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Research outputs:

Deriving Environmental Life Cycle Inventory Factors for Land Application of Garden Waste Products Under Northern European Conditions

The amount of waste which is being recycled is increasing in Europe. Garden waste is increasingly composted and land applied. However, composting to full maturity requires resources in terms of space, equipment and labour. Alternatives could include a simple shredding, or composting for a shorter time. Finally, an option could be to remove trunks and large branches which are not easy to compost and incinerate them to recover energy. In order to assess these options and the associated environmental impacts, it is necessary to have good estimates of emissions and other inventory factors during the different steps of the life cycle of the compost products. Especially, the impacts occurring after land application are difficult to estimate. The objective of the current paper is to estimate environmental inventory factors for land application of four garden waste products: shredded garden waste, shredded garden waste after removal of the woody fraction, immature garden waste compost and mature garden waste compost. Soil incubations of the materials were conducted in order to assess the carbon (C) and nitrogen (N) dynamics occurring after incorporation in soil. Subsequently, the results were used to calibrate the mineralisation kinetics of the materials in the agroecosystem model Daisy. Subsequently, the model was used to simulate C and N dynamics under different environmental conditions and emissions to the environment and used to derive inventory factors. Nine soil and climate combinations were included in the simulation study to cover local conditions commonly found in Northern Europe. The degradability of the garden waste products increased when the woody fraction of garden waste was removed and generally the degradability of the product was decreased by composting. All four products showed initial immobilisation of N in soil, but it was clear that removal of the woody fraction and composting reduced the length and severity of the immobilisation phase. The approach taken in the current paper using soil incubations to estimate decomposition parameters for the materials and subsequently an agroecosystem model to extrapolate the observations proved efficient at estimating inventory factors under various environmental conditions and fertilisation levels. Under low N availability conditions, the harvest factor, which estimates the fraction of N harvested in response to application of an amount of compost ranged between 0.10 and 0.18 for a sandy loam soil and medium precipitation conditions for Northern European while it ranged from negative values to 0.12 under conditions of ample N supply. These results were also clearly reflected in the emission factors for N leaching to the groundwater and losses to surface water, which were higher under high N availability than under low. The harvest factor, emission factors for ammonia, N leaching to ground water and loss to surface water proved to be very dependent on the local conditions like the soil type, precipitation regime and general fertilisation level, whereas the biochemical composition of the materials was of less importance for these factors. In contrast, the C sequestration factor was almost unaffected by the environmental conditions but depended on a large extent on the degradability of the added material.

General information

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Evaluation of a European textile sorting centre: Material flow analysis and life cycle inventory

Life cycle assessment (LCA) studies have shown that the optimal treatments of textile waste follow the waste hierarchy. Consequently, there is great potential for environmental improvements through ensuring that textiles are collected, reused, recycled and disposed of in the best possible way. Despite the fact that textile sorting centres play a central role in ensuring a high reuse rate, they have either been left out of previous LCAs or modelled based on low-quality data. In this study, a material flow analysis (MFA) of the textile flows in a sorting centre, and a life cycle inventory (LCI), was undertaken for the period 2015–2017, along with an assessment of the main economic factors. The MFA showed that the majority of the sorted textiles were indeed reusable, but their numbers decreased in the reference period, from 79.8% to 74.9%. The LCI and economic analysis showed increasing resource consumption in terms of electricity, gas (trucks) and packing per sorted tonne. Furthermore, the quality of textiles has generally decreased over the last decade, which is reflected in the share of reusable textiles of the highest quality, which undergo additional fine sorting. While in 2015, almost 33% of the reusable textiles were sorted out for fine sorting, in 2017, this figure was down to 29%. The number of recyclable textiles increased over the period, from 12.9% to 17.3%, and the amount of waste also increased, from 5.4 to 6.0%. The results presented herein are important for properly representing the sorting process in modelling textile waste management.
Guidelines for landfill gas emission monitoring using the tracer gas dispersion method

Landfill gas often containing 50–60% methane, is generated on waste disposal sites receiving organic waste. Regulation requires that this gas is managed in order to reduce emissions, but very few suggestions exist as to how management activities are monitored, what should be set up to ensure this management and how criteria should be developed for when monitoring activities are terminated. Methane emission monitoring procedures are suggested, based on a robust method for measuring total leakage from the site; additionally, quantitative measures, to determine the efficiency of the performed emission mitigation, are defined. The tracer gas dispersion measuring technique is suggested as the core emission measurement methodology in monitoring plans for methane emissions from landfills and a guideline for best practice measurement performance is presented. A minimum methane mitigation efficiency of 80% is suggested. Finally, several principles are presented on how criteria can be developed for when a monitoring program can be terminated. Three of the suggested principles result in comparable completion criteria of about 1–3 kg CH4/h for a small landfill (an area of 4 ha).

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Life cycle assessment of garden waste management options including long-term emissions after land application

A life cycle assessment (LCA) was performed on five garden waste treatment practices: the production of mature compost including the woody fraction (MCIW), the production of mature compost without the woody fraction (MCWW), the production of immature compost without the woody fraction (ICWW), fresh garden waste including the woody fraction (GWIW) and fresh garden waste without the woody fraction (GWWW). The assessment included carbon sequestration after land application of the garden waste and composts, and associated emissions. The removed woody fraction was incinerated and energy recovery included as heat and electricity. The functional unit of the assessment was treatment of 1000kg of garden waste generated in Denmark. Overall, the results showed that composting of garden waste resulted in comparable or higher environmental impact potentials (depletion of abiotic resources, marine eutrophication, and terrestrial eutrophication and acidification) than no treatment before land application. The toxicity potentials showed the highest normalised impact potentials for all the scenarios, but were unaffected by the different garden waste treatments. The choice of energy source for substituted heat and electricity production affected the performance of the different treatment scenarios with respect to climate change. The scenarios with removal of the woody fraction performed better than the scenarios without removal of the woody fraction when fossil energy sources were substituted, but performed worse when renewable energy sources were substituted. Furthermore, the study showed the importance of including long-term emission factors after land application of fresh and composted garden waste products since the greatest proportion of carbon and nitrogen emissions occurred after land application in three out of the five scenarios for carbon and in all scenarios for nitrogen.
Methodologies for measuring fugitive methane emissions from landfills – A review

Fugitive methane (CH4) emissions from landfills are significant global sources of greenhouse gases emitted into the atmosphere; thus, reducing them would be a beneficial way of overall greenhouse gas emissions mitigation. In Europe, landfill owners have to report their annual CH4 emissions, so direct measurements are therefore important for (1) evaluating and improving currently applied CH4 emission models, (2) reporting annual CH4 emissions and (3) quantifying CH4 mitigation initiatives. This paper aims at providing an overview of currently available methodologies used to measure fugitive CH4 emissions escaping from landfills. The measurement methodologies are described briefly, and the advantages and limitations of the different techniques are discussed with reference to published literature on the subject. Examples are given of individual published studies using different methodologies and studies comparing three or more methodologies. This review suggests that accurate, whole-site CH4 emission quantifications are best done using methods measuring downwind of the landfill, such as tracer gas dispersion and differential absorption LiDAR (DIAL). Combining aerial CH4 concentration measurements from aircraft or unmanned aerial vehicles with wind field measurements offers a great future potential for improved and cost-efficient integrated landfill CH4 emission quantification. However, these methods are difficult to apply for longer time periods, so in order to measure temporal CH4 emission changes, e.g. due to the effect of changes in atmospheric conditions (pressure, wind and precipitation), a measurement method that is able to measure continuously is required. Such a method could be eddy covariance or static mass balance, although these procedures are challenged by topography and inhomogeneous spatial emission patterns, and as such they can underestimate emissions significantly. Surface flux chambers have been used widely, but they are likely to underestimate emission rates, due to the heterogeneous nature of most landfill covers resulting in sporadic and localised CH4 emission hotspots being the dominant emission routes. Furthermore, emissions from wells, vents, etc. are not captured by surface flux chambers. The significance of any underestimation depends highly on the configuration of individual landfills, their size and emission patterns.

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Quantity and quality of clothing and household textiles in the Danish household waste

Despite the fact that studies have indicated that a large proportion of textiles is disposed in the waste, only few studies have looked at the content of textiles in waste, and even less have considered the quality of these textiles. However, it is crucial to know both quantity and quality, in order to assess the potential for improved reuse and recycling. Following a new method for assessing the quantity and quality of textile waste, this study assessed residual household waste from 17 areas and small combustible waste from six recycling stations throughout Denmark. The average contents of Clothing and Household textiles in residual household waste were 1.4±0.5% and 0.6±0.3%, respectively, whereas the content was...
4.5±2.1% for Clothing and 2.6±1.2% for Household textiles in the small combustibles. On an annual basis each resident discards to 2.4±0.9kg of Clothing and 1.1±0.5kg/resident/year of Household textiles with the residual household waste. The quality assessments showed, that an average of 65±8.0% and 65±19.3% of the Clothing and Household textiles were reusable in the residual household waste, while in small combustibles it were an average of 69±5.8% and 66±9.6% of the Clothing and Household textiles. In addition, an average of 12±5.3% and 15±10.5% of the Clothing and Household textiles in residual waste, and an average of 14±3.9% and 16±8.7% of the Clothing and Household textiles in small combustibles, could be recycled. This emphasizes that there is good potential for improving textile waste management, as most of the identified Clothing and Household textiles were misplaced and little were actually waste.

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Residual phosphorus availability after long-term soil application of organic waste

Phosphorus (P) accumulated in soil after surplus P applications can potentially serve as a P source for subsequent crop production. This study investigated residual P availability after long-term surplus P application with different organic waste products. Topsoil samples from a long-term field trial treated with different types of organic wastes were subjected to P characterization, including determination of total P, water-soluble P, and isotopically exchangeable P pools. The waste products were applied for 12 years before sampling, at rates according to crop nitrogen demand and thus typically in excess of crop P requirements. Residual waste P in soil was determined based on the difference between total soil P measured in the different specific waste-treated plots and a balanced reference treatment. After 12 years of surplus P balance (inputs – crop offtake) of 79–598 kg P ha⁻¹ yr⁻¹ with waste, significant amounts of P (636–4177 kg ha⁻¹) had accumulated in the soil as residual P. The average fraction of residual waste P which could be recovered as rapidly exchangeable P (within 1 min) followed the order: composted household waste P (2.1%) < sewage sludge P (5.1%) < cattle manure P (10.9%), indicating that type of waste has an impact on residual P availability after long-term surplus P application. Unaccounted P (surplus P balance – residual P, i.e., P potentially lost from the topsoil) followed the same order, so compost P was better retained in the soil, but with a less clear difference between sewage sludge and cattle manure. For the latter two wastes, approximately half the surplus P balance could not be accounted for in the topsoil and was assumed to be transported down the soil profile. Three years after waste application was terminated, the fraction of rapidly exchangeable residual P had not declined significantly, suggesting sustained availability of residual P in the soil after long-term application of organic waste. Overall, the availability and mobility of residual P after applying composted household waste to soil was significantly lower than that of residual P from sewage sludge and cattle manure.

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Site-specific carbon footprints of Scandinavian wastewater treatment plants, using the life cycle assessment approach

The carbon footprints of seven wastewater treatment plants using different technologies in Denmark and Sweden were evaluated. The life cycle assessment approach was applied by using site-specific data including measured plant-integrated methane and nitrous oxide emissions. Four different functional units were adopted: 1Mg of input material entering the wastewater treatment plant in 2015, and the removal of 1kg of carbon, total nitrogen and phosphorus. The net carbon footprint values found in this study were between 0.15 and 0.66kg CO2 eq (Mg of input material)−1 depending on the treatment facility. Direct greenhouse gas emissions were the main contributors to the carbon footprint, accounting for between 44 and 71% of the total burden. The remaining share of the total burden (66 and 29%) was mainly made by energy consumption, chemicals used, and emissions from effluent and land application of biosolids. Direct greenhouse gas emissions were very sensitive model parameters driving result uncertainties. When default values from emission reporting guidelines were applied instead of measured greenhouse gas emission rates, the net carbon footprint was up to four times smaller or seven times larger. The consumption of electricity from the energy grid for plant operation had a great impact on the carbon footprint, due to differences between the energy systems. The share of electricity consumption to the total carbon footprint burden for the Swedish plants was only 2%, whereas it was between 16 and 28% for the Danish plants. This difference was due to the smaller carbon footprint potential of the electricity mix in Sweden than in Denmark. Normalisation of the carbon footprint to the plant pollution load, and the calculation of model uncertainty, allowed for a reliable comparison of plants operating within the same energy system. Finally, suggestions were provided for performing a sound carbon footprint evaluation of wastewater treatment plants.

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**Treatment of landfill gas with low methane content by biocover systems**

Landfills are significant sources of anthropogenic atmospheric methane (CH4), which contributes to climate change. Large amounts of CH4 are emitted from landfills in dilute form due to mixing with air in leachate collection systems, or during lateral migration away from landfills. The objective of this study was to investigate the CH4 oxidation efficiency of a compost material subject to LFG diluted with atmospheric air resulting in CH4 concentrations of 5–10% v/v. CH4 oxidation rates and carbon dioxide (CO2) production were measured through batch and dynamic column experiments where two laboratory scale biofilters were constructed. The columns were run at increasing flow rates. Column gas concentration profiles for each of five flow campaigns were compared to each other. This showed that oxygen (O2) was present throughout the entire column and elevated CO2 concentrations throughout the biofilters were found. Moreover, the oxidation process tended to be centred in the lower parts of both columns. It was observed that the biofilters performed better once they had adapted to the increasing loads of CH4. In both columns, the maximum removal rate of CH4 was found to be 98–100%. Using CH4 mass balances the maximum oxidation rate was 238 g CH4 m~2 d~1 in Column 1 and 483 g CH4 m~2 d~1 in Column 2 (equal to the load). None of the biofilters reached their maximum CH4 oxidation capacity, hence they could have been exposed to a larger CH4 load. It was found that the retention time in the columns was not a factor limiting the
oxidation process. High O2 consumption and carbon mass balances underlined the strong microbial activity in the biofilters and it was not suspected that the methane oxidising bacteria were O2 limited. The results of this study suggest that biofilters have great potential for reducing CH4 in diluted LFG.
Validation and error assessment of the mobile tracer gas dispersion method for measurement of fugitive emissions from area sources

A controlled release test was carried out to assess the accuracy of the tracer gas dispersion method, which is used to measure whole-site landfill methane (CH4) emissions as well as fugitive emissions from other area sources. Two teams performed measurements using analytical instruments installed in two vehicles, to measure downwind concentrations of target (CH4) and tracer gases at distances of 1.2â€“3.5 km from the release locations. The controlled target gas release rates were either 5.3 or 10.9 kg CH4 hâˆ’1, and target and tracer gases were released at distances between 12 m and 140 m from each other. Five measurement campaigns were performed, where the plume was traversed between 2 and 31 times. The measured target gas emissions agreed well with the controlled releases, with rate differences no greater than 1.1 kg CH4 hâˆ’1 for Team A and 1.0 kg CH4 hâˆ’1 for Team B when quantifying a controlled release of 10.9 kg CH4 hâˆ’1. This corresponds to a maximum error of â‡‘10%. A larger error of up to 18% was seen in the campaign with a lower target gas release rate (5.3 kg CH4 hâˆ’1). Using a cross plume integration method to calculate tracer gas to target gas ratios provided the most accurate results (lowest error), whereas larger errors (up to 49%) were observed when using other calculation methods. By establishment of an error budget and comparison with the measured error based on the release test, it could be concluded that following best practice when performing measurements, the overall error of a tracer gas dispersion measurement is very likely to be less than 20%.

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A comparison of chemical MSW compositional data between China and Denmark

Chemical waste compositions are important for municipal solid waste management, as they determine the pollution potentials from different waste strategies. A representative dataset for chemical characteristics of individual waste fractions is frequently required to assess chemical waste composition, but it is usually reported in developed countries and not in developing countries. In this study, a dataset for Chinese waste was established through careful data screening and assessment, named as CN dataset. Meanwhile, a dataset for Danish waste (DK dataset) was also summarized based on previous studies. In order to quantitatively evaluate the reliabilities of CN and DK datasets, the chemical waste compositions in four Chinese cities were estimated by utilizing both of them, respectively. It is indicated that the usage of CN datasets led to significantly lower discrepancies from the actual values based on laboratory analysis in most cases. Within the datasets, the moisture contents of food waste, paper, textiles, and plastics, the carbon content of food waste, as well as the oxygen content of plastics would induce significant divergences, which should be paid special attention when gathering the information. In addition, the fractional waste compositions in China showed similar features with other developing countries but differ significantly with developed countries. Thus the above-mentioned conclusions could also be true in other developing countries.
The measurement of methane emissions from landfills is important to the understanding of landfills' contribution to greenhouse gas emissions. The Tracer Dispersion Method (TDM) is becoming widely accepted as a technique, which allows landfill emissions to be quantified accurately provided that measurements are taken where the plumes of a released tracer-gas and landfill-gas are well-mixed. However, the distance at which full mixing of the gases occurs is
generally unknown prior to any experimental campaign. To overcome this problem the present paper demonstrates that, for any specific TDM application, a simple Gaussian dispersion model (AERMOD) can be run beforehand to help determine the distance from the source at which full mixing conditions occur, and the likely associated measurement errors. An AERMOD model was created to simulate a series of TDM trials carried out at a UK landfill, and was benchmarked against the experimental data obtained. The model was used to investigate the impact of different factors (e.g. tracer cylinder placements, wind directions, atmospheric stability parameters) on TDM results to identify appropriate experimental set ups for different conditions. The contribution of incomplete vertical mixing of tracer and landfill gas on TDM measurement error was explored using the model. It was observed that full mixing conditions at ground level do not imply full mixing over the entire plume height. However, when full mixing conditions were satisfied at ground level, then the error introduced by variations in mixing higher up were always less than 10%.

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BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Assessment of a landfill methane emission screening method using an unmanned aerial vehicle mounted thermal infrared camera – A field study

An unmanned aerial vehicle (UAV)-mounted thermal infrared (TIR) camera’s ability to delineate landfill gas (LFG) emission hotspots was evaluated in a field test at two Danish landfills (Hedeland landfill and Audebo landfill). At both sites, a test area of 100m² was established and divided into about 100 measuring points. The relationship between LFG emissions and soil surface temperatures were investigated through four to five measuring campaigns, in order to cover different atmospheric conditions along with increasing, decreasing and stable barometric pressure. For each measuring campaign, a TIR image of the test area was obtained followed by the measurement of methane (CH₄) and carbon dioxide (CO₂) emissions at each measuring point, using a static flux chamber. At the same time, soil temperatures measured on the surface, at 5cm and 10cm depths, were registered. At the Hedeland landfill, no relationship was found between LFG emissions and surface temperatures. In addition, CH₄ emissions were very limited, on average 0.92–4.52g CH₄m⁻²d⁻¹, and only measureable on the two days with decreasing barometric pressure. TIR images from Hedeland did not show any significant temperature differences in the test area. At the Audebo landfill, an area with slightly higher surface temperatures was found in the TIR images, and the same pattern with slightly higher temperatures was found at a depth of 10cm. The main LFG emissions were found in the area with the higher surface temperatures. LFG emissions at Audebo were influenced significantly by changes in barometric pressure, and the average CH₄ emissions varied between 111gm⁻²d⁻¹ and 314gm⁻²d⁻¹, depending on whether the barometric pressure gradient had increased or decreased, respectively. The temperature differences observed in the TIR images from both landfills were limited to between 0.7°C and 1.2°C. The minimum observable CH₄ emission for the TIR camera to identify an emission hotspot was 150g CH₄m⁻²d⁻¹ from an area of more than 1m².

General information
State: Accepted/In press
Contributors: Fjelsted, L., Christensen, A. G., Larsen, J. E., Kjeldsen, P., Scheutz, C.
Determination of gas recovery efficiency at two Danish landfills by performing downwind methane measurements and stable carbon isotopic analysis

In this study, the total methane (CH4) generation rate and gas recovery efficiency at two Danish landfills were determined by field measurements. The landfills are located close to each other and are connected to the same gas collection system. The tracer gas dispersion method was used for quantification of CH4 emissions from the landfills, while the CH4 oxidation efficiency in the landfill cover layers was determined by stable carbon isotopic technique. The total CH4 generation rate was estimated by a first-order decay model (Afvalzorg) and was compared with the total CH4 generation rate determined by field measurements. CH4 emissions from the two landfills combined ranged from 29.1 to 49.6 kg CH4/h. The CH4 oxidation efficiency was 6–37%, with an average of 18% corresponding to an average CH4 oxidation rate of 8.1 kg CH4/h. The calculated gas recovery efficiency was 59–76%, indicating a high potential for optimization of the gas collection system. Higher gas recovery efficiencies (73–76%) were observed after the commencement of gas extraction from a new section of one of the landfills. A good agreement was observed between the average total CH4 generation rates determined by field measurements (147 kg CH4/h) and those estimated by the Afvalzorg model (154 kg CH4/h).

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Florida State University
Contributors: Fathi Aghdam, E., Fredenslund, A. M., Chanton, J., Kjeldsen, P., Scheutz, C.
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Journal: Waste Management
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Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
Development and implementation of a screening method to categorise the greenhouse gas mitigation potential of 91 landfills

A cost-effective screening method for assessing methane emissions was developed and employed to categorise 91 older Danish landfills into three categories defined by the magnitude of their emissions. The overall aim was to assess whether these landfills were relevant or irrelevant with respect to methane emission mitigation through the construction of biocovers. The method was based on downwind methane concentration measurements, using a van-mounted cavity ring-down spectrometer combined with inverse dispersion modelling to estimate whole-site methane emission rates. This method was found to be less accurate than the more labour-intensive tracer gas dispersion method, and therefore cannot be recommended if a high degree of accuracy is required. However, it is useful if a less accurate examination is sufficient. A sensitivity analysis showed the dispersion model used to be highly sensitive to variations in input parameters. Of the 91 landfills in the survey, 25 were found to be relevant for biocover construction when the methane emission threshold was set at 2kg CH4 h⁻¹.

General information
State: Accepted/In press
Organisations: Department of Environmental Engineering, Air, Land & Water Resources, Residual Resource Engineering, FORCE Technology
Contributors: Fredenslund, A. M., Mønster, J., Kjeldsen, P., Scheutz, C.
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Journal: Waste Management
ISSN (Print): 0956-053X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
Development and testing of a sorting and quality assessment method for textile waste

Due to the high resource consumption and environmental impacts of textile production, better handling of discarded materials has a great environmental improvement potential. A uniform definition of textile waste and a stringent sorting procedure is a precondition for thorough investigations of discarded textiles. A review of waste sorting studies showed that only a few included textiles, and mainly considered content and not quality. A lack of definition and quality assessment causes a high risk of mistakes when assessing the potential of textile waste prevention. This study establishes a method for sorting and quality assessment of textiles in household waste, validated through dialogue with professional textile sorting centres. It also suggests a minimum waste sample size. The quality assessment is based on analysis of product types, manufacturing methods, fibre composition and a product condition assessment based on 17 criteria. The developed method was applied in a case study and compared with other sorting methods. It showed that 61% of the clothing in residual waste and 83% in small combustibles and that 78% of the household textiles in residual waste and 85% in small combustibles was reusable or recyclable. The comparison with existing methods showed that sorted quantities varied significantly when different sorting methods were applied even when the sorting was done on the same sample. This study suggests a new standard for defining and assessing categories and qualities of used textiles, adapted to real contemporary sorting technologies, and tested on waste samples.
Development and validation of a method for determining VOCs by using multi-sorbent tubes and ATD-GC-MS

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering, Air, Land & Water Resources
Contributors: Duan, Z., Kjeldsen, P., Scheutz, C.
Number of pages: 2
Publication date: 2018
Peer-reviewed: Yes
Electronic versions:
CRETE_2018_Abstract_Zhenhan_Duan_DTU.pdf
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2018

Diagnostics, Monitoring and Mitigation of N2O Emissions from Wastewater Treatment Operations – Outcomes of the LAGAS project

General information
State: Published
Organisations: Water Technologies, Department of Environmental Engineering, Air, Land & Water Resources, Krüger Veolia Water Technologies, VEOLIA, University of Southern Denmark, Biofos A/S
Pages: 15-15
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Host publication information
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Place of publication: Lyngby, Denmark
Publisher: Danish Water Forum
Electronic versions:
Abstract
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2018

Emission quantification using the tracer gas dispersion method: The influence of instrument, tracer gas species and source simulation

The tracer gas dispersion method (TDM) is a remote sensing method used for quantifying fugitive emissions by relying on the controlled release of a tracer gas at the source, combined with concentration measurements of the tracer and target gas plumes. The TDM was tested at a wastewater treatment plant for plant-integrated methane emission quantification, using four analytical instruments simultaneously and four different tracer gases. Measurements performed using a combination of an analytical instrument and a tracer gas, with a high ratio between the tracer gas release rate and instrument precision (a high release-precision ratio), resulted in well-defined plumes with a high signal-to-noise ratio and a
high methane-to-tracer gas correlation factor. Measured methane emission rates differed by up to 18% from the mean value when measurements were performed using seven different instrument and tracer gas combinations. Analytical instruments with a high detection frequency and good precision were established as the most suitable for successful TDM application. The application of an instrument with a poor precision could only to some extent be overcome by applying a higher tracer gas release rate. A sideward misplacement of the tracer gas release point of about 250 m resulted in an emission rate comparable to those obtained using a tracer gas correctly simulating the methane emission. Conversely, an upwind misplacement of about 150 m resulted in an emission rate overestimation of almost 50%, showing the importance of proper emission source simulation when applying the TDM.

General information
State: Published
Organisations: Department of Environmental Engineering, Air, Land & Water Resources, Residual Resource Engineering, Fluxsense AB
Contributors: Delre, A., Mønster, J., Samuelsson, J., Fredenslund, A. M., Scheutz, C.
Number of pages: 8
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Peer-reviewed: Yes

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Journal: Science of the Total Environment
Volume: 634
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Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.98 SJR 1.546 SNIP 1.65
Web of Science (2017): Impact factor 4.61
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.09 SJR 1.652 SNIP 1.856
Web of Science (2016): Impact factor 4.9
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.653 SNIP 1.648
Web of Science (2015): Impact factor 3.976
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.2 SJR 1.635 SNIP 1.843
Web of Science (2014): Impact factor 4.099
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.73 SJR 1.527 SNIP 1.745
Web of Science (2013): Impact factor 3.163
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.7 SJR 1.749 SNIP 1.82
Web of Science (2012): Impact factor 3.258
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 3.61 SJR 1.802 SNIP 1.676
Web of Science (2011): Impact factor 3.286
ISI indexed (2011): ISI indexed yes
The objective of this study was to investigate the impact of four pre-selected meteorological parameters (barometric pressure, wind speed, ambient temperature and solar radiation) on recovered landfill gas (LFG) flow, methane (CH4) content of the LFG and the recovered CH4 flow by performing statistical correlation tests and a visual check on correlations in scatterplots. Meteorological parameters were recorded at an on-site weather station, while LFG data were recorded when entering the gas engine. LFG CH4 concentration, LFG flow and CH4 flow correlated highly with both barometric pressure and changes in barometric pressure, and the correlations were statistically significant. A higher correlation was observed when studying changes in barometric pressure in comparison to the absolute value of barometric pressure. LFG recovery data correlated highly and significantly with wind speed during winter, but not during summer. Ambient temperature and solar radiation were not major meteorological parameters affecting LFG recovery, as low correlation coefficients were observed between these two parameters and the LFG recovery data.
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.553 SNIP 1.821
Web of Science (2010): Impact factor 2.358
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.519 SNIP 1.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.375 SNIP 2.145
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.998 SNIP 1.785
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.021 SNIP 1.819
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.065 SNIP 1.653
Scopus rating (2004): SJR 1.271 SNIP 1.911
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.853 SNIP 1.234
Life cycle assessment comparing the treatment of surplus activated sludge in a sludge treatment reed bed system with mechanical treatment on centrifuge

In Denmark, the conventional method for treating sewage sludge is mechanical dewatering and subsequent storage. However, sludge treatment reed bed systems, which are holistic sludge treatment facilities combining the dewatering, mineralisation and storage of sludge, have been more common during the last three decades. Treatment of sludge in a sludge treatment reed bed system can be combined with post-treatment (further dewatering and mineralisation) on a stockpile area. This study aimed to compare the environmental performances of a mechanical sludge treatment method with the sludge treatment reed bed system strategy, using the life cycle assessment approach and a life cycle inventory based on newly generated data obtained from Danish reference facilities. The scenarios based on the different treatment methods were initiated by sludge entering the sludge treatment reed bed system or the centrifuge and terminated by land application of the final sludge product. The environmental impacts caused by the sludge treatment reed bed system strategy were comparable to or lower than those caused by the mechanical sludge treatment method. The impacts on climate change were the same for all the treatment scenarios; however, the conversion of organic carbon and nitrogen into gas species was more efficient in the sludge treatment reed bed system compared to mechanical treatment. Thus, mechanically treated sludge contained more nitrogen, causing higher nitrogen emissions (nitrous oxide, nitrate and ammonia) when applied on land. Furthermore, the impact of resource depletion was higher for mechanical dewatering due to a larger fossil fuel demand related to daily operation and longer transportation distances in this scenario. According to the results of the life cycle assessment, there were no considerable environmental gains made by combining the treatment of sludge in a sludge treatment reed bed system with post-treatment on a stockpile area. However, some practical aspects, which are not expressed in a life cycle assessment, should also be taken into consideration when evaluating the performances of sludge treatment scenarios.
Web of Science (2016): Impact factor 5.715
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 5.57 SJR 1.635 SNIP 2.375
Web of Science (2015): Impact factor 4.959
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.6 SJR 1.665 SNIP 2.481
Web of Science (2014): Impact factor 3.844
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.47 SJR 1.618 SNIP 2.527
Web of Science (2013): Impact factor 3.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.07 SJR 1.672 SNIP 2.296
Web of Science (2012): Impact factor 3.398
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 3.19 SJR 1.454 SNIP 1.823
Web of Science (2011): Impact factor 2.727
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.409 SNIP 1.723
Web of Science (2010): Impact factor 2.43
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.961 SNIP 1.564
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.81 SNIP 1.347
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.921 SNIP 1.497
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.84 SNIP 1.489
Scopus rating (2005): SJR 0.547 SNIP 1.324
Scopus rating (2004): SJR 0.766 SNIP 1.784
Scopus rating (2003): SJR 0.503 SNIP 1.113
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.529 SNIP 1.044
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.418 SNIP 0.896
Scopus rating (2000): SJR 0.205 SNIP 0.883
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.265 SNIP 0.763
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Source: FindIt
Source-ID: 2396646071
Research output: Research - peer-review › Journal article – Annual report year: 2018
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.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Water Technologies, University of Copenhagen, Technical University of Denmark
Contributors: Yoshida, H., ten Hoeve, M., Christensen, T. H., Bruun, S., Jensen, L. S., Scheutz, C.
Pages: 538-547
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Peer-reviewed: Yes

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Journal: Journal of Cleaner Production
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Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.79 SJR 1.467 SNIP 2.194
Web of Science (2017): Impact factor 5.651
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.83 SJR 1.659 SNIP 2.502
Web of Science (2016): Impact factor 5.715
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 5.57 SJR 1.635 SNIP 2.375
Web of Science (2015): Impact factor 4.959
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.6 SJR 1.665 SNIP 2.481
Web of Science (2014): Impact factor 3.844
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.47 SJR 1.618 SNIP 2.527
Web of Science (2013): Impact factor 3.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.07 SJR 1.672 SNIP 2.296
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.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Copenhagen
Contributors: Ten Hoeve, M., Bruun, S., Naroznova, I., Lemming, C., Magid, J., Jensen, L. S., Scheutz, C.
Pages: 1950-1965
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Peer-reviewed: Yes

**Publication information**

Journal: International Journal of Life Cycle Assessment
Volume: 23
Issue number: 10
ISSN (Print): 0948-3349
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.71 SJR 1.268 SNIP 1.454
Web of Science (2017): Impact factor 4.195
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.43 SJR 1.386 SNIP 1.517
Web of Science (2016): Impact factor 3.173
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.49 SJR 1.53 SNIP 1.579
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.65 SJR 1.726 SNIP 1.78
Web of Science (2014): Impact factor 3.988
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.35 SJR 1.672 SNIP 1.978
Web of Science (2013): Impact factor 3.089
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.89 SJR 1.529 SNIP 1.707
Web of Science (2012): Impact factor 2.773
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.82 SJR 1.595 SNIP 1.737
Web of Science (2011): Impact factor 2.362
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.447 SNIP 1.826
Web of Science (2010): Indexed yes
Measuring methane emissions from a UK landfill using the tracer dispersion method and the influence of operational and environmental factors

The methane emissions from a landfill in south-east, UK were successfully quantified during a six-day measurement campaign using the tracer dispersion method. The fair weather conditions made it necessary to perform measurements in the late afternoon and in the evening when the lower solar flux resulted in a more stable troposphere with a lower inversion layer. This caused a slower mixing of the gasses, but allowed plume measurements up to 6700m downwind from the landfill. The average methane emission varied between 217±14 and 410±18kgh−1 within the individual measurement days, but the measured emission rates were higher on the first three days (333±27, 371±42 and 410±18kgh−1) compared to the last three days (217±14, 249±20 and 263±22kgh−1). It was not possible to completely isolate the extent to which these variations were a consequence of measuring artefacts, such as wind/measurement direction and measurement distance, or from an actual change in the fugitive emission. Such emission change is known to occur with changes in the atmospheric pressure. The higher emissions measured during the first three days of the campaign were measured during a period with an overall decrease in atmospheric pressure (from approximately 1014mbar on day 1 to 987mbar on day 6). The lower emissions measured during the last three days of the campaign were carried out during a period with an initial pressure increase followed by a period of slowly reducing pressure. The average daily methane recovery flow varied between 633 and 679kgh−1 at STP (1 atm, 0°C). The methane emitted to the atmosphere accounted for approximately 31% of the total methane generated, assuming that the methane generated is the sum of the methane recovered and the methane emitted to the atmosphere, thus not including a potential methane oxidation in the landfill cover soil.

General information
State: Accepted/In press
Organisations: Department of Environmental Engineering, Air, Land & Water Resources, University of Southampton
Contributors: Rees-White, T., Mønster, J., Beaven, R. P., Scheutz, C.
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Peer-reviewed: Yes

Publication information
Journal: Waste Management
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Ratings:
BFI (2019): BFI-level 2
On-site and ground-based remote sensing measurements of methane emissions from four biogas plants: a comparison study

Methods for quantifying methane (CH4) emissions from biogas plants are needed, in order to ensure that emissions are within acceptable levels and to identify options for emission mitigation. Two emission measuring approaches were used at four biogas plants: an on-site approach, whereby emission sources were identified and subsequently quantified one at a time, and a ground-based remote sensing approach, which was applied to measure total CH4 emissions. The emissions were between 5.5 to 13.5 kg CH4 h-1 from the four plants, measured using ground-based remote sensing. Even though the measurements were performed on the same days at each facility, the sum of on-site emission rates varied between the remote sensing measurements (up to ~100%). Several factors may have caused this difference: emission sources not measured using an on-site approach and short-time emission variation. On-site measurements showed that the majority of the emissions often occurred from just a few sources.

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BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 6.28 SJR 2.029 SNIP 1.799
Web of Science (2017): Impact factor 5.807
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.94 SJR 2.215 SNIP 1.932
Web of Science (2016): Impact factor 5.651
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 5.47 SJR 2.243 SNIP 1.897
Web of Science (2015): Impact factor 4.917
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 5.3 SJR 2.399 SNIP 2.087
Web of Science (2014): Impact factor 4.494
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
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.
Regulating landfills using measured methane emissions: an English perspective

Methane emissions from landfills are an important source of greenhouse gases in the UK and worldwide. This paper considers how measurements of methane emissions could be used to regulate landfills in England in order to reduce the contribution of landfilling to climate change. The paper presents the results of a number of UK studies undertaken to quantify methane emissions from landfills. The methods used have included the DIAL (Differential Absorption Lidar) technique and a tracer gas dispersion method. A method based on aerial measurements has been developed. Methane emission rates were measured at 15 biodegradable waste landfills. All of the landfills where measurements took place had an active landfill gas extraction system. A methane collection index (MCI) is calculated for each landfill using the ratio of the methane collection rate to the sum of the collection and emission rates. The values of the index in the campaigns reported here ranged from 0.28 to 0.90. The modern operational landfills surveyed achieved MCI values with a much narrower range of between 0.64 and 0.90 with an average of 0.76. This has demonstrated that it is possible for these landfills to collect a high proportion of the landfill gas. A proposed approach is presented for regulating landfills using the measured MCI. This would involve an annual measurement campaign to quantify the methane emissions and the use of the data provided by these surveys to develop an achievable but challenging MCI limit. A limit value of 0.75 for the MCI is used to illustrate the approach. An MCI that falls below the limit would trigger actions to reduce the methane emissions from the landfill.

General information
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Remote sensing quantification of methane emissions from 10 biogas plants in Denmark and Germany

General information
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Organisations: Air, Land & Water Resources, Department of Environmental Engineering, Technical University of Denmark
Contributors: Fredenslund, A., Scheutz, C.
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Test af kompostprodukter og vurdering af komposts generelle anvendelse i biocovertilskudsordningen

General information
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Organisations: Residual Resource Engineering, Department of Environmental Engineering, Air, Land & Water Resources
Contributors: Olesen, A. O. U., Fitamo, T. M., Kjeldsen, P., Scheutz, C.
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Olesen_et_al_2018_rapport_om_test_af_kompostproever_til_udarbejdelse_af_standard.pdf
URLs:
Research output: Commissioned › Report – Annual report year: 2018

Treating low strength/high flow landfill gas in an active loaded biofilter

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering, Air, Land & Water Resources, NIRAS A/S
Validation of landfill methane measurements from an unmanned aerial system: Project SC 160006
Landfill gas is made up of roughly equal amounts of methane and carbon dioxide. Modern UK landfills capture and use much of the methane gas as a fuel. But some methane escapes and is emitted to the atmosphere. Methane is an important greenhouse gas and controls on methane emissions are a part of international and national strategies to limit climate change. Better estimates of methane emissions from landfills and other similar sources would allow the UK to improve the quantification and control of greenhouse gas emissions.

This project tested the accuracy of methane measurement using an unmanned aerial system (UAS). We released known amounts of methane and measured these emissions using an UAS. The UAS experiments successfully measured the methane releases. The measured methane emission, taking into account the uncertainty in the measurements, always overlapped with the controlled methane emission release.

An environmental assessment of landfill gas mitigation, using a biocover system

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.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Swiss Federal Institute of Technology Zurich
Contributors: Klinglmair, M., Vadenbo, C., Astrup, T. F., Scheutz, C.
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 5.31 SJR 1.462 SNIP 2.11
Web of Science (2017): Impact factor 5.12
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.73 SJR 1.211 SNIP 1.804
Web of Science (2016): Impact factor 3.313
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.98 SJR 1.284 SNIP 1.947
Web of Science (2015): Impact factor 3.28
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.7 SJR 1.324 SNIP 2.048
Web of Science (2014): Impact factor 2.564
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BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.34 SJR 1.424 SNIP 2.228
Web of Science (2013): Impact factor 2.692
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.236 SNIP 1.845
Web of Science (2012): Impact factor 2.319
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.62 SJR 1.115 SNIP 1.845
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.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Jensen, M. B., Møller, J., Scheutz, C.
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Journal: Waste Management
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Ratings:
BFI (2019): BFI-level 2
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.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Orbicon
Contributors: Larsen, J. D., Nielsen, S. M., Scheutz, C.
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Journal: Water Science and Technology
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BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.34 SJR 0.429 SNIP 0.574
Web of Science (2017): Impact factor 1.247
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.3 SJR 0.404 SNIP 0.637
Web of Science (2016): Impact factor 1.197
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.19 SJR 0.464 SNIP 0.594
Web of Science (2015): Impact factor 1.064
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
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.

General information

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Fathi Aghdam, E., Scheutz, C., Kjeldsen, P.
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Publication information

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BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
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 25kgh⁻¹ (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 17kgh⁻¹ (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.
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.

General information

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Copenhagen
Contributors: Lemming, C., Scheutz, C., Bruun, S., Jensen, L. S., Magid, J.
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Publication information

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BFI (2018): BFI-level 1
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).

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Atmospheric Environment, Water Technologies
Contributors: Bigum, M. K. K., Damgaard, A., Scheutz, C., Christensen, T. H.
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 5.31 SJR 1.462 SNIP 2.11
Web of Science (2017): Impact factor 5.12
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.73 SJR 1.211 SNIP 1.804
Web of Science (2016): Impact factor 3.313
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.98 SJR 1.284 SNIP 1.947
Web of Science (2015): Impact factor 3.28
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.7 SJR 1.324 SNIP 2.048
Web of Science (2014): Impact factor 2.564
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.34 SJR 1.424 SNIP 2.228
Web of Science (2013): Impact factor 2.692
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
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Scopus rating (2012): CiteScore 2.91 SJR 1.236 SNIP 1.845
Evaluating potentials for waste sorting in the Arctic: waste separation studies from 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, Ramboll Group AS
Contributors: Kirkelund, G. M., Diez, L., Scheutz, C., Eisted, R.
Publication date: 2017
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Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Gas collection efficiency at two danish landfills

General information
State: Published
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.
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.

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Delre, A., Mønster, J., Scheutz, C.
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Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.98 SJR 1.546 SNIP 1.65
Web of Science (2017): Impact factor 4.61
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.09 SJR 1.652 SNIP 1.856
Web of Science (2016): Impact factor 4.9
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.653 SNIP 1.648
Web of Science (2015): Impact factor 3.976
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.2 SJR 1.635 SNIP 1.843
Web of Science (2014): Impact factor 4.099
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.73 SJR 1.527 SNIP 1.745
Web of Science (2013): Impact factor 3.163
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.7 SJR 1.749 SNIP 1.82
Web of Science (2012): Impact factor 3.258
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 3.61 SJR 1.802 SNIP 1.676
Web of Science (2011): Impact factor 3.286
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
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\(^{-1}\).
Publication information
Journal: Ecological Engineering
Volume: 106
ISSN (Print): 0925-8574
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.43 SJR 1.042 SNIP 1.34
Web of Science (2017): Impact factor 3.023
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.45 SJR 1.069 SNIP 1.534
Web of Science (2016): Impact factor 2.914
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.09 SJR 1.081 SNIP 1.486
Web of Science (2015): Impact factor 2.74
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.03 SJR 1.183 SNIP 1.653
Web of Science (2014): Impact factor 2.58
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.55 SJR 1.231 SNIP 2.069
Web of Science (2013): Impact factor 3.041
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.48 SJR 1.692 SNIP 2.124
Web of Science (2012): Impact factor 2.958
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.6 SJR 1.699 SNIP 1.877
Web of Science (2011): Impact factor 3.106
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.216 SNIP 1.513
Web of Science (2010): Impact factor 2.203
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.465 SNIP 2.097
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.113 SNIP 1.55
Scopus rating (2007): SJR 1.307 SNIP 1.437
Scopus rating (2006): SJR 0.814 SNIP 1.203
Scopus rating (2005): SJR 0.931 SNIP 1.488
Scopus rating (2004): SJR 0.69 SNIP 1.111
Scopus rating (2003): SJR 1.064 SNIP 1.393
Investigating the state of a 6 years old full-scale biocover at a Danish landfill

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Olesen, A. O. U., Fredenslund, A. M., Scheutz, C., Kjeldsen, P.
Number of pages: 11
Publication date: 2017

Host publication information
Title of host publication: Proceedings Sardinia 2017 / Sixteenth International Waste Management and Landfill Symposium
Place of publication: S. Margherita di Pula, Cagliari, Italy
Publisher: CISA Publisher
Electronic versions:
Olesen_et_al_2017_Sar.pdf
Research output: Research - peer-review › Article in proceedings – Annual report year: 2017

Måling af den totale metanemission fra Lemvig Biogasanlæg A.m.b.A - januar, 2017

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

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish
Source: PublicationPreSubmission
Source-ID: 141914640
Research output: 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
Contributors: Fredenslund, A. M., Scheutz, C.
Number of pages: 8
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish
Måling af den totale metanemission fra Sønderjysk Biogas – 12. december 2017

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

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish

Bibliographical note

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
Contributors: Fredenslund, A. M., Scheutz, C.
Number of pages: 8
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish

Bibliographical note
Fortrolig rapport

"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, Vienna
Contributors: Reinelt, T., Clauss, T., Hrad, M., Scheutz, C.
Number of pages: 5
Publication date: 2017

Host publication information
Title of host publication: Proceedings Sardinia 2017
Place of publication: S. Margherita di Pula, Cagliari, Italy
Publisher: CISA Publisher
Electronic versions:
161.pdf

Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017
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, Ruminococccaeae, 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
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Number of pages: 11
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Peer-reviewed: Yes

Publication information
Journal: Water Research
Volume: 118
ISSN (Print): 0043-1354
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 7.55 SJR 2.601 SNIP 2.358
Web of Science (2017): Impact factor 7.051
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.49 SJR 2.663 SNIP 2.563
Web of Science (2016): Impact factor 6.942
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 6.63 SJR 2.665 SNIP 2.482
Web of Science (2015): Impact factor 5.991
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 6.13 SJR 2.946 SNIP 2.702
Web of Science (2014): Impact factor 5.528
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 6.02 SJR 2.956 SNIP 2.676
Web of Science (2013): Impact factor 5.323
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 5.15 SJR 2.914 SNIP 2.442
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 homogeneous 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.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Cassini, F., Scheutz, C., Skov, B. H., Mou, Z., Kjeldsen, P.
Pages: 213-225
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Waste Management
Volume: 63
ISSN (Print): 0956-053x
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
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.

**General information**

State: Published  
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark  
Contributors: Scheutz, C., Cassini, F., De Schoenmaeker, J., Kjeldsen, P.  
Number of pages: 10  
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Peer-reviewed: Yes

**Publication information**

Journal: Waste Management  
Volume: 63  
ISSN (Print): 0956-053x  
Ratings:  
BFI (2019): BFI-level 2  
Web of Science (2019): Indexed yes  
BFI (2018): BFI-level 2  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 2  
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059  
Web of Science (2017): Impact factor 4.723  
Web of Science (2017): Indexed yes  
BFI (2016): BFI-level 2  
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159  
Web of Science (2016): Impact factor 4.03  
Web of Science (2016): Indexed yes  
BFI (2015): BFI-level 2  
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263  
Web of Science (2015): Impact factor 3.829  
Web of Science (2015): Indexed yes  
BFI (2014): BFI-level 2  
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49  
Web of Science (2014): Impact factor 3.22  
Web of Science (2014): Indexed yes  
BFI (2013): BFI-level 1  
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413  
Web of Science (2013): Impact factor 3.157  
ISI indexed (2013): ISI indexed yes  
Web of Science (2013): Indexed yes  
BFI (2012): BFI-level 1  
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18  
Web of Science (2012): Impact factor 2.485  
ISI indexed (2012): ISI indexed yes  
Web of Science (2012): Indexed yes  
BFI (2011): BFI-level 1  
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Nitrogen mineralisation and greenhouse gas emission from the soil application of sludge from reed bed mineralisation systems

A sludge treatment reed bed system (STRB) is a technology used for dewatering and stabilising sewage sludge via assisted biological mineralisation, which creates a sludge residue suitable for use as fertiliser on agricultural land. We evaluated the effect of sludge residue storage time (stabilisation time) for three STRBs on soil N mineralisation and CO2 and N2O emissions in soil. The experiment revealed that the N mineralisation rate and emissions of CO2 and N2O decreased as a function of treatment time in the STRBs. Mixed sludge residue (sludge residue subjected to different treatment times) for the three STRBs resulted in N mineralisation rates similar to the sludge residue subjected to a shorter treatment time but lower N2O emissions similar to the values of the older sludge residue. This finding reveals that combining fresh and more stabilised sludge residue ensures high N availability and reduces N2O emissions when applied to land.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Office for Finance and Accounting, University of Copenhagen
Number of pages: 9
Pages: 59-67
Publication date: 2017
Peer-reviewed: Yes
Quantification of greenhouse gas emissions from a biological waste treatment facility

Whole-site emissions of methane and nitrous oxide, from a combined dry anaerobic digestion and composting facility treating biowaste, 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±11.4 kg CH4 h⁻¹, respectively. Turning the windrows resulted in an increase in methane emission from about 26.3-35.9 kg CH4 h⁻¹. Lower emissions (21.5 kg CH4 h⁻¹) were measured after work hours ended, in comparison to emissions measured during the facility’s opening hours (30.2 kg 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 1.4 kg 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 97 kg CO₂-eq. tonne⁻¹ of treated waste (wet weight) to a loading of 71 kg CO₂-eq. tonne⁻¹, ultimately flipping the environmental profile of the treatment facility.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Jensen, M. B., Møller, J., Mønster, J., Scheutz, C.
Pages: 375-384
Publication date: 2017
Peer-reviewed: Yes
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
Contributors: Mønster, J., Rees-White, T., Beaven, R., Scheutz, C.
Number of pages: 6
Publication date: 2017

Host publication information
Title of host publication: Proceedings Sardinia 2017
Place of publication: S. Margherita di Pula, Cagliari, Italy
Publisher: CISA Publisher

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
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Southern Denmark
Contributors: Fitamo, T. M., Triolo, J. M., Boldrin, A., Scheutz, C.
Pages: 242-251
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Water Research
Volume: 119
Issue number: 242-251
ISSN (Print): 0043-1354
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 7.55 SJR 2.601 SNIP 2.358
Web of Science (2017): Impact factor 7.051
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.49 SJR 2.663 SNIP 2.563
Web of Science (2016): Impact factor 6.942
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 6.63 SJR 2.665 SNIP 2.482
Web of Science (2015): Impact factor 5.991
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 6.13 SJR 2.946 SNIP 2.702
Web of Science (2014): Impact factor 5.528
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 6.02 SJR 2.956 SNIP 2.676
Web of Science (2013): Impact factor 5.323
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 5.15 SJR 2.914 SNIP 2.442
Web of Science (2012): Impact factor 4.655
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.43 SJR 2.862 SNIP 2.355
Web of Science (2011): Impact factor 4.865
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.592 SNIP 2.192
Web of Science (2010): Impact factor 4.546
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.319 SNIP 2.224
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.073 SNIP 2.178
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.94 SNIP 2.184
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.902 SNIP 2.233
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.113 SNIP 2.334
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.209 SNIP 2.108
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.702 SNIP 1.908
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.568 SNIP 1.757
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.319 SNIP 1.69
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.399 SNIP 1.662
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.432 SNIP 1.55
Original language: English
DOIs:
10.1016/j.watres.2017.04.051
Source: FindIt
Source-ID: 2356859929
Research output: Research - peer-review › Journal article – Annual report year: 2017
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.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, FORCE Technology
Contributors: Fredenslund, A. M., Mønster, J., Kjeldsen, P., Scheutz, C.
Number of pages: 8
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Title of host publication: Proceedings Sardinia 2017
Place of publication: S. Margherita di Pula, Cagliari, Italy
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Source-ID: 137167046
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Screening tool for landfill gas emission hot spots based on infrared images

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, NIRAS A/S
Contributors: Fjelsted, L., Scheutz, C., Christensen, A. G., Kjeldsen, P.
Number of pages: 5
Publication date: 2017

Host publication information
Title of host publication: Proceedings Sardinia 2017 / Sixteenth International Waste Management and Landfill Symposium
Place of publication: S. Margherita di Pula, Cagliari, Italy
Publisher: CISA Publisher
Electronic versions:
Fjelsted_et_al._2017_Sar.pdf
Research output: Research - peer-review › Article in proceedings – Annual report year: 2017

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.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Girona
There are two research outputs mentioned:

**The role of metals in methane production from shredder waste in landfills**

**General information**
- State: Published
- Organisations: Department of Environmental Engineering, Residual Resource Engineering
- Contributors: Fathi Aghdam, E., Scheutz, C., Kjeldsen, P.
- Number of pages: 2
- Publication date: 2017
- Peer-reviewed: Yes
- Event: Abstract from 5th International Conference on Sustainable Solid Waste Management, Athens, Greece.

**Electronic versions:**
- [ATHENS2017_Fathi_Aghdam.pdf](ATHENS2017_Fathi_Aghdam.pdf)

**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
- Contributors: Fredenslund, A. M., Scheutz, C.
- Number of pages: 15
- Publication date: 2017

**Publication information**
- Place of publication: Kgs. Lyngby
- Publisher: Department of Environmental Engineering, Technical University of Denmark (DTU)
- Original language: English

**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.
Bedre adgang til næringsstoffer for økologer Rapport fra arbejdsgruppen

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Copenhagen, Aarhus University
Number of pages: 62
Publication date: 2016

Publication information
Place of publication: København V
Publisher: Miljø- og Fødevareministeriet
Original language: Danish
Electronic versions:
Bedre_adgang_til_naeringsstoffer_for_oekologer_Rapport_fra_arbejdsgrup....pdf
Research output: Commissioned › Report – Annual report year: 2017

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
Contributors: Díez, L., Kirkelund, G. M., Scheutz, C.
Number of pages: 2
Pages: 100-101
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
Electronic versions:
Book_of_Abstracts_Artek_Event_2016.pdf
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016

Bibliographical note
Byg Report R-340

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
Contributors: Naroznova, I., Møller, J., Scheutz, C.
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 clipings 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 clipings 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.
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.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Jensen, M. B., Møller, J., Scheutz, C.
Number of pages: 14
Pages: 491-504
Publication date: 2016
Peer-reviewed: Yes

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Journal: Waste Management
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Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
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 °C). 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 tracer dispersion method: A tool for measuring the total methane emission from individual Danish landfills**

**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
Pages: 64-72
Publication date: 2016
Establishing bio-mitigation systems at landfills for reducing greenhouse gas emission – State-of-the-art

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Kjeldsen, P., Scheutz, C.
Number of pages: 8
Publication date: 2016
Peer-reviewed: Yes
Event: Abstract from Global Waste Management Symposium 2016, California, United States.
Electronic versions:
GWMS2016_Paper_Kjeldsen.pdf
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2016

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
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Copenhagen
Pages: 440-450
Publication date: 2016
Peer-reviewed: Yes
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±7mL 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 af 2012 A/S
Contributors: Naroznova, I., Møller, J., Larsen, B., Scheutz, C.
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BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.553 SNIP 1.821
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 AS
Contributors: Edjabou, M. E., Petersen, C., Scheutz, C., Astrup, T. F.
Number of pages: 13
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Web of Science (2019): Indexed yes
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.553 SNIP 1.821
Web of Science (2010): Impact factor 2.358
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.519 SNIP 1.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.375 SNIP 2.145
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.998 SNIP 1.785
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.021 SNIP 1.819
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.065 SNIP 1.653
Scopus rating (2004): SJR 1.271 SNIP 1.911
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.853 SNIP 1.234
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 $23 \pm 5$ kg/employee/year, of which $20 \pm 5$ kg/employee/year was source-segregated, with a considerably high purity of 99%. Mixed waste amounted to $10 \pm 5$ 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.

**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.
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.553 SNIP 1.821
Web of Science (2010): Impact factor 2.358
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.519 SNIP 1.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.375 SNIP 2.145
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.998 SNIP 1.785
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.021 SNIP 1.819
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.065 SNIP 1.653
Scopus rating (2004): SJR 1.271 SNIP 1.911
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.853 SNIP 1.234
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.498 SNIP 0.903
Scopus rating (2001): SJR 0.45 SNIP 0.731
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.328 SNIP 0.444
Scopus rating (1999): SJR 0.26 SNIP 0.541
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 (NO3− leaching to groundwater, NO3− and NH4+ loss to surface water, and NH3 and N2O 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 N2O emission, there were very small differences between high and low response conditions for organic fertilizer. The N2O emission factors varied for 1.8–3.0 % for MSW-D and 1.7–5.1 % for MSW-C. For NO3− 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.
Optimising the anaerobic codigestion 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 codigestion 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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Web of Science (2017): Impact factor 7.051
Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 7.49 SJR 2.663 SNIP 2.563
Web of Science (2016): Impact factor 6.942
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BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 6.63 SJR 2.665 SNIP 2.482
Web of Science (2015): Impact factor 5.991
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 6.13 SJR 2.946 SNIP 2.702
Web of Science (2014): Impact factor 5.528
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ISI indexed (2013): ISI indexed yes
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Scopus rating (2012): CiteScore 5.15 SJR 2.914 SNIP 2.442
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BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.43 SJR 2.862 SNIP 2.355
Web of Science (2011): Impact factor 4.865
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BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.592 SNIP 2.192
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Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.319 SNIP 2.224
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.073 SNIP 2.178
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.94 SNIP 2.184
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Scopus rating (2006): SJR 1.902 SNIP 2.233
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.113 SNIP 2.334
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Scopus rating (2004): SJR 2.209 SNIP 2.108
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.702 SNIP 1.908
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.568 SNIP 1.757
Web of Science (2002): Indexed yes
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Scopus rating (2000): SJR 1.399 SNIP 1.662
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.432 SNIP 1.55
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Overblik over målemetoder til bestemmelse af metanemission fra deponier

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Contributors: Scheutz, C., Mønster, J., Kjeldsen, P.
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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.

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Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
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.

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Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
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Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
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BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.553 SNIP 1.821
Web of Science (2010): Impact factor 2.358
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.519 SNIP 1.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.375 SNIP 2.145
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.998 SNIP 1.785
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.021 SNIP 1.819
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.065 SNIP 1.653
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Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.853 SNIP 1.234
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.498 SNIP 0.903
Scopus rating (2001): SJR 0.45 SNIP 0.731
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Quality of textile waste: a case study of residual household waste from Odense Municipality, Denmark

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Quantification of greenhouse gas (GHG) emissions from wastewater treatment plants using a ground-based remote sensing approach

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Delre, A., Mønster, J., Scheutz, C.
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Web of Science (2011): Indexed yes
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Quantification of methane emissions from two Danish landfills

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Fathi Aghdam, E., Fredenslund, A. M., Kjeldsen, P., Scheutz, C.
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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
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Vienna University of Technology
Contributors: Klinglmair, M., Zoboli, O., Laner, D., Rechberger, H., Astrup, T. F., Scheutz, C.
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Udledning af metan og andre klimagasser fra skifergasindvinding

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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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91_deponiers_egnethed_til_biocover_rapport_2016.pdf

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Metanemission fra Hedeland deponi

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Miljøvurdering (LCA) af fremtidige behandlingsmuligheder for organisk affald fra husholdninger i den dansk-tyske grænseregion

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Contributors: Jensen, M. B., Møller, J., Scheutz, C.
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Quantification of methane and nitrous oxide emissions from Borgstedt waste treatment facility, Germany

General information
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Quantification of the methane emission from three UK landfills

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Mønster, J., Delre, A., Scheutz, C.
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A comprehensive substance flow analysis of a municipal wastewater and sludge treatment plant
The fate of total organic carbon, 32 elements (Al, Ag, As, Ba, Be, Br, Ca, Cd, Cl, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Mo, N, Na, Ni, P, Pb, S, Sb, Se, Sn, Sr, Ti, V, and Zn) and 4 groups of organic pollutants (linear alkylbenzene sulfonates, bis(2-ethylhexyl)phthalate, polychlorinated biphenyl and polycyclic aromatic hydrocarbons) in a conventional wastewater treatment plant were assessed. Mass balances showed reasonable closures for most of the elements. However, gaseous emissions were accompanied by large uncertainties and show the limitation of mass balance based substance flow analysis. Based on the assessment, it is evident that both inorganic and organic elements accumulated in the sewage sludge, with the exception of elements that are highly soluble or degradable by wastewater and sludge treatment processes. The majority of metals and metalloids were further accumulated in the incineration ash, while the organic pollutants were effectively destroyed by both biological and thermal processes. Side streams from the sludge treatment process (dewatering and incineration) back to the wastewater treatment represented less than 1% of the total volume entering the wastewater treatment processes, but represented significant substance flows. In contrast, the contribution by spent water from the flue gas treatment process was almost negligible. Screening of human and eco-toxicity by applying the consensus-based environmental impact assessment method USEtox addressing 15 inorganic constituents showed that removal of inorganic constituents by the wastewater treatment plant reduced the toxic impact potential by 87-92%. © 2013 Elsevier Ltd. All rights reserved.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Avedøre Wastewater Services
Contributors: Yoshida, H., Christensen, T. H., Guildal, T., Scheutz, C.
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Peer-reviewed: Yes
Early online date: 2014

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Journal: Chemosphere
Volume: 138
ISSN (Print): 0045-6535
Ratings:
Assessment of biogas production from MBT waste under different operating conditions

In this work, the influence of different operating conditions on the biogas production from mechanically-biologically treated (MBT) wastes is investigated. Specifically, different lab-scale anaerobic tests varying the water content (26-43% w/w up to 75% w/w), the temperature (from 20 to 25 degrees C up to 55 degrees C) and the amount of inoculum have been performed on waste samples collected from a full-scale Italian MBT plant. For each test, the gas generation yield and, where applicable, the first-order gas generation rates were determined. Nearly all tests were characterised by a quite long lag-phase. This result was mainly ascribed to the inhibition effects resulting from the high concentrations of volatile fatty acids (VFAs) and ammonia detected in the different stages of the experiments. Furthermore, water content was found as one of the key factor limiting the anaerobic biological process. Indeed, the experimental results showed that when the moisture was lower than 32% w/w, the methanogenic microbial activity was completely inhibited. For the higher water content tested (75% w/w), high values of accumulated gas volume (up to 150 Nl/kgTS) and a relatively short time period to deplete the MBT waste gas generation capacity were observed. At these test conditions, the effect of temperature became evident, leading to gas generation rates of 0.007 d(-1) at room temperature that increased to 0.03-0.05 d(-1) at 37 degrees C and to 0.04-0.11 d(-1) at 55 degrees C. Overall, the obtained results highlighted that the operative conditions can drastically affect the gas production from MET wastes. This suggests that particular caution should be paid when using the results of lab-scale tests for the evaluation of long-term behaviour expected in the field where the boundary conditions change continuously and vary significantly depending on the climate, the landfill operative management strategies in place (e.g. leachate recirculation, waste disposal methods), the hydraulic characteristics of disposed waste, the presence and type of temporary and final cover systems. (C) 2015 Elsevier Ltd. All rights reserved.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Rome Tor Vergata
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Co-Digestion of Food Waste and Garden Waste With WTTP Mixed Sludge in CSTR

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
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Source: PublicationPreSubmission
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Combined anaerobic digestion of green waste with wastewater treatment plant mixed sludge in continuous stirred tank reactor (CSTR)

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Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Comparison of the organic waste management systems in the danish-german border region using life cycle assessment
The treatment of organic waste from household in the Danish-German border region is very diverse, the Danish area only uses incineration for the treatment while the German system includes combined biogas and composting, mechanical and biological treatment and incineration. Data on all parts of the organic waste treatment has been 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.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Jensen, M. B., Scheutz, C., Møller, J.
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Event: Paper presented at International Conference on Solid Waste 2015 (ICSWHK2015), Hong Kong, Hong Kong.
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Source: PublicationPreSubmission
Source-ID: 118519225
Research output: Research - peer-review › Paper – Annual report year: 2015
Compositional data analysis of household food waste in Denmark

Food waste is a growing public concern because the food production and distribution exert enormous pressure on natural resources such as land, water and energy, and leads to significant environmental, societal and economic impacts. Thus, the European Commission has aimed to reduce to 50% the total amount of discarded edible food waste by 2020 within the European Union (EU) Member States. Reliable data on food waste and a better understanding of the food waste generation patterns are crucial for planning the avoidable food waste reduction and an environmental sound treatment of unavoidable food waste. Although, food waste composition carries relative information, no attempt was made to analysis food waste composition as compositional data. Thus the relationship between food waste fractions has been analysed by mean of Pearson correlation test and log-ratio analysis. The food waste data was collected by sampling and sorting residual household waste in Denmark. The food waste was subdivided into three fractions: (1) avoidable vegetable food waste, (2) avoidable animal-derive food waste, and (3) avoidable food waste. The correlation was carried out using: (a) the amount of food waste (kg per household per week), (b) percentage composition of food waste based on the total food waste, and (c) percentage composition of food waste based on the total residual household waste. The Pearson correlation test showed different results when different datasets are used, whereas the log-ratio analysis showed the same results for all the three datasets.
Development of an innovative uav-mounted screening tool for landfill gas emissions

Identification of landfill gas emission hot spots are potentially a very time consuming process, and the use of an Unmanned Aerial Vehicle (UAV) based screening tool could be an effective investigation strategy. In this study, the potential use of a long-wave thermal infrared camera was investigated. The correlation between surface soil temperatures and landfill gas emissions was examined in a field study conducted at Hedeland Landfill near Roskilde, Denmark. The surface temperatures were both measured with a soil thermometer and a long-wave infrared camera and compared to detected methane surface concentrations and fluxes. The results showed no clear tendency of correlation between measured surface temperatures and methane surface concentrations. The differences in the surface temperature ranges were limited, hence making it difficult to detect clear anomaly temperatures. A smaller correlation between the representative emission hot spots and the temperature detected at the thermal images taken with the long-wave infrared camera, seems to be present.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, NIRAS A/S, Technical University of Denmark
Number of pages: 6
Publication date: 2015

Host publication information
Title of host publication: Proceedings Sardinia 2015, Fifteenth International Waste Management and Landfill Symposium
Place of publication: Cagliari, Italy
Publisher: CISA Publisher
Electronic versions:
Fjelsted_et_al._2015_SarSym15.pdf
Source: PublicationPreSubmission
Source-ID: 118542081
Research output: Research - peer-review » Article in proceedings – Annual report year: 2015

Development of an innovative uav-mounted screening tool for landfill gas emissions

Identification of landfill gas emission hot spots are potentially a very time consuming process, and the use of an Unmanned Aerial Vehicle (UAV) based screening tool could be an effective investigation strategy. In this study, the potential use of a long-wave thermal infrared camera was investigated. The correlation between surface soil temperatures and landfill gas emissions was examined in a field study conducted at Hedeland Landfill near Roskilde, Denmark. The surface temperatures were both measured with a soil thermometer and a long-wave infrared camera and compared to detected methane surface concentrations and fluxes. The results showed no clear tendency of correlation between measured surface temperatures and methane surface concentrations. The differences in the surface temperature ranges were limited, hence making it difficult to detect clear anomaly temperatures. A smaller correlation between the representative emission hot spots and the temperature detected at the thermal images taken with the long-wave infrared camera, seems to be present.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, NIRAS A/S, Technical University of Denmark
Contributors: Fjelsted, L., Thomasen, T. B., Valbjørn, I. L., Scheutz, C., Christensen, A. G., Kjeldsen, P.
Number of pages: 6
Publication date: 2015

Host publication information
Title of host publication: Proceedings Sardinia 2015, Fifteenth International Waste Management and Landfill Symposium
Place of publication: Cagliari, Italy
Publisher: CISA Publisher
Source: PublicationPreSubmission
Source-ID: 118984032
Research output: Research - peer-review » Conference abstract in proceedings – Annual report year: 2015

Effects of sewage sludge stabilization on fertilizer value and greenhouse gas emissions after soil application

Application of sewage sludge on agricultural land becomes more and more common in many parts of the world in order to recycle the nutrients from the sludge. A range of sewage sludge stabilization techniques are available to make the sludge more stable prior to storage, transportation, and application. These stabilization techniques include dewatering, drying, anaerobic digestion, composting, and reed bed sludge treatment. However, very few studies have investigated the effect of these techniques after the sludge has been applied to agricultural land. The objective of the current study was therefore
to investigate the effect of sewage sludge stabilization techniques on the C and N mineralization and gaseous emissions from soil. A soil incubation was conducted to determine the rate of C and N mineralization and N2O and CH4 emissions of sewage sludge stabilized using different techniques. Unstabilized sludge released up to 90% of their C content as CO2, part of which could be caused by release of CO2 from carbonates. Compared with this, sludge stabilization including anaerobic digestion and drying resulted in a reduction of the C mineralization rate of about 40%. Liming reduced C mineralization with around 29%, while treatment in a reed bed system reduced it by 74%. The current study thus clearly demonstrated that stabilization techniques resulted in sludge that was more stable once they were applied to agricultural land. Stabilization also reduced the N immobilization phase, potentially improving the value of the sludge as a fertilizer. Emissions of CH4 were also reduced through sludge stabilization and mainly occurred after application of easily degradable sludge types, which is likely to have enhanced the creation of anaerobic microsites. The stabilization processes also decreased emissions of N2O. The results for both CH4 and N2O indicate that the stabilization tends to reduce the chance of developing conditions where these gases could be produced.
Energy recovery from garden waste in a LCA perspective

According to the common strategies regarding waste management and energy supply in EU countries, more efficient utilization of organic waste resources (including garden waste) with both nutrient and energy recovery is desired. Each of the most common treatments applied today – composting, direct use on land and incineration – only provides one of the two services. A technology ensuring both nutrient and energy utilization is anaerobic digestion (AD) that has become applicable for treatment of garden waste recently. In this study, life cycle assessment aimed to compare four garden waste treatment alternatives (AD, composting, direct use on land and incineration) was conducted. The results showed that none of the scenarios assessed was best in all impact categories simultaneously, i.e. an overall ranking of the technologies was not possible. Moreover, many trade-offs between nutrient and energy recovery were observed.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Naroznova, I., Møller, J., Scheutz, C.
Pages: 198-201
Publication date: 2015

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Title of host publication: International conference on Life Cycle Assessment as reference methodology for assessing supply chains and supporting global sustainability challenges : LCA for 'feeding the planet and energy for life'
Place of publication: Roma
Publisher: ENEA
Editors: Scalbi, S., Fominici Loprieno, A., Sposato, P.
Source: PublicationPreSubmission
Source-ID: 118852502
Research output: Research - peer-review » Conference abstract in proceedings – Annual report year: 2015

Evaluating the methane generation rate constant (k value) of low-organic waste at Danish landfills

General information
State: Published
Evaluation and application of site-specific data to revise the first-order decay model for estimating landfill gas generation and emissions at Danish landfills

Methane (CH₄) generated from low-organic waste degradation at four Danish landfills was estimated by three first-order decay (FOD) landfill gas (LFG) generation models (LandGEM, IPCC, and Afvalzorg). Actual waste data from Danish landfills were applied to fit model (IPCC and Afvalzorg) required categories. In general, the single-phase model, LandGEM, significantly overestimated CH₄ generation, because it applied too high default values for key parameters to handle low-organic waste scenarios. The key parameters were biochemical CH₄ potential (BMP) and CH₄ generation rate constant (k-value). In comparison to the IPCC model, the Afvalzorg model was more suitable for estimating CH₄ generation at Danish landfills, because it defined more proper waste categories rather than traditional municipal solid waste (MSW) fractions. Moreover, the Afvalzorg model could better show the influence of not only the total disposed waste amount, but also various waste categories. By using laboratory-determined BMPs and k-values for shredder, sludge, mixed bulky waste, and street-cleaning waste, the Afvalzorg model was revised. The revised model estimated smaller cumulative CH₄ generation results at the four Danish landfills (from the start of disposal until 2020 and until 2100). Through a CH₄ mass balance approach, fugitive CH₄ emissions from whole sites and a specific cell for shredder waste were aggregated based on the revised Afvalzorg model outcomes. Aggregated results were in good agreement with field measurements, indicating that the revised Afvalzorg model could provide practical and accurate estimation for Danish LFG emissions. This study is valuable for both researchers and engineers aiming to predict, control, and mitigate fugitive CH₄ emissions from landfills receiving low-organic waste.

Implications: Landfill operators use the first-order decay (FOD) models to estimate methane (CH₄) generation. A single-phase model (LandGEM) and a traditional model (IPCC) could result in overestimation when handling a low-organic waste scenario. Site-specific data were important and capable of calibrating key parameter values in FOD models. The comparison study of the revised Afvalzorg model outcomes and field measurements at four Danish landfills provided a guideline for revising the Pollutants Release and Transfer Registers (PRTR) model, as well as indicating noteworthy waste fractions that could emit CH₄ at modern landfills.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Mou, Z., Scheutz, C., Kjeldsen, P.
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Publication date: 2015
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Publication information
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Volume: 65
Food waste generation in office areas at DTU

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Edjabou, M. E., Boldring, A., Scheutz, C., Astrup, T. F.
Number of pages: 1
Publication date: 2015

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Title of host publication: Book of Abstracts. DTU's Sustain Conference 2015
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Publisher: Technical University of Denmark (DTU)
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Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2015

Håndbog i monitering af gasemission fra danske affaldsdeponier

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Number of pages: 56
Publication date: 2015

Publication information
Place of publication: København K
Publisher: Miljøministeriet. Miljøstyrelsen
ISBN (Electronic): 978-87-93283-69-5
Original language: Danish
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Electronic versions:
H ndbog_i_gasmonitering_Milj_projekt_1646_2015_978_87_93283_69_5.pdf
Source: PublicationPreSubmission
Source-ID: 105173256
Research output: Research › Report – Annual report year: 2015

Importance of food waste pre-treatment efficiency for global warming potential in life cycle assessment of anaerobic digestion systems

A need for improvement of food waste (FIAT) pre-treatment methods has been recognized, but few life cycle assessments (LCA) of FIN management systems have considered the pre-treatment with respect to input energy, loss of organic material and nutrients for anaerobic digestion (AD) and/or further treatment of the refuse. The objective of this study was
to investigate how FW pre-treatment efficiency impacts the environmental performance of waste management, with respect to global warming potential (GWP). The modeling tool EASETECH was used to perform consequential LCA focusing on the impact of changes in mass distribution within framework conditions that were varied with respect to biogas utilization and energy system, representing different geographical regions and/or different time-frames. The variations of the GWP due to changes in pre-treatment efficiency were generally small, especially when biogas and refuse were substituting the same energy carriers, when energy conversion efficiencies were high and slurry quality good enough to enable digestate use on land. In these cases other environmental aspects, economy and practicality could be guiding when selecting pre-treatment system without large risk of sub-optimization with regards to GWP. However, the methane potential of the slurry is important for the net LCA results and must be included in the sensitivity analysis. Furthermore, when biogas is used as vehicle fuel the importance of pre-treatment is sensitive to assumptions and approach of modelling marginal energy which must be decided based on the focus and timeframe of the study in question. (C) 2015 Elsevier B.V. All rights reserved.
Landfill gas generation and emission at Danish waste disposal sites receiving waste with a low organic waste content

The landfill gas (LFG) generation from four Danish landfills was estimated using three first-order-decay (FOD) models; the LandGEM model (developed by the US EPA), the IPCC model (developed by the Intergovernmental Panel on Climate Change) and the Afvalzorg model (developed by a Dutch company). The last two models are multi-phase models, which defines waste fractions into traditional MSW and low-organic waste categories, respectively. Both the LandGEM and the IPCC model estimated significantly larger methane (CH4) generation in comparison to the Afvalzorg model. The Afvalzorg model could better show the influence of not only the total disposed waste amount, but also various waste categories, and was found more suitable to estimate LFG generation from landfills receiving low-organic waste. Four major waste categories currently being disposed at Danish landfills (mixed bulky, shredder, dewatered sludge and street cleansing waste) and temporarily stored combustible waste were sampled and characterized in terms of TS, VS, TC, TOC, and biochemical methane potential (BMP). Decay rates (k values), were determined by conducting anaerobic degradation experiments and applying FOD equations to the experimental results. The LFG generation from four Danish landfills was estimated by the Afvalzorg model using the experimentally based BMP and k values and compared to whole landfill emission rates measured by applying a tracer gas dispersion method. The results showed that the revised modelled LFG generation rates were in good agreement with field emission measurements, indicating that the revised model with site-specific data could provide a practical and accurate estimation of LFG emissions.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Mou, Z., Scheutz, C., Kjeldsen, P.
Number of pages: 6
Publication date: 2015
Måling af den totale metanemission fra Affaldscenter Skårup - Renosyd I/S

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Fredenslund, A. M., Delre, A., Scheutz, C.
Number of pages: 11
Publication date: 2015

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish
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Bibliographical note
Rapport
Source: PublicationPreSubmission
Source-ID: 117989294
Research output: Commissioned - peer-review › Report – Annual report year: 2015

Måling af den totale metanemission fra Affaldscenter Tandskov

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Contributors: Fredenslund, A. M., Delre, A., Scheutz, C.
Number of pages: 10
Publication date: 2015

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish
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Bibliographical note
Rapport
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Source-ID: 117989320
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Måling af den totale metanemission fra Audebo Miljøcenter

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Fredenslund, A. M., Delre, A., Scheutz, C.
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Publication information
Måling af den totale metanemission fra biogasanlægget på BIOFOS Spildevandscenter Avedøre A/S

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State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Fredenslund, A. M., Scheutz, C.
Number of pages: 7
Publication date: 2015

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish
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Research output: Commissioned › Report – Annual report year: 2015

Måling af den totale metanemission fra ESØ 90 I/S

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Fredenslund, A. M., Delre, A., Scheutz, C.
Number of pages: 9
Publication date: 2015

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish
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Research output: Commissioned › Report – Annual report year: 2015

Måling af den totale metanemission fra Frederiksværk losseplads

General information
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Contributors: Fredenslund, A. M., Delre, A., Scheutz, C.
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Publication date: 2015

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish
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Research output: Commissioned › Report – Annual report year: 2015
Måling af den totale metanemission fra Horsens Bioenergi ApS

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Fredenslund, A. M., Scheutz, C.
Number of pages: 8
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Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish
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Måling af den totale metanemission fra Horsens Deponeringsanlæg

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Fredenslund, A. M., Delre, A., Scheutz, C.
Number of pages: 10
Publication date: 2015

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish
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2015_Måling_af_den_totale_metanemission_fra_Horsens_Deponeringsanlæg.pdf
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Måling af den totale metanemission fra Klintholm I/S

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Contributors: Fredenslund, A. M., Delre, A., Scheutz, C.
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Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
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Måling af den totale metanemission fra Køge deponi
Measurements of methane emissions from biogas production – Data collection and comparison of measurement methods: Energiforsk report 2015:158

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
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Publication information
Place of publication: Sweden
Publisher: Energiforsk AB
Municipal solid waste composition: Sampling methodology, statistical analyses, and case study evaluation

Sound waste management and optimisation of resource recovery require reliable data on solid waste generation and composition. In the absence of standardised and commonly accepted waste characterisation methodologies, various approaches have been reported in literature. This limits both comparability and applicability of the results. In this study, a waste sampling and sorting methodology for efficient and statistically robust characterisation of solid waste was introduced. The methodology was applied to residual waste collected from 1442 households distributed among 10 individual sub-areas in three Danish municipalities (both single and multi-family house areas). In total 17 tonnes of waste were sorted into 10-50 waste fractions, organised according to a three-level (tiered approach) facilitating comparison of the waste data between individual sub-areas with different fractionation (waste from one municipality was sorted at "Level III", e.g. detailed, while the two others were sorted only at "Level I"). The results showed that residual household waste mainly contained food waste (42 +/- 5%, mass per wet basis) and miscellaneous combustibles (18 +/- 3%, mass per wet basis). The residual household waste generation rate in the study areas was 3-4 kg per person per week. Statistical analyses revealed that the waste composition was independent of variations in the waste generation rate. Both, waste composition and waste generation rates were statistically similar for each of the three municipalities. While the waste generation rates were similar for each of the two housing types (single-family and multi-family house areas), the individual percentage composition of food waste, paper, and glass was significantly different between the housing types. This indicates that housing type is a critical stratification parameter. Separating food leftovers from food packaging during manual sorting of the sampled waste did not have significant influence on the proportions of food waste and packaging materials, indicating that this step may not be required. (C) 2014 Elsevier Ltd. All rights reserved.
Phosphorus in Denmark: national and regional anthropogenic flows

Substance flow analyses (SFA) of phosphorus (P) have been examined on a national or supra-national level in various recent studies. SFA studies of P on the country scale or larger can have limited informative value; large differences between P budgets exist within countries and are easily obscured by country-wide average values. To quantify and evaluate these imbalances we integrated a country-scale and regional-scale model of the Danish anthropogenic P flows and stocks. We examine three spatial regions with regard to agriculture, as the main driver for P use, and waste management, the crucial sector for P recovery. The regions are characterised by their differences in agricultural practice, population and industrial density. We show considerable variation in P flows within the country. First, these are driven by agriculture, with mineral fertiliser inputs varying between 3 and 5 kg ha\(^{-1}\) yr\(^{-1}\), and animal feedstuff inputs between 5 and 19 kg ha\(^{-1}\) yr\(^{-1}\). We identified surpluses especially in areas with a larger proportion of animal husbandry, owing to additional application of manure in excess of crop P demand. However, redistribution of the large amounts of P in manure is not feasible owing to transport limitations. Second, waste management, closely linked to population and industrial density is the driver behind differences in recoverable P flows. Current amounts of potentially recoverable P cannot change the reliance on primary P. The most immediate P re-use potential exists in the areas around the eastern urban agglomerations, from more complete recovery of sewage sludge (with unrecovered P amounts of up to 33% of P in current
mineral fertiliser imports) and the biowaste fraction in municipal solid waste currently not collected separately (24% of P in current mineral fertiliser imports), since this region shows both the highest proportion of crop production and fertiliser use and lowest soil P budget.

**General information**

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Organisations: Department of Environmental Engineering, Residual Resource Engineering, IT Service, University of Copenhagen, Vienna University of Technology
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Peer-reviewed: Yes

**Publication information**

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Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 5.31 SJR 1.462 SNIP 2.11
Web of Science (2017): Impact factor 5.12
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.73 SJR 1.211 SNIP 1.804
Web of Science (2016): Impact factor 3.313
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.98 SJR 1.284 SNIP 1.947
Web of Science (2015): Impact factor 3.28
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.7 SJR 1.324 SNIP 2.048
Web of Science (2014): Impact factor 2.564
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.34 SJR 1.424 SNIP 2.228
Web of Science (2013): Impact factor 2.692
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.236 SNIP 1.845
Web of Science (2012): Impact factor 2.319
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.62 SJR 1.115 SNIP 1.845
Web of Science (2011): Impact factor 1.759
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.16 SNIP 1.812
Web of Science (2010): Impact factor 1.974
Quantification of fugitive methane emissions from a landfill in Hedeland, Roskilde (DK)

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Delre, A., Mønster, J., Scheutz, C.
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Publication date: 2015

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Publisher: Technical University of Denmark, DTU Environment
Original language: English

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NOTE: Not available report
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Research output: Commissioned; Report – Annual report year: 2015

Quantification of fugitive methane emissions from a landfill in Køge (DK)

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Delre, A., Scheutz, C.
Number of pages: 21
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Original language: English

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Not public available.
Quantification of methane and nitrous oxide emission from wastewater treatment plants

**General information**

State: Published  
Organisations: Department of Environmental Engineering, Residual Resource Engineering  
Contributors: Delre, A., Mønster, J., Scheutz, C.  
Number of pages: 2  
Publication date: 2015  
Peer-reviewed: Yes  

Electronic versions:

Delre_CH4.and.N2O.quantification.WWTPs.pdf

**Bibliographical note**

The conference was cancelled due to terrorist attach.

Quantification of methane emissions from 15 Danish landfills using the mobile tracer dispersion method

Whole-site methane emissions from 15 Danish landfills were assessed using a mobile tracer dispersion method with either Fourier transform infrared spectroscopy (FTIR), using nitrous oxide as a tracer gas, or cavity ring-down spectrometry (CRDS), using acetylene as a tracer gas. The landfills were chosen to represent the different stages of the lifetime of a landfill, including open, active, and closed covered landfills, as well as those with and without gas extraction for utilisation or flaring. Measurements also included landfills with biocover for oxidizing any fugitive methane. Methane emission rates ranged from 2.6 to 60.8 kg h(-1), corresponding to 0.7-13.2 g m(-2) d(-1), with the largest emission rates per area coming from landfills with malfunctioning gas extraction systems installed, and the smallest emission rates from landfills closed decades ago and landfills with an engineered biocover installed. Landfills with gas collection and recovery systems had a recovery efficiency of 41-81%. Landfills where shredder waste was deposited showed significant methane emissions, with the largest emission from newly deposited shredder waste. The average methane emission from the landfills was 154 tons y(-1). This average was obtained from a few measurement campaigns conducted at each of the 15 landfills and extrapolating to annual emissions requires more measurements. Assuming that these landfills are representative of the average Danish landfill, the total emission from Danish landfills were calculated at 20,600 tons y(-1), which is significantly lower than the 33,300 tons y(-1) estimated for the national greenhouse gas inventory for 2011. (C) 2014 Published by Elsevier Ltd.

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State: Published  
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Chalmers University of Technology  
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Web of Science (2019): Indexed yes  
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Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 2  
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059  
Web of Science (2017): Impact factor 4.723
Quantification of the methane emission from Masons landfill - Part II

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Mønster, J., Scheutz, C.
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Original language: English
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Research output: Commissioned - peer-review › Report – Annual report year: 2015

Seasonal variation of household food waste in Denmark
This paper analysed the influence of seasonal variation in the generation of the Danish household food waste. Residual household waste was sampled and manually sorted into six food waste fractions. Vegetable food wastes were the main fraction contributing to the household food waste. Statistical analysis showed a significant relationship between avoidable food waste and household size. However, there were no significant seasonal differences in the amount of avoidable food waste.

General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Econet AS
Contributors: Edjabou, V. M. E., Petersen, C., Scheutz, C., Astrup, T. F.
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Source-ID: 113791823
Research output: Research - peer-review › Paper – Annual report year: 2015

Source segregation of food waste in office areas: Factors affecting waste generation rates and quality
Existing legislation mandates that the amount of waste being recycled should be increased. Among others, in its Resource Strategy Plan, the Danish Government decided that at least 60% of food waste generated by the service sector, including in office areas, should be source-sorted and collected separately by 2018. To assess the achievability of these targets, source-sorted food waste and residual waste from office areas was collected and weighed on a daily basis during 133 working days. Waste composition analyses were conducted every week to investigate the efficiency of the source-sorting campaign and the purity of the source-sorted food waste. The moisture content of source-sorted food waste and residual waste fractions, and potential methane production from source-sorted food waste, was also investigated. Food waste generation equated to 23. ± 5. kg/employee/year, of which 20. ± 5. kg/employee/year was source-sorted, with a considerably high purity of 99%. Residual waste amounted to 10. ± 5. kg/employee/year and consisted mainly of paper (29. ± 13%), plastic (23. ± 9%) and missorted food waste (24. ± 16%). The moisture content of source-sorted food waste was significantly higher (8%) than missorted food waste, and the methane potential of source-sorted food waste was 463. ± 42. mL CH4/g VS. These results show that food waste in office areas offers promising potential for relatively easily collectable and pure source-sorted food waste, suggesting that recycling targets for food waste could be achieved with reasonable logistical ease in office areas.
General information
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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Edjabou, V. M. E., Boldrin, A., Scheutz, C., Astrup, T. F.
Pages: 94-102
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.553 SNIP 1.821
Web of Science (2010): Impact factor 2.358
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.519 SNIP 1.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Suggested guidelines for gas emission monitoring at danish landfills

Landfill gas is produced on waste disposal sites receiving organic waste resulting in emission of methane. Regulation requires that the landfill gas is managed in order to reduce emissions, but very few suggestions exist to how the landfill gas management activities are monitored, what requirements to the ability of the landfill gas management to reduce the emission should be set up, and how criteria are developed for when the monitoring activities can be terminated. Monitoring procedures are suggested centred on a robust method for measuring the total methane emission from the site, and quantitative measures to determine the efficiency of the performed emission mitigation is defined. Finally, several principles are presented for how criteria can be developed for when a monitoring program can be terminated.

General information

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Kjeldsen, P., Scheutz, C.
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Publisher: CISA Publisher
Electronic versions: Kjeldsen_Scheutz_2015_SarSym15.pdf
Source: PublicationPreSubmission
Source-ID: 118542105
Research output: Research - peer-review › Article in proceedings – Annual report year: 2015

Assessing methods to estimate emissions of non-methane organic compounds from landfills

The non-methane organic compound (NMOC) emission rate is used to assess compliance with landfill gas emission regulations by the United States Environmental Protection Agency (USEPA). A recent USEPA Report (EPA/600/R-11/033) employed a ratio method to estimate speciated NMOC emissions (i.e., individual NMOC emissions): speciated NMOC emissions=measured methane (CH4) emission multiplied by the ratio of individual NMOCs concentration relative to CH4 concentration (CNMOCs/CCH4) in the landfill header gas. The objectives of this study were to (1) evaluate the efficacy of the ratio method in estimating speciated NMOC flux from landfills; (2) determine for what types of landfills the ratio method...
may be in error and why, using recent field data to quantify the spatial variation of (CNMOCs/CCH4) in landfills; and (3) formulate alternative models for estimating NMOC emissions from landfills for cases in which the ratio method results in biased estimates. This study focuses on emissions through landfill covers measured with flux chambers and evaluates the utility of the ratio method for estimating NMOC emission through this pathway. Evaluation of the ratio method was performed using CH4 and speciated NMOC concentration and flux data from 2012/2013 field sampling of four landfills, an unpublished landfill study, and literature data from three landfills. The ratio method worked well for landfills with thin covers (}

**General information**

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Organisations: Department of Environmental Engineering, Residual Resource Engineering, University of Delaware, Yolo County Planning & Public Works Department, North Carolina State University, University of California, Florida State University
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BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
Data for the composition of municipal solid waste in Denmark is a critical basis for any assessment of waste technologies and waste management systems. The detailed quantification of waste fractions is absolutely needed for a better technological development of waste treatment. The current waste composition data in Denmark are among the most detailed in the world. However, these data are more than 10 years old, and the following issues remain very important: (1) sampling approach, (2) representativeness of samples, (3) data uncertainties, (4) time and geographical variation. Moreover, in the absence of standardised and commonly accepted waste characterization methodologies, various approaches have been reported in literature. This limits both comparability and applicability of the results. The purpose of this study was to
introduce a consistent methodology that reduces uncertainties and ensures data comparability to characterize municipal solid waste. This methodology was applied to residual waste collected from 1,442 households in three municipalities in Denmark. The main fractions contributing to the residual household waste were food waste and miscellaneous waste. Statistical analysis suggested that housing type is a critical stratification parameter for characterization of residual household waste.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Econet AS
Contributors: Edjabou, V. M. E., Petersen, C., Scheutz, C., Astrup, T. F.
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Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Research output: Research - peer-review ▶ Conference abstract in proceedings – Annual report year: 2014

**Effects of bioaugmentation on enhanced reductive dechlorination of 1,1,1-trichloroethane in groundwater - a comparison of three sites**

Microcosm studies investigated the effects of bioaugmentation with a mixed Dehalococcoides (Dhc)/Dehalobacter (Dhb) culture on biological enhanced reductive dechlorination for treatment of 1,1,1-trichloroethane (TCA) and chloroethenes in groundwater at three Danish sites. Microcosms were amended with lactate as electron donor and monitored over 600 days. Experimental variables included bioaugmentation, TCA concentration, and presence/absence of chloroethenes. Bioaugmented microcosms received a mixture of the Dhc culture KB-1 and Dhb culture ACT-3. To investigate effects of substrate concentration, microcosms were amended with various concentrations of chloroethanes (TCA or monochloroethane [CA]) and/or chloroethenes (tetrachloroethene [PCE], trichloroethene [TCE], or 1,1-dichloroethene [1,1-DCE]). Results showed that combined electron donor addition and bioaugmentation stimulated dechlorination of TCA and 1,1-dichloroethane (1,1-DCA) to CA, and dechlorination of PCE, TCE, 1,1-DCE and cDCE to ethane. Dechlorination of CA was not observed. Bioaugmentation improved the rate and extent of TCA and 1,1-DCA dechlorination at two sites, but did not accelerate dechlorination at a third site where geochemical conditions were reducing and Dhc and Dhb were indigenous. TCA at initial concentrations of 5 mg/L inhibited (i.e., slowed the rate of) TCA dechlorination, TCE dechlorination, donor fermentation, and methanogenesis. 1 mg/L TCA did not inhibit dechlorination of TCA, TCE or cDCE. Moreover, complete dechlorination of PCE to ethene was observed in the presence of 3.2 mg/L TCA. In contrast to some prior reports, these studies indicate that low part-per million levels of TCA (<3 mg/L) in aquifer systems do not inhibit dechlorination of PCE or TCE to ethene. In addition, the results show that co-bioaugmentation with Dhc and Dhb cultures can be an effective strategy for accelerating treatment of chloroethane/chloroethene mixtures in groundwater, with the exception that all currently known Dhc and Dhb cultures cannot treat CA.

**General information**

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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Water Resources Engineering GeoSyntec Consultants
Contributors: Scheutz, C., Durant, N. D., Broholm, M. M.
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- Web of Science (2019): Indexed yes
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Scopus rating (2017): CiteScore 2.43 SJR 0.876 SNIP 0.922
- Web of Science (2017): Impact factor 2.41
- Web of Science (2017): Indexed yes
Erfaringer med biocovers i Danmark: Fra labforsøg til fuldskalaanlæg

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Kjeldsen, P., Scheutz, C.

Erfaringer med biocovers i Danmark: Fra labforsøg til fuldskalaanlæg

Research output: Research - peer-review Journal article – Annual report year: 2013

Scopus rating (2016): CiteScore 2.41 SJR 0.818 SNIP 1.072
Web of Science (2016): Impact factor 2.018
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.37 SJR 0.895 SNIP 1.071
Web of Science (2015): Impact factor 2.208
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.42 SJR 0.968 SNIP 1.208
Web of Science (2014): Impact factor 2.336
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.63 SJR 1.105 SNIP 1.447
Web of Science (2013): Impact factor 2.492
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.22 SJR 1.034 SNIP 1.197
Web of Science (2012): Impact factor 2.173
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.31 SJR 1.068 SNIP 1.103
Web of Science (2011): Impact factor 2.017
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.1 SNIP 0.989
Web of Science (2010): Impact factor 2.012
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.012 SNIP 1.19
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.969 SNIP 1.192
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.811 SNIP 1.101
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.977 SNIP 1.092
Scopus rating (2005): SJR 0.809 SNIP 0.953
Scopus rating (2004): SJR 0.868 SNIP 0.759
Scopus rating (2003): SJR 0.736 SNIP 0.849
Scopus rating (2002): SJR 0.771 SNIP 0.681
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.658 SNIP 0.953
Scopus rating (2000): SJR 0.905 SNIP 0.824
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.878 SNIP 0.69
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Erfaringer med biocovers i Danmark: Fra labforsøg til fuldskalaanlæg

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Kjeldsen, P., Scheutz, C.
Estimating household food waste in Denmark: case study of single family households

Food waste prevention remains the first priority in the European Waste Framework Directive, which aimed to halve the amount of food wasted within the EU Member States by 2025. Thus, reliable data on food waste composition and quantity are crucial for assessing the current food waste situation and determine potential improvements. In Denmark, although many sorting campaigns involving household waste has been conducted, little attention has been placed on food waste. Comparison of recent studies made for examples in Austria, and the UK suggests that quantity and material composition of food waste vary significantly among the studies and differ from one country to another. Here, we provide a consistent methodology for characterization of household food waste, so that data comparability and source information are ensured.

In this study, residual household waste was sampled and manually sorted from more than 211 single-family houses in Denmark. The residual waste from each household was collected and sorted separately to obtain a representative variation of the quantity and composition of food waste among households. The main fractions contributing to the household food waste were avoidable vegetable food waste and non-avoidable vegetable food waste. Furthermore, avoidable vegetable and animal food waste were the primary source of household food waste. Statistical analysis found a positive linear relationship between household size and the amount of the household food waste suggesting the amount of household food waste increases with the number of occupants per household.

Evaluating the biochemical methane potential (BMP) of low-organic waste at Danish landfills

The biochemical methane potential (BMP) is an essential parameter when using first order decay (FOD) landfill gas (LFG) generation models to estimate methane (CH4) generation from landfills. Different categories of waste (mixed, shredder and sludge waste) with a low-organic content and temporarily stored combustible waste were sampled from four Danish landfills. The waste was characterized in terms of physical characteristics (TS, VS, TC and TOC) and the BMP was analyzed in batch tests. The experiment was set up in triplicate, including blank and control tests. Waste samples were incubated at 55°C for more than 60 days, with continuous monitoring of the cumulative CH4 generation. Results showed that samples of mixed waste and shredder waste had similar BMP results, which was in the range of 5.4–9.1 kg CH4/ton waste (wet weight) on average. As a calculated consequence, their degradable organic carbon content (DOCC) was in the range of 0.44–0.70% of total weight (wet waste). Numeric values of both parameters were much lower than values of traditional municipal solid waste (MSW), as well as default numeric values in current FOD models. The sludge waste and temporarily stored combustible waste showed BMP values of 51.8–69.6 and 106.6–117.3 kg CH4/ton waste on average, respectively, and DOCC values of 3.84–5.12% and 7.96–8.74% of total weight. The same category of waste from different Danish landfills did not show significant variation. This research studied the BMP of Danish low-organic waste for the first time, which is important and valuable for using current FOD LFG generation models to estimate realistic CH4 emissions from modern landfills receiving low-organic waste.
Full-scale quantification of CH4 emissions from wastewater treatment plants and biogas facilities

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Delre, A., Mønster, J., Scheutz, C.
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URLs:
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Gasmisssjoner fra danske deponier målt med sporstofmetoder (15 deponier)

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Contributors: Scheutz, C., Kjeldsen, P.
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Abstractsamling_Lossepladser_State_of_the_Art.pdf
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2014
Influence of data collection schemes on the Life Cycle Assessment of a municipal wastewater treatment plant.

A Life Cycle Assessment (LCA) of a municipal wastewater treatment plant (WWTP) was conducted to illustrate the effect of an emission inventory data collection scheme on the outcomes of an environmental impact assessment. Due to their burden in respect to data collection, LCAs often rely heavily on existing emission and operational data, which are gathered under either compulsory monitoring or reporting requirements under law. In this study, an LCA was conducted using three input data sources: Information compiled under compulsory disclosure requirements (the European Pollutant Release and Transfer Registry), compliance with national discharge limits, and a state-of-the-art emission data collection scheme conducted at the same WWTP. Parameter uncertainty for each collection scheme was assessed through Monte Carlo simulation. The comparison of the results confirmed that LCA results depend heavily on input data coverage. Due to the threshold on reporting value, the E-PRTR did not capture the impact for particulate matter emission, terrestrial acidification, or terrestrial eutrophication. While the current practice can capture more than 90% of non-carcinogenic human toxicity and marine eutrophication, an LCA based on the data collection scheme underestimates impact potential due to limitations of substance coverage. Besides differences between data collection schemes, the results showed that 3-13,500% of the impacts came from background systems, such as from the provisioning of fuel, electricity, and chemicals, which do not need to be disclosed currently under E-PRTR. The incidental release of pollutants was also assessed by employing a scenario-based approach, the results of which demonstrated that these non-routine emissions could increase overall WWTP greenhouse gas emissions by between 113 and 210%. Overall, current data collection schemes have the potential to provide standardized data collection and form the basis for a sound environmental impact assessment, but several improvements are recommended, including the additional collection of energy and chemical usage data, the elimination of a reporting threshold, the expansion of substance coverage, and the inclusion of non-point fugitive gas emissions.

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Contributors: Yoshida, H., Clavreul, J., Scheutz, C.; Christensen, T. H.
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Volume: 56
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 7.55 SJR 2.601 SNIP 2.358
Web of Science (2017): Impact factor 7.051
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.49 SJR 2.663 SNIP 2.563
Web of Science (2016): Impact factor 6.942
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 6.63 SJR 2.665 SNIP 2.482
Web of Science (2015): Impact factor 5.991
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 6.13 SJR 2.946 SNIP 2.702
Web of Science (2014): Impact factor 5.528
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 6.02 SJR 2.956 SNIP 2.676
Web of Science (2013): Impact factor 5.323
ISI indexed (2013): ISI indexed yes
Landfill gas generation and emission at Danish waste disposal sites receiving low-organic waste

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Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Mou, Z., Kjeldsen, P., Scheutz, C.
Number of pages: 43
Publication date: 2014
Landfill methane emission mitigation – How to construct and document a full-scale biocover system

Landfills receiving organic wastes produce biogas (landfill gas – LFG) containing methane (CH₄). Landfills are significant sources of methane, which contributes to climate change. As an alternative to gas utilization systems or as a follow-on technology when a gas utilization system gets non-cost-effective, bio-mitigation systems may be implemented. Bio-mitigation systems are defined here as systems based on microbial removal processes implemented at landfills to reduce emission of methane (or other harmful substances). In respect to CH₄, experiments have documented that a very high methane oxidation rate can be obtained in soils, compost and other materials, high enough to significant reduce the methane emission from landfills. The process has been scaled up by DTU Environment to a full-scale implemented technology at two Danish landfills. Now the Danish government has decided to establish bio-mitigation systems at up to 100 closed and old Danish landfills. The presentation will introduce the technology and methodologies for documentation of the gained greenhouse gas mitigation.

Life cycle assessment of sewage sludge treatment and its use on land

Sewage sludge is generated as an end-product of wastewater treatment processes, and its management holds importance in the operation of wastewater treatment plants from both an economic and an environmental point of view. At the same time, the management of sewage sludge is becoming increasingly multi-focused, as renewable energy and nutrient recovery have been added to the list beyond sanitation and stabilisation of sewage sludge. In order to organise and quantify environmental benefits and associated burdens, in order to facilitate an informed decision making process, life cycle assessments (LCAs) have been applied in the field of sewage sludge management for the past two decades. While providing a flexible platform for comparing a range of sewage sludge management options, a knowledge gap has been identified through the review of existing studies, including inconsistencies in pollutant coverage and quantification, the omission of unmetered gaseous emissions and a lack of long-term emission data regarding the land application of sewage sludge. An LCA depends heavily on existing emission and operational data, as generating such data could be prohibitively time- and resource-consuming. Emission and operational data are already collected by wastewater treatment plants for compliance with pollutant discharge requirements, but a part of this pollutant discharge is also reported to a web-based registry (European Pollutant Release and Transfer Registry (E-PRTR)) and is available to the public free of charge. While this data source provides a standardised data collection format, its viability has been questioned due to its limited pollutant coverage and the thresholds regarding reporting requirements. To address this issue, a targeted input data collection campaign was conducted at a municipal wastewater treatment plant. The substance flow analysis of a municipal wastewater treatment plant was conducted to identify the fate of 32 elements, and a reduction in toxicity potential was evaluated by applying USETox. The result was largely confirmative of previous studies, in that wastewater treatment is effective at removing pollutants from wastewater and concentrates them in sewage sludge. Efforts to collect site specific emission data were also expanded to gaseous emission measurements. The tracer dilution method was applied to measure a plant-integrated emission of N₂O and CH₄ from the wastewater treatment plant. Large variations in emissions were found within and between measurement campaigns, and almost ten times more emissions were found during periods of operational difficulty such as foaming or the malfunction of in-line control systems. The LCA was based on three input data collection schemes: a compulsory environmental information disclosure requirement, a pollutant discharge monitoring requirement and state-of-the-art on-site data collection. While adequately capturing impacts in relation to global warming and marine eutrophication, an LCA based on existing data sources might underestimate impacts associated with wastewater and sludge treatment processes. Finally, the effort to collect emission data was expanded to the use of sludge on agricultural land. The long-term consequences of sewage sludge application on land were evaluated by applying the DAISY dynamic agro-ecosystem model. The C and N mineralisation rates obtained from the 190-day laboratory-scale incubation test for sewage sludge were used to calibrate the DAISY model, and the fates of...
This thesis shows the importance of including a detailed composition of the special waste types, as well as the importance of further scientific development in order to ensure that LCA is applicable and accepted as a decision-making tool. One of these issues is the evaluation of resource depletion and scarcity. This area is in need of a much broader consensus and must therefore also be able to incorporate issues related to special waste streams and management. The ability for LCAs to incorporate these issues is crucial for the tool to be able to support decisions and to further justify the use of waste-LCAs when decisions are made.

Life cycle assessment of the management of special waste types: WEEE and batteries

There has been an increased focus on special waste types (WEEE, batteries, ink cartridges and cables) in Denmark and abroad, as many of these fractions constitute a special threat to the environment, due to their content of hazardous compounds and valuable resources. Waste Electrical and Electronic Equipment (WEEE) and batteries are some of the special waste types receiving significant focus as hazardous and valuable substances in WEEE and batteries are plentiful. WEEE and batteries, which are not sorted out for recycling and recovery, do not only imply a loss of materials and metals but could also lead to pollution of other waste streams. In addition to this, there are significant environmental benefits to be obtained when recycling special wastes.

Many of the raw materials found in special waste are in an immediate supply risk for the development of emerging green technologies. The inherent resources in waste have become an obvious focus as a source of these critical raw materials, and the municipal solid waste is considered to be one of the largest potential sources for the recovery and recycling of scarce elements.

Special waste streams should, therefore, be collected and recycled. In particular, precious and scarce metals should be recovered due to environmental as well as sustainability issues.

In Denmark, there are still waste flows that are unaccounted for. One of these flows is the special waste that is being misplaced with residual household waste. Bigum et al. (II) investigated this by conducting a sorting analysis of the Danish residual household waste. The analysis showed that especially small household appliances, lamps, toys, leisure and sports equipment, and portable batteries were frequently misplaced with residual household waste. Misplaced special waste will, in Denmark, be incinerated. This leads to pollution of the surrounding environment with heavy and toxic metals, as well as being a significant source for abiotic resource depletion (Bigum et al., III).

Improvements with respect to the treatment of special waste are necessary. Traditional pre-treatment facilities seem to focus primarily on the traditional metals such as iron (Fe), aluminium (Al), and copper (Cu), which can be recovered in bulk amounts. Recovery of the precious and scarce metals is to a lesser degree carried out, as these appear in much smaller amounts. Future recovery facilities should, however, aim at recovering these metals, even though they appear in smaller concentrations, as the recovery of these can have larger environmental relevance exceeding that of the traditionally recovered metals (Bigum et al., I).

Life cycle assessments (LCAs) are used as decision-making tools for supporting waste management decisions. LCAs must therefore also be able to incorporate issues related to special waste streams and management. The ability for LCAs to incorporate these issues is crucial for the tool to be able to support decisions and to further justify the use of waste-LCAs when decisions are made.

One of these issues is related to special waste being a very heterogeneous waste type. The variation in composition is significant and data availability is scarce, which can make it difficult to include special waste in waste-LCAs. This also means that the environmental aspects connected with the special waste types can be difficult to fully assess, and that the consequences of these may risk being overlooked or underestimated.

The field of environmental assessment of special waste is relatively new, and many issues need to be resolved. One of these issues is the evaluation of resource depletion and scarcity. This area is in need of a much broader consensus and further scientific development in order to ensure that LCA is applicable and accepted as a decision-making tool.

This thesis shows the importance of including a detailed composition of the special waste types, as well as the importance of further scientific development in order to ensure that LCA is applicable and accepted as a decision-making tool.
of incorporating the resource depletion of unrecovered elements in waste-LCAs (Bigum et al., III). The thesis also shows that the recycling of metals is of significant environmental importance (Bigum et al., I) and quantifies the amount of special waste types being misplaced with residual household waste (Bigum et al., II). The thesis also concludes that there are still many issues that need to be resolved and suggested which areas need further research in order to improve the field of environmental assessments of special waste types.

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**Metanemission fra AVØ’s deponeringsanlæg i Skagen**

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Mitigation of methane emission from an old unlined landfill in Klintholm, Denmark using a passive biocover system

Methane generated at landfills contributes to global warming and can be mitigated by biocover systems relying on microbial methane oxidation. As part of a closure plan for an old unlined landfill without any gas management measures, an innovative biocover system was established. The system was designed based on a conceptual model of the gas emission patterns established through an initial baseline study. The study included construction of gas collection trenches along the slopes of the landfill where the majority of the methane emissions occurred. Local compost materials were tested as to their usefulness as bioactive methane oxidizing material and a suitable compost mixture was selected. Whole site methane emission quantifications based on combined tracer release and downwind measurements in combination with several local experimental activities (gas composition within biocover layers, flux chamber based emission measurements and logging of compost temperatures) proved that the biocover system had an average mitigation efficiency of approximately 80%. The study showed that the system also had a high efficiency during winter periods with temperatures below freezing. An economic analysis indicated that the mitigation costs of the biocover system were competitive to other existing greenhouse gas mitigation options.
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Organisations: Department of Environmental Engineering, Residual Resource Engineering, Ramboll Group AS, Klintholm I/S, Chalmers University of Technology
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Overblik over målemetoder til bestemmelse af metanemission fra deponier: fordele og ulemper

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**Phosphorus in Denmark: national and regional anthropogenic flows**

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Plant-integrated measurement of greenhouse gas emissions from a municipal wastewater treatment plant

Wastewater treatment plants (WWTPs) contribute to anthropogenic greenhouse gas (GHG) emissions. Due to its spatial and temporal variation in emissions, whole plant characterization of GHG emissions from WWTPs face a number of obstacles. In this study, a tracer dispersion method was applied to quantify plant-integrated, real-time emissions of methane and nitrous oxides. Two mobile cavity ring-down spectroscopy sampling devices were used to record downwind gas concentrations emitted from a municipal WWTP situated in Copenhagen, Denmark. This plant is equipped to remove biological nitrogen and employs anaerobic digestion for sludge stabilization. Over the course of nine measurement campaigns, a wide range of emissions were detected: methane from 4.99kg/h-1 up to 92.3kg/h-1 and nitrous oxide from below the detection limit (0.37kg/h-1) up to 10.5kg/h-1. High emissions were observed during periods experiencing operational problems, such as during foaming events in anaerobic digesters and during sub-optimal operation of biological nitrogen removal in the secondary treatment of wastewater. Methane emissions detected during measurement campaigns corresponded to 2.07-32.7% of the methane generated in the plant. As high as 4.27% of nitrogen entering the WWTP was emitted as nitrous oxide under the sub-optimal operation of biological treatment processes. The study shows that the unit process configuration, as well as the operation of the WWTP, determines the rate of GHG emission. The applied plant-integrated emission measurement method could be used to ease the burden of quantifying GHG emissions from WWTPs for reporting purposes and could contribute to the development of more accurate depictions of environmental performance of WWTPs. © 2014 Elsevier Ltd.
Quantification of fugitive methane emissions from the biogas plant in Linköping (SE)

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Quantification of the methane emission from Masons landfill - Part I

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Quantifying greenhouse gas emissions from waste treatment facilities
Methane is a greenhouse gas (GHG) and the anthropogenic emission of methane to the atmosphere contributes to global warming. There are several anthropogenic methane sources, and the quantification of methane from these emission sources are often based on emission factors and model calculations making reporting uncertain. Reducing the methane emission is an effective way of reducing the overall greenhouse gas emission. Methane reductions can often be difficult to quantify and document, as accurate measurements methods are lacking and not commercial available.

The methane emission from the waste sector is a significant part of the global anthropogenic methane emission, and landfills are responsible for the majority of the GHG emission. Several initiatives have been taken to minimize the methane emission from landfills, e.g. by methane recovery followed by flaring or utilization, or by constructing mitigation installations such as a cover material with enhanced methane oxidizing capability. Due to a series of factors, methane from landfills is emitted very heterogeneous in both time and space, challenging methane quantification. Several methods have been developed to quantify methane emissions from landfills, but none of these have been accepted internationally as the best way to perform emission measurements. The overall aim of this PhD study was to identify, develop, document and apply an optimal method for quantifying fugitive GHG emissions from waste treatment facilities such as landfills and wastewater treatment plants. The primary objective was to identify a potential measurement method, build the associated analytical platform and document and verify the method. The secondary objective was to apply the method to quantify emissions from Danish landfills and from wastewater treatment plants.

The PhD study reviewed and evaluated previously used methane measurement methods and found the tracer dispersion method promising. The method uses release of tracer gas and the use of mobile equipment with high analytical sensitivity, to measure the downwind plumes of methane and tracer gas. The method was chosen as in enable measurements of the emission from whole landfill areas, including possible hotspot emissions occurring at the landfill.

A fast response and high resolution analytical equipment was purchased and tested. An analytical platform was build, enabling the instrument to be in-stalled in any vehicle and thereby enabling measurements wherever there were roads. The validation of the measurement method was done by releasing a controlled amount of methane and quantifying the emission using the release of tracer gas. The validation test showed that even in areas with large turbulence, such as urban areas, the measured emission could be quantified within a few percent of the released methane. The sensitivity of incorrect location of tracer gas release was also tested, showing the possibility of a significant over-/underestimation of the methane emission by misplacing the tracer gas, and that this error becomes smaller with increasing measurement distance.

A measurement protocol was developed and the methane emission was quantified from a series of landfills with different size, age and gas recovery and mitigation conditions. The landfills were measured between one and four times and the emissions ranged from 2.6 to 60.8 kg methane per hour, with the lowest emissions from the oldest and smallest landfills.
and the highest emissions from the bigger landfills. It was not possible to correlate the measured emission with a single factor such as landfill age, size or mitigation actions. As an example the highest emission was measured at a landfill with active methane recovery and utilization. Compared with national and European greenhouse gas reporting schemes the measurement showed a large difference, with reporting ranging a factor of 100 above to a factor of 10 below the measured methane emission. The average reporting was three times higher the average measured emission, even when included the two landfills without reporting. The landfills recovering methane for utilization showed a methane recovery efficiency ranging between 41 and 81%, excluding a possible methane oxidation in the top layer of the landfills.

To expand the application of the developed analytical platform to also cover fugitive emissions of other gasses, an additional instrument for measuring nitrous oxide (greenhouse gas) and ammonia (causes eutrophication) was developed and tested in collaboration with the manufacture. The development was done in two stages. First stage was optimization and field testing done during an external research stay at the instrument manufacture in USA. The second stage was field measurements conducted in Denmark with subsequent tuning of the spectroscopy in the instrument. The implementation of nitrous oxide measurements were done by intensive measurements at a Danish wastewater treatment plant. The measurement campaigns showed that the nitrous oxide emission mainly occurred from the aeration tanks during aeration. The nitrous oxide emission showed high temporal variations ranging from below quantifiable and up to 10.3 kg nitrous oxide per hour. The methane emission from the wastewater treatment was also quantified and the majority (99%) was emitted from the sludge treatment processes, including anaerobic digestion and open air storage of digested sludge. The methane emission ranged from 10 to 92 kg per hour and was found to change in even short timescales of a few hours. The periods with large emissions correlated with a drop in methane utilization, indicating that emissions came from the digesters tanks or gas storage/usage. The measurements indicated that the main emissions occurred in elevated heights, but theoretically calculation showed that this only resulted in a 2% underestimation, although measurement conditions could make the error more significant. Besides the extensive emission research, the outcome of the PhD study is a mobile analytical platform implementable on any means of transportation able to carry approximately 100 kg, including batteries, inverter, weather station, GPS, pumps, analyzers and screens. The mobile analytical platform can measure real time atmospheric concentrations of methane, nitrous oxide and ammonia and measure concentration changes in parts per billion levels, enabling the use of dynamic tracer dispersion method for quantifying fugitive emissions from various sources. The analytical setup was proven applicable for measuring methane emissions from landfills and methane and nitrous oxide emission from wastewater treatment plants. The flexibility of the analytical platform allows many setups, including short term mobile measurements and long term, stationary measurements, opening up for a large range of applications both for emission quantification and concentration monitoring.

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Quantifying methane emission from fugitive sources by combining tracer release and downwind measurements – A sensitivity analysis based on multiple field surveys

Using a dual species methane/acetylene instrument based on cavity ring down spectroscopy (CRDS), the dynamic plume tracer dispersion method for quantifying the emission rate of methane was successfully tested in four measurement campaigns: (1) controlled methane and trace gas release with different trace gas configurations, (2) landfill with unknown emission source locations, (3) landfill with closely located emission sources, and (4) comparing with an Fourier transform infrared spectroscopy (FTIR) instrument using multiple trace gasses for source separation. The new real-time, high precision instrument can measure methane plumes more than 1.2km away from small sources (about 5kg/h−1) in urban areas with a measurement frequency allowing plume crossing at normal driving speed. The method can be used for quantification of total methane emissions from diffuse area sources down to 1kg per hour and can be used to quantify individual sources with the right choice of wind direction and road distance. The placement of the trace gas is important for obtaining correct quantification and uncertainty of up to 36% can be incurred when the trace gas is not co-located with the methane source. Measurements made at greater distances are less sensitive to errors in trace gas placement and model calculations showed an uncertainty of less than 5% in both urban and open-country for placing the trace gas 100m from the source, when measurements were done more than 3km away. Using the ratio of the integrated plume concentrations of tracer gas and methane gives the most reliable results for measurements at various distances to the source, compared to the ratio of the highest concentration in the plume, the direct concentration ratio and using a Gaussian plume model. Under suitable weather and road conditions, the CRDS system can quantify the emission from different sources located close to each other using only one kind of trace gas due to the high time resolution, while the FTIR system can measure
multiple trace gasses but with a lower time resolution.
Landfills are significant sources of methane, which contributes to climate change. As an alternative to mitigation by gas utilization systems, bio-mitigation systems may be implemented. Such systems are based on microbial methane oxidation in full surface biological covers, so-called biocovers, or open or closed bed biofilter systems. The objective of this paper is to describe the relationship between research on process understanding of the oxidation of landfill gas contained methane and the up-scale to full bio-mitigation systems implemented at landfills. The oxidation of methane is controlled by several environmental factors such as soil texture, temperature, soil moisture content, methane and oxygen supply, and nutrients, and both soils and compost materials have been shown to exhibit high methane oxidation rates. For compost materials high methane oxidation is observed even during cold periods due to self-heating processes. Bio-mitigation can be used as a stand-alone technology or combined with active or passive gas collection. When implementing bio-mitigation systems focus should be on additional fugitive methane emissions or the presence of uncontrolled point releases. A protocol for implementing a bio-mitigation system is presented, and the reported landfill-implemented bio-mitigation systems either established as full-scale or pilot-scale systems are reviewed. It is concluded that bio-mitigation systems have a large potential for providing cost-efficient mitigation options for reducing methane emissions when landfill gas utilization systems cannot be implemented or cease to perform as cost-efficient, sustainable solutions.
Stable carbon isotope analysis to distinguish biotic and abiotic degradation of 1,1,1-trichloroethane in groundwater sediments

The fate and treatability of 1,1,1-TCA by natural and enhanced reductive dechlorination was studied in laboratory microcosms. The study shows that compound-specific isotope analysis (CSIA) identified an alternative 1,1,1-TCA degradation pathway that cannot be explained by assuming biotic reductive dechlorination. In all biotic microcosms 1,1,1-TCA was degraded with no apparent increase in the biotic degradation product 1,1-DCA. 1,1,1-TCA degradation was documented by a clear enrichment in 13C in all biotic microcosms, but not in the abiotic control, which suggests biotic or biotically mediated degradation. Biotic degradation by reductive dechlorination of 1,1-DCA to CA only occurred in bioaugmented microcosms and in donor stimulated microcosms with low initial 1,1,1-TCA or after significant decrease in 1,1,1-TCA concentration (after ∼day 200). Hence, the primary degradation pathway for 1,1,1-TCA does not appear to be reductive dechlorination via 1,1-DCA. In the biotic microcosms, the degradation of 1,1,1-TCA occurred under iron and sulfate reducing conditions. Biotic reduction of iron and sulfate likely resulted in formation of FeS, which can abiotically degrade 1,1,1-TCA. Hence, abiotic degradation of 1,1,1-TCA mediated by biotic FeS formation constitute an explanation for the observed 1,1,1-TCA degradation. This is supported by a high 1,1,1-TCA 13C enrichment factor consistent with abiotic degradation in biotic microcosms. 1,1-DCA carbon isotope field data suggest that this abiotic degradation of 1,1,1-TCA is a relevant process also at the field site.
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Scopus rating (2012): CiteScore 3.5 SJR 1.794 SNIP 1.618
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Scopus rating (2010): SJR 1.879 SNIP 1.424
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Scopus rating (2009): SJR 1.842 SNIP 1.572
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Web of Science (2008): Indexed yes
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Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.479 SNIP 1.558
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.627 SNIP 1.479
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Scopus rating (2003): SJR 1.321 SNIP 1.323
Web of Science (2003): Indexed yes
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The impact of bioaugmentation on dechlorination kinetics and on microbial dechlorinating communities in subsurface clay till

A molecular study on how the abundance of the dechlorinating culture KB-1 affects dechlorination rates in clay till is presented. DNA extracts showed changes in abundance of specific dechlorinators as well as their functional genes. Independently of the KB-1 added, the microbial dechlorinator abundance increased to the same level in all treatments. In the non-bioaugmented microcosms the reductive dehalogenase gene bvcA increased in abundance, but when KB-1 was added the related vcrA gene increased while bvcA genes did not increase. Modeling showed higher vinyl-chloride dechlorination rates and shorter time for complete dechlorination to ethene with higher initial concentration of KB-1 culture, while cis-dichloroethene dechlorination rates were not affected by KB-1 concentrations. This study provides high resolution abundance profiles of Dehalococcoides spp. (DHC) and functional genes, highlights the ecological behavior of KB-1 in clay till, and reinforces the importance of using multiple functional genes as biomarkers for reductive dechlorination. © 2013 Elsevier Ltd. All rights reserved.

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Web of Science (2015): Indexed yes
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Scopus rating (2014): CiteScore 4.57 SJR 1.987 SNIP 2.005
Web of Science (2014): Impact factor 4.143
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BFI (2013): BFI-level 2
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Web of Science (2013): Impact factor 3.902
A conceptual model linking functional gene expression and reductive dechlorination rates of chlorinated ethenes in clay rich groundwater sediment

We used current knowledge of cellular processes involved in reductive dechlorination to develop a conceptual model to describe the regulatory system of dechlorination at the cell level; the model links bacterial growth and substrate consumption to the abundance of messenger RNA of functional genes involved in the dechlorination process. The applicability of the model was tested on a treatability study of biostimulated and bioaugmented microcosms. Using quantitative real time PCR, high-resolution expression profiles of the functional reductive dehalogenase genes bvcA and vcrA were obtained during two consecutive dechlorination events of trichloroethene, cis-dichloroethene and vinyl chloride. Up-regulation of the bvcA (for the biostimulated microcosms) and vcrA (for the bioaugmented microcosms) gene expression fitted well with high rates of dechlorination of vinyl chloride, while no known transcripts could be measured during trichloroethene and cis-dichloroethene dechlorination. Maximum concentrations of 2.1 and 1.7 transcripts per gene of the bvcA and vcrA genes, respectively, were measured at the same time points as maximum dechlorination rates were observed. The developed model compared well with the experimental data for both biostimulated and bioaugmented
microcosms under non-steady state conditions and was supported by results from a recently published study under steady state conditions.

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**Contributors:** Bælum, J., Chambon, J. C. C., Scheutz, C., Binning, P. J., Laier, T., Bjerg, P. L., Jacobsen, C.  
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- Web of Science (2015): Impact factor 5.991  
- Web of Science (2015): Indexed yes  
- BFI (2014): BFI-level 2  
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- Web of Science (2013): 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): CiteScore 5.43 SJR 2.862 SNIP 2.355  
- Web of Science (2011): Impact factor 4.865  
- ISI indexed (2011): ISI indexed yes  
- Web of Science (2011): Indexed yes  
- BFI (2010): BFI-level 2  
- Scopus rating (2010): SJR 2.592 SNIP 2.192  
Characterization of household food waste in Denmark

This paper presents a methodology and the results of compositional analysis of food waste from Danish families living in single-family houses. Residual household waste was sampled and manually sorted from 211 single-family houses in the suburb of Copenhagen. The main fractions contributing to the household food waste were avoidable vegetable food waste and non-avoidable vegetable food waste. Statistical analysis found a positive linear relationship between household size and the amount of the household food waste.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Econet AS
Contributors: Edjabou, V. M. E., Petersen, C., Scheutz, C., Astrup, T. F.
Number of pages: 5
Publication date: 2013
Peer-reviewed: Yes
Source: dtu
Source-ID: u::8920
Research output: Research - peer-review › Paper – Annual report year: 2013

Greenhouse gas emissions from five waste water treatment plants

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Mønster, J., Scheutz, C.
Number of pages: 48
Publication date: 2013
Publication information
Place of publication: Kgs. Lyngby
Publisher: Department of Environmental Engineering, Technical University of Denmark (DTU)
Original language: English
Source: dtu
Source-ID: u::10362
Research output: Research › Report – Annual report year: 2013

Identification of chlorinated solvents degradation zones in clay till by high resolution chemical, microbial and compound specific isotope analysis

The degradation of chlorinated ethenes and ethanes in clay till was investigated at a contaminated site (Vadsby, Denmark) by high resolution sampling of intact cores combined with groundwater sampling. Over decades of contamination, bioactive zones with degradation of trichloroethene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA) to 1,2-cis-dichloroethene (cis-DCE) and 1,1-dichloroethane, respectively, had developed in most of the clay till matrix. Dehalobacter dominated over Dehalococcoides (Dhc) in the clay till matrix corresponding with stagnation of sequential dechlorination at cis-DCE. Sporadically distributed bioactive zones with partial degradation to ethene were identified in the clay till matrix (thickness from 0.10 to 0.22 m). In one sub-section profile the presence of Dhc with the vcrA gene supported the occurrence of degradation of cis-DCE and VC, and in another enriched δ13C for TCE, cis-DCE and VC documented degradation. Highly enriched δ13C for 1,1,1-TCA (25‰) and cis-DCE (- 4‰) suggested the occurrence of abiotic degradation in a third sub-section profile. Due to fine scale heterogeneity the identification of active degradation zones in the clay till matrix depended on high resolution subsampling of the clay till cores. The study demonstrates that an integrated approach combining chemical analysis, molecular microbial tools and compound specific isotope analysis (CSIA) was required in order to document biotic and abiotic degradations in the clay till system. © 2013 Elsevier B.V.

General information
State: Published
Organisations: Water Resources Engineering, Department of Environmental Engineering, Novo Nordisk Foundation Center for Biosustainability, CFB - Metagenomic Systems Biology, Residual Resource Engineering, University of Neuchatel, Orbicon, University of Copenhagen
Pages: 37-50
Publication date: 2013
Peer-reviewed: Yes
Publication information
Integrated resource management and recovery (IRMAR): a new danish initiative

DTU Environment has launched the IRMAR initiative in collaboration with internationally leading partners to improve the scientific basis for integrated assessment of both the quality of resources in waste and the environmental aspects of resource recovery. Today, the basis for prioritization between individual resources is not available: which resources should be recovered from waste and which waste streams should be prioritised for this recovery? Which final resource quality should be achieved? The answers to these questions are less simple than they may appear. With IRMAR, we offer a critical analysis of existing resource assessment approaches (e.g. exergy, statistical entropy, resource indicators, criticality, etc.). On this basis, we develop a consistent framework for integrated assessment of resource recovery and implement this in our EASETECH waste LCA model. The entire concept is demonstrated based on a range of full-scale case studies in collaboration with the waste industry.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Number of pages: 6
Publication date: 2013
Peer-reviewed: Yes
Source: dtu
Source-ID: u::8934
Research output: Research - peer-review › Paper – Annual report year: 2013


General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Naroznova, I., Møller, J., Scheutz, C.
Number of pages: 35
Publication date: 2013

Publication information
Place of publication: Kgs. Lyngby
Publisher: DTU Environment
Original language: English
Source: dtu
Source-ID: u::10088
Research output: Research › Report – Annual report year: 2013
Life Cycle Assessment of pretreatment technologies for anaerobic digestion of source-separated organic household waste

The environmental performance of two pretreatment technologies for source-separated organic waste was compared using life cycle assessment (LCA). An innovative pulping process where source-separated organic waste is pulped with cold water forming a volatile solid rich biopulp was compared to a more traditional pretreatment method using a screw press. The inventory of the technologies was constructed including the mass balance, amount of biogas produced, nutrient recovery rates, and produced biomass quality. The technologies were modelled in the LCA-model EASETECH and the potential environmental impacts including a number of non-toxic and toxic impact categories were assessed. No big difference in the overall performance of the two technologies was observed. The difference for the separate life cycle steps was, however, more pronounced. More efficient material transfer in the scenario with waste pulping resulted in a higher biogas output and nutrient recovery and, thus, the higher impact savings related to biogas production and digest utilization. Meanwhile, larger reject amount in the scenario with screw press led to more savings obtained by utilization of the reject in this scenario.

Life cycle assessment of sewage sludge management: A review

In this article, 35 published studies on life cycle assessment (LCA) of sewage sludge were reviewed for their methodological and technological assumptions. Overall, LCA has been providing a flexible framework to quantify environmental impacts of wastewater and sewage sludge treatment and disposal processes for multiple scales, ranging from process selection to policy evaluation. The results of LCA are, in principle, unique to the goal and scope of each study, reflecting its local conditions and comparison between different LCAs is not intended. Furthermore, the assessments are limited by the methodological development of the life cycle impact assessment (LCIA) and the advancement of research in quantifying environmental emissions associated with wastewater and sewage sludge treatment processes. Thus, large discrepancies were found in the selection of the environmental emissions to be included and how they were estimated in the analysis. In order to reduce these choice uncertainties, consolidation of the modelling approach in the following area are recommended: quantification of fugitive gas emissions and modelling of disposal practices. Besides harmonization of the key technical assumptions, clear documentation of the modelling approach and the uncertainties associating with each assumption is encouraged so as to improve the integrity and robustness of assessment.
Meeting the EU recycling targets by introducing a 2-compartment bin to households

A Danish municipality has introduced a 2-compartment bin in the waste collection scheme, this bin should increase recycling of dry household recyclables. An excessive waste sorting campaign was conducted and the efficiency of the bin assessed. The waste sorting campaign yielded a full waste composition with focus on the dry recyclables, and it was used to determine whether the 2-compartment bin could fulfill the EU recycling targets for 2020. Only 2 of 4 calculation methods for meeting the EU targets were applicable and only one of these fulfilled the EU target. Eventhough the EU recycling targets can be fulfilled, there is still room for improvement (increase source separation), especially for hard plastic and metals.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Jensen, M. B., Scheutz, C., Møller, J.
Number of pages: 6
Publication date: 2013
Peer-reviewed: Yes
Source: dtu
Source-ID: u::9205
Research output: Research - peer-review › Paper – Annual report year: 2013

Metanemissioner fra deponierne ved Glatved, Odense, Audebo og Avedøre

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Mønster, J., Kjeldsen, P., Scheutz, C.
Number of pages: 44
Publication date: 2013

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish

Bibliographical note
Rapporten er konfidentiel - også internt
Source: dtu
Source-ID: u::10361
Research output: Research › Report – Annual report year: 2013

Metanemission fra Ærø Lossplads

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Mønster, J., Scheutz, C.
Number of pages: 10
Publication date: 2013
**Metanemission fra Frederiksværk losseplads**

**General information**
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Mønster, J., Scheutz, C.
Number of pages: 9
Publication date: 2013

**Publication information**
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish

**Bibliographical note**
Rapporten er konfidentiel - også internt
Source: dtu
Source-ID: u::10363
Research output: Research › Report – Annual report year: 2013

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**Metanemission fra Hedeland losseplads**

**General information**
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Mønster, J., Scheutz, C.
Number of pages: 13
Publication date: 2013

**Publication information**
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish

**Bibliographical note**
Rapporten er konfidentiel - også internt
Source: dtu
Source-ID: u::10364
Research output: Research › Report – Annual report year: 2013

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**Metanemission fra Skovsted losseplads**

**General information**
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Mønster, J., Scheutz, C.
Number of pages: 10
Publication date: 2013

**Publication information**
Place of publication: Kgs. Lyngby
Publisher: Institut for Vand og Miljøteknologi, Danmarks Tekniske Universitet
Original language: Danish

**Bibliographical note**
Rapporten er konfidentiel - også internt
Source: dtu
Source-ID: u::10365
Research output: Research › Report – Annual report year: 2013
Methane concentrations at Ovnstrupvej 6

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Mønster, J., Scheutz, C.
Number of pages: 8
Publication date: 2013

Publication information
Place of publication: Kgs. Lyngby
Publisher: DTU Environment
Original language: English
Source: dtu
Source-ID: u::10360
Research output: Research - peer-review › Article in proceedings – Annual report year: 2013

Mitigation of methane emissions in a pilot-scale biocover system at the AV Miljø landfill, Denmark: quantification of methane oxidation

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark
Contributors: Scheutz, C., Skov, B., Cassini, F., Mou, Z., Kjeldsen, P.
Number of pages: 8
Publication date: 2013

Host publication information
Title of host publication: Proceedings Sardinia 2013, Fourteenth International Waste Management and Landfill Symposium
Place of publication: Cagliari, Italy
Publisher: CISA Publisher
Research output: Research - peer-review › Article in proceedings – Annual report year: 2013

Mitigation of methane emissions in a pilot-scale biocover system at the AV Miljø landfill, Denmark: 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. The biocover is fed by landfill gas pumped out of three leachate wells. An innovative gas distribution system was used to overcome the often observed overloaded hot spot areas resulting from uneven gas distribution to the active methane oxidation layer. Performed screening of methane and carbon dioxide concentration at the surface of the biocover showed homogenous distributions indicating an even gas distribution. This was supported by result from a performed tracer test where the compound HFC-134a was added to the gas inlet over a 12 day period. Studies of the tracer movement within the biocover system showed very even gas distribution in gas probes installed in the gas distribution layer. Also the flux of tracer out of the biocover surface as measured by flux chamber technique showed a spatially even distribution. The methane oxidation efficiency was studied in a follow on paper included in these proceedings.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark
Contributors: Kjeldsen, P., Skov, B., Cassini, F., Mou, Z., Scheutz, C.
Number of pages: 10
Publication date: 2013

Host publication information
Title of host publication: Proceedings Sardinia 2013, Fourteenth International Waste Management and Landfill Symposium
Modelling $N_2O$ dynamics in the engineered $N$ cycle: Observations, assumptions, knowns, and unknowns

Research on nitrous oxide formation in engineered wastewater systems has experienced an exponential development in the recent years due to the important environmental impact of this greenhouse gas. These efforts have crystallized in a large number of publications that aim to identify the importance of the main microbial processes responsible for its production and consumption. The conceptualization of these pathways in mathematical models has the potential to become a key tool to increase our understanding on the complex interrelationship within these ecosystems and develop strategies to minimize the carbon footprint of wastewater treatment plants. Unfortunately, existing model structures are limited to describe the emissions of individual microbial pathways in an attempt to decrease their complexity and facilitate their calibration. The present contribution summarizes the recent developments in this field and makes use of sensitivity analyses, and an in-depth study of model uncertainties to establish experimental protocols that facilitate the calibration and predictive ability of a new generation of more realistic models describing $N_2O$ production during wastewater treatment.

**General information**

State: Published
Organizations: Department of Environmental Engineering, Department of Chemical and Biochemical Engineering, Computer Aided Process Engineering Center
Number of pages: 1
Publication date: 2013
Peer-reviewed: Yes
Event: Abstract from ICON3: 3rd international conference on Nitrification, Tokyo, Japan.
Electronic versions:
Abstract_ICON3_bfsm.pdf

**Bibliographical note**

Oral presentation
Source: dtu
Source-ID: u::8823
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2013

Phosphorus, agriculture & organic waste: a Danish P balance

**General information**

State: Published
Organizations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Klinglmair, M., Scheutz, C., Astrup, T. F.
Number of pages: 1
Publication date: 2013
Peer-reviewed: Yes
Event: Poster session presented at 7th International Phosphorus Workshop (IPW7), Uppsala, Sweden.
Electronic versions:
Poster_Uppsala_2013.pdf
Source: dtu
Source-ID: u::8926
Research output: Research - peer-review › Poster – Annual report year: 2013

Phosphorus, agriculture & organic waste: a Danish P balance

**General information**

State: Published
Organizations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Klinglmair, M., Scheutz, C., Astrup, T. F.
Number of pages: 1
Pages: 110
Publication date: 2013
Quantification of methane emissions from danish landfills

Whole-landfill methane emission was quantified using a tracer technique that combines controlled tracer gas release from the landfill with time-resolved concentration measurements downwind of the landfill using a mobile high-resolution analytical instrument. Methane emissions from 13 Danish landfills varied between 2.6 and 60.8 kg CH₄ h⁻¹. The highest methane emission was measured at the largest (in terms of disposed waste amounts) of the 13 landfills, whereas the lowest methane emissions (2.6-6.1 kgCH₄ h⁻¹) were measured at the older and smaller landfills. At two of the sites, which had gas collection, emission measurements showed that the gas collection systems only collected between 30-50% of the methane produced (assuming that the produced methane equalled the sum of the emitted methane and the collected methane). Significant methane emissions were observed from disposed shredder waste. At Odense an emission of 19.7 kg CH₄ h⁻¹ was measured from a disposal cell containing 900,000 tons of shredder waste. Several of the sites had additional on-site waste treatment activities including composting and biological treatment, which resulted in significant methane emissions comparable to the emissions measured from waste disposal.

Review of reactive kinetic models describing reductive dechlorination of chlorinated ethenes in soil and groundwater

Reductive dechlorination is a major degradation pathway of chlorinated ethenes in anaerobic subsurface environments, and reactive kinetic models describing the degradation process are needed in fate and transport models of these contaminants. However, reductive dechlorination is a complex biological process, where many microbial populations including dechlorinating, fermentative, methanogenic, iron and sulfate reducing, interact. In this article the modeling approaches and the experimental data needed to calibrate them are reviewed, classified, and discussed. Model approaches considered include first order kinetics, Monod kinetics to describe sequential reductive dechlorination and bacterial growth, and metabolic models which simulate fermentation and redox processes interacting with reductive dechlorination processes. The review shows that the estimated kinetic parameters reported vary over a wide range, and that experimental microbial data are scarce. Very few studies have been performed evaluating the influence of sulfate and iron reduction, and contradictory conclusions on the interaction of redox processes with reductive dechlorination have been reported. The modeling approaches for metabolic reductive dechlorination employing different descriptions of the interaction between redox and dechlorination processes and competition for hydrogen are classified. The current concepts lead to different results, suggesting a need for further investigations on the interactions between the microbial communities performing dechlorination and redox processes, including the establishment of biomarkers quantifying dechlorination, and on geochemical characterization. Finally, the relevance of laboratory data and the development of practical modeling tools for field applications are discussed. Biotechnol. Bioeng. 2013; 110: 1–23. © 2012 Wiley Periodicals, Inc.
WEEE and portable batteries in residual household waste: Quantification and characterisation of misplaced waste

A total of 26.1 Mg of residual waste from 3129 households in 12 Danish municipalities was analysed and revealed that 89.6 kg of Waste Electrical and Electronic Equipment (WEEE), 11 kg of batteries, 2.2 kg of toners and 16 kg of cables had been wrongfully discarded. This corresponds to a Danish household discarding 29 g of WEEE (7 items per year), 4 g of batteries (9 batteries per year), 1 g of toners and 7 g of unidentifiable cables on average per week, constituting 0.34% (w/w), 0.04% (w/w), 0.01% (w/w) and 0.09% (w/w), respectively, of residual waste. The study also found that misplaced WEEE and batteries in the residual waste constituted 16% and 39%, respectively, of what is being collected properly through the dedicated special waste collection schemes. This shows that a large amount of batteries are being discarded with the residual waste, whereas WEEE seems to be collected relatively successfully through the dedicated special waste collection schemes. Characterisation of the misplaced batteries showed that 20% (w/w) of the discarded batteries were discarded as part of WEEE (built-in). Primarily alkaline batteries, carbon zinc batteries and alkaline button cell batteries were found to be discarded with the residual household waste. Characterisation of WEEE showed that primarily small WEEE (WEEE directive categories 2, 5a, 6, 7 and 9) and light sources (WEEE directive category 5b) were misplaced. Electric tooth brushes, watches, clocks, headphones, flashlights, bicycle lights, and cables were items most frequently found. It is recommended that these findings are taken into account when designing new or improving existing special waste collection schemes. Improving the collection of WEEE is also recommended as one way to also improve the collection of batteries due to the large fraction of batteries found as built-in. The findings in this study were comparable to other western European studies, suggesting that the recommendations made in this study could apply to other western European countries as well.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Econet AS
Contributors: Bigum, M. K., Petersen, C., Christensen, T. H., Scheutz, C.
Pages: 2372-2380
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Waste Management
Volume: 33
Issue number: 11
ISSN (Print): 0956-053X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.553 SNIP 1.821
Web of Science (2010): Impact factor 2.358
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.519 SNIP 1.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.375 SNIP 2.145
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.998 SNIP 1.785
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.021 SNIP 1.819
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.065 SNIP 1.653
Scopus rating (2004): SJR 1.271 SNIP 1.911
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.853 SNIP 1.234
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.498 SNIP 0.903
Scopus rating (2001): SJR 0.45 SNIP 0.731
A remediation performance model for enhanced metabolic reductive dechlorination of chloroethenes in fractured clay till

A numerical model of metabolic reductive dechlorination is used to describe the performance of enhanced bioremediation in fractured clay till. The model is developed to simulate field observations of a full scale bioremediation scheme in a fractured clay till and thereby to assess remediation efficiency and timeframe. A relatively simple approach is used to link the fermentation of the electron donor soybean oil to the sequential dechlorination of trichloroethene (TCE) while considering redox conditions and the heterogeneous clay till system (clay till matrix, fractures and sand stringers). The model is tested on lab batch experiments and applied to describe sediment core samples from a TCE-contaminated site. Model simulations compare favorably to field observations and demonstrate that dechlorination may be limited to narrow bioactive zones in the clay matrix around fractures and sand stringers. Field scale simulations show that the injected donor is expected to be depleted after 5 years, and that without donor re-injection contaminant rebound will occur in the high permeability zones and the mass removal will stall at 18%. Long remediation timeframes, if dechlorination is limited to narrow bioactive zones, and the need for additional donor injections to maintain dechlorination activity may limit the efficiency of ERD in low-permeability media. Future work should address the dynamics of the bioactive zones, which is essential to understand for predictions of long term mass removal.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Residual Resource Engineering
Contributors: Manoli, G., Chambon, J. C., Bjerg, P. L., Scheutz, C., Binning, P. J., Broholm, M. M.
Pages: 64-78
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Journal of Contaminant Hydrology
Volume: 131
Issue number: 1-4
ISSN (Print): 0169-7722
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.36 SJR 0.891 SNIP 1.003
Web of Science (2017): Impact factor 2.284
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.26 SJR 1.037 SNIP 1.077
Web of Science (2016): Impact factor 2.009
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.12 SJR 0.941 SNIP 1.073
Web of Science (2015): Impact factor 2.063
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.4 SJR 1.293 SNIP 1.516
Web of Science (2014): Impact factor 2.204
Assessment of 1,1,1-TCA Degradation using Stable Carbon Isotope Fractionation

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Residual Resource Engineering, University of Neuchatel, Orbicon, Capital Region of Denmark
Assessment of 1,1,1-TCA Degradation using Stable Carbon Isotope Fractionation

General information
State: Published
Organisations: Department of Environmental Engineering, Water Resources Engineering, Residual Resource Engineering, University of Neuchatel, Orbicon, Capital Region of Denmark
Number of pages: 1
Publication date: 2012
Peer-reviewed: Yes
Event: Abstract from 4th Joint Nordic Meeting on Remediation of Contaminated Sites, Oslo, Norway.
Electronic versions:
prod21341496087889.Broholm_Abs_NORDROCS_2012_Isotope.pdf
Source: dtu
Source-ID: u::4409
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2012

Development of substance flow based Life Cycle Assessment tool for sewage sludge treatment and disposal

Life Cycle Assessment (LCA) is a method to quantify environmental impacts of products or systems. It is often done by correlating material and energy demands with certain input characteristics. An attempt was made to evaluate the robustness of the substance flow based LCA for wastewater and sludge treatment processes. Operational data of a conventional wastewater treatment plant over 12 years was collected. A cluster analysis was conducted to determine the relatedness of each input and output characteristic at the whole plant level. The results indicate that the output from the wastewater and sludge treatment processes correlate sufficiently with the solids content of wastewater influent, while energy use correlates with the total input volume. However, the correlations appeared to be stronger when individual treatment processes were separately analysed.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Yoshida, H., Clavreul, J., Scheutz, C., Christensen, T. H.
Number of pages: 7
Publication date: 2012
Peer-reviewed: Yes
Event: Abstract from EcoTechnologies for Wastewater Treatment 2012 , Santiago de Compostela, Spain.
Keywords: Sawage sludge, Life cycle assessment, Material flow analysis
Bibliographical note
Oral presentation (awarded as the best platform presentation)
Source: dtu
Source-ID: u::4429
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2012

Home composting as an alternative treatment option for organic household waste in Denmark: An environmental assessment using life cycle assessment-modelling

An environmental assessment of the management of organic household waste (OHW) was performed from a life cycle perspective by means of the waste-life cycle assessment (LCA) model EASEWASTE. The focus was on home composting of OHW in Denmark and six different home composting units (with different input and different mixing frequencies) were modelled. In addition, incineration and landfilling was modelled as alternatives to home composting. The most important processes contributing to the environmental impact of home composting were identified as greenhouse gas (GHG) emissions (load) and the avoided emissions in relation to the substitution of fertiliser and peat when compost was used in hobby gardening (saving). The replacement of fertiliser and peat was also identified as one of the most sensible
parameters, which could potentially have a significant environmental benefit. Many of the impact categories (especially human toxicity via water (HTw) and soil (HTs)) were affected by the heavy metal contents of the incoming OHW. The concentrations of heavy metals in the compost were below the threshold values for compost used on land and were thus not considered to constitute a problem. The GHG emissions were, on the other hand, dependent on the management of the composting units. The frequently mixed composting units had the highest GHG emissions. The environmental profiles of the home composting scenarios were in the order of −2 to 16 milli person equivalents (mPE) Mg−1 wet waste (ww) for the non-toxic categories and −0.9 to 28mPEMg−1 ww for the toxic categories. Home composting performed better than or as good as incineration and landfilling in several of the potential impact categories. One exception was the global warming (GW) category, in which incineration performed better due to the substitution of heat and electricity based on fossil fuels.

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering, Technical University of Denmark
Contributors: Andersen, J., Boldrin, A., Christensen, T. H., Scheutz, C.
Pages: 31-40
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Waste Management
Volume: 32
Issue number: 1
ISSN (Print): 0956-053X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
Methane emission fra Viborg affaldsdeponi

Reduktion af metanemissionen fra Klintholm losseplads ved etablering af biocover

Assessment of 1,1,1-TCA Degradation Using Carbon Isotope Fractionation
Comparison Of Four Landfill Gas Models Using Data From Four Danish Landfills

Data about type and quantity of waste disposed in four Danish landfills was collected and used on four different landfill gas generation models. This was done to compare the output data in order to evaluate the performance of the four landfill gas models when used on Danish waste types, and to compare the four Danish landfill sites. The results show that three of the models generally give similar methane generation output. Only the LandGem model seems to give a much higher methane generation for Danish waste data, most likely due to a low organic fraction. Interpretation of the waste data and the categorization of the waste play an important role in the methane prediction and combining the model predictions with whole site methane measurements would therefore be advised.

Development and Sensitivity Analysis of a Fully Kinetic Model of Sequential Reductive Dechlorination in Groundwater

A fully kinetic biogeochemical model of sequential reductive dechlorination (SERD) occurring in conjunction with lactate and propionate fermentation, iron reduction, sulfate reduction, and methanogenesis was developed. Production and consumption of molecular hydrogen (H2) by microorganisms have been modeled using modified Michaelis–Menten kinetics and has been implemented in the geochemical code PHREEQC. The model have been calibrated using a Shuffled Complex Evolution Metropolis algorithm to observations of chlorinated solvents, organic acids, and H2 concentrations in laboratory batch experiments of complete trichloroethene (TCE) degradation in natural sediments. Global sensitivity analysis was performed using the Morris method and Sobol sensitivity indices to identify the most influential model parameters. Results show that the sulfate concentration and fermentation kinetics are the most important factors influencing SERD. The sensitivity analysis also suggests that it is not possible to simplify the model description if all system behaviors are to be well described.
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 6.58 SJR 2.535 SNIP 1.941
Web of Science (2017): Impact factor 6.653
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.26 SJR 2.559 SNIP 1.902
Web of Science (2016): Impact factor 6.198
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 5.61 SJR 2.546 SNIP 1.838
Web of Science (2015): Impact factor 5.393
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 5.5 SJR 2.777 SNIP 2.003
Web of Science (2014): Impact factor 5.33
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 5.52 SJR 2.952 SNIP 2.102
Web of Science (2013): Impact factor 5.481
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 5.17 SJR 3.115 SNIP 2.043
Web of Science (2012): Impact factor 5.257
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.16 SJR 3.18 SNIP 1.945
Web of Science (2011): Impact factor 5.228
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.979 SNIP 1.726
Web of Science (2010): Impact factor 4.827
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.86 SNIP 1.809
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.96 SNIP 1.935
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.774 SNIP 1.914
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.55 SNIP 1.893
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.608 SNIP 1.999
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.86 SNIP 2.046
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.54 SNIP 2.065
Environmental Aspects Of Home Composting Of Organic Household Waste
Six composting units were monitored during a two-year long experimental campaign. Data regarding chemical compositions of waste inputs and outputs, gaseous emissions and leachate productions were collected, organized in mass balances and assessed by means of LCA. The management of the home composting unit was very relevant for the environmental performance of home composting, as the turning frequency influence the emissions of CH4 which is the main responsible for potential impacts on global warming. Results showed that overall home composting has low environmental impacts (between -2 and 16 mPE Mg-1ww for the non-toxic categories and between -0.9 and 28 mPE Mg-1ww for the toxic categories) and has similar or even better environmental profile that incineration and landfilling in some of the impact categories.

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Contributors: Boldrin, A., Andersen, J. K., Christensen, T. H., Scheutz, C.
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Place of publication: Italy
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Source-ID: 316021
Research output: Research - peer-review › Article in proceedings – Annual report year: 2011

Evaluating Gas Emissions From Landfills – Which Methodologies Can Be Used?
Many methodologies exist to measure whole landfill methane emission as alternatives to imprecise estimation of the methane emission using existing landfill gas generation models. An overview of the different measurement methodologies is given, and suggestions to the most promising methodologies are presented. Methods based on the tracer dilution approach are most promising. However, still some developments are needed, both in respect to the technical implementation, and in respect to the protocols needed to obtain annual emission estimates based on the limited number of measurement campaigns.

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Contributors: Kjeldsen, P., Scheutz, C.
Publication date: 2011

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Title of host publication: Proceedings Sardinia 2011, Thirteenth International Waste Management and Landfill Symposium
Place of publication: Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Source-ID: 312369
Research output: Research - peer-review › Article in proceedings – Annual report year: 2011
Evaluation of respiration in compost landfill biocovers intended for methane oxidation

A low-cost alternative approach to reduce landfill gas (LFG) emissions is to integrate compost into the landfill cover design in order to establish a biocover that is optimized for biological oxidation of methane (CH4). A laboratory and field investigation was performed to quantify respiration in an experimental compost biocover in terms of oxygen (O2) consumption and carbon dioxide (CO2) production and emission rates. O2 consumption and CO2 production rates were measured in batch and column experiments containing compost sampled from a landfill biowindow at Fakse landfill in Denmark. Column gas concentration profiles were compared to field measurements. Column studies simulating compost respiration in the biowindow showed average CO2 production and O2 consumption rates of 107±14gm−2d−1 and 63±12gm−2d−1, respectively. Gas profiles from the columns showed elevated CO2 concentrations throughout the compost layer, and CO2 concentrations exceeded 20% at a depth of 40cm below the surface of the biowindow. Overall, the results showed that respiration of compost material placed in biowindows might generate significant CO2 emissions. In landfill compost covers, methanotrophs carrying out CH4 oxidation will compete for O2 with other aerobic microorganisms. If the compost is not mature, a significant portion of the O2 diffusing into the compost layer will be consumed by non-methanotrophs, thereby limiting CH4 oxidation. The results of this study however also suggest that the consumption of O2 in the compost due to aerobic respiration might increase over time as a result of the accumulation of biomass in the compost after prolonged exposure to CH4.

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Organisations: Residual Resource Engineering, Department of Environmental Engineering
Contributors: Scheutz, C., Pedicone, A., Pedersen, G. B., Kjeldsen, P.
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
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BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
Extraction of nucleic acids from trichloroethylene (TCE) degrading bacteria in extremely clayey groundwater sediments

General information
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Organisations: Residual Resource Engineering, Department of Environmental Engineering, Geological Survey of Denmark and Greenland, University of Copenhagen
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Source: orbit
Source-ID: 275124
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2011
Gas production, composition and emission at a modern disposal site receiving waste with a low-organic content

AV Miljø is a modern waste disposal site receiving non-combustible waste with a low-organic content. The objective of the current project was to determine the gas generation, composition, emission, and oxidation in top covers on selected waste cells as well as the total methane (CH4) emission from the disposal site. The investigations focused particularly on three waste disposal cells containing shredder waste (cell 1.5.1), mixed industrial waste (cell 2.2.2), and mixed combustible waste (cell 1.3). Laboratory waste incubation experiments as well as gas modeling showed that significant gas generation was occurring in all three cells. Field analysis showed that the gas generated in the cell with mixed combustible waste consisted of mainly CH4 (70%) and carbon dioxide (CO2) (29%) whereas the gas generated within the shredder waste, primarily consisted of CH4 (27%) and nitrogen (N2) (71%), containing no CO2. The results indicated that the gas composition in the shredder waste was governed by chemical reactions as well as microbial reactions. CH4 mass balances from three individual waste cells showed that a significant part (between 15% and 67%) of the CH4 generated in cell 1.3 and 2.2.2 was emitted through leachate collection wells, as a result of the relatively impermeable covers in place at these two cells preventing vertical migration of the gas. At cell 1.5.1, which is un-covered, the CH4 emission through the leachate system was low due to the high gas permeability of the shredder waste. Instead the gas was emitted through the waste resulting in some hotspot observations on the shredder surface with higher emission rates. The remaining gas that was not emitted through surfaces or the leachate collection system could potentially be oxidized as the measured oxidation capacity exceeded the potential emission rate. The whole CH4 emission from the disposal site was found to be 820±202kgCH4d⁻¹. The total emission rate through the leachate collection system at AV Miljø was found to be 211kgCH4d⁻¹. This showed that approximately ¼ of the emitted gas was emitted through the leachate collections system making the leachate collection system an important source controlling the overall gas migration from the site. The emission pathway for the remaining part of the gas was more uncertain, but emission from open cells where waste is being disposed of or being excavated for incineration, or from horizontal leachate drainage pipes placed in permeable gravel layers in the bottom of empty cells was likely.

General information

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Organisations: Residual Resource Engineering, Department of Environmental Engineering, AV Miljø, Chalmers University of Technology
Contributors: Scheutz, C., Fredenslund, A. M., Nedenskov, J., Samuelsson, J., Kjeldsen, P.
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Web of Science (2018): Indexed yes
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Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
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Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Landfill Top Covers
The purpose of the final cover of a landfill is to contain the waste and to provide for a physical separation between the waste and the environment for protection of public health. Most landfill covers are designed with the primary goal to reduce or prevent infiltration of precipitation into the landfill in order to minimize leachate generation. In addition the cover also has to control the release of gases produced in the landfill so the gas can be ventilated, collected and utilized, or oxidized in situ. The landfill cover should also minimize erosion and support vegetation. Finally the cover is landscaped in order to fit into the surrounding area/environment or meet specific plans for the final use of the landfill. To fulfill the above listed requirements landfill covers are often multicomponent systems which are placed directly on top of the waste. The top cover may be placed immediately after the landfill section has been filled or several years later depending on the settlement patterns. Significant differential settlements may disturb the functioning of the top cover. The specific design of the cover system depends on the type of waste landfilled (municipal, hazardous, or inert waste) and the requirement for protection of the local environment/situation (climatology, morphology, etc.). At modern landfills the cover system is only one of the environmental protection measures which often also include leachate and gas collection and subsequently
treatment or recovery. At old abandoned landfills however, top covers may be the only environmental protection measure. In some landfill regulations (for instance the Subtitle D landfills receiving municipal solid waste in the USA) it is required to minimize infiltration into the waste layers. Therefore top covers containing liner components such as lowpermeability clay soils and geomembranes are required. The avoidance of water input to organic waste may impede the microbial stabilization processes including gas generation. Therefore watertight top covers may be in conflict with the purposes of reactor landfills (see Chapter 10.6). At some sites covers sometimes are made to include components for recirculation of landfill leachate (see Section 10.9.2 for more details). The top cover is an important factor in the water management of landfills. Details about water infiltration through top covers and its influence on the hydrology of the landfill is covered in Chapter 10.3 on landfill hydrology. This chapter provides an overview on the components of traditional top covers used at landfills and the alternatives used for meeting other requirements (such as leachate recirculation or passive gas management by microbial oxidation processes).

**General information**

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Organisations: Residual Resource Engineering, Department of Environmental Engineering
Contributors: Scheutz, C., Kjeldsen, P.
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Publisher: Wiley
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Source: orbit
Source-ID: 269323
Research output: Research - peer-review » Book chapter – Annual report year: 2011

**Mass balances and life cycle inventory of home composting of organic waste**

A comprehensive experimental setup with six single-family home composting units was monitored during 1 year. The composting units were fed with 2.6–3.5 kg organic household waste (OHW) per unit per week. All relevant consumptions and emissions of environmental relevance were addressed and a full life-cycle inventory (LCI) was established for the six home composting units. No water, electricity or fuel was used during composting, so the major environmental burdens were gaseous emissions to air and emissions via leachate. The loss of carbon (C) during composting was 63–77% in the six composting units. The carbon dioxide (CO2) and methane (CH4) emissions made up 51–95% and 0.3–3.9% respectively of the lost C. The total loss of nitrogen (N) during composting was 51–68% and the nitrous oxide (N2O) made up 2.8–6.3% of this loss. The NH3 losses were very uncertain but small. The amount of leachate was 130 L Mg⁻¹ wet waste (ww) and the composition was similar to other leachate compositions from home composting (and centralised composting) reported in literature. The loss of heavy metals via leachate was negligible and the loss of C and N via leachate was very low (0.3–0.6% of the total loss of C and 1.3–3.0% of the total emitted N). Also the compost composition was within the typical ranges reported previously for home composting. The level of heavy metals in the compost produced was below all threshold values and the compost was thus suitable for use in private gardens.

**General information**

State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Contributors: Andersen, J. K., Boldrin, A., Christensen, T. H., Scheutz, C.
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2016): Impact factor 3.829
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.763 SNIP 2.49
Web of Science (2015): Impact factor 3.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2014): Impact factor 2.485
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.553 SNIP 1.821
Web of Science (2010): Impact factor 2.358
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.519 SNIP 1.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.375 SNIP 2.145
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.998 SNIP 1.785
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.021 SNIP 1.819
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.065 SNIP 1.653
Scopus rating (2004): SJR 1.271 SNIP 1.911
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.853 SNIP 1.234
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.498 SNIP 0.903
Scopus rating (2001): SJR 0.45 SNIP 0.731
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.328 SNIP 0.444
Scopus rating (1999): SJR 0.26 SNIP 0.541
Mitigation of methane emission from Fakse landfill using a biowindow system

Landfills are significant sources of atmospheric methane (CH4) that contributes to climate change, and therefore there is a need to reduce CH4 emissions from landfills. A promising cost efficient technology is to integrate compost into landfill covers (so-called “biocovers”) to enhance biological oxidation of CH4. A full scale biocover system to reduce CH4 emissions was installed at Fakse landfill, Denmark using composted yard waste as active material supporting CH4 oxidation. Ten biowindows with a total area of 5000m2 were integrated into the existing cover at the 12ha site. To increase CH4 load to the biowindows, leachate wells were capped, and clay was added to slopes at the site. Point measurements using flux chambers suggested in most cases that almost all CH4 was oxidized, but more detailed studies on emissions from the site after installation of the biocover as well as measurements of total CH4 emissions showed that a significant portion of the emission quantified in the baseline study continued unabated from the site. Total emission measurements suggested a reduction in CH4 emission of approximately 28% at the end of the one year monitoring period. This was supported by analysis of stable carbon isotopes which showed an increase in oxidation efficiency from 16% to 41%. The project documented that integrating approaches such a whole landfill emission measurements using tracer techniques or stable carbon isotope measurements of ambient air samples are needed to document CH4 mitigation efficiencies of biocover systems. The study also revealed that there still exist several challenges to better optimize the functionality. The most important challenges are to control gas flow and evenly distribute the gas into the biocovers.
Natural and enhanced anaerobic degradation of 1,1,1-trichloroethane and its degradation products in the subsurface – A critical review

1,1,1-Trichloroethane (TCA) in groundwater is susceptible to a variety of natural degradation mechanisms. Evidence of intrinsic decay of TCA in aquifers is commonly observed; however, TCA remains a persistent pollutant at many sites and some of the daughter products that accumulate from intrinsic decay of TCA have been determined to be more toxic than the parent compound. Research advances from the past decade indicate that in situ enhanced reductive dechlorination (ERD) offers promise as a cost-effective solution toward the cleanup of groundwater contaminated with TCA and its transformation daughter products. Laboratory studies have demonstrated that pure or mixed cultures containing certain
Dehalobacter (Dhb) bacteria can catalyze respiratory dechlorination of TCA and 1,1-dichloroethane (1,1-DCA) to monochloroethane (CA) in groundwater systems. 16S rRNA Dhb gene probes have been used as biomarkers in groundwater samples to both assess ERD potential and quantify growth of Dhb in ERD applications at TCA sites. Laboratory findings suggest that iron-bearing minerals and methanogenic bacteria that co-occur in reduced aquifers may synergistically affect dechlorination of TCA. Despite these advances, a number of significant challenges remain, including an inability of any known cultures to completely dechlorinate TCA to ethane. CA is commonly observed as a terminal product of the biological reductive dechlorination of TCA and 1,1-DCA. Also important is the lack of rigorous field studies demonstrating the utility of bioaugmentation with Dhb cultures for remediation of TCA in the field. In this paper we review the state-of-the-science of TCA degradation in aquifers, examining results from both laboratory experiments and twenty-two field case studies, focusing on the capabilities and limits of ERD technology, and identifying aspects of the technology that warrant further development.

General information
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Organisations: Residual Resource Engineering, Department of Environmental Engineering, GeoSyntec Consultants
Contributors: Scheutz, C., Durant, N. D., Hansen, M. H., Bjerg, P. L.
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BFI (2017): BFI-level 2
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Web of Science (2017): Impact factor 7.051
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.49 SJR 2.663 SNIP 2.563
Web of Science (2016): Impact factor 6.942
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 6.63 SJR 2.665 SNIP 2.482
Web of Science (2015): Impact factor 5.991
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 6.13 SJR 2.946 SNIP 2.702
Web of Science (2014): Impact factor 5.528
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BFI (2013): BFI-level 2
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Web of Science (2013): Impact factor 5.323
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 5.15 SJR 2.914 SNIP 2.442
Web of Science (2012): Impact factor 4.655
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.43 SJR 2.862 SNIP 2.355
A measurement method combining a controlled trace gas release with downwind concentrations measurements was successfully used to quantify greenhouse gas (GHG) emissions from three Danish open windrow composting facilities. Overall, the results showed that composting of organic waste generate GHG emissions in terms of methane (CH4) and nitrous oxide (N2O) and thus contribute to climate change. At all three facilities significant CH4 emissions were occurring. The CH4 emission varied between 0.50 and 5.73 kg CH4 h⁻¹. The highest CH4 emission (5.73 kg CH4 h⁻¹) were measured at the Aarhus composting facility and was believed to be a result of the windrow lay-out with very broad and high windrows and a low turning frequency. The lowest CH4 emission (0.50 kg CH4 h⁻¹) was measured at Fakse composting area and was most likely a result of the relatively small windrows and frequent weekly turnings. For all three facilities, the N2O emissions were significantly smaller than the CH4 emissions ranging from 0.08 to 1.18 kg N2O h⁻¹.
Quantification of multiple methane emission sources at landfills using a double tracer technique

A double tracer technique was used successfully to quantify whole-site methane (CH4) emissions from Fakse Landfill. Emissions from different sections of the landfill were quantified by using two different tracers. A scaled-down version of the tracer technique measuring close-by to localized sources having limited areal extent was also used to quantify emissions from on-site sources at the landfill facility, including a composting area and a sewage sludge storage pit. Three field campaigns were performed. At all three field campaigns an overall leak search showed that the CH4 emissions from the old landfill section were localized to the leachate collection wells and slope areas. The average CH4 emissions from the old landfill section were quantified to be 32.6±7.4kg CH4h⁻¹, whereas the source at the new section was quantified to be 10.3±5.3kg CH4h⁻¹. The CH4 emission from the compost area was 0.5±0.25kg CH4h⁻¹, whereas the carbon dioxide (CO2) and nitrous oxide (N2O) flux was quantified to be in the order of 332±166kg CO2h⁻¹ and 0.06±0.03kg N2Oh⁻¹, respectively. The sludge pit located west of the compost material was quantified to have an emission of 2.4±0.63kg h⁻¹ CH4, and 0.03±0.01kg h⁻¹ N2O.

General information
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Contributors: Scheutz, C., Samuelsson, J., Fredenslund, A. M., Kjeldsen, P.
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Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Waste Management
Volume: 31
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Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Temperatures In Compost Landfill Covers As Result Of Methane Oxidation And Compost Respiration

This study investigated the influence of the temperature on methane (CH4) oxidation and respiration in compost sampled at a full scale biocover implemented at Klintholm landfill exhibiting high temperatures. Compost material was collected at Klintholm landfill and incubated with and without CH4 in the laboratory at 10 different temperatures varying between 4 ºC and 70 ºC. The temperature optimum of the methanotrophic community in the biocover material was 45 C. The results indicate that a moderately thermophilic methanotrophic community adapted to the elevated temperature conditions in the biocover had developed. The temperature optimum was comparable to maximum temperatures measured in the deeper parts of the biocover.

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering, Technical University of Denmark
Contributors: Scheutz, C., Merono, A. R., Pedersen, R. B., Kjeldsen, P.
Publication date: 2011
Availability and properties of materials for the Fakse Landfill biocover

Methane produced in landfills can be oxidized in landfill covers made of compost; often called biocovers. Compost materials originating from seven different sources were characterized to determine their methane-oxidizing capacity and suitability for use in a full-scale biocover at Fakse Landfill in Denmark. Methane oxidation rates were determined in batch incubations. Based on material availability, characteristics, and the results of batch incubations, five of the seven materials were selected for further testing in column incubations. Three of the best performing materials showed comparable average methane oxidation rates: screened garden waste compost, sewage sludge compost, and an unscreened 4-year old garden waste compost (120, 112, and 108 g m$^{-2}$ d$^{-1}$, respectively). On the basis of these results, material availability and cost, the unscreened garden waste compost was determined to be the optimal material for the biocover. Comparing the results to criteria given in the literature it was found that the C/N ratio was the best indicator of the methane oxidation capacity of compost materials. The results of this work indicate that batch incubations measuring methane oxidation rates offer a low-cost and effective method for comparing compost sources for suitability of use in landfill biocovers.

General information

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Pedersen, G. B., Scheutz, C., Kjeldsen, P.
Pages: 884-894
Publication date: 2010
Peer-reviewed: Yes

Publication information

Journal: Waste Management
Volume: 31
Issue number: 5
ISSN (Print): 0956-053X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
One of the major challenges when using enhanced reductive dechlorination (ERD) as a remediation technology at clay till sites is to obtain good contact between added agents such as donor, bacteria and the contamination. It is unclear whether degradation only takes place in fractures and/or sand lenses/stringers or if degradation in the clay till matrix is possible. In this study a 30 year old contaminated clay till site where natural degradation of chlorinated ethenes and ethanes is occurring is investigated to obtain a better understanding of the processes driving anaerobic dechlorination including the location of degradation in the fracture matrix geology. An extensive field collection of cores and discrete soil sampling has been conducted and samples have been analysed using state of the art microbial and chemical tools including isotope fractionation.

Characterization of natural anaerobic dechlorination of TCE and 1,1,1-TCA in clay till including isotope fractionation and molecular biological tools

One of the major challenges when using enhanced reductive dechlorination (ERD) as a remediation technology at clay till sites is to obtain good contact between added agents such as donor, bacteria and the contamination. It is unclear whether degradation only takes place in fractures and/or sand lenses/stringers or if degradation in the clay till matrix is possible. In this study a 30 year old contaminated clay till site where natural degradation of chlorinated ethenes and ethanes is occurring is investigated to obtain a better understanding of the processes driving anaerobic dechlorination including the location of degradation in the fracture matrix geology. An extensive field collection of cores and discrete soil sampling has been conducted and samples have been analysed using state of the art microbial and chemical tools including isotope fractionation.

General information
State: Published
Organisations: Department of Environmental Engineering
Development and sensitivity analysis of a fully kinetic model of sequential reductive dechlorination in subsurface

Chlorinated hydrocarbons originating from point sources are amongst the most prevalent contaminants of ground water and often represent a serious threat to groundwater-based drinking water resources. Natural attenuation of contaminant plumes can play a major role in contaminated site management and natural degradation of chlorinated solvents frequently occurs in the subsurface through sequential reductive dechlorination. However, the occurrence and the performance of natural sequential reductive dechlorination strongly depends on environmental factors such as redox conditions, presence of fermenting organic matter / electron donors, presence of specific biomass, etc. Here we develop a new fully-kinetic biogeochemical reactive model able to simulate chlorinated solvents degradation as well as production and consumption of molecular hydrogen. The model is validated using batch experiment data and global sensitivity analysis is performed.

General information
State: Published
Organisations: Department of Environmental Engineering
Pages: S7.2
Publication date: 2010

Feltundersøgelse af den naturlige PCE og TCA nedbrydning i moræneler ved en tidligere kemikaliefordelingscentral

General information
State: Published
Organisations: Department of Environmental Engineering
Pages: 1-12
Publication date: 2010

Field Evaluation of Biological Enhanced Reductive Dechlorination of Chloroethenes in Clayey Till

General information
State: Published
Organisations: Department of Environmental Engineering
Pages: 5134-5141
Publication date: 2010
Peer-reviewed: Yes
Greenhouse gas emissions from home composting of organic household waste

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Andersen, J. K., Boldrin, A., Christensen, T. H., Scheutz, C.
Pages: 2475-2482
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Waste Management
Volume: 30
ISSN (Print): 0956-053X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
How do we avoid releases of chlorofluorocarbons (CFCs) from insulation foam waste?

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Contributors: Kjeldsen, P., Scheutz, C.
Number of pages: 26
Publication date: 2010

Host publication information
Mass balances and life-cycle inventory for a garden waste windrow composting plant (Aarhus, Denmark)

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Andersen, J. K., Boldrin, A., Christensen, T. H., Scheutz, C.
Pages: 1010-1020
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Waste Management and Research
Volume: 28
Issue number: 11
ISSN (Print): 0734-242X
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.78 SJR 0.519 SNIP 0.92
Web of Science (2017): Impact factor 1.631
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.76 SJR 0.673 SNIP 1.091
Web of Science (2016): Impact factor 1.803
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.53 SJR 0.623 SNIP 0.893
Web of Science (2015): Impact factor 1.338
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.28 SJR 0.733 SNIP 1.097
Web of Science (2014): Impact factor 1.297
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.17 SJR 0.58 SNIP 0.925
Web of Science (2013): Impact factor 1.114
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.4 SJR 0.874 SNIP 1.053
Web of Science (2012): Impact factor 1.047
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.33 SJR 1.028 SNIP 0.858
Web of Science (2011): Impact factor 1.193
ISI indexed (2011): ISI indexed yes
Quantification of Greenhouse Gas Emissions from Windrow Composting of Garden Waste

Microbial degradation of organic wastes entails the production of various gases such as carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and carbon monoxide (CO). Some of these gases are classified as greenhouse gases (GHGs), thus contributing to climate change. A study was performed to evaluate three methods for quantifying GHG emissions from central composting of garden waste. Two small-scale methods were used at a windrow composting facility: a static flux chamber method and a funnel method. Mass balance calculations based on measurements of the C content in the in- and out-going material showed that 91 to 94% of the C could not be accounted for using the small-scale methods, thereby indicating that these methods significantly underestimate GHG emissions. A dynamic plume method (total emission method) employing Fourier Transform Infra Red (FTIR) absorption spectroscopy was found to give a more accurate estimate of the GHG emissions, with CO2 emissions measured to be 127 +/- 15% of the degraded C. Additionally, with this method, 2.7 +/- 0.6% and 0.34 +/- 0.16% of the degraded C was determined to be emitted as CH4 and CO. In this study, the dynamic plume method was a more effective tool for accounting for C losses and, therefore, we believe that the method is Suitable for measuring GHG emissions from composting facilities. The total emissions were found to be 2.4 +/- 0.5 kg CH4-C Mg-1 wet waste (ww) and 0.06 +/- 0.03 kg N2O-N Mg-1 ww from a facility treating 15,540 Mg of garden waste yr(-1), or 111 +/- 30 kg CO2-equivalents Mg-1 ww.

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Contributors: Andersen, J. K., Boldrin, A., Samuelsson, J., Christensen, T. H., Scheutz, C.
Pages: 713-724
Publication date: 2010
Peer-reviewed: Yes
Reduction of greenhouse gas emissions from landfills by use of engineered bio-covers - experiences from two full-scale systems

General information
State: Published
Release and fate of fluorocarbons in a shredder residue landfill cell: 1. Laboratory experiments

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Fredenslund, A. M., Nedenskov, J., Kjeldsen, P.
Pages: 2153-2162
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Waste Management
Volume: 30
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Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Release and fate of fluorocarbons in a shredder residue landfill cell: 2. Field investigations

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Fredenslund, A. M., Nedenskov, J., Kjeldsen, P.
Pages: 2163-2169
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Waste Management
Volume: 30
ISSN (Print): 0956-053X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes

Original language: English
DOIs: 10.1016/j.wasman.2010.03.035
Source: orbit
Source-ID: 267761
Research output: Research - peer-review › Journal article – Annual report year: 2010
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.553 SNIP 1.821
Web of Science (2010): Impact factor 2.358
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.519 SNIP 1.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.375 SNIP 2.145
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.998 SNIP 1.785
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.021 SNIP 1.819
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.065 SNIP 1.653
Scopus rating (2004): SJR 1.271 SNIP 1.911
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.853 SNIP 1.234
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.498 SNIP 0.903
Scopus rating (2001): SJR 0.45 SNIP 0.731
Web of Science (2001): Indexed yes
Rigorous field demonstrations of enhanced reductive dechlorination in clayey till and a sand aquifer at a Danish test site

General information
State: Published
Organisations: Department of Environmental Engineering
Pages: 129-130
Publication date: 2010

Host publication information
Title of host publication: ConSoil 2010, 22-24 September 2010 Salzburg, Austria : The 11th International UFZ-Deltares/TNO Conference on Management of Soil, Groundwater and Sediments
Volume: Abstracts of presentations
Publisher: UFZ
Source: orbit
Source-ID: 268034
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2010

Stimuleret nedbrydning af 1,1,1-trichlorethan forurening i moræneler på 3 danske lokaliteter

General information
State: Published
Organisations: Department of Environmental Engineering
Pages: 153-163
Publication date: 2010

Host publication information
Title of host publication: Vintermøde om jord- og grundvandsforurening, Vingstedcentret 9.-10 marts, 2010
Volume: Bind 2
Place of publication: Kgs. Lyngby
Publisher: ATV Jord og Grundvand
Source: orbit
Source-ID: 259795
Research output: Research › Article in proceedings – Annual report year: 2010

Substitution of peat, fertiliser and manure by compost in hobby gardening: User surveys and case studies

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Andersen, J. K., Christensen, T. H., Scheutz, C.
Pages: 2483-2489
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Waste Management
Volume: 30
ISSN (Print): 0956-053X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.553 SNIP 1.821
Web of Science (2010): Impact factor 2.358
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.519 SNIP 1.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.375 SNIP 2.145
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.998 SNIP 1.785
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.021 SNIP 1.819
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.065 SNIP 1.653
Scopus rating (2004): SJR 1.271 SNIP 1.911
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.853 SNIP 1.234
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.498 SNIP 0.903
Tracer method to measure landfill gas emissions from leachate collection systems

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Fredenslund, A. M., Scheutz, C., Kjeldsen, P.
Pages: 2146-2152
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Waste Management
Volume: 30
ISSN (Print): 0956-053X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.34 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Biocover: Evaluation of methane oxidation efficiency of biocover system

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Contributors: Scheutz, C., Fredenslund, A. M., Pedersen, G. B., Pedicone, A., Kjeldsen, P.
Publication date: 2009

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark. Department of Environmental Science and Engineering
Original language: English
Electronic versions:
ENV2009_078.pdf
Source: orbit
Source-ID: 239751
Research output: Research - peer-review › Journal article – Annual report year: 2010

Biodegradation of Methane and Halocarbons in Simulated Landfill Biocover Systems Containing Compost Materials

The attenuation potential of methane (CH4) and of selected volatile organic Compounds (VOCs) was compared in four types of compost materials using dynamic flow column experiments over a period of 255 d. Garden waste compost mixed with wood chips showed the highest steady-state CH4 oxidation rate (161 g m(-2) d(-1)), followed by a commercial
compost product Supermuld (110 g m(-2) d(-1)). In the column containing the highest fraction of compost (compost/sand mixed in 1: 1), CH4 oxidation declined significantly during the period of operation, probably due to clogging by formation of exopolymeric substances. After 40 d of operation, CH production was observed. All the VOCs tested were degraded. CFC-11 (CCl3F) and HCFC-21 (CCl2FH) were anaerobically degraded by reductive dechlorination, generating HCFC-31 (CClFH2) and HFC-41 (CFH3), which were both aerobically degraded in the oxic portion of the columns. Overall, the highest removal of VOCs was observed in the column containing the compost/wood chip mixture. This study demonstrates that biocovers consisting of compost materials have the potential to attenuate trace gas emissions from landfills.
Establishing a biocover system for mitigating methane emissions from an old unlined landfill - baseline studies and biocover construction

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Kjeldsen, P., Scheutz, C., Samuelsson, J., Petersen, P., Jørgensen, J.
Pages: 509
Publication date: 2009

Host publication information
Title of host publication: Sardinia 2009: Twelfth International Waste Management and Landfill Symposium, 5-9 October, Sardinia, Italy
Volume: Proceedings. CD-ROM
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Source: orbit
Source-ID: 253119
Research output: Research › Article in proceedings – Annual report year: 2009

Evaluation of respiration-based CO2 emissions from compost landfill covers

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Pedicone, A., Kjeldsen, P.
Pages: 616
Publication date: 2009

Host publication information
Title of host publication: Sardinia 2009: Twelfth International Waste Management and Landfill Symposium
Volume: Proceedings. CD-ROM
Place of publication: Cagliari, Italy
**Greenhouse gases, radiative forcing, global warming potential and waste management – an introduction**

Management of post-consumer solid waste contributes to emission of greenhouse gases (GHGs) representing about 3% of global anthropogenic GHG emissions. Most GHG reporting initiatives around the world utilize two metrics proposed by the Intergovernmental Panel on Climate Change (IPCC): radiative forcing (RF) and global warming potential (GWP). This paper provides a general introduction of the factors that define a GHG and explains the scientific background for estimating RF and GWP, thereby exposing the lay reader to a brief overview of the methods for calculating the effects of GHGs on climate change. An objective of this paper is to increase awareness that the GWP of GHGs has been re-adjusted as the concentration and relative proportion of these GHGs has changed with time (e.g., the GWP of methane has changed from 21 to 25 CO2-eq). Improved understanding of the indirect effects of GHGs has also led to a modification in the methodology for calculating GWP. Following a presentation of theory behind GHG, RF and GWP concepts, the paper briefly describes the most important GHG sources and sinks in the context of the waste management industry. The paper serves as a primer for more detailed research publications presented in this special issue of Waste Management & Research providing a technology-based assessment of quantitative GHG emissions from different waste management technologies.

**General information**

State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Contributors: Scheutz, C., Kjeldsen, P., Gentil, E.
Pages: 716-723
Publication date: 2009
Peer-reviewed: Yes

**Publication information**

Journal: Waste Management and Research
Volume: 27
Issue number: 8
ISSN (Print): 0734-242X
Ratings:

BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.78 SJR 0.519 SNIP 0.92
Web of Science (2017): Impact factor 1.631
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.76 SJR 0.673 SNIP 1.091
Web of Science (2016): Impact factor 1.803
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.53 SJR 0.623 SNIP 0.893
Web of Science (2015): Impact factor 1.338
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.28 SJR 0.733 SNIP 1.097
Web of Science (2014): Impact factor 1.297
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.17 SJR 0.58 SNIP 0.925
Web of Science (2013): Impact factor 1.114
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
In-situ oprensning af chlorerede opløsningsmidler i moræneler ved stimuleret reduktiv dechlorering

General information
State: Published
Organisations: Department of Environmental Engineering
Publication date: 2009

Host publication information
Title of host publication: SWECO Unter Ytan 2009, Stockholm 21-22 oktober 2009
Place of publication: Stockholm
Publisher: SWECO
In-situ remediation of chlorinated solvents in clayey till by enhanced reductive dechlorination

General information
State: Published
Organisations: Department of Environmental Engineering
Publication date: 2009

Host publication information
Title of host publication: University Consortium for Field-Focused Groundwater Contamination Research, 2009 Annual Meeting, May 19-20, Guelph, Ontario. Presentation Abstracts
Place of publication: Ontario, Canada
Publisher: University of Guelph
Source-ID: 247338

Methods for quantification of GHG emissions from composting of garden waste

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Andersen, J. K., Boldrin, A., Christensen, T. H., Scheutz, C.
Pages: 574
Publication date: 2009

Host publication information
Title of host publication: Sardinia 2009: Twelfth International Waste Management and Landfill Symposium, 5-9 October, Sardinia, Italy
Volume: Proceedings. CD-ROM
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Source-ID: 253122

Microbial methane oxidation processes and technologies for mitigation of landfill gas emissions
Landfill gas containing methane is produced by anaerobic degradation of organic waste. Methane is a strong greenhouse gas and landfills are one of the major anthropogenic sources of atmospheric methane. Landfill methane may be oxidized by methanotrophic microorganisms in soils or waste materials utilizing oxygen that diffuses into the cover layer from the atmosphere. The methane oxidation process, which is governed by several environmental factors, can be exploited in engineered systems developed for methane emission mitigation. Mathematical models that account for methane oxidation can be used to predict methane emissions from landfills. Additional research and technology development is needed before methane mitigation technologies utilizing microbial methane oxidation processes can become commercially viable.
and widely deployed.

**General information**

State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Pages: 409-455
Publication date: 2009
Peer-reviewed: Yes

**Publication information**

Journal: Waste Management and Research
Volume: 27
Issue number: 5
ISSN (Print): 0734-242X
Ratings:

BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.78 SJR 0.519 SNIP 0.92
Web of Science (2017): Impact factor 1.631
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.76 SJR 0.673 SNIP 1.091
Web of Science (2016): Impact factor 1.803
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.53 SJR 0.623 SNIP 0.893
Web of Science (2015): Impact factor 1.338
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.28 SJR 0.733 SNIP 1.097
Web of Science (2014): Impact factor 1.297
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.17 SJR 0.58 SNIP 0.925
Web of Science (2013): Impact factor 1.114
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.4 SJR 0.874 SNIP 1.053
Web of Science (2012): Impact factor 1.047
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.33 SJR 1.028 SNIP 0.858
Web of Science (2011): Impact factor 1.193
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.662 SNIP 0.957
Web of Science (2010): Impact factor 1.222
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.869 SNIP 1.251
Mitigating methane emissions from landfills using biocovers - lessons learned and future challenges

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Kjeldsen, P., Scheutz, C., Fredenslund, A. M., Pedersen, G. B.
Pages: 510
Publication date: 2009

Host publication information
Title of host publication: Sardinia 2009 : Twelfth International Waste Management and Landfill Symposium, 5-9 October, Sardinia, Italy
Volume: Proceedings. CD-ROM
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Source: orbit
Source-ID: 253120
Research output: Research › Article in proceedings – Annual report year: 2009

Nedbrydning af 1,1,1-TCA ved stimuleret reduktiv dechlorering: Treatability-forsøg for lokaliteterne: Baldersbækvej, Høje Taastrup Vej og Vasbyvej

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Broholm, M. M., Scheutz, C., Bjerg, P. L.
Publication date: 2009

Publication information
Place of publication: Kgs. Lyngby
The Danish method for emission reporting to PRTR from waste disposal sites

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Kjeldsen, P., Trolle, C., Scharff, H.
Pages: 617
Publication date: 2009

Host publication information
Title of host publication: Sardinia 2009: Twelfth International Waste Management and Landfill Symposium, 5-9 October, Sardinia, Italy
Volume: Proceedings. CD-ROM
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Source: orbit
Source-ID: 253124
Research output: Research › Article in proceedings – Annual report year: 2009

Atmospheric emissions and attenuation of non-methane organic compounds in cover soils at a French landfill

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Contributors: Scheutz, C., Bogner, J., Chanton, J., Blake, D., Morcet, M., Aran, C., Kjeldsen, P.
Pages: 1892-1908
Publication date: 2008
Peer-reviewed: Yes

Publication information
Journal: Waste Management
Volume: 28
Issue number: 10
ISSN (Print): 0956-053X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.94 SJR 1.456 SNIP 2.059
Web of Science (2017): Impact factor 4.723
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4 SJR 1.407 SNIP 2.159
Web of Science (2016): Impact factor 4.03
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.732 SNIP 2.263
Web of Science (2015): Impact factor 3.829
Web of Science (2015): Indexed yes
Biocover - Testing improvement strategies

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering

BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.43 SJR 1.763 SNIP 2.49
Web of Science (2014): Impact factor 3.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.39 SJR 1.815 SNIP 2.413
Web of Science (2013): Impact factor 3.157
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.91 SJR 1.59 SNIP 2.18
Web of Science (2012): Impact factor 2.485
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.99 SJR 1.694 SNIP 2.071
Web of Science (2011): Impact factor 2.428
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.553 SNIP 1.821
Web of Science (2010): Impact factor 2.358
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.519 SNIP 1.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.375 SNIP 2.145
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.998 SNIP 1.785
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.021 SNIP 1.819
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.065 SNIP 1.653
Scopus rating (2004): SJR 1.271 SNIP 1.911
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.853 SNIP 1.234
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.498 SNIP 0.903
Scopus rating (2001): SJR 0.45 SNIP 0.731
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.328 SNIP 0.444
Scopus rating (1999): SJR 0.26 SNIP 0.541
Original language: English
DOIs:
10.1016/j.wasman.2007.09.010
Source: orbit
Source-ID: 235414
Research output: Research - peer-review ; Journal article – Annual report year: 2008

Biocover - Testing improvement strategies
Concurrent ethene generation and growth of Dehalococcoides containing vinyl chloride reductive dehalogenase genes during an enhanced reductive dechlorination field demonstration

Dehalococcoides bacteria that produce catabolic vinyl chloride (VC) reductive dehalogenase enzymes have been implicated as a requirement for successful biological dechlorination of VC to ethene in groundwater systems. Therefore, the functional genes in Dehalococcoides that produce VC reductase (e.g., vcrA) may be important biomarkers for predicting and monitoring the performance of bioremediation systems treating chloroethenes via enhanced reductive dechlorination (ERD). As part of an ERD field demonstration, 45 groundwater samples were analyzed for vcrA using quantitative PCR. The demonstration delivered lactate continuously via groundwater recirculation over 201 days to an aquifer contaminated with cis-1,2-dichloroethene (cDCE, similar to 150 μM) and VC (similar to 80 μM). Ethene (similar to 4 μM) and Dehalococcoides containing vcrA (average concentration of 4 x 10³ gene copies L⁻¹) were detected a priori in the demonstration plot however, aquifer materials in a bench treatability test were able to dechlorinate cDCE with only a 4-month lag period. Given the short (7-month) schedule for the field demonstration, the field plot was bioaugmented on Day 69 with a mixed culture (KB-1) that included Dehalococcoides containing vcrA. Stimulated ethene generation commenced within four weeks of donor addition. Ethene concentrations increased until Day 145, and reached maximum concentrations of 10-25 μM. Concentrations of vcrA increased concurrently with ethene production until Day 145, and plateaued thereafter at 10⁷ to 10⁸ gene copies L⁻¹. These results indicate simultaneous growth of Dehalococcoides containing vcrA and ethene generation in an ERD field application. The quantitative increase in concentrations of Dehalococcoides containing vcrA at this site provide further evidence that the vcrA gene is an effective biomarker for field-scale ERD systems.
Kan vi reducere udslippet af drivhugasser fra vores lossepladser?

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Contributors: Kjeldsen, P., Scheutz, C., Fredenslund, A. M.
Pages: 26-28
Publication date: 2008
Peer-reviewed: No

Methods for quantifying gaseous emissions from full-scale windrow composting of garden waste

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Contributors: Andersen, J. K., Boldrin, A., Christensen, T. H., Scheutz, C.
Pages: 088
Publication date: 2008

Host publication information
Volume: Proceedings. CD-ROM
Place of publication: Weimar, Germany
Publisher: Verlag ORBIT e.V.
Source: orbit
Source-ID: 224643
Research output: Research › Article in proceedings – Annual report year: 2008

Reduction of methane emissions from landfills by use of engineered biocover system established at the Fakse Landfill, Denmark

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Publication date: 2008

Host publication information
Title of host publication: Global waste management symposium, Promoting technology and scientific innovation, 7-10 September 2008, Copper Conference Center, Colorado, USA. Manuscripts
Volume: CD-ROM
Place of publication: New York, NY
Publisher: Penton Media Inc.
Source: orbit
Source-ID: 223804
Research output: Research - peer-review › Article in proceedings – Annual report year: 2008

Spatial and temporal variability in load and how it affects total methane oxidation in a field trial biocover window in Fakse, Denmark

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Stimulated reductive dechlorination of 1,1,1-trichloroethane in mixed chlorinated solvent contamination in clayey till: Integrated treatability tests and field site characterization

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Pages: A-040
Publication date: 2008

Stimulated reductive dechlorination of 1,1,1-trichloroethane in mixed chlorinated solvent contamination in clayey till: Integrated treatability tests and field site characterization

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Pages: 38-41
Publication date: 2008

Transport and reaction processes affecting the attenuation of landfill gas in cover soils
Methane and trace organic gases produced in landfill waste are partly oxidized in the top 40 cm of landfill cover soils under aerobic conditions. The balance between the oxidation of landfill gases and the ingress of atmospheric oxygen into the soil cover determines the attenuation of emissions of methane, chlorofluorocarbons, and hydrochlorofluorocarbons to the atmosphere. This study was conducted to investigate the effect of oxidation reactions on the overall gas transport regime and to evaluate, the contributions of various gas transport processes on methane attenuation in landfill cover soils. For this purpose, a reactive transport model that includes advection and the Dusty Gas Model for simulation of multicomponent gas diffusion was used. The simulations are constrained by data from a series of counter-gradient laboratory experiments. Diffusion typically accounts for over 99% of methane emission to the atmosphere. Oxygen supply into the soil column is driven exclusively by diffusion, whereas advection outward offsets part of the diffusive contribution. In the reaction zone, methane consumption reduces the pressure gradient, further decreasing the significance of advection near the top of the column. Simulations suggest that production of water or accumulation of exopolymeric substances due to microbially mediated methane oxidation can significantly reduce diffusive fluxes. Assuming a constant
rate of methane production within a landfill, reduction of the diffusive transport properties, primarily due to exopolymeric substance production, may result in reduced methane attenuation due to limited O2-ingress. Copyright © 2008 by the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America. All rights reserved.
Chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), and hydrofluorocarbons (HFCs) have been used as blowing agents (BAs) for foam insulation in home appliances and building materials, which after the end of their useful life are disposed of in landfills. The objective of this project was to evaluate the potential for degradation of BAs in landfills, and to develop a landfill model, which could simulate the fate of BAs in landfills. The investigation was performed by use of anaerobic microcosm studies using different types of organic waste and anaerobic digested sludge as inoculum. The BAs studied were CFC-11, CFC-12, HCFC-141b, HFC-134a, and HFC-245fa. Experiments considering the fate of some of the expected degradation products of CFC-11 and CFC-12 were included like HCFC-21, HCFC-22, HCFC-31, HCFC-32, and HFC-41. Degradation of all studied CFCs and HCFCs was observed regardless the type of waste used. In general, the degradation followed first-order kinetics. CFC-11 was rapidly degraded from 590 μg L⁻¹ to less than 5 μg L⁻¹ within 15-20 days. The degradation pattern indicated a sequential production of HCFC-21, HCFC-31, and HFC-41. However, the production of degradation products did not correlate with a stoichiometric removal of CFC-11 indicating that other degradation products were produced. HCFC-21 and HCFC-31 were further degraded whereas no further degradation of HFC-41 was observed. The degradation rate coefficient was directly correlated with the number of chlorine atoms attached to the carbon. The highest degradation rate coefficient was obtained for CFC-11, whereas lower rates were seen for HCFC-21 and HCFC-31. Equivalent results were obtained for CFC-12. HCFC-141b was also degraded with rates comparable to HCFC-21 and CFC-12. Anaerobic degradation of the studied HFCs was not observed in any of the experiments within a run time of up to 200 days. The obtained degradation rate coefficients were used as input for an extended version of an existing landfill fate model incorporating a time dependent BA release from co-disposed foam insulation waste. Predictions with the model indicate that the emission of foam released BAs may be strongly attenuated by microbial degradation reactions. Sensitivity analysis suggests that there is a need for determination of degradation rates under more field realistic scenarios.
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 6.58 SJR 2.535 SNIP 1.941
Web of Science (2017): Impact factor 6.653
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.26 SJR 2.559 SNIP 1.902
Web of Science (2016): Impact factor 6.198
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 5.61 SJR 2.546 SNIP 1.838
Web of Science (2015): Impact factor 5.393
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 5.5 SJR 2.777 SNIP 2.003
Web of Science (2014): Impact factor 5.33
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 5.52 SJR 2.952 SNIP 2.102
Web of Science (2013): Impact factor 5.481
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 5.17 SJR 3.115 SNIP 2.043
Web of Science (2012): Impact factor 5.257
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.16 SJR 3.18 SNIP 1.945
Web of Science (2011): Impact factor 5.228
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.979 SNIP 1.726
Web of Science (2010): Impact factor 4.827
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.86 SNIP 1.809
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.96 SNIP 1.935
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.774 SNIP 1.914
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.55 SNIP 1.893
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.608 SNIP 1.999
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.86 SNIP 2.046
Web of Science (2004): Indexed yes
Host publication information
Title of host publication: Progress in environmental science and technology : Proceedings of the 2007 International Symposium, Beijing, China, November 13-16, 2007
Volume: Vol. I
Place of publication: Beijing
Publisher: Science Press
Source: orbit
Source-ID: 224651
Research output: Research › Article in proceedings – Annual report year: 2007

Biocover - Whole landfill methane emission

General information
State: Published
Organisations: Department of Environmental Engineering
Number of pages: 27
Publication date: 2007

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institute of Environment & Resources, Technical University of Denmark
Original language: English
Electronic versions:
MR2007_280.pdf
Source: orbit
Source-ID: 209699
Research output: Research › Report – Annual report year: 2007

Challenges in remediation of low permeability sediments by enhanced reductive dechlorination of chlorinated solvents

General information
State: Published
Organisations: Department of Environmental Engineering
Publication date: 2007

Host publication information
Volume: CD-ROM
Place of publication: Wembly, WA
Publisher: CSIRO
Source: orbit
Source-ID: 208441
Research output: Research › peer-review › Article in proceedings – Annual report year: 2007

Dynamics of reductive TCE dechlorination in two distinct H2 supply scenarios and at various temperatures

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Heimann, A. C., Fris, A. K., Scheutz, C., Jakobsen, R.
Pages: 167-179
Publication date: 2007
Peer-reviewed: Yes

Publication information
Journal: Biodegradation
Volume: 18
ISSN (Print): 0923-9820
Ratings:

BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes

BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes

BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.43 SJR 0.876 SNIP 0.922
Web of Science (2017): Impact factor 2.41
Web of Science (2017): Indexed yes

BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.41 SJR 0.818 SNIP 1.072
Web of Science (2016): Impact factor 2.018

BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.37 SJR 0.895 SNIP 1.071
Web of Science (2015): Impact factor 2.208

BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.42 SJR 0.968 SNIP 1.208
Web of Science (2014): Impact factor 2.336
Web of Science (2014): Indexed yes

BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.63 SJR 1.105 SNIP 1.447
Web of Science (2013): Impact factor 2.492

ISI indexed (2013): ISI indexed yes

BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.22 SJR 1.034 SNIP 1.197
Web of Science (2012): Impact factor 2.173
ISI indexed (2012): ISI indexed yes

BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.31 SJR 1.068 SNIP 1.103
Web of Science (2011): Impact factor 2.017

ISI indexed (2011): ISI indexed yes

BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.1 SNIP 0.989
Web of Science (2010): Impact factor 2.012

BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.012 SNIP 1.19
Web of Science (2009): Indexed yes

BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.969 SNIP 1.192
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.811 SNIP 1.101
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.977 SNIP 1.092
Scopus rating (2005): SJR 0.809 SNIP 0.953
Scopus rating (2004): SJR 0.868 SNIP 0.759
Scopus rating (2003): SJR 0.736 SNIP 0.849
Scopus rating (2002): SJR 0.771 SNIP 0.681
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.658 SNIP 0.953
Scopus rating (2000): SJR 0.905 SNIP 0.824
Web of Science (2000): Indexed yes
Engineered biocovers - Passive mitigation systems for landfill gas: Status for the demonstration project, BIOCOVER

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Kjeldsen, P., Fredenslund, A. M., Scheutz, C., Lemming, G.
Pages: 133-142
Publication date: 2007

Host publication information
Title of host publication: Waste matters. Integrating views : 2nd BOKU waste conference, 16-19 April 2007, Vienna, Austria
Place of publication: Wien
Publisher: Facultas
Source: orbit
Source-ID: 199226
Research output: Research - peer-review › Article in proceedings – Annual report year: 2007

Forundersøgelser til pilotprojekt om stimuleret reduktiv deklorering

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Number of pages: 216
Publication date: 2007

Publication information
Place of publication: København
Publisher: Miljøstyrelsen
Original language: Danish
(Miljøprojekt; No. 1146).
Source: orbit
Source-ID: 196126
Research output: Research › Report – Annual report year: 2007

Implementing biocover on Fakse landfill: landfill characterization, gas production modeling and mapping spatial variability in emissions

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Fredenslund, A. M., Lemming, G., Scheutz, C., Kjeldsen, P.
Publication date: 2007

Host publication information
Title of host publication: Sardinia 2007 : Eleventh International Waste Management and Landfill Symposium, 1-5 October, Sardinia, Italy. Proceedings
Volume: CD-ROM
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Source: orbit
Source-ID: 207413
Research output: Research › Article in proceedings – Annual report year: 2007
Investigation of emissions from the AV Miljø Landfill: 1. Gas quantity, quality and attenuation properties

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Fredenslund, A. M., Lemming, G., Kjeldsen, P.
Publication date: 2007

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institute of Environment & Resources, Technical University of Denmark
ISBN (Print): 978-87-91855-36-8
Original language: English
Electronic versions:
MR2007-117.pdf
Source: orbit
Source-ID: 201315
Research output: Research › Report – Annual report year: 2007

Methane emission quantification from landfills using a double tracer approach
A tracer method was successfully used for quantification of the whole methane (CH4) emission from Fakse landfill. By using two different tracers the emission from different sections of the landfill could be quantified. Furthermore, it was possible to determine the emissions from local on site sources; a composting facility and a sewage sludge storage unit by scaling the tracer method down. Two field campaigns were performed; during October 11-12, 2006 and February 19-20, 2007. At both field campaigns an overall leak search showed that the CH4 emission from the old landfill section was localized to the leachate collection wells and some slope areas. The average CH4 emission from the old landfill section was estimated to be 31.2±6.8 kg CH4 h-1 in October 2006 and 30.5±2.2 kg CH4 h-1 in February 2007, whereas the source at the new section was quantified to be 12.2±3.3 and 7.3±2.2 kg CH4 h-1 in the October respectively February measurement. The CH4 emission from the compost area was 0.5 kg CH4 h-1, whereas the carbon dioxide (CO2) flux and nitrous oxide (N2O) was quantified to be in the order of 332 kg CO2 h-1 and 0.06 kg N2O h-1 respectively. The sludge pit located west of the compost material was quantified to have an emission of 2.4 kg h-1 CH4, and 0.03 kg h-1 N2O.

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Samuelsson, J., Fredenslund, A. M., Kjeldsen, P.
Number of pages: 9
Publication date: 2007

Host publication information
Title of host publication: Sardinia 2007 : 11th International Waste Management and Landfill Symposium
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Source: orbit
Source-ID: 207412
Research output: Research › Article in proceedings – Annual report year: 2007

Methane mass balance for AV Miljø - a modern disposal site receiving waste with a low organic content

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Fredenslund, A. M., Nedenskov, J., Kjeldsen, P.
Publication date: 2007

Host publication information
Title of host publication: Sardinia 2007 : Eleventh International Waste Management and Landfill Symposium, 1-5 October, Sardinia, Italy. Proceedings
Volume: CD-ROM
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Oprensning af klorerede opløsningsmidler i moræneler med stimuleret reduktiv deklorering - pilotforsøg: Hovedrapport - Lok. nr. 461-169. Rugårdsvej 234-238, 5210 Odense NV

General information
State: Published
Organisations: Department of Environmental Engineering
Publication date: 2007

Pilotprojekt med stimuleret in situ reduktiv deklorering: Hovedrapport

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Number of pages: 124
Publication date: 2007

Pilotprojekt med stimuleret in situ reduktiv deklorering: Bilagsrapport

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Number of pages: 197
Publication date: 2007
Release of fluorocarbons from insulation foam in home appliances during shredding

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering
Contributors: Scheutz, C., Fredenslund, A. M., Kjeldsen, P.
Pages: 1452-1460
Publication date: 2007
Peer-reviewed: Yes

Publication information
Journal: Journal of Air and Waste Management Association
Volume: 57
Original language: English
DOIs: 10.3155/1047-3289.57.12.1452
Source: orbit
Source-ID: 208041
Research output: Research - peer-review › Journal article – Annual report year: 2007

Stimuleret reduktiv dechlorering: Dokumentation af pilotforsøg. Industrivej 3, Glostrup. Region Hovedstaden, Koncern Miljø

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Riis, C., Broholm, M. M., Hansen, M. H., Christensen, A., Bjerg, P. L.
Publication date: 2007

Publication information
Place of publication: Allerød
Publisher: Niras
Original language: Danish
Source: orbit
Source-ID: 199176
Research output: Research › Report – Annual report year: 2007

Testing a simple and low cost methane emission measurement method

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Jacobs, J., Scharff, H., Hensen, A., Raa, A., Scheutz, C., Samuelsson, J.
Publication date: 2007

Host publication information
Title of host publication: Sardinia 2007 : Eleventh International Waste Management and Landfill Symposium, 1-5 October, Sardinia, Italy
Volume: Proceedings. CD-ROM
Source: orbit
Source-ID: 208052
Research output: Research › Article in proceedings – Annual report year: 2007

Anaerob dechlorering: Processer og bakterier

General information
State: Published
Biocover - Measurement of spatial variability in emissions

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Fredenslund, A. M., Kjeldsen, P., Scheutz, C.
Publication date: 2006

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institute of Environment & Resources, Technical University of Denmark

A rigorous field demonstration of stimulated reductive dechlorination and bioaugmentation in clay

General information
State: Published
Organisations: Department of Environmental Engineering
Publication date: 2006

Host publication information
Title of host publication: Remediation of Chlorinated and Recalcitrant Compounds, The 5th International Conference, Monterey, May 22-25, 2006 : Platform Abstracts
Volume: B7. Improved delivery mechanisms
Place of publication: Columbus, OH
Publisher: Battelle Memorial Institute
Source: orbit
Source-ID: 189428
Research output: Research › Conference abstract in proceedings – Annual report year: 2006

Organisations: Department of Environmental Engineering
Pages: 85-96
Publication date: 2006
Fate of fluorocarbons released from insulation foam waste disposed of in an automotive shredder residue landfill cell

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Kjeldsen, P., Fredenslund, A. M., Scheutz, C.
Pages: 120-121
Publication date: 2006

Host publication information
Title of host publication: Abstracts proceedings of the 4th intercontinental landfill research symposium, 14-16 June 2006, Gällivare, Sweden
Place of publication: Luleå
Publisher: Luleå University of Technology, Department of Civil and Environmental Engineering, Division of Waste Science and Technology
Editor: Lagerkvist, A.
Source: orbit
Source-ID: 262584
Research output: Research › Conference abstract in proceedings – Annual report year: 2006

Fate of fluorocarbons released from polyurethane insulation foam waste disposed of in an automotive shredder residue landfill cell

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Kjeldsen, P., Fredenslund, A. M., Scheutz, C., Lemming, G.
Pages: 595-605
Publication date: 2006

Host publication information
Volume: Conference Proceedings. CD-ROM
Place of publication: Arlington,VA
Publisher: American Chemistry Council
Source: orbit
Source-ID: 222807
Research output: Research › Article in proceedings – Annual report year: 2006

Field demonstration of biostimulation and bioaugmentation for remediation of chlorinated solvents in a sand aquifer

General information
State: Published
Organisations: Department of Environmental Engineering
Publication date: 2006
Peer-reviewed: No
Event: Abstract from 1st Joint Nordic Meeting on Remediation of Contaminated Sites, Malmö, Sweden.
Source: orbit
Source-ID: 191328
Research output: Research › Conference abstract for conference – Annual report year: 2006

Field demonstration of stimulated reductive dechlorination and bioaugmentation after hydraulic fracturing in clayey till

General information
Field measurements of methane emissions and oxidation at a modern disposal site receiving waste with a low organic content

Field-scale pilot test evaluating pneumatic fracturing in clayey till: Paper B-03

Field-scale pilot test evaluating pneumatic fracturing in clayey till

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Fredenslund, A. M., Nedenskov, J., Kjeldsen, P.
Pages: 179-180
Publication date: 2006

Host publication information
Title of host publication: Remediation of Chlorinated and Recalcitrant Compounds: The 5th International Conference, Monterey, May 22-25, 2006, Proceedings
Volume: CD-ROM
Place of publication: Columbus, OH
Publisher: Battelle Memorial Institute
Source: orbit
Source-ID: 193341
Research output: Research › peer-review › Article in proceedings – Annual report year: 2006

Field-scale pilot test evaluating pneumatic fracturing in clayey till

General information
State: Published
Organisations: Department of Environmental Engineering
Publication date: 2006

Host publication information
Title of host publication: Remediation of Chlorinated and Recalcitrant Compounds: The 5th International Conference, Monterey, May 22-25, 2006
Volume: Poster Abstracts. B7. In Situ Chemical Oxidation (ISCO) and Biological Treatment
Measuring methane emission rates through leachate collection system at a modern landfill using a small scale tracer release technique

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Fredenslund, A. M., Kjeldsen, P., Scheutz, C.
Pages: 77-78
Publication date: 2006

Host publication information
Title of host publication: Abstracts proceedings of the 4th intercontinental landfill research symposium, 14-16 June 2006, Gällivare, Sweden
Place of publication: Luleå
Publisher: Luleå University of Technology, Department of Civil and Environmental Engineering, Division of Waste Science and Technology
Editor: Lagerkvist, A.
Source: orbit
Source-ID: 262583
Research output: Research › Conference abstract in proceedings – Annual report year: 2006

Naturlig og stimuleret nedbrydning af 1,1,1-TCA

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Hansen, M. H., Bjerg, P. L.
Publication date: 2006

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Miljø & Ressourcer, Danmarks Tekniske Universitet & Københavns Amt
ISBN (Print): 8791855217
Original language: Danish
URLs:
Source: orbit
Source-ID: 195400
Research output: Research › Report – Annual report year: 2006

Oprensning af chlorerede opløsningsmidler i moræne: Betydning af diffusion

General information
State: Published
Organisations: Department of Environmental Engineering
Pages: 37-48
Publication date: 2006

Host publication information
Title of host publication: Vintermøde om jord- og grundvandsforurening, Vingstedcentret 7.-8. marts 2006
Volume: bind 1
Place of publication: Kgs. Lyngby
Publisher: ATV Jord og Grundvand
Source: orbit
Source-ID: 188673
Research output: Research › Article in proceedings – Annual report year: 2006
Oprensning af klorerede opløsningsmidler med stimuleret reduktiv deklorering: felterfaringer og perspektivering

General information
State: Published
Organisations: Department of Environmental Engineering
Pages: 97-110
Publication date: 2006

Host publication information
Title of host publication: Vintermøde om jord- og grundvandsforurening, Vingstedcentret 7.-8. marts 2006
Volume: bind 1
Place of publication: Kgs. Lyngby
Publisher: ATV Jord og Grundvand
Source: orbit
Source-ID: 188674
Research output: Research › Article in proceedings – Annual report year: 2006

Pilotforsøg med pneumatisk frakturering til oprensning af forurening i moræneler

General information
State: Published
Organisations: Department of Environmental Engineering
Pages: 13-24
Publication date: 2006

Host publication information
Title of host publication: Vintermøde om jord- og grundvandsforurening
Volume: bind 1
Place of publication: Kgs. Lyngby
Publisher: ATV Jord og Grundvand
Source: orbit
Source-ID: 188672
Research output: Research › Article in proceedings – Annual report year: 2006

Pneumatisk frakturering: Dokumentation af pilotforsøg. Industrivej 3, Glostrup. Københavns Amt

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Riis, ..., Christensen, A., Scheutz, C., Christensen, S. B., Broholm, M. M., Bjerg, P. L.
Publication date: 2006

Publication information
Place of publication: Allerød
Publisher: Niras
Original language: Danish
URLs:
Source: orbit
Source-ID: 194021
Research output: Research › Report – Annual report year: 2006

Pneumatisk frakturering: Dokumentation af pilotforsøg Vadsbyvej 16A, Hedehusene. Københavns Amt

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Riis, C., Christensen, A., Bjerg, P. L., Christensen, S. B., Broholm, M. M., Scheutz, C.
Stimulated in situ reductive dechlorination of TCE in clayey till: Tommerup field pilot test

General information
State: Published
Organisations: Department of Environmental Engineering
Publication date: 2006

Host publication information
Title of host publication: Remediation of Chlorinated and Recalcitrant Compounds, The 5th International Conference, Monterey, May 22-25, 2006 : Platform Abstracts
Place of publication: Columbus, OH
Publisher: Battelle Memorial Institute
Source: orbit
Source-ID: 189422
Research output: Research › Conference abstract in proceedings – Annual report year: 2006

Udbredelse af Dehalococciider i danske grundvandsakviferer

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Begtrup, E., Bjerg, P. L.
Publication date: 2006

Publication information
Place of publication: Kgs. Lyngby
Publisher: Institut for Miljø & Ressourcer, Danmarks Tekniske Universitet & Københavns Amt
ISBN (Print): 8791855233
Original language: Danish
URLs:
Source: orbit
Source-ID: 195402
Research output: Research › Report – Annual report year: 2006

Biodegradation of trace gases in simulated landfill soil cover systems

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Kjeldsen, P.
Pages: 878-885
Publication date: 2005
Peer-reviewed: Yes
Biodegradation of trace gases in simulated landfill biocover systems

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Pedersen, G. B., Kjeldsen, P.
Publication date: 2005

Host publication information
Title of host publication: Sardinia 2005: Tenth International Waste Management and Landfill Symposium, 3-7 October, Sardinia, Italy
Volume: Proceedings. CD-ROM
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Editors: Cossu, R., Stegmann, R.
Source: orbit
Source-ID: 183544
Research output: Research › Article in proceedings – Annual report year: 2005

Field measurements of methane emissions and oxidation at a modern disposal site receiving waste with a low organic content

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Fredenslund, A. M., Nedenskov, J., Kjeldsen, P.
Publication date: 2005

Host publication information
Title of host publication: Sardinia 2005: Tenth International Waste Management and Landfill Symposium, 3-7 October, Sardinia, Italy
Volume: Proceedings. CD-ROM
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Editors: Cossu, R., Stegmann, R.
Source: orbit
Source-ID: 183546
Research output: Research › Article in proceedings – Annual report year: 2005

Modelling the behaviour of slowly released organic compounds in landfills

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Kjeldsen, P., Scheutz, C.
Publication date: 2005
Protocol for the use of enhanced in situ bioremediation at chlorinated solvent sites in Denmark

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Durant, N., Cox, E., Jørgensen, T., Bjerg, P. L., Scheutz, C., Rasmussen, P.
Publication date: 2005

Stimuleret in situ reduktiv deklorering: Videnopsamling og screening af lokaliteter

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Jørgensen, T., Scheutz, C., Durant, N., Cox, E., Bordum, N., Rasmussen, P., Bjerg, P. L.
Number of pages: 153
Publication date: 2005

Stimuleret in situ reduktiv deklorering: Videnopsamling og screening af lokaliteter - Appendiksrappport

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Jørgensen, T., Scheutz, C., Durant, N., Cox, E., Bordum, N., Rasmussen, P., Bjerg, P. L.
Number of pages: 136
Publication date: 2005
Attenuation of methane and volatile organic compounds in landfill soil covers

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Mosbæk, H., Kjeldsen, P.
Pages: 61-71
Publication date: 2004
Peer-reviewed: Yes

Publication information
Journal: Journal of Environmental Quality
Volume: 33
ISSN (Print): 0047-2425
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.54 SJR 1.092 SNIP 1.066
Web of Science (2017): Impact factor 2.405
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.51 SJR 1.065 SNIP 1.157
Web of Science (2016): Impact factor 2.344
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.69 SJR 1.269 SNIP 1.237
Web of Science (2015): Impact factor 2.238
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.66 SJR 1.268 SNIP 1.28
Web of Science (2014): Impact factor 2.652
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.7 SJR 1.325 SNIP 1.279
Web of Science (2013): Impact factor 2.345
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.51 SJR 1.364 SNIP 1.23
Web of Science (2012): Impact factor 2.353
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.53 SJR 1.478 SNIP 1.364
Web of Science (2011): Impact factor 2.324
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.307 SNIP 1.319
Web of Science (2010): Impact factor 2.236
Environmental factors influencing attenuation of methane and hydrochlorofluorocarbons in landfill cover soils

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Kjeldsen, P.
Pages: 72-79
Publication date: 2004
Peer-reviewed: Yes

Publication information
Journal: Journal of Environmental Quality
Volume: 33
ISSN (Print): 0047-2425
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.54 SJR 1.092 SNIP 1.066
Web of Science (2017): Impact factor 2.405
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.51 SJR 1.065 SNIP 1.157
Web of Science (2016): Impact factor 2.344
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.69 SJR 1.269 SNIP 1.237
Web of Science (2015): Impact factor 2.238
Web of Science (2015): Indexed yes
Evaluation of bioenergetics of redox reactions and dechlorination processes in redox sequence experiments

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Jakobsen, R., Begtrup, E., Palstrom, P., Scheutz, C., Bjerg, P. L.
Number of pages: 52
Publication date: 2004

Host publication information
Fyns Amt. Forurenet lokalitet nr. 485-20 - Tidligere maskinfabrik, Sortebrovej 26, 5690 Tommerup: Undersøgelser til vurdering af stimuleret in-situ reduktiv deklorering og kemisk oxidation ved oprensning af grundvandsforurening

General information
State: Published
Organisations: Department of Environmental Engineering
Publication date: 2004

Publication information
Place of publication: Odense
Publisher: Fyns Amt & Hedeselskabet
Original language: Danish
Electronic versions:
MR2004_231.pdf
Source: orbit
Source-ID: 189556
Research output: Research › Report – Annual report year: 2004


General information
State: Published
Organisations: Department of Environmental Engineering
Publication date: 2004

Publication information
Place of publication: Odense
Publisher: Fyns Amt & Hedeselskabet
Original language: Danish
Source: orbit
Source-ID: 189554
Research output: Research › Report – Annual report year: 2004

Landfill gas migration studies at a selected landfill in Malaysia

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Fauziah, S., Agamuthu, P., Kjeldsen, P., Scheutz, C.
Pages: 71-78
Publication date: 2004
Peer-reviewed: Yes

Publication information
Volume: 23
ISSN (Print): 1394-1712
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Source: orbit
Source-ID: 90504
Research output: Research - peer-review › Journal article – Annual report year: 2004
NAPL plumes and in situ remediation: Future challenges?

**General information**
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Urban Water Engineering
Number of pages: 16
Publication date: 2004

**Host publication information**
Publisher: IAHS Press
Source: orbit
Source-ID: 135566
Research output: Research › peer-review › Conference abstract in proceedings – Annual report year: 2004

Vurdering af oxidantforbrug ved in situ kemisk oxidation på danske lokaliteter

**General information**
State: Published
Organisations: Department of Environmental Engineering
Contributors: Hønning, J., Skou, J., Scheutz, C., Bjerg, P. L.
Pages: 51-62
Publication date: 2004

**Host publication information**
Title of host publication: Vintermøde om jord- og grundvandsforurening, Vingstedcentret 9.-10. marts
Volume: bind 1
Place of publication: Kgs. Lyngby
Publisher: ATV Jord og Grundvand
Source: orbit
Source-ID: 135668
Research output: Research › Article in proceedings – Annual report year: 2004

Aerobic degradation of non-methane organic compounds in landfill cover soils

**General information**
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Bogner, J., Morcet, M., Kjeldsen, P.
Publication date: 2003

**Host publication information**
Title of host publication: Sardinia 2003: Ninth International Waste Management and Landfill Symposium, 6-10 October, Sardinia, Italy. Proceedings
Volume: CD-ROM
Place of publication: Cagliari
Publisher: CISA, Environmental Sanitary Engineering Centre
Editors: Christensen, T. H., Cossu, R., Stegmann, R.
Source: orbit
Source-ID: 135730
Research output: Research › Article in proceedings – Annual report year: 2003

Atmospheric emissions and attenuation of non-methane organic compounds in cover soils at Grand’Landes Landfill

**General information**
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Kjeldsen, P., Bogner, J., Blake, D., Chanton, J.
Number of pages: 57
Publication date: 2003
Attenuation of alternative blowing agents in landfills

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Fredenslund, A. M., Kjeldsen, P.
Number of pages: 66
Publication date: 2003

Capacity for biodegradation of CFCs and HCFCs in a methane oxidative counter-gradient laboratory system simulating landfill soil covers

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Kjeldsen, P.
Pages: 5143-5149
Publication date: 2003
Peer-reviewed: No
Comparative oxidation and net emissions of methane and selected non-methane organic compounds in landfill cover soils

**General information**
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Bogner, J., Chanton, J., Blake, D., Morcet, M., Kjeldsen, P.
Pages: 5150-5158
Publication date: 2003
Peer-reviewed: No

**Publication information**
Journal: Environmental Science and Technology
Volume: 37
ISSN (Print): 1382-3124
Ratings:
Web of Science (2019): Indexed yes
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed yes
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
Source: orbit
Source-ID: 43905
Research output: Research › Journal article – Annual report year: 2003

Field measurement of non-methane organic compound emissions from landfill cover soils

**General information**
State: Published
Organisations: Department of Environmental Engineering
Contributors: Bogner, J., Scheutz, C., Chanton, J., Blake, D., Morcet, M., Aran, C., Kjeldsen, P.
Publication date: 2003

**Host publication information**
Title of host publication: Sardinia 2003 : Ninth International Waste Management and Landfill Symposium, 6-10 October, Sardinia, Italy. Proceedings
Volume: CD-ROM
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Editors: Christensen, T. H., Cossu, R., Stegmann, R.
Source: orbit
Source-ID: 135693
Research output: Research › Article in proceedings – Annual report year: 2003

In situ chemical oxidation of natural organic matter by potassium permanganate: Evaluation of potassium permanganate consumption and oxidation kinetics

**General information**
State: Published
Organisations: Department of Environmental Engineering
Contributors: Hønning, J., Skou, J., Scheutz, C., Bjerg, P. L.
Number of pages: 262
Publication date: 2003

**Host publication information**
Title of host publication: OSR-1, TiO2-8 & AOTs-9, October 23-26, 2003, Montreal, Quebec : Abstracts
Place of publication: London, Ontario, Canada
Publisher: Redox Technologies, Inc.
Release and attenuation of fluorocarbons in landfills

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Kjeldsen, P., Scheutz, C., Fredenslund, A. M., Poulsen, H.
Publication date: 2003

Host publication information
Title of host publication: Sardinia 2003 : Ninth International Waste Management and Landfill Symposium, 6-10 October, Sardinia, Italy. Proceedings
Volume: CD-ROM
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Editors: Christensen, T. H., Cossu, R., Stegmann, R.
Source: orbit
Source-ID: 135723
Research output: Research › Article in proceedings – Annual report year: 2003

Several halocarbons with very high global warming and ozone depleting potentials have been used as blowing agent for insulation foam in refrigerators and freezers. Many appliances are shredded after the end of their useful life. Release experiments carried out in the laboratory on insulation foam blown with CFC-11, HCFC-141b, HFC-134a, and HFC-245fa revealed that most of the blowing agent is not released to the atmosphere during a six-week period following the shredding process. The fraction which is released in the six-week period is highly dependent on how fine the foam is shredded. The residual blowing agent remaining after the six-week period may be very slowly released if the integrity of the foam particles with respect to diffusional properties is kept after disposal of the foam waste in landfills. Laboratory experiments simulating attenuation processes in the landfilled waste and the landfill soil cover showed a substantial degradation of CFC-11 and to a lesser extent of HCFC-141b which may lead to significant emission reduction of the blowing agents. HFC-134a and HFC-245fa were not degraded in the landfilled waste or the cover soil within the time frame of the experiments (210 days).

Short- and long-term releases of fluorocarbons from disposal of polyurethane foam waste

Several halocarbons having very high global warming or ozone depletion potentials have been used as a blowing agent (BA) for insulation foam in home appliances, such as refrigerators and freezers. Many appliances are shredded after the end of their useful life. Release experiments carried out in the laboratory on insulation foam blown with the blowing agents CFC-11, HCFC-141b, HCF-134fa, and HFC-245fa revealed that not all blowing agents are released during a 6-week period following the shredding process. The experiments confirmed the hypothesis that the release could be divided into three segments: By shredding foam panels, a proportion of the closed cells is either split or damaged to a degree allowing for a sudden release of the contained atmosphere in the cell (the instantaneous release). Cells adjacent to the cut surface may be only slightly damaged by tiny cracks or holes allowing a relative slow release of the BA to the surroundings (the short-term release). A significant portion of the cells in the foam particle will be unaffected and only allows release governed by slow diffusion through the PUR cell wall (the long-term release). The magnitude of the releases is for all three types highly dependent on how fine the foam is shredded. The residual blowing agent remaining after the 6-week period may be very slowly released if the integrity of the foam particles with respect to diffusion properties is kept after disposal of the foam waste on landfills. It is shown by setting up a national model simulating the BA releases following
decommissioning of used domestic refrigerators/freezers in the United States that the release patterns are highly dependent on how the appliances are shredded.

**General information**

State: Published

Organisations: Department of Environmental Engineering

Contributors: Kjeldsen, P., Scheutz, C.

Pages: 5071-5079

Publication date: 2003

Peer-reviewed: Yes

**Publication information**

Journal: Environmental Science & Technology (Washington)

Volume: 37

Issue number: 21

ISSN (Print): 0013-936X

Ratings:

BFI (2019): BFI-level 2

Web of Science (2019): Indexed yes

BFI (2018): BFI-level 2

Web of Science (2018): Indexed yes

BFI (2017): BFI-level 2

Scopus rating (2017): CiteScore 6.58 SJR 2.535 SNIP 1.941

Web of Science (2017): Impact factor 6.653

Web of Science (2017): Indexed yes

BFI (2016): BFI-level 2

Scopus rating (2016): CiteScore 6.26 SJR 2.559 SNIP 1.902

Web of Science (2016): Impact factor 6.198

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 2

Scopus rating (2015): CiteScore 5.61 SJR 2.546 SNIP 1.838

Web of Science (2015): Impact factor 5.393

Web of Science (2015): Indexed yes

BFI (2014): BFI-level 2

Scopus rating (2014): CiteScore 5.5 SJR 2.777 SNIP 2.003

Web of Science (2014): Impact factor 5.33

Web of Science (2014): Indexed yes

BFI (2013): BFI-level 2

Scopus rating (2013): CiteScore 5.52 SJR 2.952 SNIP 2.102

Web of Science (2013): Impact factor 5.481

ISI indexed (2013): ISI indexed yes

Web of Science (2013): Indexed yes

BFI (2012): BFI-level 2

Scopus rating (2012): CiteScore 5.17 SJR 3.115 SNIP 2.043

Web of Science (2012): Impact factor 5.257

ISI indexed (2012): ISI indexed yes

Web of Science (2012): Indexed yes

BFI (2011): BFI-level 2

Scopus rating (2011): CiteScore 5.16 SJR 3.18 SNIP 1.945

Web of Science (2011): Impact factor 5.228

ISI indexed (2011): ISI indexed yes

Web of Science (2011): Indexed yes

BFI (2010): BFI-level 2

Scopus rating (2010): SJR 2.979 SNIP 1.726

Web of Science (2010): Impact factor 4.827

Web of Science (2010): Indexed yes
Studies of gas migration on a selected landfill in Malaysia

General information
State: Published
Organisations: Department of Environmental Engineering, University of Malaya
Contributors: Fauziah, S., Agamuthu, P., Kjeldsen, P., Scheutz, C.
Pages: 321-324
Publication date: 2003

Host publication information
Title of host publication: Proceedings of the International Conference: Environmental Management & Technology: A Clean Environment Towards sustainable Development
Place of publication: Kuala Lumpur, Malaysia
Publisher: Malaysian University Consortium for Environment and Development - Industry and Urban Areas (MUCED-I&UA)
Source: orbit
Source-ID: 135703
Research output: Research › Article in proceedings – Annual report year: 2003

Attenuation of methane and trace organics in landfill soil covers

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C.
Number of pages: 25
Publication date: 2002

Publication information
Place of publication: Kgs. Lyngby
Determination of the fraction of blowing agent released from refrigerator/freezer foam after decommissioning the product

Several halocarbons having very high global warming potential have been used as blowing agent for insulation foam in refrigerators and freezers. Many appliances are shredded after the end of their useful life. Release experiments carried out in the laboratory on insulation foam revealed that most of the blowing agent is not released to the atmosphere during a six-week period following the shredding process. The fraction which is released in the six-week period, is highly dependent on how fine the foam is shredded. The residual blowing agent remaining after the six-week period may be very slowly released if the integrity of the foam particles with respect to diffusional properties is kept after disposal of the foam waste in landfills.

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Kjeldsen, P., Scheutz, C.
Pages: 219-224
Publication date: 2002

Host publication information
Place of publication: Rotterdam, NL
Publisher: Millpress
Editors: van Ham, J., Baede, A. P. M., Guicherit, R., Williams-Jacobse, J. G. F. M.
ISBN (Print): 90-77017-70-4
Determination of the fraction of blowing agent released from refrigerator/freezer foam after decommissioning the product

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Kjeldsen, P.
Publication date: 2002

Publication information
Place of publication: Kgs. Lyngby, Denmark
Publisher: Environment & Resources DTU. Technical University of Denmark
Original language: English
Electronic versions:
MR2002-052.pdf
Source: orbit
Source-ID: 43897
Research output: Research › Report – Annual report year: 2002

Methane oxidation and degradation of halocarbons in landfill soil covers

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Kjeldsen, P.
Pages: 453-454
Publication date: 2002

Host publication information
Place of publication: Rotterdam, NL
Publisher: Millpress
Editors: van Ham, J., Baede, A. P. M., Guicherit, R., Williams-Jacobse, J. G. F. M.
ISBN (Print): 90-77017-70-4
Keywords: biodegradation, soil column experiments, methane oxidation, halocarbons, Landfill gas
Source: orbit
Source-ID: 135792
Research output: Research › Article in proceedings – Annual report year: 2002

Methane oxidation and degradation of organic compounds in landfill soil covers

High rates of methane oxidation and degradation of the lowed halogenated methanes (TCM and DCM) and HCFCs (HCFC-21 and HCFC-22) were found in an investigation of the oxidation of methane and halogenated organic compounds (HOCs) in landfill gas affected soil. The degradation followed zero-order kinetics and occurred in parallel with the oxidation of methane. TcCM, CFC-11, and CFC-12 were not degradable in presence of oxygen and degradation of these compounds in the oxidative zone in landfill top covers is therefore expected to be limited. However these compounds were found degradable in the anaerobic zone in the lower part of soil columns permeated with artificial landfill gas. The lesser-chlorinated compounds were degraded in the upper oxic zone with overlapping gradients of methane and oxygen. Methane oxidation and degradation of HOCs in the top-soils may play a very important role in reducing the emission of both methane and trace components into the atmosphere.

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Kjeldsen, P.
Pages: 115-123
Publication date: 2002

Host publication information
Title of host publication: Proceedings from the Solid Waste Association of North America’s 25th Annual landfill gas Symposium, Monterey, CA March 25-28
Methane oxidation and biodegradation of halogenated organic compounds in landfill soil covers

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Scheutz, C., Kjeldsen, P.
Pages: 565-574
Publication date: 2001

Host publication information
Title of host publication: Sardinia 2001 : Leachate and Landfill Gas
Volume: Vol. II
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Editors: Christensen, T. H., Cossu, R., Stegmann, R.
Source: orbit
Source-ID: 135841
Research output: Research › Article in proceedings – Annual report year: 2001

Release of fluorocarbons from disposal of insulation foam waste

General information
State: Published
Organisations: Department of Environmental Engineering
Contributors: Kjeldsen, P., Scheutz, C., Jensen, M.
Pages: 209-216
Publication date: 2001

Host publication information
Title of host publication: Sardinia 2001 : The Sustainable Landfill
Volume: Vol. I
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Editors: Christensen, T. H., Cossu, R., Stegmann, R.
Source: orbit
Source-ID: 135828
Research output: Research › Article in proceedings – Annual report year: 2001

Methane oxidation and degradation of halogenated organic compounds in landfill gas affected soil

General information
State: Published
Organisations: Department of Environmental Science and Engineering
Contributors: Scheutz, C., Kjeldsen, P.
Publication date: 2000

Host publication information
Title of host publication: Proceedings of the Intercontinental Landfill Research Symposium
Source: orbit
Source-ID: 318608
Research output: Research › Article in proceedings – Annual report year: 2000

Removal of halogenated organic compounds in landfill gas by top covers containing zero-valent iron
Transformation of gaseous CCl3F and CCl4 by zero-valent iron was studied in systems unsaturated with water under anaerobic conditionss in an N2 gas and in a landfill gas atmosphere. The transformation was studied in batch as well as flow-through column tests. In both systems, the transformation process of the compounds was pseudo-firstorder. Transformation rate constants, referring to the water phase and normalized to 1 m2 iron surface/mL, of up to 1100 mL m-2 h-1 (batch) and 200 mL m-2 h-1 (flowthrough) were found. The transformation was strongly dependent on pH and the
presence of oxygen. During continuous aerobic conditions, the transformation of CCl3F decreased toward zero. Model calculations show that use of zero-valent iron in landfill top covers is a potential treatment technology for emission reduction of halogenated trace compounds from landfills.

Degradation of halogenated organic compounds in landfill top covers using iron metal

General information
State: Published
Organisations: Department of Environmental Science and Engineering
Contributors: Scheutz, C., Winther, K., Kjeldsen, P.
Publication date: 1999

Host publication information
Title of host publication: Sardinia 99, (eds. Christensen, T.H., Cossu, R. & Stegmann, R.)
Place of publication: Cagliari, Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Source: orbit
Source-ID: 172952
Research output: Research - peer-review › Article in proceedings – Annual report year: 1999

Projects:

Development of innovative remote sensing measurement techniques for quantification of greenhouse gases and ammonia from industrial and agricultural sources
Vechi, N. D. R., PhD Student, Department of Environmental Engineering
Scheutz, C., Main Supervisor
Mellqvist, J., Supervisor
01/12/2018 → 30/11/2021
Project: PhD

Understanding landfill methane emission dynamics as a basis for emission quantification
Kissas, K., PhD Student, Department of Environmental Engineering
Scheutz, C., Main Supervisor
Ibrom, A., Supervisor
Kjeldsen, P., Supervisor
01/12/2018 → 30/11/2021
Project: PhD

Quantification of trace gas emissions from waste management facilities
Duari, Z., PhD Student, Department of Environmental Engineering
Kjeldsen, P., Main Supervisor
Scheutz, C., Supervisor
Stipendie fra udlandet
01/11/2016 → 31/10/2019
Award relations: Quantification of trace gas emissions from waste management facilities
Project: PhD

Miljøvurdering af indsamling, genanvendelse og bortskaffelse af tøj, og tekstilaffald
Nørup, N., PhD Student, Department of Environmental Engineering
Scheutz, C., Main Supervisor
Damgaard, A., Supervisor
Pihl, K. A., Supervisor
Christensen, T. H., Examiner
Laitala, K., Examiner
Laner, D., Examiner
Industrial PhD
15/01/2015 → 17/02/2019
Award relations: Miljøvurdering af indsamling, genanvendelse og bortskaffelse af tøj, og tekstilaffald
Project: PhD

Whole gaseous emission measurements from waste treatment facilities / Gasemissionsmålinger fra affaldshåndteringssystemer
Mønster, J., PhD Student, Department of Environmental Engineering
Scheutz, C., Main Supervisor
Kjeldsen, P., Supervisor
Boldrin, A., Examiner
Oonk, J., Examiner
Imhoff, P. T., Examiner
1/3 DTU-stip, 2/3 FUR/andet
01/06/2010 → 27/08/2014
Award relations: Whole gaseous emission measurements from waste treatment facilities / Gasemissionsmålinger fra affaldshåndteringssystemer
Project: PhD

Optimization of greenhouse gas mitigation af landfills
Fathi Aghdam, E., PhD Student, Department of Environmental Engineering
Kjeldsen, P., Main Supervisor
Scheutz, C., Supervisor
Damgaard, A., Examiner
Oonk, J., Examiner
Gregory, R. G., Examiner
Samfinansierede - Virksomhed
01/01/2015 → 20/06/2018
Award relations: Optimization of greenhouse gas mitigation af landfills
Project: PhD

Development of innovative landfill gas management technologies
Fjelsted, L., PhD Student, Department of Environmental Engineering
Kjeldsen, P., Main Supervisor
Christensen, A. G., Supervisor
Scheutz, C., Supervisor
Damgaard, A., Examiner
Barlaz, M. A., Examiner
Gregory, R. G., Examiner
Industrial PhD
01/10/2014 → 22/01/2019
Award relations: Development of innovative landfill gas management technologies
Project: PhD

Full-scale quantification of greenhouse gas emissions from wastewater treatment plants
Delre, A., PhD Student, Department of Environmental Engineering
Scheutz, C., Main Supervisor
Mønster, J., Supervisor
Ibrom, A., Examiner
Allen, G., Examiner
Thomsen, M., Examiner
Samfinansieret - Andet
15/12/2013 → 21/03/2018
Award relations: Full-scale quantification of greenhouse gas emissions from wastewater treatment plants
Project: PhD

Partitioning between heterotrophic and autotrophic forest respiration by means of stable isotopes
Brændholt, A., PhD Student, Department of Environmental Engineering
Pilegaard, K., Main Supervisor
Ibrom, A., Supervisor
Larsen, K. S., Supervisor
Scheutz, C., Examiner
Rutting, T., Examiner
Jacobsen, T. F., Examiner
Offentlig finansiering
01/03/2014 → 30/09/2017
Award relations: Partitioning between heterotrophic and autotrophic forest respiration by means of stable isotopes
Project: PhD

Reduktion af gasemission fra lossepladser i reaktive barrierer
Scheutz, C., PhD Student, Department of Environmental Engineering
Kjeldsen, P., Main Supervisor
Christensen, T. H., Examiner
Höhener, P., Examiner
Stegmann, R., Examiner
DTU-lønnet stipendie
01/08/1998 → 10/01/2003
Award relations: Reduktion af gasemission fra lossepladser i reaktive barrierer
Project: PhD

Gas Generation and Emissions from Decomposition of Organic Wastes at Full-Scale Waste Treatment Facilities
Andersen, J. K., PhD Student, Department of Environmental Engineering
Scheutz, C., Main Supervisor
Christensen, T. H., Supervisor
Kjeldsen, P., Examiner
Jönsson, H., Examiner
Kranert, M., Examiner
DTU-lønnet stipendie
01/09/2007 → 21/12/2010
Award relations: Gas Generation and Emissions from Decomposition of Organic Wastes at Full-Scale Waste Treatment Facilities
Project: PhD

Fremtidens integrerede indsamlilng af affald
Larsen, A. W., PhD Student, Department of Environmental Engineering
Christensen, T. H., Main Supervisor
Scheutz, C., Examiner
Bilitewski, B., Examiner
Björklund, A., Examiner
DTU-lønnet stipendie
01/01/2006 → 11/11/2009
Award relations: Fremtidens integrerede indsamlilng af affald
Defining Quality Indicators in Waste Management
Merrild, H. K., PhD Student, Department of Environmental Engineering
Christensen, T. H., Main Supervisor
Scheutz, C., Examiner
Hansen, J. A., Examiner
Salhofer, S., Examiner
DTU-lønnet stipendie
01/02/2005 → 01/07/2009
Award relations: Defining Quality Indicators in Waste Management
Project: PhD

Reduction of Methane Emissions from Landfills by Use of Engineered Biocovers
Pedersen, G. B., PhD Student, Department of Environmental Engineering
Kjeldsen, P., Main Supervisor
Scheutz, C., Supervisor
Christensen, T. H., Examiner
Gebert, J., Examiner
Rintala, J. A., Examiner
DTU-lønnet stipendie
01/09/2004 → 25/08/2010
Award relations: Reduction of Methane Emissions from Landfills by Use of Engineered Biocovers
Project: PhD

PhD Project 12 - Life cycle assessment of special and hazardous waste types and fractions
Bigum, M. K. K., PhD Student, Department of Environmental Engineering
Christensen, T. H., Main Supervisor
Scheutz, C., Supervisor
Kjeldsen, P., Examiner
Olsen, S. I., Examiner
Salhofer, S., Examiner
1/3 DTU-stip, 2/3 FUR/andet
01/06/2009 → 26/01/2015
Award relations: PhD Project 12 - Life cycle assessment of special and hazardous waste types and fractions
Project: PhD

Life cycle assessment of energy technologies and energy systems
Turconi, R., PhD Student, Department of Environmental Engineering
Astrup, T. F., Main Supervisor
Scheutz, C., Examiner
Olsen, S. I., Examiner
Powers, S. E., Examiner
Technical University of Denmark
01/09/2010 → 04/06/2014
Award relations: Life cycle assessment of energy technologies and energy systems
Project: PhD

Gad generation and emission at waste disposal sites receiving low organic waste
Mou, Z., PhD Student, Department of Environmental Engineering
Kjeldsen, P., Main Supervisor
Scheutz, C., Supervisor
Damgaard, A., Examiner
Rintala, J. A., Examiner
Gregory, R. G., Examiner
1/3 DTU-stip, 2/3 FUR/andet
01/09/2010 → 01/12/2014
Award relations: Gad generation and emission at waste disposal sites receiving low organic waste
Project: PhD
Systematic quantification of biogas potential in urban organic waste
Fitamo, T. M., PhD Student, Department of Environmental Engineering
Scheutz, C., Main Supervisor
Boldrin, A., Supervisor
De Francisci, D., Examiner
La Cour Jansen, J., Examiner
Ward, A. J., Examiner
Samfinansieret - Andet
15/11/2013 → 26/04/2017
Award relations: Systematic quantification of biogas potential in urban organic waste
Project: PhD

Environmental assessment of biowaste management in the Danish-german border region
Jensen, M. B., PhD Student, Department of Environmental Engineering
Scheutz, C., Main Supervisor
Møller, J., Supervisor
Boldrin, A., Examiner
Kirkeby, J. S., Examiner
Hansson, P., Examiner
Ansat eksternt
01/10/2012 → 21/04/2016
Award relations: Environmental assessment of biowaste management in the Danish-german border region
Project: PhD

Composition of waste materials and recyclables
Götze, R., PhD Student, Department of Environmental Engineering
Astrup, T. F., Main Supervisor
Boldrin, A., Supervisor
Scheutz, C., Supervisor
Kjeldsen, P., Examiner
Riber, C., Examiner
Grosso, M., Examiner
Technical University of Denmark
01/10/2012 → 21/04/2016
Award relations: Composition of waste materials and recyclables
Project: PhD

Municipal organic waste management
Naroznova, I., PhD Student, Department of Environmental Engineering
Scheutz, C., Main Supervisor
Møller, J., Supervisor
Boldrin, A., Examiner
La Cour Jansen, J., Examiner, Department of Environmental Engineering
Hansen, T. L., Examiner
La Cour Jansen, J., Examiner
Technical University of Denmark
15/09/2012 → 22/03/2016
Award relations: Municipal organic waste management
Project: PhD

LCA model for sewage sludge - an EASEWASTE extension
Yoshida, H., PhD Student, Department of Environmental Engineering
Scheutz, C., Main Supervisor
Christensen, T. H., Supervisor
Damgaard, A., Examiner
Jönsson, H., Examiner
Hansen, T. L., Examiner
1/3 DTU-stip, 2/3 FUR/andet
01/01/2011 → 19/12/2014
Award relations: LCA model for sewage sludge - an EASEWASTE extension
Project: PhD
Composition of municipal solid waste in Denmark
Edjabou, M. E., PhD Student, Department of Environmental Engineering
Astrup, T. F., Main Supervisor
Scheutz, C., Supervisor
Kjeldsen, P., Examiner
Fischer, C., Examiner
Salhofer, S., Examiner
Technical University of Denmark
01/09/2012 → 01/09/2016
Award relations: Composition of municipal solid waste in Denmark
Project: PhD

Environmental Assessment of Sewage Sludge Management - Focusing on Sludge Treatment Reed Beds
Larsen, J. D., PhD Student, Department of Environmental Engineering
Scheutz, C., Main Supervisor
Pilegaard, K., Examiner
Nielsen, S. M., Supervisor
Molle, P., Examiner
Headley, T., Examiner
Industrial PhD
01/08/2013 → 30/09/2017
Award relations: Environmental Assessment of Sewage Sludge Management - Focusing on Sludge Treatment Reed Beds
Project: PhD

Quantification and critical analysis of resource flows in Denmark
Klinglmair, M., PhD Student, Department of Environmental Engineering
Scheutz, C., Main Supervisor
Astrup, T. F., Supervisor
Ibrom, A., Examiner
Kirkeby, J. S., Examiner
Binder, C. R., Examiner
Technical University of Denmark
01/09/2012 → 29/09/2016
Award relations: Quantification and critical analysis of resource flows in Denmark
Project: PhD

Life cycle assessment of waste management: Assessing technical externalities
Brogaard, L. K., PhD Student, Department of Environmental Engineering
Christensen, T. H., Main Supervisor
Scheutz, C., Examiner
Eriksson, O. N., Examiner
Olsen, S. I., Examiner
1/3 DTU-stip, 2/3 FUR/andet
01/09/2009 → 18/09/2013
Award relations: Life cycle assessment of waste management: Assessing technical externalities
Project: PhD

Life cycle assessment of emerging waste-to-energy technologies
Tonini, D., PhD Student, Department of Environmental Engineering
Astrup, T. F., Main Supervisor
Scheutz, C., Examiner
Hellweg - SLET, S., Examiner
Jensen, L. S., Examiner
Technical University of Denmark
01/05/2009 → 27/03/2013
Award relations: Life cycle assessment of emerging waste-to-energy technologies
Project: PhD

Environmentally Sustainable Utilization of Waste Resources for Energy Production
Fruergaard, T., PhD Student, Department of Environmental Engineering
Christensen, T. H., Main Supervisor
Scheutz, C., Examiner
Olsen, S. I., Examiner
Tillman, A., Examiner
1/3 DTU-stip, 2/3 FUR/andet
01/08/2006 → 21/04/2010
Award relations: Environmentally Sustainable Utilization of Waste Resources for Energy Production
Project: PhD

Reduction of Greenhouse Gas Emissions from Landfills by use of Engineered Biocovers: Full Scale Studies
Fredenslund, A. M., PhD Student, Department of Environmental Engineering
Kjeldsen, P., Main Supervisor
Scheutz, C., Supervisor
Christensen, T. H., Examiner
Börjesson, G., Examiner
Poulsen, T., Examiner
DTU, Samfinansiering
01/01/2006 → 26/05/2010
Award relations: Reduction of Greenhouse Gas Emissions from Landfills by use of Engineered Biocovers: Full Scale Studies
Project: PhD

Pilotprojekt til et frivilligt måleprogram for metanudledning fra biogas - og opgraderings anlæg.
Fredenslund, A. M., Project Participant, Department of Environmental Engineering, Residual Resource Engineering
Kjeldsen, P., Project Manager, Department of Environmental Engineering
09/10/2015 → 20/11/2015
Collaborators: Danish Energy Agency, Research Institutes of Sweden, AgroTech AS
Project: Research

AVMljø-Biocover: Reduktion af methanemission fra AVMljø ved opbygning af biocover system. Forstudie
Reduktion af methanemission fra AVMljø
Skov, B. H., Project Participant, Department of Environmental Engineering
Scheutz, C., Project Participant, Department of Environmental Engineering
Kjeldsen, P., Project Manager, Department of Environmental Engineering
Project ID: 30667
Ukendt: DKK262,900.00
01/12/2008 → 01/07/2009
Award relations: Reduktion af methanemission fra AVMljø ved opbygning af biocover system. Forstudie
Project: Research

SET 5 PhD: 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
Scheutz, C., Project Participant, Department of Environmental Engineering
Arvin, E., Project Participant, Department of Environmental Engineering
Albrechtsen, H., Project Participant, Department of Environmental Engineering
Henze, M., Project Manager, Department of Environmental Engineering
Kjeldsen, P., Project Participant, Department of Environmental Engineering
Mikkelsen, P. S., Project Participant, Department of Environmental Engineering
Christensen, T. H., Project Participant, Department of Environmental Engineering
Smets, B. F., Project Participant, Department of Environmental Engineering
Ukendt: DKK0.00
01/10/2009 → 30/09/2013
Award relations: Sustainable Environmental Technology. Application for 5 fellowships
Project: Research
1094: Undersøgelser af gasproduktion og emission på Uggerløse Losseplads
Det overordnede formål med projektet er at undersøgelse gasproduktion og emission på Uggerløse Losseplads
Scheutz, C., Project Manager, Department of Environmental Engineering
Project ID: 30754
Ukendt: DKK96,200.00
15/12/2009 → 15/02/2010
Award relations: Undersøgelser af gasproduktion og emission på Uggerløse Losseplads
Project: Research

908: 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.
Scheutz, C., Project Participant, Department of Environmental Engineering
Kjeldsen, P., Project Manager, Department of Environmental Engineering
Project ID: 30575
Ukendt: DKK197,780.00
01/12/2007 → 31/12/2008
Award relations: Development of method for reporting emissions from waste disposal sites to the PRTR-register
Project: Research

792: 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.
Scheutz, C., Project Participant, Department of Environmental Engineering
Broholm, M. M., Project Participant, Department of Environmental Engineering
Bjerg, P. L., Project Manager, Department of Environmental Engineering
Project ID: 30540
Ukendt: DKK926,548.00
01/05/2007 → 31/12/2007
Award relations: Degradation of 1,1,1-TCA
Project: Research

337: 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 *Udvaksling af data mhp. nærmere studier foretaget af speciale- eller Ph.D.studerende *Udvaksle viden om processer og tekniker *Publicering af artikler *Møliggøre praktikordning for studerende fra M&R i Fyns Amt
Scheutz, C., Project Participant, Department of Environmental Engineering
Albrechtsen, H., Project Participant, Department of Environmental Engineering
Broholm, M. M., Project Participant, Department of Environmental Engineering
Bjerg, P. L., Project Manager, Department of Environmental Engineering
Jakobsen, R., Project Participant, Department of Environmental Engineering
Henriksen, K. B., Project Participant, Department of Environmental Engineering
Hønning, J., Project Participant, Department of Environmental Engineering
Project ID: 30260
Ukendt: DKK105,000.00
05/12/2002 → 31/12/2006
Collaborators: Fyns Amt
Award relations: Development of remediation technologies for chlorinated solvents
Project: Research

340: 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.
Scheutz, C., Project Participant, Department of Environmental Engineering
Kjeldsen, P., Project Manager, Department of Environmental Engineering
Project ID: 30252
Ukendt: DKK220,800.00
Collaborators: University of California, Landfills, Inc.
Award relations: Evaluation of the attenuation of (NMOCs) in the top cover of Grand Landes landfill
Project: Research

303: 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.
Scheutz, C., Project Participant, Department of Environmental Engineering
Albrechtsen, H., Project Participant, Department of Environmental Engineering
Bjerg, P. L., Project Manager, Department of Environmental Engineering
Jakobsen, R., Project Participant, Department of Environmental Engineering
Henriksen, K. B., Project Participant, Department of Environmental Engineering

Ukendt: DKK0.00
01/01/2000 → 31/12/2006
Collaborators: NIRAS A/S, Hedeselskabet, COWI AS, Fyns Amt, GeoSyntec Consultants
Award relations: Enhanced bioremediation of groundwater contaminants
Project: Research

311: 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.
Scheutz, C., Project Participant, Department of Environmental Engineering
Kjeldsen, P., Project Manager, Department of Environmental Engineering

Project ID: 30223
Ukendt: DKK600,000.00
01/03/2002 → 01/01/2004
Award relations: Attenuation of alternative foam blowing agents in landfill
Project: Research

Kærgård Plantage-afværge: Afværgestrategi for Kærgård Plantage.
Kortlægning af grundvandsforurening ved afskæringssløsning og udstrømningforhold til havstokken. Undersøge naturlig nedbrydning af forureningskomponenter i grundvandszonen.
Bjerg, P. L., Project Manager, Department of Environmental Engineering
Scheutz, C., Project Participant, Department of Environmental Engineering

Project ID: 30469
Sam.arb.aftaler, Private danske - Andre virksomheder: DKK46,500.00
09/05/2006 → 31/12/2006
Award relations: Afværgestrategi for Kærgård Plantage.
Project: Research

Biocover: 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.
Kjeldsen, P., Project Participant, Department of Environmental Engineering
Fredenslund, A., M., Project Participant, Department of Environmental Engineering
Sandegaard, G. L., Project Participant, Department of Environmental Engineering
Scheutz, C., Project Participant, Department of Environmental Engineering
Kjeldsen, P., Project Manager, Department of Environmental Engineering
Kjeldsen, P., Project Manager, Department of Environmental Engineering
Samarbejdsafgørelse med Fyns Amt: *Gennemførere studier af de grundlæggende geokemiske, mikrobiologiske og hydrogeologiske processer for forskellige opløsningsmidler med det formål at kunne forbedre opløsningsmidlerne ved praktiske opløsningsmidler *Udvikle, afprøve og dokumentere forskellige
afværgemetoder *udvikling af data m.h. nærmere studier foretaget af speciale- eller Ph.D.studerende *udveksle viden om processer og teknikker *publicerings af artikler *muliggøre praktikordning for studerende fra M&R i Fyns Amt
Bjerg, P. L., Project Manager, Department of Environmental Engineering
Jakobsen, R., Project Participant, Department of Environmental Engineering
Scheutz, C., Project Participant, Department of Environmental Engineering
Project ID: 30354
Sam.arb. aftale - Amter og kommuner: DKK290,000.00
15/09/2004 → 01/05/2005
Award relations: Fase 2.Development of remediation technologies for chlorinated solvents.
Project: Research

433: 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 sporstofforfølgelse -at generere
overblik over nuværende perkolatkvalitet og udvaskningsbetingelser -at etablere facilitet til storskala udvaskningstest med efterfølgende test af én affaldstype
Scheutz, C., Project Participant, Department of Environmental Engineering
Kjeldsen, P., Project Participant, Department of Environmental Engineering
Christensen, T. H., Project Manager, Department of Environmental Engineering
Pedersen, G. B., Project Participant, Department of Environmental Engineering
Nedenskov, J., Project Participant, AV Miljø
Project ID: 30331
Sam.arb. aftaler, Private danske - Andre virksomheder: DKK1,066,500.00
01/05/2004 → 31/12/2005
Collaborators: AV Miljø
Award relations: Udvikling af deponeringsanlægget AV-Miljø - Et dynamisk samarbejde mellem AV-Miljø og Miljø & Ressourcer DTU.
Project: Research

371: 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
Scheutz, C., Project Participant, Department of Environmental Engineering
Kjeldsen, P., Project Manager, Department of Environmental Engineering
Project ID: 30369
Project: Research

548: Forundersøgelser i forbindelse med projekt til belysning af stimuleret in-situ reductiv deklorering som afværgemetode
overfor forurening med klorerede opløsningsmidler i morænelager på Rugårdsvej 234, O
Bjerg, P. L., Project Manager
Broholm, M. M., Project Participant
Scheutz, C., Project Participant
Begtrup, E., Project Participant
Project ID: 30369
Ukendt: DKK702,500.00
01/12/2004 → 30/06/2006
Collaborators: COWI AS, Technical University of Denmark
**Kbh. Amt, del B, Anaerob dechlorering: 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)

Bjerg, P. L., Project Manager, Department of Environmental Engineering
Broholm, M. M., Project Participant, Department of Environmental Engineering
Christensen, S. B., Project Participant, Department of Environmental Engineering
Hansen, M. H., Project Participant, Department of Environmental Engineering
Scheutz, C., Project Participant, Department of Environmental Engineering
Christiansen, C., Project Participant, Department of Environmental Engineering

Project ID: 30383
Ukendt: DKK2,200,000.00
01/03/2005 → 31/12/2006

**Determining the fraction of blowing agent released from refrigerator/freezer foam after decommissioning the product**

The objective of the study is to determine the fraction of blowing agent that escapes when a foamed refrigerator is shredded and the amount released as a function of time during the following 6 weeks. The objectives will be met through performance of laboratory experiments on cut foam cubes and foam particles obtained from realistic shredding. Developed foam diffusion models will be used for evaluating and extrapolating results.

Kjeldsen, P., Project Manager, Department of Environmental Science and Engineering
Scheutz, C., Project Participant, Department of Environmental Science and Engineering

01/01/1995 → 31/08/2001

**Attenuation of non methane organic compounds (NMOCs) in landfill gas**

Landfill gas contains besides high concentrations of methane also aromatic hydrocarbons (benzene, toluene, etc.), which by emission to the ambient air can be a health threat to workers and local inhabitants, chlorinated solvents which besides health effects may influence the ozone layer, and CFC compounds which may influence the ozone layer. The potential of attenuation of these compounds in top cover soil or soils adjacent to landfills is studied by laboratory experiments both on natural systems and engineered system where the degradation of the compounds is beeing optimized. Investigations on soil formerly affected by landfill gas showed revealed large attenuation potentials especially for the aromatic hydrocarbons. In 1999 laboratory experiments with degradation in landfill gas affected soils of CFCs and chlorinated solvents was started.

Kjeldsen, P., Project Manager, Department of Environmental Science and Engineering
Scheutz, C., Project Participant, Department of Environmental Science and Engineering

Project: Research

**Development and validation of a method for determining VOCs by using muti-sorbent tubes and ATD-GC-MS**

Period: 4 Sep 2018 → 7 Sep 2018

Zhenhan Duan (Guest lecturer)
Peter Kjeldsen (Panel member)
Charlotte Scheutz (Panel member)

Department of Environmental Engineering
Residual Resource Engineering
Air, Land & Water Resources

**Description**

Abstract and full paper
Degree of recognition: International
Remote sensing quantification of methane emissions from 10 biogas plants in Denmark and Germany

Period: 14 May 2018
Anders Michael Fredenslund (Guest lecturer)
Charlotte Scheutz (Guest lecturer)

Department of Environmental Engineering
Air, Land & Water Resources

Description
A key benefit of biogas production is mitigation of anthropogenic greenhouse gas emissions by substituting fossil fuels. However, several life cycle assessment studies have shown that methane loss from biogas production may significantly reduce greenhouse gas mitigation due to the high global warming potential of methane gas. It is therefore important to minimise methane emission from biogas production to ensure the societal value and thereby the validity of providing subsidies to support biogas production.

Accurate measurement methods are needed to quantify methane emission from biogas plants and thus assess the need for taking actions to reduce leakage. Recent developments in analytical instrumentation have provided new opportunities for accurate remote sensing of fugitive emissions. We have applied a remote sensing technique referred to as the "tracer gas dispersion method" to measure total methane emissions from 10 biogas plants. The method relies on the continuous release of a gaseous tracer combined with downwind measurements of methane and tracer gas using a mobile analytical platform, where a high precision gas analyser was installed.

Methane emission rates varied from 1.3 kg CH4 h⁻¹ to 25.5 kg CH4 h⁻¹. The average methane loss corresponded to 2.0% of the gas production, where the loss calculated for the individual measurement campaigns on the various plants ranged from 0.3% to 21.0%.

Degree of recognition: International

Documents:
Abstract, Fredenslund, EUBCE 2018 short
Abstract, Fredenslund, EUBCE 2018, explanatory pages
Fredenslund - poster for EUBCE 2018

Related event

26th European Biomass Conference and Exhibition (EUBCE 2018)
14/05/2018 → 17/05/2018
Copenhagen, Denmark
Activity: Talks and presentations » Conference presentations

Remote sensing quantification of methane emissions from 10 biogas plants in Denmark and Germany
Period: 4 May 2018
Anders Michael Fredenslund (Guest lecturer)
Charlotte Scheutz (Guest lecturer)

Department of Environmental Engineering
Air, Land & Water Resources
Degree of recognition: International

Documents:
Abstract, Fredenslund, EUBCE 2018 short
Abstract, Fredenslund, EUBCE 2018, explanatory pages
Fredenslund - poster for EUBCE 2018

Related event
Brancheindsats for at minimere metantab. Kvantificering - metoder og usikkerhed
Period: 13 Mar 2018
Anders Michael Fredenslund (Guest lecturer)
Charlotte Scheutz (Guest lecturer)
Department of Environmental Engineering
Air, Land & Water Resources
Degree of recognition: National

Related event
Temadag arrangeret af Foreningen Biogasbranchen
13/03/2018 → 13/03/2018
Vejle, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Press clippings:

Hvor meget metan udleder danske biogasanlæg
Anders Michael Fredenslund & Charlotte Scheutz
11/06/2018
Department of Environmental Engineering, Air, Land & Water Resources

Media contribution (1)

Hvor meget metan udleder danske biogasanlæg?
11/06/2018
Forskning 1 (National), Denmark, Print
Anders Fredenslund & Charlotte Scheutz
2 pages
http://www.biopress.dk/PDF/hvor-meget-metan-udleder-danske-biogasanlaeg
Anders Michael Fredenslund & Charlotte Scheutz
Department of Environmental Engineering, Air, Land & Water Resources
Press/Media: Press / Media