How a 10-day heatwave impacts barley grain yield when superimposed onto future levels of temperature and CO$_2$ as single and combined factors

Heatwaves pose a threat to crop production and are predicted to increase in frequency, length and intensity as a consequence of global warming. Future heatwaves will occur in addition to the ongoing increase of mean temperature and CO$_2$. To test effects of heatwaves superimposed to future climate scenarios, 22 barley accessions were cultivated with elevated temperature (+5 °C) and CO$_2$ (700 ppm) as single factors and in combination. The control treatment mimicked ambient Scandinavian early summer conditions (19/12 °C, day/night; 400 ppm CO$_2$). Around flowering a 10-day heatwave of 33/28 °C (day/night) was superimposed to all treatments. The lowest average grain yield was observed when the heatwave was superimposed onto the combined elevated temperature and CO$_2$ treatment. Here the yield decreased by 42% compared to no heatwave and 52% compared to ambient conditions. When the heatwave was superimposed onto ambient conditions the average grain yield decreased by 37% compared to no heatwave. There was no significant difference between the relative grain yield decrease caused by the heatwave in the ambient and future climate scenarios. In contrast, the vegetative aboveground biomass increased upon heatwave exposure, leading to a strong decline in the harvest index. Our results strongly emphasize the need to produce heatwave resilient cultivars.

General information
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Organisations: Department of Environmental Engineering, Air, Land & Water Resources, Technical University of Denmark, Statistics and Data Analysis, University of Copenhagen, Natural Resources Institute Finland (Luke)
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Applying no-depletion equilibrium sampling and full-depletion bioaccessibility extraction to 35 historically polycyclic aromatic hydrocarbon contaminated soils

Assessing the bioaccessibility of organic pollutants in contaminated soils is considered a complement to measurements of total concentrations in risk assessment and legislation. Consequently, methods for its quantification require validation with historically contaminated soils. In this study, 35 such soils were obtained from various locations in Switzerland and Cuba. They were exposed to different pollution sources (e.g., pyrogenic and petrogenic) at various distance (i.e., urban to rural) and were subject to different land use (e.g., urban gardening and forest). Passive equilibrium sampling with polyoxymethylene was used to determine freely dissolved concentrations (C_{free}) of polycyclic aromatic hydrocarbons (PAHs), while sorptive bioaccessibility extraction (SBE) with silicone rods was used to determine the bioaccessible PAH concentrations (C_{bioacc}) of these soils. The organic carbon partition coefficients of the soils were highest for skeet soils, followed by traffic, urban garden and rural soils. Lowest values were obtained from soil exposed to petrogenic sources. Applicability of SBE to quantify C_{bioacc} was restricted by silicone rod sorption capacity, as expressed quantitatively by the Sorption Capacity Ratio (SCR); particularly for soils with very high K_{D}. The source of contamination determined bioaccessible fractions (f_{bioacc}). The smallest f_{bioacc} were obtained with skeet soils (15%), followed by the pyrogenically influenced soils, rural soils, and finally, the petrogenically contaminated soil (71%). In conclusion, we present the potential and limitations of the SBE method to quantify bioaccessibility in real soils. These results can be used for additional development of this and similar bioaccessibility methods to guarantee sufficient sorption capacity to obtain reliable results. Freely dissolved concentrations and bioaccessible fractions of PAHs in soils depended on pollutant source and site characteristics, while the sink capacity was limiting during bioaccessibility extractions of soils with low PAH content and high K_{D} values.

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Selenium and selenium species in feeds and muscle tissue of Atlantic salmon

Selenium (Se) is an essential element for animals, including fish. Due to changes in feed composition for Atlantic salmon (Salmo salar), it may be necessary to supplement feeds with Se. In the present work, the transfer of Se and Se species from feed to muscle of Atlantic salmon fed Se supplemented diets was studied. Salmon were fed basal fish feed (0.35 mg Se/kg and 0.89 mg Se/kg feed), or feed supplemented either with selenised yeast or sodium selenite, at low (1–2 mg Se/kg feed) and high (15 mg Se/kg feed) levels, for 12 weeks. For the extraction of Se species from fish muscle, enzymatic cleavage with protease type XIV was applied. The extraction methods for Se species from fish feed were optimised, and two separate extraction procedures were applied, 1) enzymatic cleavage for organic Se supplemented...
feeds and 2) weak alkaline solvent for inorganic Se supplemented feeds, respectively. For selenium speciation analysis in feed and muscle tissue anion-exchange HPLC-ICP-MS for analysis of inorganic Se species and cation-exchange HPLC-ICP-MS for analysis of organic Se species, were applied. In addition, reversed phase HPLC-ICP-MS was applied for analysis of selenocysteine (SeCys) in selected muscle samples. The results demonstrated that supplemented Se (organic and inorganic) accumulated in muscle of Atlantic salmon, and a higher retention of Se was seen in the muscle of salmon fed organic Se diets. Selenomethionine (SeMet) was the major Se species in salmon fed basal diets and diets supplemented with organic Se, accounting for 91–118% of the total Se. In contrast, for muscle of salmon fed high inorganic Se diet, SeMet accounted for 30% of the total Se peaks detected. Several unidentified Se peaks were detected, in the fish fed high inorganic diet, and analysis showed indicated SeCys is a minor Se species present in this fish muscle tissue.
Order of draw practices in venous blood sampling at clinical biochemistry departments in the Danish health care system

BACKGROUND: Deviation in blood collection procedures is a central source of preanalytical variation affecting overall analytical and diagnostic precision. The order of draw of venous sampling is suspected to affect analytical results, in particular for coagulation analysis. Here we compare the procedures in venous blood sampling among clinical biochemistry departments to assess the uniformity of order of blood draw and adherence to international guidelines in the Danish health care system.

METHODS: We collected venous order of draw procedures from 49 clinical biochemistry departments at 22 public hospitals in Denmark. Procedures were compared to the international guidelines from the Clinical Laboratory Standards Institute (CLSI) and World Health Organization (WHO), and assessed in relation to department ISO 15189:2012 accreditation.

RESULTS: We observed seven different order of draw procedures related to citrate, serum, heparin, and EDTA tubes, and the use of discard tubes in relation to coagulation assays. 31 departments (63.3%) were found to adhere to CLSI and WHO guidelines. A majority of departments instructs the use of discard tubes before collection for coagulation assays in citrate tubes (44 departments; 89.8%). The citrate tube was the first sample tube to be drawn for most departments (35 departments; 75.5%); and the preferred order of non-citrate tubes was serum-heparin-EDTA (36 departments; 73.5%). Adherence to the CLSI and WHO guidelines was not associated with department ISO 15189:2012 accreditation (p=.57).

CONCLUSIONS: Venous order of draw procedures is diverse at Danish clinical biochemistry departments and show moderate adherence to international guidelines.
Effect of low energy diet for eight weeks to adults with overweight or obesity on folate, retinol, vitamin B\textsubscript{12}, D and E status and the degree of inflammation: a post hoc analysis of a randomized intervention trial

Background: Obesity is associated with vitamin insufficiency and low grade inflammation. The purpose of this study was to investigate the effect of weight loss on folate, retinol, vitamin B\textsubscript{12}, D and E status and the degree of inflammation.

Methods: Out of 110, 85 individuals (75% women) aged 39 ± 11 years with a mean ± SD BMI of 33 ± 4 kg/m\textsuperscript{2}, completed an eight-week low energy diet (LED). Serum concentration of folate, retinol, B\textsubscript{12}, D and E and C-reactive protein and homocysteine (Hcy) were measured at baseline and at end of the LED. Results: At baseline, 8% of the participants were deficient in folate, 13% in vitamin B\textsubscript{12}, 2% in retinol, 28% in vitamin D (72% were insufficient in vitamin D), and none were deficient in vitamin E. At baseline, BMI was inversely associated with retinol (P < 0.05) as was total and abdominal fat percentage with folate (P < 0.05): further BMI and measures of adiposity were positively associated with CRP (P < 0.01) and Hcy (P < 0.05). Homocysteine was inversely associated with all vitamins but retinol (P < 0.001). After the LED, the participants lost a mean [95% confidence intervals] of 12.3 [- 13.1,-11.6] kg. The serum concentration of folate, retinol, B\textsubscript{12}, and E were increased (P < 0.001) after the LED whereas the concentration of retinol and vitamin E were reduced (P < 0.001). Conclusion: Eight-weeks LED resulted in 13% weight loss and an increase in the serum concentrations of folate, vitamin B\textsubscript{12}, and D. Baseline adiposity was inversely associated with folate and retinol, and positively associated with markers of inflammation. Trial registration: Ethical Committee of Copenhagen as no. H-4-2013-135, NCT01561131.
Traditional methods v. new technologies – dilemmas for dietary assessment in large-scale nutrition surveys and studies: a report following an international panel discussion at the 9th International Conference on Diet and Activity Methods (ICDAM9), Brisbane, 3 September 2015

The aim of the present paper is to summarise current and future applications of dietary assessment technologies in nutrition surveys in developed countries. It includes the discussion of key points and highlights of subsequent developments from a panel discussion to address strengths and weaknesses of traditional dietary assessment methods (food records, FFQ, 24 h recalls, diet history with interviewer-assisted data collection) v. new technology-based dietary assessment methods (web-based and mobile device applications). The panel discussion ‘Traditional methods v. new technologies: dilemmas for dietary assessment in population surveys’, was held at the 9th International Conference on Diet and Activity Methods (ICDAM9), Brisbane, September 2015. Despite respondent and researcher burden, traditional methods have been most commonly used in nutrition surveys. However, dietary assessment technologies offer potential advantages including faster data processing and better data quality. This is a fast-moving field and there is evidence of increasing demand for the use of new technologies amongst the general public and researchers. There is a need for research and investment to support efforts being made to facilitate the inclusion of new technologies for rapid, accurate and representative data.
Microbial contamination level profiles attributed to contamination of beef carcasses, personnel, and equipment: case of small and medium enterprise slaughterhouses

The microbial contamination level profiles (MCLPs) attributed to contamination of beef carcasses, personnel, and equipment in five Kenyan small and medium enterprise slaughterhouses were determined. Aerobic plate counts, Enterobacteriaceae, Staphylococcus, and Salmonella were used to determine contamination at four different slaughter stages, namely, dehiding, evisceration, splitting, and dispatch. Microbiological criteria of the four microorganisms were used to score contamination levels (CLs) as poor (0), poor to average (1), average (2), or good (3). MCLPs were further assigned to carcasses, personnel, and equipment at each stage by summing up the CL scores. The CL score attributed to aerobic plate count contamination was 2 or 3 for carcasses but 0 for personnel and equipment in almost all slaughterhouses. A score of 0 on carcasses was mostly attributed to Enterobacteriaceae at evisceration and to Salmonella at dehiding and evisceration. In addition, a score of 0 was mostly attributed to Staphylococcus contamination of personnel at dehiding. A score of 3 was attributed mostly to Enterobacteriaceae on hands at splitting, whereas a score of 2 was mostly attributed to the clothes at dehiding and evisceration. A CL score of 3 was mostly attributed to Enterobacteriaceae and Salmonella contamination of equipment at dehiding and splitting, respectively. Although CLs attributed to contamination of carcasses, personnel, and equipment ranged from 0 to 3, the maximum MCLP score of 9 was only attained in carcasses from two slaughterhouses at dehiding and from one slaughterhouse at dispatch. There is, therefore, a lot of room for small and medium enterprise slaughterhouses to improve their food safety objectives by improving food safety management systems at the points characterized by low CL scores.
Greenhouse gas emissions from integrated urban drainage systems: Where do we stand?

As sources of greenhouse gas (GHG) emissions, integrated urban drainage systems (IUDSs) (i.e., sewer systems, wastewater treatment plants and receiving water bodies) contribute to climate change. This paper, produced by the International Working Group on Data and Models, which works under the IWA/IAHR Joint Committee on Urban Drainage, reviews the state-of-the-art and modelling tools developed recently to understand and manage GHG emissions from IUDS. Further, open problems and research gaps are discussed and a framework for handling GHG emissions from IUDSs is presented. The literature review reveals that there is a need to strengthen already available mathematical models for IUDS to take GHG into account.

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Organisations: Department of Environmental Engineering, Urban Water Systems, Universita di Palermo, Columbia University, University of Exeter, University of New South Wales, School of Civil and Environmental Engineering, Unit for Environmental Engineering, University of Innsbruck, University of Queensland, KU Leuven, Waterways d.o.o.
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Dynamic mechanical characterization with respect to temperature, humidity, frequency and strain in mPOFs made of different materials

This paper presents a dynamic mechanical analysis (DMA) of polymer optical fibers (POFs) to obtain their Young modulus with respect to the variation of strain, temperature, humidity and frequency. The POFs tested are made of polymethyl methacrylate (PMMA), Topas grade 5013, Zeonex 480R and Polycarbonate (PC). In addition, a step index POF with a core composed of Topas 5013 and cladding of Zeonex 480R is also analyzed. Results show a tradeoff between the different fibers for different applications, where the Zeonex fiber shows the lowest Young modulus among the ones tested, which makes it suitable for high-sensitivity strain sensing applications. In addition, the fibers with Topas in their composition presented low temperature and humidity sensitivity, whereas PMMA fibers presented the highest Young modulus variation with different frequencies. The results presented here provide guidelines for the POF material choice for different applications and can pave the way for applications involving the combination of different polymer materials.
Type-2 fuzzy elliptic membership functions for modeling uncertainty

Whereas type-1 and type-2 membership functions (MFs) are the core of any fuzzy logic system, there are no performance criteria available to evaluate the goodness or correctness of the fuzzy MFs. In this paper, we make extensive analysis in terms of the capability of type-2 elliptic fuzzy MFs in modeling uncertainty. Having decoupled parameters for its support and width, elliptic MFs are unique amongst existing type-2 fuzzy MFs. In this investigation, the uncertainty distribution along the elliptic MF support is studied, and a detailed analysis is given to compare and contrast its performance with existing type-2 fuzzy MFs. Furthermore, fuzzy arithmetic operations are also investigated, and our finding is that the elliptic MF has similar features to the Gaussian and triangular MFs in addition and multiplication operations. Moreover, we have tested the prediction capability of elliptic MFs using interval type-2 fuzzy logic systems on oil price prediction problem for a data set from 2nd Jan 1985 till 25th April 2016. Throughout the simulation studies, an extreme learning machine is used to train the interval type-2 fuzzy logic system. The prediction results show that, in addition to their various advantages mentioned above, elliptic MFs have comparable prediction results when compared to Gaussian and triangular MFs. Finally, in order to test the performance of fuzzy logic controller with elliptic interval type-2 MFs, extensive real-time experiments are conducted for the 3D trajectory tracking problem of a quadrotor. We believe that the results of this study will open the doors to elliptic MFs’ wider use of real-world identification and control applications as the proposed MF is easy to interpret in addition to its unique features.
Learning-by-doing: experience from 20 years of teaching LCA to future engineers

Purpose: In support of the sustainable development of our societies, future engineers should have elementary knowledge in sustainability assessment and use of life cycle assessment. Publications on pedagogical experience with teaching life cycle assessment (LCA) in high-level education are however scarce. Here, we describe and discuss 20 years of experience in teaching LCA at MSc level in an engineering university with the ambition to share our insights and inspire teaching of LCA as part of a university curriculum.

Methods: We detail the design of an LCA course taught at the Technical University of Denmark since 1997. The course structure relies on (i) a structured combination of theoretical teaching, practical assignments and hands-on practice on LCA case studies, and (ii) the conduct of real-life LCA case studies in collaboration with companies or other organisations. Through the semester-long duration of the course, students from different engineering backgrounds perform full-fledged LCA studies in groups, passing through two iterations—a screening LCA supporting a more targeted LCA. Results and discussion: The course design, which relies on a learning-by-doing principle, is transparently described to inspire LCA teachers among the readers. Historical evolution and statistics about the course, including its 192 case studies run in collaboration with 105 companies and institutions, are analysed and serve as basis to discuss the benefits and challenges of its different components, such as the theory acquisition, the assignment work, the LCA software learning, the conduct of case studies, the merits of industrial collaborations and grading approaches. Conclusions: We demonstrate the win-win situation created by the setting of the course, in which the students are actively engaged and learn efficiently how to perform an LCA while the collaborating companies often get useful insights into their analysed case studies. The course can also be an eye opener for companies unfamiliar with LCA, who get introduced to life cycle thinking and the potential benefits of LCA. We have no hesitation in recommending industries and LCA teachers to engage into such collaborations even in the fundamental teaching of LCA techniques.
Monitoring and ming bio-physical parameters for hypoxia hazard in a coastal sand pit

Management of coastal areas requires monitoring and modeling of the anthropogenic drivers and the bio-physical processes affecting water quality. To assess the range of hydrographic conditions controlling oxygen distribution in the bottom layers of sand pits, a multi-year oceanographic survey has been conducted in a coastal area with several extraction pits. Hydrographic data including profiles of temperature, salinity and oxygen were collected and related to local wind conditions and circulation. Moreover, 1D and 3D high-resolution non-hydrostatic ocean models were used to describe turbulent mixing regimes and to obtain the range of wind speeds for which the critical anoxic conditions may occur. It is shown that wind speed appears to control the dynamics of oxygen concentrations, with oxygen depleted zones developing in a short time in low wind speed conditions. Moreover, the depth and the shape of the extraction pit contribute to decrease the mixing of the bottom layers and increase the water retention in the hole increasing the output and the persistence of oxygen depleted zones in the excavated area. The results of the numerical simulations show that the risk of hypoxia at the bottom of the sand pits is associated with higher temperatures and wind speed lower than 5 m/s, which is not infrequent during the summer season. However, the number of consecutive days of oxygen depletion can be considered lower than the danger threshold level assumed in the literature.

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Environmentally friendly treatment of highly potent pharmaceuticals in hospital wastewater - Mermiss


Den traditionelle metode til rensning af spilldevand er baseret på aktivt slam. Metoden er effektiv overfor letnedbrydelige lægemidler, men ineffektiv overfor middelsvære og svært nedbrydelige lægemidler.

Teknologien med biofilm er testet i laboratorieskala og i pilot-skala på dels råspilldevand med koncentreret indhold af lægemidler fra en kræftafdeling, dels blandet råspildevand fra et hospital, dels almindeligt råspildevand fra Herning Vand, og dels på udløbsvand fra Viby renseanlæg. Over 95% af den samlede belastning med lægemidler i miljøet kommer i dag fra almindeligt husspilldevand, både fra håndkøbs medicin og fra patienter i ambulant behandling.

Projektet gennemførte således en benchmarking af lægemiddelfjernelse på forskellige typer af spilldevand, og kunne på den baggrund demonstrere, at en biofilm-baseret teknologi er langt mere effektiv end den konventionelle aktiv slam behandling, som bruges i dag. Bl.a. viser projektet, at teknologien med fordel kan anvendes til at efterpolere allerede renset spilldevand, og at driftsomkostningerne til teknologien er relativt lave.

Resultaterne af projektet er så lovende, at de allerede er anvendt til at starte et nyt MUDP-projekt, MerEff, der tester teknologien til at efterpolere renset spilldevand i større skala på Herning Vands renseanlæg.

General information

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Organisations: Department of Environmental Engineering, Water Technologies, Municipality of Århus, Henning Municipality, Aarhus University Hospital, Air Liquide, Krüger A/S, Aarhus University, Teknologisk Institut, Danish Technological Institute
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High diversity of genes and plasmids encoding resistance to third-generation cephalosporins and quinolones in clinical Escherichia coli from commercial poultry flocks in Italy

The aim was to investigate occurrence and diversity of plasmid-mediated resistance to third-generation cephalosporins (3GC) and quinolones in clinical Escherichia coli from 200 industrial poultry farms across Italy. E. coli was isolated from colibacillosis lesions in turkeys (n = 109), broilers (n = 98) and layers (n = 22) between 2008 and 2012. 3GC-resistant isolates were screened for extended-spectrum and AmpC β-lactamase (ESBL/AmpC), while all isolates were tested for plasmid-mediated quinolone resistance (PMQR) genes. ESBL/AmpC- and PMQR-positive isolates were typed by pulsed-field gel electrophoresis and antimicrobial susceptibility testing, and their plasmids were characterised by replicon typing, multilocus sequence typing, restriction fragment length polymorphism and conjugation. ESBL/AmpC genes (blaCTX-M-1, blaCTX-M-14, blaCTX-M-2, blaSHV-12 and blaCMY-2) were detected in 7%, 9% and 4% of isolates from turkeys, broilers and layers, respectively. We identified seven ESBL/AmpC-encoding plasmid types, usually conjugative (78%), with a marked prevalence of IncI1/pST3 plasmids carrying blaCTX-M-1. PMQR occurred less frequently among isolates from turkeys (0.9%) compared to those from broilers (5%) and layers (4%). The PMQR genes qnrS, qnrB19 and qoxA/B were located on three plasmid types and two non-typeable plasmids, mostly (85%) conjugative. ESBL/AmpC- and PMQR-positive isolates were genetically unrelated and 64% of them were additionally resistant to aminoglycosides, sulfonamides and tetracyclines. Our data show that 3GC- and quinolone-resistant clinical E. coli in Italian poultry production represent a highly diverse population often resistant to most antimicrobials available for poultry. These findings underline the crucial need to develop new strategies for prevention and control of colibacillosis.

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Fast Inscription of Long Period Gratings in Microstructured Polymer Optical Fibers

We demonstrate 20 dB long period grating (LPG) fast inscription in microstructured polymer optical fibers (mPOFs) using a point-by-point technique obtaining an LPG total length of 25 mm. Two 248 nm UV laser pulses of 15 ns duration have been employed for every inscription point, which means a time reduction by over 21 times compared with the fastest
inscription time already reported in literature. The device has been fabricated in a single-mode mPOF with a core that has been doped with benzyl dimethyl ketal for photosensitivity enhancement. Moreover, we characterize the strain and temperature responses and the stability of the fabricated gratings response under different conditions in order to assess the viability for different applications.

General information
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Organisations: Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Universidad Politécnica de Valencia, University of Aveiro
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ISI indexed (2012): ISI indexed yes
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Direct whole-genome sequencing of Plasmodium falciparum specimens from dried erythrocyte spots

Background: Plasmodium falciparum malaria remains a major health burden and genomic research represents one of the necessary approaches for continued progress towards malaria control and elimination. Sample acquisition for this purpose is troublesome, with the majority of malaria-infected individuals living in rural areas, away from main infrastructure and the electrical grid. The aim of this study was to describe a low-tech procedure to sample P. falciparum specimens for direct whole genome sequencing (WGS), without use of electricity and cold-chain. Methods: Venous blood samples were collected from malaria patients in Bandim, Guinea-Bissau and leukocyte-depleted using Plasmodipur filters, the enriched parasite sample was spotted on Whatman paper and dried. The samples were stored at ambient temperatures and subsequently used for DNA-extraction. Ratios of parasite:human content of the extracted DNA was assessed by qPCR, and five samples with varying parasitaemia, were sequenced. Sequencing data were used to analyse the sample content, as well as sample coverage and depth as compared to the 3d7 reference genome. Results: qPCR revealed that 73% of the 199 samples were applicable for WGS, as defined by a minimum ratio of parasite:human DNA of 2:1. WGS revealed an even distribution of sequence data across the 3d7 reference genome, regardless of parasitaemia. The acquired read depths varied from 16 to 99×, and coverage varied from 87.5 to 98.9% of the 3d7 reference genome. SNP-analysis of six genes, for which amplicon sequencing has been performed previously, confirmed the reliability of the WGS-data. Conclusion: This study describes a simple filter paper based protocol for sampling P. falciparum from malaria patients for subsequent direct WGS, enabling acquisition of samples in remote settings with no access to electricity.

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Determining Biodegradation Kinetics of Hydrocarbons at Low Concentrations: Covering 5 and 9 Orders of Magnitude of Kow and Kaw

A partitioning-based experimental platform was developed and applied to determine primary biodegradation kinetics of 53 hydrocarbons at ng/L to μg/L concentrations covering C8-C20, 11 structural classes, and several orders of magnitude in hydrophobicity and volatility: (1) Passive dosing from a loaded silicone donor was used to set the concentration of each hydrocarbon in mixture stock solutions; (2) these solutions were combined with environmental water samples in gastight auto sampler vials for 1-100 days incubation, and (3) automated solid phase microextraction (SPME) coupled to GC-MS was applied directly on these test systems for measuring primary biodegradation relative to abiotic controls. First order biodegradation kinetics were obtained for 40 hydrocarbons in activated sludge filtrate, 18 in seawater, and 21 in lake water. Water phase half-lives in seawater and lake water were poorly related to hydrophobicity and volatility but were, with a few exceptions, within a factor of 10 or shorter than BioHCwin predictions. The most persistent hydrocarbons, 1,1,4,4,6-pentamethyldecalin, perhydropyrene, 1,2,3,6,7,8-hexahydropyrene, and 2,2,4,4,6,8,8-heptamethylnonane, showed limited or inconsistent degradation in all three environmental media. This biodegradation approach can cover a large chemical space at low substrate concentrations, which makes it highly suited for optimizing predictive models for environmental biodegradation.
Prevalence and risk factors for CTX-M gram-negative bacteria in hospitalized patients at a tertiary care hospital in Kilimanjaro, Tanzania

Emergence and spread of extended spectrum beta-lactamase (ESBL)-producing gram-negative bacteria, mainly due to CTX-M, is a major global public health problem. Patients infected with ESBL-producing gram-negative bacteria have an increased risk of treatment failure and death. We investigated the prevalence and risk factors for CTX-M gram-negative bacteria isolated from clinical specimens of patients hospitalized at a tertiary care hospital in Kilimanjaro, Tanzania. Isolated gram-negative bacteria from inpatients admitted at Kilimanjaro Christian Medical Centre (KCMC) between August 2013 and August 2015 were fully genome sequenced. The prevalence of ESBL-producing gram-negative bacteria was determined based on the presence of blaCTX-M. The odds ratio (OR) and risk factors for ESBL-producing gram-negative bacteria due to CTX-M were assessed using logistic regression models. The overall CTX-M prevalence (95% CI) was 13.6% (10.1–18.1). Adjusted for other factors, the OR of CTX-M gram-negative bacteria for patients previously hospitalized was 0.26 (0.08–0.88), p = 0.031; the OR for patients currently on antibiotics was 4.02 (1.29–12.58), p = 0.017; the OR for patients currently on ceftriaxone was 0.14 (0.04–0.46), p = 0.001; and the OR for patients with wound infections was 0.24 (0.09–0.61), p = 0.003. The prevalence of ESBL-producing gram-negative bacteria due to CTX-M in this setting is relatively low compared to other previous reports in similar settings. However, to properly stop further spread in the hospital, we recommend setting up a hospital surveillance system that takes full advantage of the available next-generation sequencing facility to routinely screen for all types of bacterial resistance genes.

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