wastewater Treatment: Lecture: Xenobiotics in wastewater and sludge
Period: 2011 → 2016
Eva Eriksson (Lecturer)
Department of Environmental Engineering
Environmental Chemistry

Description
Annual 3-day course
Lund University, Technical University of Denmark together with Svenskt Vatten

Related event

Advanced Urban Wastewater Treatment
01/01/2011 → 31/12/2016
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

3rd Nanosafety Autumn School 2011
Denisa Cupi (Participant)
Department of Environmental Engineering
Environmental Chemistry

Related event

3rd Nanosafety Autumn School 2011: Understanding Human Health Effects and Environmental Impacts of Engineered Nanomaterials
Venice, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
EcoDesign MBR Centre
Period: 10 Nov 2011 → 11 Nov 2011
Marlene Mark Jensen (Speaker)
Department of Environmental Engineering

Related external organisation
EcoDesign MBR Centre
Aalborg, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

2011 Symposium The Danish Microbiological Society
Period: 7 Nov 2011
Ana Faria Tomás (Speaker)
Department of Environmental Engineering
Residual Resource Engineering

Description
Presentation with the title "Use of extreme thermophilic bacteria for second generation bio-ethanol production"
Invited speaker

Related event
2011 Symposium The Danish Microbiological Society
07/11/2011 → …
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

PhD Nano 2011 - Nano Connect Scandinavia
Denisa Cupi (Participant)
Department of Environmental Engineering
Environmental Chemistry

Related event
PhD Nano 2011 - Nano Connect Scandinavia
20/10/2011 → 21/10/2011
Copenhagen, Denmark
Activity: attending an event › Participating in or organising workshops, courses, seminars etc.

Nordic Environmental Nucleotide Network 2011 (NENUN)
Period: 7 Sep 2011 → 10 Sep 2011
Barth F. Smets (Participant)
Department of Environmental Engineering

Related event
Nordic Environmental Nucleotide Network 2011 (NENUN): Molecular investigation and quantification of microbes in Rapid Sand Filters
07/09/2011 → 10/09/2011
Reykjavik, Iceland.
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Nordic Environmental Nucleotide Network 2011 (NENUN)
Period: 7 Sep 2011 → 10 Sep 2011
Sanin Musovic (Speaker)
Related event

Nordic Environmental Nucleotide Network 2011 (NENUN): Molecular investigation and quantification of microbes in Rapid Sand Filters  
07/09/2011 → 10/09/2011  
Reykjavik, Iceland.  
Activity: Talks and presentations › Conference presentations

Nitrogen loss in the intertidal permeable sediment: ph.d. defence  
Period: 1 Jun 2011  
Marlene Mark Jensen (External examiner)  
Environmental Chemistry  
Department of Environmental Engineering  
Activity: Examinations and supervision › External examination

Dansk Svømmebadstekniisk Forening - Årsøde 2011  
Period: 13 Apr 2011 → 14 Apr 2011  
Kamilla Marie Speht Kaarsholm (Speaker)  
Department of Environmental Engineering  
Documents:  
referat svømmebadet nr 24.pdf  
Related external organisation

Unknown external organisation  
Activity: Talks and presentations › Conference presentations

Society of Toxicology Annual Spring Meeting/North Carolina Chapter  
Period: 17 Feb 2011  
Denisa Cupi ( Participant)  
Department of Environmental Engineering  
Environmental Chemistry  
Related event

Society of Toxicology Annual Spring Meeting/North Carolina Chapter  
17/02/2011 → …  
Research Triangle Park, United States  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

12th World Congress on Anaerobic Digestion  
Period: 31 Oct 2010 → 4 Nov 2010  
Ana Faria Tomás (Speaker)  
Department of Environmental Engineering  
Residual Resource Engineering  
Description  
Oral presentation with the title "Effect of xylose and nutrient concentration in ethanol production by a newly isolated extreme thermophile"  
Related event

12th World Congress on Anaerobic Digestion
31/10/2010 → 04/11/2010
Guadalajara, Mexico
Activity: Talks and presentations › Conference presentations

**Advanced Water Treatment**
Period: 23 Jun 2010
Martin Rygaard (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

**Related event**

**DANVA Årsmøde**
23/06/2010 → 23/06/2010
Kolding, Denmark
Activity: Talks and presentations › Conference presentations

**EnviroSymp 2010 “Nanoparticles in the Environment”**
Period: 10 Jun 2010 → 11 Jun 2010
Denisa Cupi (Organizer)
Department of Environmental Engineering
Environmental Chemistry

**Related event**

**EnviroSymp 2010 “Nanoparticles in the Environment”**
10/06/2010 → 11/06/2010
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Invertebrate animals in Danish drinking water distribution networks**
Period: 7 Jun 2010 → 9 Jun 2010
Sarah Christine Boesgaard Christensen (Speaker)
Department of Environmental Engineering
Urban Water Engineering

**Related event**

**7th Nordic Drinking Water Conference**
07/06/2010 → 09/06/2010
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

**Efterpolering af spildevand for mikroforureningsstoffer: IdaMiljø møde 4.maj 2010 om “Fremtidens Spildevandsbehandling”**
Period: 4 May 2010
Henrik Rasmus Andersen (Speaker)
Department of Environmental Engineering
Urban Water Engineering
Links:

**Related external organisation**

København
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations
Spildevand/Vand: Hospitalsspildevand rejser helt særlige problemer, som skal håndteres allerede i projekteringen
Period: 24 Feb 2010
Henrik Rasmus Andersen (Lecturer)
Department of Environmental Engineering
Urban Water Engineering
Links:
http://s-kbh.dk/sidste-nyt/%E2%80%9Db%C3%A6redygtige-hospitaler%E2%80%9D-%E2%80%93-skal-der-nu-vindm%C3%B8ller-p%C3%A5-tagene-616 (Link to program.)

Related event

Bæredygtige hospitaler : Skal der nu vindmøller på tagene?
24/02/2010 → …
København, Denmark
Activity: Talks and presentations › Conference presentations

Rewiev of proposals for Qatar National Research Fund (QNRF) (External organisation)
Period: Mar 2009 → …
Henrik Rasmus Andersen (Member)
Urban Water Engineering
Department of Environmental Engineering
Description
Review of individual proposals in 1-2 yearly application rounds.
Degree of recognition: International

Related external organisation

Rewiev of proposals for Qatar National Research Fund (QNRF)
Activity: Membership › Membership in review committee

Small animals in water distribution networks
Period: 29 Jan 2009
Sarah Christine Boesgaard Christensen (Invited speaker)
Department of Environmental Engineering
Urban Water Engineering

Related event

3rd Annual Meeting of the Danish Water Research Platform DWRP - Forskningsplatformen Vand
29/01/2009 → …
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Invertebrate animals in Danish drinking water distribution networks
Period: 7 Sep 2008
Sarah Christine Boesgaard Christensen (Speaker)
Department of Environmental Engineering
Urban Water Engineering

Related event

6th IWA World Water Congress and Exhibition
07/09/2008 → 12/09/2008
Vienna, Austria
Activity: Talks and presentations › Conference presentations
Hydrograv - Improving Hydrological Models with Ground-Based and Space-Borne Time-lapse Gravity Surveys
Period: 1 Jan 2007 → …
Peter Bauer-Gottwein (Speaker)
Department of Environmental Engineering

Description
Place: ESA Hydrospace conference, Geneva, Switzerland

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Local to Regional Hydrological Model Calibration for the Okavango River Basin From In-Situ and Spaceborne Gravity Data
Period: 1 Jan 2007 → …
Peter Bauer-Gottwein (Speaker)
Department of Environmental Engineering

Description
Place: ESA Hydrospace conference, Geneva, Switzerland

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Merging GRACE gravimetry, satellite altimetry and in-situ data for Terrestrial water storage and flood monitoring;
EGU2007 G3-1WE2O-001
Period: 1 Jan 2007 → …
Peter Bauer-Gottwein (Speaker)
Department of Environmental Engineering

Description
Place: Vienna, Austria

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Terrestrial Water Storage Monitoring from GRACE and Satellite Altimetry in Bangladesh and the Okawango Delta (Botswana)
Period: 1 Jan 2007 → …
Peter Bauer-Gottwein (Speaker)
Department of Environmental Engineering

Description
Place: ESA Hydrospace conference, Geneva, Switzerland

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Environmental Effects of Nanoparticles and Nanomaterials
Period: 18 Sep 2006 → 19 Sep 2006
Sara Nørgaard Sørensen (Participant)
Department of Environmental Engineering
Environmental Chemistry

Description
Participant, co-author of presented study

Related event

Environmental Effects of Nanoparticles and Nanomaterials
London, United Kingdom
Activity: Attending an event › Participating in or organising a conference

Prizes:

2nd prize winner in Green Challenge at the Technical University of Denmark: Project 817: Reducing overflow to River Aarhus by using MPC - Master thesis, idea category
Nadia Schou Vorndran Lund (Recipient)
Department of Environmental Engineering, Urban Water Systems

Description
Student conference at the Technical University of Denmark

Details
Awarded date: 24 Jun 2016
Prize: Prizes, scholarships, distinctions

3rd prize "Best Student Presentation" at ARTEK Event 2016, International Conference - Sanitation in Cold Climate Regions
Camilla Tang (Recipient)
Department of Environmental Engineering, Urban Water Systems

Details
Awarded date: 14 Apr 2016
Prize: Prizes, scholarships, distinctions

Best Master Thesis - Idea Category
Mathilde Jørgensen Hedegaard (Recipient)
Department of Environmental Engineering, Urban Water Systems

Description
Grøn Dyst 2014 - second prize

Details
Awarded date: 2014
event: Green Challenge (Grøn Dyst) 2014
Prize: Prizes, scholarships, distinctions

Best Presentation Award at 7th International Conference Swimming Pool & Spa
Waqas Akram Cheema (Recipient)
Department of Environmental Engineering, Water Technologies

Description
At the 7th International Swimming Pool & Spa Conference (Kos Island, Greece), Waqas A. Cheema (WCHE) received the award for the best presentation out of 48 presentations. The title of the presentation was “Destruction of DBPs and their precursors in swimming pool water by combined UV treatment and ozonation”.

Details
Awarded date: 5 May 2017
Degree of recognition: International
Granting Organisations: National University of Sciences & Technology (NUST)
Best Student Project winner at the VandTek fair 2016
Camilla Tang (Recipient)
Department of Environmental Engineering, Urban Water Systems

Details
Awarded date: 22 Sep 2016
Prize: Prizes, scholarships, distinctions

Chemicals in the Environment - Best course of the year 2012/2013 chosen by the students
Steffen Foss Hansen (Recipient)
Department of Environmental Engineering, Environmental Chemistry

Details
Awarded date: 2013
Degree of recognition: Local
Prize: Prizes, scholarships, distinctions

DTU's Sustain Conference Poster Award
Sarah Brudler (Recipient)
Department of Environmental Engineering, Urban Water Engineering

Details
Awarded date: 17 Dec 2015
Prize: Prizes, scholarships, distinctions

EliteForsk-rejsestipendierne 2017
Aikaterini Spiliotopoulou (Recipient)
Department of Environmental Engineering, Water Technologies

Description
The Elite Research Prize is awarded to outstanding researchers under 45 years of international excellence. The Ministry for Higher Education and Science annually distributes five prizes. Each prize is 1.2 million. 200,000 is a personal award and 1,000,000 goes to research. The Elite Research travel grant is DKK 200,000 and helps very talented PhD students to perform longer-term studies in some of the best research environments in the world. The Ministry of Higher Education and Science annually distributes up to 20 Elite Research travel grants. Recipients of Elite Research prices are presented and honoured at the annual Elite Research Conference.

Details
Awarded date: 23 Feb 2017
Degree of recognition: National
Granting Organisations: The Ministry for Higher Education and Science (Danish)
event: EliteForsk-konferencen
Prize: Prizes, scholarships, distinctions

Environmental Management and Ethics - Best course of the year 2004/2005 chosen by the students
Steffen Foss Hansen (Recipient)
Department of Environmental Engineering, Environmental Chemistry

Details
Awarded date: 2005
Degree of recognition: Local
Prize: Prizes, scholarships, distinctions

Nanoscale zero-valent iron impregnation of covalent organic polymer grafted activated carbon for water treatment: 11th International Conference on the Environmental Effects of Nanoparticles and Nanomaterials (ICEENN 2016)
Paul D. Mines (Recipient)
Department of Environmental Engineering, Water Technologies, Department of Micro- and Nanotechnology, Surface Engineering
**Best Poster Prize**

**Details**
- Awarded date: 18 Aug 2016
- Granting Organisations: Royal Society of Chemistry
- Prize: Prizes, scholarships, distinctions

**The Director Gorm-Petersen memorial grant to young scientist in promising development**  
Steffen Foss Hansen (Recipient)  
Department of Environmental Engineering, Environmental Chemistry

**Details**
- Awarded date: 2009
- Degree of recognition: National
- Granting Organisations: Direktør P. Gorm-Petersens og Hustrus Legat
- Event: PhD graduation ceremony
- Prize: Prizes, scholarships, distinctions

**The NIRAS award**  
Mathilde Jørgensen Hedegaard (Recipient)  
Department of Environmental Engineering, Urban Water Systems

**Description**
The NIRAS Award of 10.000 DKK is given to a young researcher or student, who through her/his studies or research has contributed with new and ground-breaking research

**Details**
- Awarded date: 30 Jan 2018
- Granting Organisations: NIRAS A/S
- Event: 12th annual meeting of DWF
- Prize: Prizes, scholarships, distinctions

**Trophées Performance Veolia Environment**  
Aikaterini Spiliotopoulou (Recipient)  
Department of Environmental Engineering, Water Technologies

**Details**
- Awarded date: 2013
- Granting Organisations: VEOLIA
- Prize: Prizes, scholarships, distinctions

**Press clippings:**

- **Ny lovgivning om regnvand er nødvendig**  
  Katrine Nielsen  
  17/10/2017  
  Department of Environmental Engineering, Urban Water Systems

**Media contribution (1)**

- **Ny lovgivning om regnvand er nødvendig**  
  17/10/2017  
  Denmark, Web  
  http://www.dtu.dk/Nyheder/Nyhed?id=b934fbd4-42f7-4669-b8bf-d97bee3ec830  
  Katrine Nielsen  
  Press / Media

- **Bornholm: Flere bassiner har problemer med vandkvalitet**  
  Henrik Rasmus Andersen  
  24/07/2017  
  Department of Environmental Engineering, Water Technologies
Media contribution (1)

Bornholm: Flere bassiner har problemer med vandkvalitet
24/07/2017
Danmarks Radio (National), Denmark, Television
http://www.dr.dk/nyheder/regionale/bornholm/bornholm-flere-bassiner-har-problemer-med-vandkvalitet
Henrik Rasmus Andersen
Press / Media

Fire sandheder om vandet i poolen: Nej, det er hverken kloren der lugter eller svier i øjnene
Henrik Rasmus Andersen
19/07/2017
Description
Subject
swimming pool; chlorine
Department of Environmental Engineering, Water Technologies

Media contribution (1)

Fire sandheder om vandet i poolen: Nej, det er hverken kloren der lugter eller svier i øjnene
19/07/2017
TV2 (National), Denmark, Web
Marie Kjempff
2p
Det er højsæson for plasken og sjasken i swimmingpools og badebassiner. Men hvad er det egentlig, der foregår under vandoverfladen? Er det for eksempel farligt at sluge poolvandet? Og hvad er det egentlig, der svier sådan i øjnene?
Henrik Rasmus Andersen
Press / Media

Water may prevent holes in teeth.
Erik Arvin
01/06/2017
Description
Interview with journalist Sidsel Boye from the news magazine "Danish communes" on Erik Arvin's research on the significance of water quality on caries among school children. In particular the significance of calcium and fluoride in drinking water and family income.
The article is published in the magazine "Danske Kommuner" No. 17 from 2017. The article is based on the interview with Erik Arvin.
Department of Environmental Engineering

Media contribution (1)

Vand kan forebygge huller
01/06/2017
Danske Kommuner (National), Denmark, Print
Sidsel Boye
4 pages
Reports on Erik Arvin's research on how caries is affected by drinking water hardness, fluoride content and family income
Erik Arvin
Press / Media

OECD nanomaterials programme 'of little value' for risk assessment
Steffen Foss Hansen
02/03/2017
Description
Criticism from Ecos, Ciel and Oeko-Institute aimed at industry and EU policy makers
Department of Environmental Engineering, Environmental Chemistry
OECD nanomaterials programme ‘of little value’ for risk assessment
02/03/2017
Chemical Watch (International), Web
Andrew Turley
Criticism from Ecos, Ciel and Oeko-Institute aimed at industry and EU policy makers
Steffen Foss Hansen
Press / Media

Five Questions for Steffen Foss Hansen
Steffen Foss Hansen
23/02/2017

Description
A Danish scholar talks about his online database of ‘nano-enhanced’ products — many made with materials that could be hazardous.
Department of Environmental Engineering, Environmental Chemistry

Five Questions for Steffen Foss Hansen
23/02/2017
UNDARK (International), Web
Fabio Turone
https://undark.org/article/five-questions-steffen-foss-hansen/
A Danish scholar talks about his online database of ‘nano-enhanced’ products — many made with materials that could be hazardous.
Steffen Foss Hansen
Press / Media

Blødt vand i hovedstaden skal spare husstande for millioner
Camilla Tang
14/02/2017
Department of Environmental Engineering, Urban Water Systems

Blødt vand i hovedstaden skal spare husstande for millioner
14/02/2017
Politiken (National), Denmark, Web
Anna Belling-Ladegaard
http://politiken.dk/indland/art5833405/Bl%C3%B8dt-vand-i-hovedstaden-skal-spare-husstande-for-millioner
Camilla Tang
Press / Media

No small deal: Evaluating nanomaterials with alternatives assessment, with Rune Hjorth
Rune Hjorth
27/01/2017
Department of Environmental Engineering

No small deal: Evaluating nanomaterials with alternatives assessment, with Rune Hjorth
27/01/2017
IEAM Podcast, Web
Rune Hjorth
Department of Environmental Engineering

Relations
Research outputs:
OECD conclusions about nanomaterials and test guidelines disputed
Steffen Foss Hansen
05/01/2017

Description
Danish, US researchers say further research needed to substantiate suitability claim
Department of Environmental Engineering, Environmental Chemistry

Media contribution (1)

OECD conclusions about nanomaterials and test guidelines disputed
05/01/2017
Chemical Watch (International), Web
Andrew Turley
Danish, US researchers say further research needed to substantiate suitability claim
Steffen Foss Hansen

Hård kritik af Total og kommune
Steffen Foss Hansen
01/12/2016

Description
HØRING: Prøveboring efter skifergas har slidt på kommune og borgere.

Subject
Shale gas extraction and environment
Department of Environmental Engineering, Environmental Chemistry

Media coverage (1)

Hård kritik af Total og kommune
01/12/2016
https://apps-infomedia-dk.proxy.findit.dtu.dk/mediearkiv/link?articles=e601d8de (Regional), Denmark, Print
Esben Agerlin Olsen
HØRING: Prøveboring efter skifergas har slidt på kommune og borgere.
Steffen Foss Hansen

Netbutikker har markant flere antibakterielle sølvprodukter på hylderne
Steffen Foss Hansen
13/10/2016

Description
Antallet af hverdagsprodukter med bakteriebekæmpende sølv i nanopartikelform er vokset med 80 procent på bare fire år, viser tal fra DTU Miljø. Men sølv kan skabe antibiotikaresistente bakterier og skade miljøet.
Department of Environmental Engineering, Environmental Chemistry

Media contribution (1)

Netbutikker har markant flere antibakterielle sølvprodukter på hylderne
13/10/2016
DR (National), Denmark, Web
Thomas Lemke, Helle Slejborg, Simon Risum Pedersen
https://www.dr.dk/nyheder/penge/kontant/netbutikker-har-markant-fiere-antibakterielle-soelvprodukter-paa-hyl/derne
Antallet af hverdagsprodukter med bakteriebekæmpende sølv i nanopartikelform er vokset med 80 procent på bare fire år, viser tal fra DTU Miljø. Men sølv kan skabe antibiotikaresistente bakterier og skade miljøet.
Steffen Foss Hansen
Press / Media

Stort fokus på branchens vækstpotentiale ved VandTek
Hans-Jørgen Albrechtsen
10/10/2016
Department of Environmental Engineering, Urban Water Systems

Media contribution (1)

Stort fokus på branchens vækstpotentiale ved VandTek
10/10/2016
DansVAND, Print
Hans-Jørgen Albrechtsen
Department of Environmental Engineering, Urban Water Systems
Press / Media

Ph.d.-forsvar om at vurdere risikoen for udsættelse for nanomaterialer i arbejdsmiljøet ved hjælp af control-banding værktøjer
Steffen Foss Hansen
27/09/2016
Department of Environmental Engineering, Environmental Chemistry

Media contribution (1)

Ph.d.-forsvar om at vurdere risikoen for udsættelse for nanomaterialer i arbejdsmiljøet ved hjælp af control-banding værktøjer
27/09/2016
Arbejdsmiljoforskning.dk (National), Denmark, Web
Kirsten Rydahl
Steffen Foss Hansen
Press / Media

Stort fokus på branchens vækstpotentiale ved Vandtek
20/09/2016

Description
Mention of Camilla Tang winning "Best Student Project" at Vandtek
Department of Environmental Engineering, Urban Water Systems

Media contribution (1)

Stort fokus på branchens vækstpotentiale ved Vandtek
20/09/2016
dansVAND, Print
Department of Environmental Engineering, Urban Water Systems
Press / Media

Commission seeks input to third nanomaterials regulatory review
Steffen Foss Hansen
23/06/2016

Description
Interplay between REACH and CLP key, says NGO
Department of Environmental Engineering, Environmental Chemistry

Media contribution (1)
Commission seeks input to third nanomaterials regulatory review
23/06/2016
Chemical Watch (International), Web
Luke Buxton
https://chemicalwatch.com/48240/commission-seeks-input-to-third-nanomaterials-regulatory-review?q=steffen+foss+hansen
Steffen Foss Hansen
Press / Media

Debat: Nej, skifergas er da alt andet end forsvarligt
Steffen Foss Hansen
23/02/2016

Description
SKIFERGAS Politikerne må enten forbyde skifergas eller indrømme, at de gambler med miljø og sundhed.
Department of Environmental Engineering, Environmental Chemistry

Media coverage (1)

Debat: Nej, skifergas er da alt andet end forsvarligt
23/02/2016
Politiken (National), Denmark, Print
Jens Voldby Crumlin
374 words
SKIFERGAS Politikerne må enten forbyde skifergas eller indrømme, at de gambler med miljø og sundhed.
Steffen Foss Hansen

Relations
Projects:
Shale gas in a Danish context
Press / Media

Naturstyrelsen kortlægger erfaringer 36 farer ved skifergas i Danmark
Steffen Foss Hansen
19/02/2016

Description
Naturstyrelsen advarer om, at udvinding af skifergas kan føre til forurening af grundvandet, og at der er brug for mere
viden om de kemikalier, der bruges til at udvinding.
Department of Environmental Engineering, Environmental Chemistry

Media contribution (1)

Naturstyrelsen kortlægger erfaringer 36 farer ved skifergas i Danmark
19/02/2016
Arbejderen (National), Denmark, Web
http://arbejderen.dk/indland/36-farer-ved-skifergas-i-danmark
Naturstyrelsen advarer om, at udvinding af skifergas kan føre til forurening af grundvandet, og at der er brug for mere
viden om de kemikalier, der bruges til at udvinding.
Steffen Foss Hansen
Press / Media

Forskere står med mange ubesvarede skifergasspørgsmål: Der er stadig mange ubesvarede spørgsmål om
skifergasboringernes konsekvenser for miljøet og grundvandet.
Steffen Foss Hansen
10/02/2016
Department of Environmental Engineering, Environmental Chemistry

Media contribution (1)

Forskere står med mange ubesvarede skifergasspørgsmål: Der er stadig mange ubesvarede spørgsmål om
skifergasboringernes konsekvenser for miljøet og grundvandet.
10/02/2016
Energisten, Web
Morten Kammersgaard  
http://energisten.mediajungle.dk/2016/02/10/forskere-staar-med-mange-ubesvarede-skifergasspoergsmaal/  
Steffen Foss Hansen  
Department of Environmental Engineering, Environmental Chemistry

**Relations**  
Projects:  
Shale gas in a Danish context  
Press / Media

**36 risici ved at bore efter skifergas**  
Steffen Foss Hansen  
03/02/2016

**Description**  
Regeringsrapport peger på, at der er 36 risici ved at bore efter skifergas. Ifølge lektor ved DTU Steen Foss Hansen er der dog behov for yderligere undersøgelser.  
Department of Environmental Engineering, Environmental Chemistry

**Media coverage (1)**

**36 risici ved at bore efter skifergas**  
03/02/2016  
Danskfjernvarme.dk, Denmark, Print  
Dansk Fjernvarme  
162 words  
Steffen Foss Hansen

**Relations**  
Projects:  
Shale gas in a Danish context  
Press / Media

**Rapport: Sådan gør vi skifergas miljøvenlig**  
Steffen Foss Hansen  
02/02/2016

**Description**  
Der er en række miljømæssige risici ved at bore efter skifergas, men en ny rapport fra Naturstyrelsen bringer mulige løsninger for dagen.  
Department of Environmental Engineering, Environmental Chemistry

**Media contribution (1)**

**Rapport: Sådan gør vi skifergas miljøvenlig**  
02/02/2016  
Ingeniøren (National), Denmark, Web  
Julie Lykke-Nedergaard  
461 words  
https://ing.dk/artikel/rapport-saadan-goer-vi-skifergas-miljoevenlig-181929  
Der er en række miljømæssige risici ved at bore efter skifergas, men en ny rapport fra Naturstyrelsen bringer mulige løsninger for dagen.  
Steffen Foss Hansen

**Relations**  
Projects:  
Shale gas in a Danish context  
Press / Media

**Sådan gør vi skifergas miljøvenlig: Der er en række miljømæssige risici ved at bore efter skifergas, men en ny rapport fra Naturstyrelsen bringer mulige løsninger for dagen**  
Steffen Foss Hansen  
02/02/2016  
Department of Environmental Engineering, Environmental Chemistry
Sådan gør vi skifergas miljøvenlig: Der er en række miljømæssige risici ved at bore efter skifergas, men en ny rapport fra Naturstyrelsen bringer mulige løsninger for dagen
02/02/2016
Ingeniøren, Web
Julie Lykke-Nedergaard
Steffen Foss Hansen
Department of Environmental Engineering, Environmental Chemistry
Press / Media

Bacteria Monitoring in 3D
Hans-Jørgen Albrechtsen
01/01/2016

Description
Article on new 3D monitor that DTU Environment (Hans-Jørgen Albrechtsen) is collaborating on with Grundfos and HOFOR A/S. Published in Water online August 10, 2016
Department of Environmental Engineering, Urban Water Systems

Nanoteknologien buldrer frem på arbejdspladserne
Steffen Foss Hansen
11/11/2015

Subject
Nr. 11 - 2015
Department of Environmental Engineering, Environmental Chemistry

Nanoteknologien buldrer frem på arbejdspladserne
11/11/2015
Arbejdsmiljø, Print
Birgit Bruun Christensen
Steffen Foss Hansen
Department of Environmental Engineering, Environmental Chemistry
Press / Media

Nanoteknologien buldrer frem på arbejdspladserne
Steffen Foss Hansen
02/11/2015

Description
Man kan ikke se en nanopartikel med det blotte øje. Nogle er sundhedsskadelige, mens andre er helt ufarlige. En af de store udfordringer for arbejdspladserne er at få overblik over, om der er nano i arbejdsmiljøet – og derefter at tage de rigtige forholdsregler.
Department of Environmental Engineering, Environmental Chemistry

Interview
02/11/2015
Magasinet Arbejdsmiljø (National), Denmark, Print
Birgit Bruun Christensen
Kulstofnanorør kan blive vor tids asbest
Steffen Foss Hansen
21/09/2015
Department of Environmental Engineering, Environmental Chemistry

Media contribution (1)

Kulstofnanorør kan blive vor tids asbest
21/09/2015
Ingeniøren (National), Denmark, Web
https://apps-infomedia-dk.proxy.findit.dtu.dk/mediearkiv/link?articles=e538ebaa
Steffen Foss Hansen
Press / Media

Første maling i Danmark med kulstofnanorør vækker bekymring
Steffen Foss Hansen
21/09/2015

Description
Kulstofnanorørerne er så mikroskopiske, at de kan udrette betydelig skade på lungerne, hvis de bliver indåndet. Den første maling med kulstofnanorør er netop kommet på makredet til professionelle. For fire år siden blev malingen Tesla Nanocoating kåret som en af de 100 bedste opfindelser af R & D Magazine. Nu er malingen kommet på det danske marked for professionelle malere - og nu vækker malingen bekymring hos flere eksperter. Årsagen er malingens indhold af kulstofnanorør. Det skriver dagbladet Ingeniøren.
Steffen Foss Hansen
Press / Media

Kulstofnanorør kan angribe lungerne
Steffen Foss Hansen
21/09/2015

Description
Steffen Foss Hansen
Press / Media

Kulstofnanorør kan angribe lungerne
21/09/2015
Ingeniøren, Print
Bjørn Godske
Denmark: Early adopter of water and climate solutions
Sara Maria Lerer
01/09/2015
Department of Environmental Engineering, Urban Water Engineering

Media contribution (1)

Spildevand er ikke spildevand
Ravi Kumar Chhetri
01/08/2015

Description
Our field work on wastewater treatment in Kangerlussuaq, Greenland was published in this newspaper.
Department of Environmental Engineering, Urban Water Engineering

Media contribution (1)

Storkøbenhavn får mindre kalk i drikkevandet: Når Hovedstadsområdets Forsyningsselskab frem mod 2024 reducerer kalken i drikkevandet, vil københavners vaskemaskiner og opvaskemaskiner holde lige så længe som de midt- og vestjyske. Samtidig vil de spare energi og bruge mindre sæbe.
Martin Rygaard
16/07/2015
Department of Environmental Engineering, Urban Water Engineering

Media contribution (1)

Fordelene ved bioforgasning af organisk affald
Morten Bang Jensen
17/03/2015

Description
Subject
biowaste
Department of Environmental Engineering, Residual Resource Engineering

Media contribution (1)

Fordelene ved bioforgasning af organisk affald
17/03/2015
Dakofa, Web
Morten Bang Jensen
Department of Environmental Engineering, Residual Resource Engineering
Press / Media

Dansk Fjernvarme
Morten Bang Jensen
10/03/2015

Description
http://www.danskfjernvarme.dk/nyheder/presseklip/150309ny-rapport-godkender-afbraending-af-madaffald

Subject
Biowaste
Department of Environmental Engineering, Residual Resource Engineering

Media contribution (1)

Dansk Fjernvarme
10/03/2015
Dansk Fjernvarme, Web
Morten Bang Jensen
Department of Environmental Engineering, Residual Resource Engineering
Press / Media

News with P4KBH
Morten Bang Jensen
09/03/2015

Description
http://www.dr.dk/p4kbh/p4kbh-morgen/p4-morgen-2015-03-09
Department of Environmental Engineering, Residual Resource Engineering

Media contribution (1)

News with P4KBH
09/03/2015
P4KBH, Radio
2 minutes
Morten Bang Jensen
Department of Environmental Engineering, Residual Resource Engineering
Press / Media

ny-rapport-affaldssortering-kan-skade-miljoeet
Morten Bang Jensen
09/03/2015

Description
http://www.b.dk/nationalt/ny-rapport-affaldssortering-kan-skade-miljoeet
Department of Environmental Engineering, Residual Resource Engineering

Media contribution (1)

ny-rapport-affaldssortering-kan-skade-miljoeet
09/03/2015
News
Morten Bang Jensen
03/03/2015

Subject
Crossborder biowaste
Department of Environmental Engineering, Residual Resource Engineering

Media contribution (1)

News
03/03/2015
TVSyd, Television
2:00
Morten Bang Jensen
Department of Environmental Engineering, Residual Resource Engineering

News with P4Syd
Morten Bang Jensen
03/03/2015

Subject
Biowaste
Department of Environmental Engineering, Residual Resource Engineering

Media contribution (1)

News with P4Syd
03/03/2015
P4Syd, Radio
2 minutes
Morten Bang Jensen
Department of Environmental Engineering, Residual Resource Engineering

Forskere sår tvivl om madaffald som energikilde
Morten Bang Jensen
02/03/2015
Department of Environmental Engineering, Residual Resource Engineering

Media contribution (1)

Forskere sår tvivl om madaffald som energikilde
02/03/2015
Jydske Vestkysten, Print
Morten Bang Jensen
Department of Environmental Engineering, Residual Resource Engineering

Madaffald er en god forretning i Billund
Morten Bang Jensen
02/03/2015
Madaffald er en god forretning i Billund
02/03/2015
Jydske Vestkysten, Print
Morten Bang Jensen
Department of Environmental Engineering, Residual Resource Engineering
Press / Media

Udskældt fracking skal rense danske giftgrunde: En variant af den frackingmetode, der bruges til udvinding af skifergas, kan blive fremtidens metode til rensning af forurenet jord. Danmark er først til at forsøge.
Mette Martina Broholm
21/11/2014
Department of Environmental Engineering, Water Resources Engineering
Press / Media

Professor: Ingen kan give pris på Engsøen: Billund : Kommunens datagrundlag for forureningen af Engsøen er for spinkelt, siger DTU-professor.
Poul Legstrup Bjerg
20/11/2014
Department of Environmental Engineering, Water Resources Engineering
Press / Media

Spis rolig grønt fra byens haver
Stefan Trapp
25/08/2014
Department of Environmental Engineering, Environmental Chemistry
Press / Media

Experts call for focus on hazards of emerging technologies
Steffen Foss Hansen
Danish experts are calling for increased environmental, health and safety (EHS) funding to improve prediction of potential hazards from emerging technologies, while also maximising commercial lifespan.

Steffen Foss Hansen

Experts call for focus on hazards of emerging technologies

Steffen Foss Hansen

Nu skal nanoprodukter registreres

Steffen Foss Hansen

Årsmøde 2014 - De tekniske oplæg: Den kemiske strategi for et godt badevand

Kamilla Marie Speht Kaarsholm

**Losseplader truer danskernes rene drikkevand i 50 år**
Poul Løgstrup Bjerg
27/05/2014
Department of Environmental Engineering, Water Resources Engineering

**Media contribution (1)**

**Losseplader truer danskernes rene drikkevand i 50 år**
27/05/2014
Ingeniøren, Print
Christian Østergaard
http://ing.dk/artikel/lossepladser-truer-danskernes-renedrikkevand-i-50-aar-168630
Poul Løgstrup Bjerg
Department of Environmental Engineering, Water Resources Engineering

**De tre millimeter mellem os og Solen**
Marlene Mark Jensen
15/05/2014

**Subject**
Gasser, Ozonlaget, Lattergas
Department of Environmental Engineering, Urban Water Engineering

**Media contribution (1)**

**De tre millimeter mellem os og Solen**
15/05/2014
Weekendavisen, Print
Christoffer Muusmann
Marlene Mark Jensen
Department of Environmental Engineering, Urban Water Engineering

**Blødt vand sparer os for millioner: Vandværkerne i hovedstaden vil halvere mængden af kalk i vandet.**
Martin Rygaard
10/05/2014

**Description**
Newspaper frontpage.
Department of Environmental Engineering, Urban Water Engineering

**Media contribution (1)**

**Blødt vand sparer os for millioner: Vandværkerne i hovedstaden vil halvere mængden af kalk i vandet.**
10/05/2014
Politiken, Print
Martin Rygaard
Department of Environmental Engineering, Urban Water Engineering

**Ny forskning: Ingen gevinst ved at genanvende madaffald**
Morten Bang Jensen
09/03/2014
Department of Environmental Engineering, Residual Resource Engineering

**Media contribution (1)**

**Ny forskning: Ingen gevinst ved at genanvende madaffald**
09/03/2014
Information, Print
Morten Bang Jensen
Department of Environmental Engineering, Residual Resource Engineering
Interview on consequences of drinking water softening in Brøndby
Martin Rygaard
15/02/2014
Department of Environmental Engineering, Urban Water Engineering

Media contribution (1)

Interview on consequences of drinking water softening in Brøndby
15/02/2014
DR P4, Radio
Martin Rygaard
Department of Environmental Engineering, Urban Water Engineering
Press / Media

Nu skal miljøbombe afmonteres
Poul Løgstrup Bjerg
01/01/2014
Department of Environmental Engineering, Water Resources Engineering

Media contribution (1)

Nu skal miljøbombe afmonteres
01/01/2014
Dialog, Print
Marianne Gregersen
Poul Løgstrup Bjerg
Department of Environmental Engineering, Water Resources Engineering
Press / Media

Job hænger på træerne for miljøstudierende: Vandnørdermes legeplads
Florian Benedikt Wagner
18/12/2013
Department of Environmental Engineering, Urban Water Engineering, Technical University of Denmark

Media contribution (1)

Job hænger på træerne for miljøstudierende: Vandnørdermes legeplads
18/12/2013
Børsen, Print
Signe Sørensen & Pia Lykke
Florian Benedikt Wagner
Urban Water Engineering, Department of Environmental Engineering, Technical University of Denmark
Press / Media

Job hænger på træerne for miljøstudierende: Vandnørdermes legeplads
Mathilde Jørgensen Hedegaard
18/12/2013
Department of Environmental Engineering, Urban Water Engineering

Media contribution (1)

Job hænger på træerne for miljøstudierende: Vandnørdermes legeplads
18/12/2013
Børsen, Print
Signe Sørensen og Pia Lykke
Mathilde Jørgensen Hedegaard
Department of Environmental Engineering, Urban Water Engineering
Press / Media

Hvad kan vi danskere: Gode forhold tiltrækker ph.d-studerende
Florian Benedikt Wagner
18/12/2013
Hvad kan vi danskere: Gode forhold tiltrækker ph.d-studerende
18/12/2013
Børsen TV, Web
Pia Lykke
http://borsen.dk/nyheder/hvad_kan_vi_danskere/artikel/1/272981/gode_forhold_tiltraekker_phd-studerende.html
Link to interview (Børsen login necessary to see full interview)
Florian Benedikt Wagner
Urban Water Engineering, Department of Environmental Engineering, Technical University of Denmark
Press / Media

Den dag Europa kom til Kalundborg
Susan Løvstad Holdt
01/12/2013
Description
Grand opening of the Bioreactor Greenhouse facility in the Kalundborg wastewater treatment plant.
Department of Environmental Engineering, Residual Resource Engineering, National Food Institute, National Institute of Aquatic Resources
Press / Media

Nano-produkter
Anders Baun
13/11/2013
Department of Environmental Engineering, Environmental Chemistry
Press / Media

Regeringen vil bruge 24 millioner på et nano-register
Steffen Foss Hansen
12/11/2013
Department of Environmental Engineering, Environmental Chemistry
Press / Media
Lessons nanotechnology can learn from past mistakes
Steffen Foss Hansen
16/09/2013

Description
Falling in love with a new technology and wanting to apply it everywhere is not a good idea.
Department of Environmental Engineering, Environmental Chemistry

Media contribution (1)

Lessons nanotechnology can learn from past mistakes
16/09/2013
The Guardian, Web
Michele Catanzaro
http://www.theguardian.com/science/small-world/2013/sep/16/nanotechnology-lessons-safety
Steffen Foss Hansen
Department of Environmental Engineering, Environmental Chemistry
Press / Media

Danish engineer supports water scarcity problems in China
Claus Davidsen
02/09/2013

Description
Background article concerning our research in China.
Department of Environmental Engineering, Water Resources Engineering

Media contribution (1)

Danish engineer supports water scarcity problems in China
02/09/2013
Ingeniøren, Print
Sigrid Møller
Claus Davidsen
Department of Environmental Engineering, Water Resources Engineering
Press / Media

Kina giver mulighed for store armbevægelser
Claus Davidsen
02/05/2013

Description
Special edition of the paper Information (Videnskapløb Forår 2013) with focus on experiences gained by Danish Ph.D.-students during research stays abroad.
Department of Environmental Engineering, Water Resources Engineering

Media contribution (1)

Kina giver mulighed for store armbevægelser
02/05/2013
Information, Print
Martin Gøttske
Claus Davidsen
Department of Environmental Engineering, Water Resources Engineering
Press / Media

Skejby-hospital satser på rationel spildevandsrensning
Henrik Rasmus Andersen
23/03/2013
Department of Environmental Engineering, Urban Water Engineering

Media contribution (1)
Skejby-hospital satser på rationel spildevandsrensning
23/03/2013
Ingeniøren, Print
http://ing.dk/artikel/skejby-hospital-satser-paa-rationel-spildevandsrensning-157270
Henrik Rasmus Andersen
Department of Environmental Engineering, Urban Water Engineering
Press / Media

The tiniest particles that may be a threat as bad as asbestos
Steffen Foss Hansen
27/01/2013

Description
Nanomaterials are everywhere, but their use is totally unregulated.
Department of Environmental Engineering, Environmental Chemistry

Media contribution (1)

The tiniest particles that may be a threat as bad as asbestos
27/01/2013
The Independent, Web
Emily Dugan
Steffen Foss Hansen
Department of Environmental Engineering, Environmental Chemistry
Press / Media

Forfra med Jeppesen (1)
Sarah Christine Boesgaard Christensen
25/01/2013
Department of Environmental Engineering, Urban Water Engineering

Media contribution (1)

Forfra med Jeppesen (1)
25/01/2013
Radio 24syv, Radio
55:27
http://arkiv.radio24syv.dk/video/7649950/forfra-med-jeppesen-uge-4-2013
Sarah Christine Boesgaard Christensen
Department of Environmental Engineering, Urban Water Engineering
Press / Media

Millioner til tang
Susan Løvstad Holdt
29/11/2012
Department of Environmental Engineering

Media contribution (1)

Millioner til tang
29/11/2012
Sydkystens avis, Print
Susan Løvstad Holdt
Department of Environmental Engineering
Press / Media

Alge-biorafinaderi
Susan Løvstad Holdt
28/11/2012
Department of Environmental Engineering

Media contribution (1)
Alge-biorafinaderi
28/11/2012
Danskkernes Akademi/DR2, Television
http://www.dtu.dk/forskning/danskkernes_akademi/susan%20l%C3%B8vstad%20holdt.aspx
Link
Susan Løvstad Holdt
Department of Environmental Engineering
Press / Media

Tang til sushi og salat: Tang er havets grøntsag og en ny afgrøde i Danmark
Susan Løvstad Holdt
20/11/2012
Department of Environmental Engineering

Media contribution (1)

Tang til sushi og salat: Tang er havets grøntsag og en ny afgrøde i Danmark
20/11/2012
Foodculture.dk, Web
Anne Mette Ehlers
http://www.foodculture.dk/Produktion/Gartneri_og_Akvakultur/2012/Tang_til_sushi_og_salat.aspx#.UOb61KxW1Bk
Link
Susan Løvstad Holdt
Department of Environmental Engineering
Press / Media

Havets grønbrune guld
Susan Løvstad Holdt
16/11/2012
Department of Environmental Engineering

Media contribution (1)

Havets grønbrune guld
16/11/2012
Rasio/Natursyn/P1, Radio
Dorte Dalgaard
41 min
http://www.dr.dk/P1/Naturkonference/2012/11/15122202.htm
Susan Løvstad Holdt
Department of Environmental Engineering
Press / Media

Asellus aquaticus and other invertebrates in drinking water distribution systems - occurrence and influence on microbial water quality
Sarah Christine Boesgaard Christensen
30/10/2012

Description
Portrait of Sarah Christine Christensen
Department of Environmental Engineering, Urban Water Engineering

Media contribution (1)

Asellus aquaticus and other invertebrates in drinking water distribution systems - occurrence and influence on microbial water quality
30/10/2012
Web
DTUbroadcast
4:06
http://www.youtube.com/watch?v=FdFROp-gzoI
Link to video
Sarah Christine Boesgaard Christensen
Department of Environmental Engineering, Urban Water Engineering
Jyllandsposten: Blodtud til rygeradvokat
Stefan Trapp
13/10/2011
Department of Environmental Engineering, Environmental Chemistry

Media contribution (1)

Jyllandsposten: Blodtud til rygeradvokat
13/10/2011
København, Print
Stefan Trapp
Department of Environmental Engineering, Environmental Chemistry

En overset guldgrube
Susan Løvstad Holdt
01/05/2011
Department of Environmental Engineering

Media contribution (1)

En overset guldgrube
01/05/2011
Print
Susan Løvstad Holdt
Department of Environmental Engineering

Søsalat og fedtemøg baner vej for fremtidige havlandmænd
Susan Løvstad Holdt
01/01/2011
Department of Environmental Engineering

Media contribution (1)

Søsalat og fedtemøg baner vej for fremtidige havlandmænd
01/01/2011
Print
Susan Løvstad Holdt
Department of Environmental Engineering

Tang kan både dyrkes og fanges
Susan Løvstad Holdt
01/01/2011
Department of Environmental Engineering

Media contribution (1)

Tang kan både dyrkes og fanges
01/01/2011
Print
Susan Løvstad Holdt
Department of Environmental Engineering

Små dyr lever i vandrørene
Sarah Christine Boesgaard Christensen
01/02/2010
Department of Environmental Engineering, Urban Water Engineering
Smådyr lever i vandrør overalt i Danmark
Sarah Christine Boesgaard Christensen
01/02/2010
Department of Environmental Engineering, Urban Water Engineering
Press / Media

50+ appearances in news media regarding "Animals are living in the drinking water"
Sarah Christine Boesgaard Christensen
29/01/2010
Department of Environmental Engineering, Urban Water Engineering
Press / Media