Comparing chemical analysis with literature studies to identify micropollutants to be treated or upstream source controlled in a catchment of Copenhagen (DK)

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Published in:
Abstract Book

Publication date:
2012

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
and biochemical responses. For example, a number of highly replicated fish-life cycle and multi-generational tests have examined growth, development, and reproductive success in combination with biomarker endpoints such as vitellogenin, GSI, and gonad histology. Analyses of sperm quality, gonadal development, VTG, genomic markers, and other non-traditional endpoints have also been reported in the literature, often in isolation of a link with more traditional endpoints. In determining the utility and relevance of these endpoints in predicting the novel relationship between water quality and sublethal endpoints, which may or may not be adverse, to population relevant assessment endpoints must be established and data quality and reliability must be determined. The evaluation of data, including both traditional and non-traditional endpoints should be done in a weight of evidence approach in order to reach a scientifically defensible risk determination. In so doing, potential sources of the exposure including those used as measures of effects that are directly related to assessment endpoints for a sound and robust risk assessment. A case study describing this approach for the evaluation and use of both traditional and non-traditional endpoints will be presented from the extensive aquatic database for BPA.

RA23P - Wastewater effluent discharges: characterization and understanding potential risks in receiving waters

TH 303
Risk assessment of WWTPs water effluents using fuzzy logic
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This paper presents a new methodology to assess the risk of water effluents based on fuzzy logic, a very well-known theory to treat uncertainty and vagueness, especially in the environmental field where data may not be fully available. The method has been tested using the effluent's pollution data coming from 22 waste-water treatment plants (WWTPs) located in Catalonia (NE Spain). The driving force to develop this study has been the increasing need of prioritizing pollutants appointed by different water regulations such as the Regulation 166/2006 [1] concerning the establishment of a European Pollutant Release and Transfer Register. It aims at establishing a Community level register of integrated pollutant release and transfer (known as the European PRTR or E-PRTR). Its application is required for waste-water treatment plants (WWTPs) with a capacity of more than 100,000 equivalent inhabitants. Data gathered under the E-PRTR regulation provide a valuable source of information regarding the emission of pollutants to air, water and waste from the assessed installations. The Catalan Water Agency (ACA) conducted three different campaigns with this purpose in 2008, 2009 and 2010. A total of 41 micropollutants belonging to different families (e.g. heavy metals, volatile organochlorine compounds (VOX), Polycyclic Aromatic Hydrocarbons (PAHs)), were analysed in the sampling campaigns and their concentrations in the effluents were determined.

The driving force to develop this study has been the increasing need of prioritizing pollutants appointed by different water regulations such as the Regulation 166/2006 [1] concerning the establishment of a European Pollutant Release and Transfer Register. It aims at establishing a Community level register of integrated pollutant release and transfer (known as the European PRTR or E-PRTR). Its application is required for waste-water treatment plants (WWTPs) with a capacity of more than 100,000 equivalent inhabitants. Data gathered under the E-PRTR regulation provide a valuable source of information regarding the emission of pollutants to air, water and waste from the assessed installations. The Catalan Water Agency (ACA) conducted three different campaigns with this purpose in 2008, 2009 and 2010. A total of 41 micropollutants belonging to different families (e.g. heavy metals, volatile organochlorine compounds (VOX), Polycyclic Aromatic Hydrocarbons (PAHs)), were analysed in the sampling campaigns and their concentrations in the effluents were determined.

In order to ensure the appropriateness and consistency of this new method, the results have been compared with a well-trusted method used for chemicals prioritization, the COMPPS methodology, obtaining more conservative results with the first one due to the inclusion of persistence and variable's weight and the consideration of uncertainty. However, the behaviour of the two models is quite similar, fact that gives consistency to the fuzzy logic model.

TH 304
Simple equation allows assessment of biodegradation of cationic surfactants in activated sludge reactors (OECD 303)
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The Continuously-fed Activated Sludge (CAS) test is suitable to predict the removal of organic compounds from wastewater in activated sludge plants. However, a method to distinghiush between removal by adsorption and biodegradation has not been provided in the Guidelines. Accurate knowledge on the relative role of the different mechanisms in the overall removal processes in activated sludge systems is therefore not available. The main operating parameters i.e. hydraulic retention time (HRT) and sludge retention time (SRT) are strictly maintained during operation of a CAS unit. The following equations are used to calculate the maximum concentration in adsorption of surfactant adsorbed on the sludge and the measured surfactant concentration in the mixed liquid suspended solids allow calculation of biodegradation percentages. The removal of five cationic surfactants with varying adsorption capacities (dioctylamine, dicaprylylammine, decylamine, octadecylamine and dioctadecylammonium chloride) was assessed in CAS tests. The removal from the wastewater ranged from 98.8% (dioctadecylammonium chloride) to >99.9% (decylamine). Removal by biodegradation was 69% (dioctadecylammonium chloride) and 99.9% (decylamine). These removal percentages were compared with modelling results obtained with SimpleTreat. Simple Treat not prioritised the potential of biological treatment systems to remove surfactants from wastewater but also the fraction removed by biodegradation. Especially, biodegradation of surfactants with a high potential to adsorb is not enough appreciated by SimpleTreat. The expression should be included in an update of the test guideline.

TH 305
Predictive modelling of steroid oestrogens in sewage effluent demonstrates the potential for endocrine disruptive effects in wild fish populations in South Australia
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Endocrine disruption (ED) has been observed in wild fish populations worldwide and is particularly well characterised in the UK, where the presence of oocytes in the male Atlantic salmon at a normal female stage of sexual development (protandry) has been linked to sewage effluent containing the natural oestrogens 17β-oestradiol (E2) and oestrone (E1) as well as the pharmaceutical α-ethinylestradiol (EE2) originating from human excretion. In contrast, little is known about the presence and effects of these chemicals in Australia, where there is a greater strain on water resources. Oestrogens have been measured in sewage effluents at levels comparable with the UK and there is some evidence of ED effects in fish downstream of sewage treatment works (STW's). It is therefore advisable to determine the potential levels of oestrogens entering Australian rivers and to assess the risk to wild fish populations. This study demonstrates the first use of predictive modelling of oestrogens in Australian STW effluent, creating predicted environmental concentrations (PECs) for a set of STW's in South Australia and comparing them to the UK using a modified version of a model previously for risk assessment in both Europe and Japan. The PEC's were accumulated into an E2 equivalant concentration (EEQ) and were corroborated against measured concentrations from one UK and one Australian STW to determine their accuracy. These were then compared with the UK Environment Agency's predicted no-effect concentration (PNEC) of 1ng/L E2. Predictive modelling was shown to provide a good method for first tier assessment of the contamination in sewage effluents. The model overestimated the measured EEQ by an average factor of 1.4 when corroborated with the more robust UK STW data, however the effluent EEQ PEC's for all STW's were 3-11 times higher than the 1ng/L PNEC. The model demonstrated that although Australian STW's have a lower population, their EEQ's are not significantly different to the UK's, which is likely to be due to the lower flow through Australian STW's which lowers the concentration of pollutants in the effluent. The results predict that effluents discharged in both the UK and Australia both contain oestrogens at concentrations exceeding the Environment Agency PNEC, suggesting that without sufficient dilution in rivers there is a risk of ED effects occurring in wild fish.

TH 306
Inputs of pollutants by urban wet and dry weather pollution in combined sewer systems: pau urban catchment (CDAPP, France)
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There are combined sewage systems which contain both urban catchments and wastewater flow. This project relates to the evaluation of urban pollution, when it is conveyed to receiving water bodies. An average of 83% of the average urban pollution is due to urban pollution (dry weather and wet weather). Urban inputs that include household effluents, drainage water, business effluents (e.g. car washes, dental uses, other enterprises, etc.), atmospheric deposition and traffic-related emissions (vehicle exhaust, brake linings, tires, asphalt wear, gasoline/oil leakage, etc.) transported either to sewer or treatment plants or directly to the aquatic environment, are expected to represent today important sources of pollution to the aquatic environment. Wastewater treatment plants represent a major threat to the aquatic environment since they are collecting a wide variety of sources from both domestic and industrial activities and they are continuously discharging various polluted effluents. Urban pollution, which is a considerable transient source may also contain high levels of pollutants directly discharged in receiving streams by Combined Sewer Overflow (CSO). Implementation of the European Water Framework Directive and its affiliated directives requires Member States to improve their understanding of priority pollutants in urban areas and obviously within wastewater systems. We present the results of a two-year study carried out in the pau urban catchment (CDAPP, France) which is about 50 km² with about 150 000 inhabitants. 4 rain gauges and about 40 flow meters were installed in all the study area to monitor the combined sewer network. Effluents were followed during about 10 campaigns including wet and dry periods for Suspended Solids (SS), Chemical Oxygen Demand (COD), Total Nitrogen (TN) and trace metals (Cd, Cu, Pb, Zn, Al, Fe, Cr, As, Sn). Emphasis is given to the characteristic, the partitioning and the evolution of these elements from wastewater inputs during dry periods and wet periods in the combined sewer system of Pau. Concentrations of pollutants were combined with flow rate to assess fluxes that were directly discharge into receiving stream by CSO or carry on to the Waste Water Treatment Plant (WWTP). Following a storm event of about 2 hours we showed that this storm event induced an increase of fluxes by a factor of 1.5 to 3 compared to dry conditions. Half to two thirds of pollutants fluxes were treated by the WWTP during this period. The remaining part of the effluent was discharged in the receiving stream the river Gave de Pau. Fluxes of trace metals followed generally the same percentage than SS, suggesting that metal load is mainly associated to SS.

TH 307
Demb.poly, economical activities and health equipments as potential sources of pharmaceutical compounds in wastewater and performance of wastewater treatment in two

SETAC 6th World Congress/SETAC Europe 22nd Annual Meeting 285
French catchments

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Presentations on wastewater treatment are presented by numerous studies. Although important research work is conducted on wastewater treatment plant (WWTP) performances, less is known on the contaminants sources. In fact, this information coupled with the knowledge of treatment efficiency could be very useful to manage WWTPs. In this perspective, the objectives of this work were to assess if pharmaceutical chemicals concentrations in wastewaters could be explained by urban parameters in two urban catchments comparing their treatment performance.

Only 40 km separate both catchments, which have similar population density and distribution. However, catchment A has a higher number of inhabitants, health equipments and economic activities. Both WWTPs use the same technology (membrane bioreactor) to treat urban wastewater, but have different inflows (catchment A 10 times higher than B). Influent and effluents streams were monitored during 3 campaigns over 3 days with 24 hours composite samples. Pharmaceuticals and hormones were analyzed using LC-MS-MS. Results are shown for 6/32 studied compounds: acetaminophen (ACT), diclofenac (DIC), carbamazepine (CBZ), sulfamethoxazole (SMZ), isopropim (IMP) and 17-estradiol (E2).

Fluxes were 3 times higher in WWTP-A for ACT, E2, SMZ and DIC, 80 times higher for CBZ and 1350 times higher for IMP. The differences for CBZ and IMP were not only explained by the cities size but also by the presence of more potential sources in catchment A than B. Concentrations of DIC, SMZ and E2 were similar in both WWTPs. CBZ and IMP were respectively 10 and 183 times higher in WWTP-A. In contrast, ACT was 2 times higher in WWTP-B. Those concentrations could be explained by a dilution effect due to the higher discharge in WWTP-A. Then, in both WWTPs, concentrations of CBZ and DIC in effluents were respectively 6-42% lower than in influents. In contrast, IMP, ACT and E2 showed higher elimination between 76% and 99% in both WWTPs. Therefore, removal efficiencies SMZ was quite stable in WWTP-A (4-6%) and 76% in WWTP-B (0% to 96%). Those results showed the presence of potential pharmaceuticals sources: some were strongly suspected, others needed further investigation. Consequently, a methodology could be developed to predict the fluxes of compounds entering the WWTP based on urban characteristics to define suitable technologies for the best treatment efficiencies.

TH 308

Wastewater effluents and river sources: sources of organic micropollutants to NW Mediterranean coastal waters. Their characterization, fluxes and potential risks

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This study provides a first estimation on the risk associated with the inputs of organic micropollutants (OMPs) to coastal waters from NW Mediterranean Sea. Pollution sources were wastewater treatment plants (WWTP) effluents and river waters discharged to the sea. Polycyclic aromatic hydrocarbons, polychlorinated biphenyls, organonitrocarbons, pesticides, polbrominated diphenyl ethers, phthalates and alkylphenols were analyzed by solid phase extraction and gas chromatography coupled to tandem mass spectrometry (SPE-GC-MS). Eight WWTP effluents and six rivers discharge an estimated amount of around of 25800 g d-1 of OMPs in coastal areas from 7.4 to 8442 ng L-1. A summarized overview of the patterns and sources of OMPs contamination on the investigated coastal sea waters of NW Mediterranean Sea, as well as of their geographical distribution was obtained by Principal Component Analysis of the complete data set after its adequate pretreatment. The concentration of SOMP in coastal areas ranged from 1.7 to 25800 ng L-1. A summarized overview of the patterns and sources of OMPs contamination on the investigated coastal sea waters of NW Mediterranean Sea, as well as of their geographical distribution was obtained by Principal Component Analysis of the complete data set after its adequate pretreatment. The concentration of SOMP in coastal areas ranged from 1.7 to 25800 ng L-1.

TH 309

Chemical characterization and treatment by enhanced coagulation of dissolved organic matter in biochemical-treated effluent of textile wastewater


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Performed with regular physicochemical-biochemical combined treatment process, textile wastewater effluent was treated by enhanced coagulation with a new kind of coagulant. Divalent cations (Fe3+ and Al3+) were used in the treatment as well as effluent treated by enhanced coagulation were isolated and enriched by extraction. Both DOM isolates were characterized by Gas Chromatography-Mass Spectrum (GC-MS) and both effluents by Excitation Emission Matrix (EEM) Analysis. Results showed that biochemically treated textile wastewater effluent contained hydrophilic organic matters: triethylene glycol, tributyl phosphate and phthalates, and hydrophobic organic matters: amino acids and humic substances. And after enhanced coagulation treatment, most of the dissolved organic matter was removed from the biochemically treated textile wastewater effluent.

TH 310

Emerging substances in aquatic phase of landfill leachate

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The potential impacts related to landfill leachate are pollution of groundwater and surface waters. The risk of groundwater pollution is probably the most severe environmental impact from landfill bodies as historically most landfills were built without engineered liners and leachate collection systems. Emerging pollutants are used in large quantities in everyday life and include a variety of substances of different types (e.g., pharmaceutical compounds from different therapeutic classes, personal-care products (PCPs), flame retardants, industrial additives, anticorrosive compounds and others emerging species). The emerging substances are contaminants that have been recognized in wastewater effluents but have not been detected in the natural environment due to their low concentration and poor removal during wastewater treatment. In the leachate, emerging substances are present at higher concentrations than those reported in wastewater effluents. Environmental risk assessments are often focused on emerging contaminants present at high concentrations in the aquatic phase as these are more easily detected and monitored. However, emerging substances are ubiquitous in aquatic media of all levels of the environment. This study presents an inventory of emerging substances found in landfill leachate from small and medium-sized landfills in Serbia, along with an assessment of the potential contribution of these substances to environmental risk. The emerging substances detected in our study included pharmaceuticals, personal care products, and industrial chemicals. The results indicate that emerging substances are present at low concentrations in landfill leachate, and the potential environmental risk related to landfill leachate is unlikely to be significant.
two locations. This was largely caused by a small number of pesticides with very low PNEC values being present at this location. Although not significant, all three wetlands seemed to be more efficient in biologically vitalizing the effluent.

TH 313
Assessing the potential of constructed wetlands in reducing environmental impact of STP effluents: the WIPE project
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At some pilot locations in the Netherlands, the effluent of sewage treatment plants (STPs) is lead through a constructed wetland (so called ‘waterharmonica’) before being discharged into surface water. This has been shown to result in a lower environmental impact. Improving Purification Effectiveness (WIPE) project studied the potential of such methods to reduce the environmental impact of STP effluents on the receiving water, with special emphasis on ecotoxicological aspects. The (changes in) effluent quality of three STPs was monitored during the passage through constructed wetlands. This monitoring programme included the characterization of STP effluents in-vivo and in-vitro bioassays, microtoxicity and biological and gene expression responses of chronically exposed stickleback (Gasterosteus aculeatus). The monitoring was performed between 2008 and 2011 and generated an extensive dataset. In this presentation we will give an overview of how different environmental relevant end points were affected during the passage through the constructed wetlands.

TH 314
Inventories of emission of priority hazardous substances in the surface waters in France
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Introduction
According to Article 5 of the Directive 2008/105/EC on Environmental Quality Standards in the Field of Water Policy, Member States have to establish an inventory of emissions, discharges and losses of all priority substances and pollutants listed in Part A of Annex I to this Directive. This paper aims at describing the french approach used to revise and update the existing inventory.

Methodology
Methodology was guided by the following key ideas:
- A state-of-the-art methodology in agreement with regulatory requirements, and EU guidance.
- A database specific methodology. The approach is based on efficient discharges data, in their absence some explicit estimation formulas are proposed.
- A single methodology applicable at different spatial scales.
- A methodology that will work despite scarcity of information and data, and uncertainties.

- Samples were collected from each of the four septic tanks as described above and conditioned in the same way. A total of 32 samples were collected, 4 of which were used for toxicity testing, 24 for composition analysis and 4 for comparison. Each sample was then divided into two fractions: 50% of the sample was used for the acute toxicity test, while the remaining 50% was used for the elemental analysis. The toxicity test was performed using the bioluminescence inhibition of the marine photobacterium Vibrio fischeri. It is a test with many advantages such as ecological relevance, sensitivity, reproducibility, standardization and simple execution. A series of physical-chemical parameters were also analyzed based on Standard Methods for Examination of Water and Wastewater 20th (APHA - 1998). Sludge from four septic tanks was used in the study. From each tank four samples were collected, each aliquot representing a distinct depth, classified as:
  - 1st liquid: 1st zone (sludge);
  - 2nd liquid: 2nd zone (sludge);
  - 3rd liquid: 3rd zone (sludge);
  - 4th liquid: 4th zone (sludge);

TH 316
Acute toxicity analysis of urban septic tank sludge
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The objective of this work was to evaluate possible toxic effects of sludge samples from urban septic tanks and upflow anaerobic sludge blanket (UASB) from a wastewater treatment plant located in the University of Espirito Santo, Vitória, Brazil. The method employed was the acute toxicity test Microtox (Azur Environmental) based on the luminescence inhibition of the marine photobacterium Vibrio fischeri. It is a test with many advantages such as ecological relevance, sensitivity, reproducibility, standardization and simple execution. A series of physical-chemical parameters were also analyzed based on Standard Methods for Examination of Water and Wastewater 20th (APHA - 1998). Sludge from four septic tanks was used in the study. From each tank four samples were collected, each aliquot representing a distinct depth, classified as:
  - 1st liquid: 1st zone (sludge);
  - 2nd liquid: 2nd zone (sludge);
  - 3rd liquid: 3rd zone (sludge);
  - 4th liquid: 4th zone (sludge);

TH 317
Comparing chemical analysis with literature studies to identify micropollutants to be treated or upstream source controlled in a catchment of Copenhagen (DK)
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The European Water Framework Directive aims at obtaining good ecological and chemical status of European water bodies by the year 2015 (EU, 2000). The directive also requires monitoring of effluents, sampling of source inventory to design and perform monitoring programs as well as to outline strategies to reduce emissions if the environmental quality standards are exceeded (EU, 2008). The aim of this study was to compare two different approaches to identify micropollutants in stormwater from a specified catchment; a literature inventory of potential pollution sources and chemical analysis of urban stormwater runoff. The selected catchment covers an area with roads, a shopping centre, a parking lot, office buildings, an upper secondary school and restaurants in Copenhagen (Denmark). The literature approach is limited to the range of included micropolulants and to how and which information is compiled, whereas the analytical chemical approach is limited to and affected by the sampling procedure, the selection of analysed
TH 318
Toxicity identification evaluation for wastewater treatment plant working at different industrial and municipal scales
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A toxicity identification evaluation according treatment in consideration the system used for depuration of wastewater. Process control in this system was monitored by the VFA concentration, and the microorganisms concentration. The PH value, the temperature, the time of retention, the DO concentration, were monitored in online. After the treatment, COD, BOD, N, P, and other contaminants were measured to assess the impact of the treatment process. The results showed that the treatment process significantly reduced the contaminants in the wastewater.

TH 319
Application of delayed fluorescence to estimate the influence of waste water effluent on algae
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Waste water effluent is major source of chemicals discharge in to aquatic ecosystems. Since algae are important primarily producers in aquatic ecosystems, it is necessary to influence the estimate of effluent not only on animals but also the algae. We are investigating a new method of for evaluating the influence of chemicals on algae by using delayed fluorescence (DF) from algae. The DF is a specific type of luminescence; it detects the growth of only those cells that have photosynthetic capability. Since the DF originates from re-excitation of chlorophyll by a reverse reaction of photosynthetic electron transfer, the DF inhibition reflects inhibition of photosynthetic activity that is necessary for growth. Therefore, DF is a potential endpoint for the estimation of the influence of chemical substances on algae growth in a shorter time than the conventional 72 hours growth inhibition test (e.g. OECD test guideline 201).

TH 320
Ecological health assessment and stressor identification using multi-response bioindicators of fish
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This study was evaluated the effect of environmental stressors using various parameters such as chemical water quality, habitat evaluation, and chemical exposure biomarkers in the Gap stream, South Korea during May-June 2009. We collected the pale chub (Zacco platypus) as sentinel species to evaluate biomarkers and indicators at four sampling sites in the stream. In the bioassay, the major changes observed were increased detoxification enzymes (EROD), DNA damage, physiological parameters, % of DIF anomalies, impaired reproduction, and reduced fish population structure in the downstream site (GS 7.2) of municipal wastewater treatment plant (MWTP). By the stressor identification (SI) process, five candidate processes of fish population degradation were winnowed including habitat alteration, low dissolved oxygen, nutrient enrichment, ammonia toxicity, and pH alteration. The results of causal analysis suggest that the principal probable causes of fish population impairment in the downstream site below the MWTP were a combination of effects associated with recruitment failure and size-selective mortality caused by nutrient enrichment, ammonia toxicity, and habitat alteration such as degradation in spawning and nursery space.

TH 321
Monitoring potential ecotoxicological effects in the effluent of an urban wastewater treatment plant
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Organic micropollutants cannot be removed by traditional wastewater treatment technologies. Therefore it is being discussed to add additional treatment steps such as ozonation, active carbon filtration, UV-treatment etc. However, there is a lack of long-term studies to clearly prove a direct relationship between micropollutants in waste water and ecotoxicological effects on the macrozoo-benthous fauna in the recipient stream to justify future expensive installations. Online biomonitoring of the ecotoxicity of waste water just before release into the river Limmat. Potential short term responses to episodic pollution pulses as well as long-term effects of the potentially toxic cocktail of the waste water were monitored on real-time basis over several weeks. Different species of gammarads were applied (D. villosus, G. pulex) and their sensitivity compared. These studies establish the baseline toxicity of the waste water in its current treatment before additional treatment steps might be installed in the future in order to record the change of toxicity potential. On the other hand, if during long-term monitoring with gammarads no toxic effects can be seen, compared with sporadic in situ benthos assessment, the need of additional treatment steps should be reevaluated on a case-by-case basis for each wastewater treatment plant and its recipient river ecosystem.

TH 322
Implications of municipal wastewater on macroinvertebrate community structure and leaf litter breakdown
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European streams receive huge amounts of municipal wastewater, which, due to the limitations of conventional secondary treatment (i.e. mechanical and biological), may contain a wide range of micropollutants, like pharmaceuticals and personal care products. As such micropollutants are continuously released into aquatic environments, they may pose a potential risk for the integrity of ecosystems. Hence, the present study assessed adverse structural and functional implications of wastewater released by the municipal wastewater treatment plant (WWTP) in Landau, Germany, on its receiving stream, the Queich. For this purpose several endpoints related to the ecosystem function of leaf litter breakdown (microbial and invertebrate mediated leaf litter breakdown, in situ bioassays with Gammarus fossarum) and the structure of the aquatic invertebrate community were investigated for six and three weeks during winter and summer 2011, respectively. Macroturbidity related leaf litter breakdown in terms of leaf mass loss was by up to 63% significantly reduced at sites situated up to 500 m downstream of the WWTP outlet compared to the upstream site during both seasons. This effect may be explained by the reduced availability of organic substrates. Reduced feeding rate at downstream sites, indicating lower energy availability and reduced reproductive output. These implications in leaf shading macroturbidity and the ecosystem function of leaf litter breakdown may be on the one hand caused by direct ecotoxicological effects of the released micropollutants. The results of the in situ bioassays on Gammarus fossarum, which is supported by the results of the in situ bioassays, supported our findings. Given by a lower nutritional quality of leaf material, indicated by a significantly reduced fungal biomass (up to 75%) at the downstream site, may have influenced the physiological fitness of shredders. Furthermore, this study also examined the specific procedure in wastewater treatment by considering advanced treatment methods (e.g. ozonation), which may help to meet the requirements of the EU Water Framework Directive.

TH 323
Water quality investigations in the river Lea downstream a sewage treatment works: preliminary results of a case study
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In the east of London the Lea Navigation is a canalised reach of the river Lea, is affected by episodes of very low levels of dissolved oxygen. The problem was detected by the Environment Agency in the stretch from the confluence with Pymmes Brook (which receives the final effluent of Deptford sewage treatment works) to the Olympic camp (Marshgate Lane, Stratford). In this study the river water ecotoxicity to the freshwater alga Pseudokirchneriella subcapitata was tested by algal growth inhibition test according to modified OECD guidelines (Organization for Economic Co-operation and Development, 2006). Results showed inhibited growth rate after 24 hours that was most pronounced in the middle of the poling area, where populations of the polar water were higher. Rapid acute toxicity tests were carried out using immobilized amperometric whole cell biosensors (CellSense). Results indicated no evidence of acute toxicity in the river water, as no significant differences were detected between pre and post exposure response to river water samples, with an exposure time of 30 minutes. These results indicate chronic pollution of the river, affecting photosynthetic algae during long-term exposure.
Enrichment free LC-HRMS screening method of anthropogenic sewage pollutants in waste water, receiving water, ground water and drinking water samples
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In last decade, there has been growing public concern of potential contamination of water and environment with anthropogenic compounds and their degradation products and possible negative influence to the nature and public health. As a response to this fact, there is an increased interest in more efficient screening techniques of larger number of compounds compared to traditionally carried out by triple quadrupole mass spectrometry. This has been described as the preferred screening tool due to the possibility to look for a large number of compounds and also because it enables retrospective analysis [1]. Furthermore, the use of a resolving power \( \geq 50,000 \) FWHM is reported as being as selective as 2 SRM transitions when using triple quadrupole instruments [2]. In this work, direct injection has been applied to the screening of anthropogenic sewage pollutants in different matrices using a quadrupole-Orbitrap analyser. The experiment consisted on combining full scan mode at a resolving power of 70,000 FWHM with data dependent MS/MS spectra acquired at a resolving power of 17,500 FWHM. The MS/MS spectra were generated by using a high energy collision induced dissociation cell (HCD). This experiment was tested and evaluated in terms of qualitative and quantitative capability of the MS/MS spectra of pharmaceutical wastewater pollutants. Differ to sample types were elumed, including waste water, receiving water, ground water and drinking water representing different steps within the water cycle of densely populated and intensively agriculturally used areas.

References

Whole effluent assessment as an alternative to in situ ecological impact measurement? An experimental approach
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There is increasing recognition by regulators that there is a substance-specific approach for assessing and controlling the environmental fate and effects of effluents. Often, single regulatory agencies are seeking more holistic techniques such as whole effluent assessment (WEA) to supplement existing approaches. However, to ensure that these approaches are capable of indicating potential environmental effects, it is important to test scientifically robust WEA protocols. In general, WEA methodology assesses toxicity to aquatic organisms. WEA has relevance for the protection of ecosystems although the relevance and interpretation of results ultimately depends on the tests used. In this work, a team of experts carrying out this type of assessment in the framework of the ICM2 project presented in this paper, conducted an extensive ecotoxicological analysis using standard ecotoxicological bioassays in order to assess the suite of pollutants present in the effluent in order to limit its variation (how to minimize volatilization, oxidation and crystallization how to resist to outdoor climatic variation...); (2) Feasibility of the WEA approach was demonstrated in the context of the ICM2 project presented in this paper, which includes a comprehensive analysis of effluent, receiving water and reference water and in the area (3DOTS), this approach is difficult to be applied. In this case, WEA methodology might represent an alternative to ecological indicators. Results of the WEA carried out in the context of the ICM2 project presented in this paper, show the relevance of WEA methodology which is conservative and in situ impact measurement for risk assessment. In this project, the difference between WEA and in situ impact assessment is assessed using dynamic outdoor mesocosms. This project has been designed and realized in three successive steps: (1) Preliminary experiments in Laboratory to assess the best solution to store one effluent sample; (2) Evaluation of the potential mixture assessment factor (MAF) and its magnitude shall be discussed on the basis of the results gained.

Combination effects of pharmaceuticals and industrial chemicals in waste water effluents
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Bioassays offer an opportunity for a more holistic and meaningful way of assessing effects of environmental samples and wastes on ecosystems than what is possible by using chemical-based monitoring alone. They can provide predictions of environmental impacts whereas ecological community measures only determine impacts after they have occurred. Therefore, bioassays are useful in helping to implement the Water Framework Directive (WFD). In Wallonia (Belgium), an effect directed active monitoring using bioassays is being carried out for many years. It combines ecotoxicological measurements at emission and immission and physico-chemical measurements. We use a battery of short term and chronic bioassays with the bacteria Vibrio fischeri, the alga Pseudokirchneriella subcapitata, the rotifer Brachionus calyciflorus and the microcrustacean Daphnia magna. Moreover, a yeast estrogen screen (YES) assay was conducted as an assessment tool to detect the presence of endocrine disrupting compounds. During 2011, 14 major industrial discharges and 26 sampling points in the receiving waters (upstream and downstream of the effluent) were monitored. The effluents were sampled 6 times a year whereas receiving waters were sampled 4 times a year. Priority List substances of the WFD and other pollutants discharged in significant quantities were also measured. More detailed studies were carried out with complementary tools: upstream and downstream of a discharge of a metalurgical industry, bioassays were conducted on both waste lakes and sediments and bioaccumulation of metals was assessed using encaged bryophytes; upstream and downstream of a pharmaceutical industry, YES assay was conducted as potential assessment tools in combination with passive samplers (POCIS). The results of these monitoring show that bioassays are good diagnostic tools to determine the causes of poor ecological quality and to trace back to the source of contamination. They are an important "tool in the toolbox" for environmental management. They add value and provide complementary information to that supplied by the chemical and ecological community measures and could help to design appropriate management measures.

Combination effects of pharmaceuticals and industrial chemicals in waste water effluents
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We will present our currently starting research activities in testing combination effects of pharmaceuticals and industrial chemicals known for their (co-)occurrence in WWTP effluents. Mixtures of industrial chemicals and human pharmaceuticals can be found in surface waters as so called micropollutants. Effluents of waste water treatment plants (WWTP) are the main exposure route for both kinds of substances. The emission of these chemicals into WWTP originated from consumer usage of products, articles and drugs. It is commonly known from literature and discussed in different scientific and regulatory communities that effects of chemical mixtures are significantly larger than single substances. At the moment neither in the environmental risk assessment of chemicals (REACH) nor of human pharmaceuticals (EMEA/CHMP/SWP/4447/00) possible combination effects in the environment is considered. But taking into account realistic exposure scenarios we assume that combination effects are the rule and not the exception. Consequently an underestimation of environmental risks is likely. The study focuses on the question if combination effects of pollutants in WWTP effluents require further assessment. Therefore ecotoxicity tests with algae and daphnids for 6 environmentally relevant substances shall be conducted individually and in different combinations respectively. These substances, (i.e. nonylphenol and ibuprofen) are known to occur in WWTP effluents. Consequently, many regulators are seeking more holistic techniques such as whole effluent assessment (WEA) to supplement existing approaches. However, to ensure that these approaches are capable of indicating potential environmental effects, it is important to test scientifically robust WEA protocols. In general, WEA methodology assesses toxicity to aquatic organisms. WEA has relevance for the protection of ecosystems although the relevance and interpretation of results ultimately depends on the tests used. In the following presentation the project presented in this paper, which includes a comprehensive analysis of effluent, receiving water and reference water and in the area (3DOTS), this approach is difficult to be applied. In this case, WEA methodology might represent a different approach to ecological indicators. Results of the WEA carried out in the context of the ICM2 project presented in this paper, show the relevance of WEA methodology which is conservative and in situ impact measurement for risk assessment. In this project, the difference between WEA and in situ impact assessment is assessed using dynamic outdoor mesocosms. This project has been designed and realized in three successive steps: (1) Preliminary experiments in Laboratory to assess the best solution to store one effluent sample; (2) Evaluation of the potential mixture assessment factor (MAF) and its magnitude shall be discussed on the basis of the results gained.
Environmental impact of current reserve-antibiotics with increasing incidence of severe infections using modern waste water treatment

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Antibiotic resistance is increasing since 30 years. Antibiotics previously used as reserve antibiotics, e.g. ciprofloxacin, are found in guidelines for treatment of slight infections. Thus, reserve antibiotics are no longer a sufficient protection against bacteria. The new generation of reserve antibiotics are cephalosporins and carbapenems.

Our approach was taken into account the ecotoxicity of solutions simulating a wash cycle in a dishwasher in typical use conditions, as recommended by the manufacturer. The "washing solutions" were selected because they offered the best conditions to destroy or remove organic chemicals of concern such as oestrogens or pharmaceuticals. The "washing solutions" were relevant and allowed the classification of the different dishwasher detergents. Mostly, it was shown that the reproduction of C. dubia was the most sensitive endpoint compared with the inhibition of the mobility of D. magna and the growth of the algae P. subcapitata. Our approach was taken into account the ecotoxicity of solutions simulating a wash cycle in a dishwasher in typical use conditions, as recommended by the manufacturer. The "washing solutions" were selected because they offered the best conditions to destroy or remove organic chemicals of concern such as oestrogens or pharmaceuticals. The "washing solutions" were relevant and allowed the classification of the different dishwasher detergents. Mostly, it was shown that the reproduction of C. dubia was the most sensitive endpoint compared with the inhibition of the mobility of D. magna and the growth of the algae P. subcapitata. Therefore, the ecotoxicity recorded for "classical" products and "multibenefit" tablets. This study also revealed that the ecotoxicity of "classical" products was, most of the time, higher than the ecotoxicity of "multibenefit" tablets. Additional studies confirmed that the ecotoxicity recorded for "classical" products was mostly due to the addition of rinse aid in the "washing solution". These results suggested that the ecotoxicity recorded for ecolabelled products should be weighted regarding to the intrinsic ecotoxicity of the rinse aids which are currently not covered by "European Ecolabel".

TH 330

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TH 331

Comparative study of the ecotoxicity of dishwasher detergents

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This study aimed at assessing the ecotoxicity of dishwasher detergents. Indeed, despite the high consumption of such products, available information regarding their environmental impact was scarce. Thus, twenty five of the most representative dishwasher products available on the French market were selected, covering the different dishwasher detergent categories: "multibenefit" tablets, "classical" products (tablets and powder) and "gel" (both "classical" products and "gel" need the use of rinse aid).

Regarding the automatic dishwasher products, it was shown that the ecotoxicity of "washing solutions" from the "gel" products was higher than the ecotoxicity recorded for "classical" products and "multibenefit" tablets. This study also revealed that the ecotoxicity of "classical" tablets was, most of the time, higher than the ecotoxicity of "multibenefit" tablets. Additional studies confirmed that the ecotoxicity recorded for "classical" products was mostly due to the addition of rinse aid in the "washing solution". These results suggested that the ecotoxicity recorded for ecolabelled products should be weighted regarding to the intrinsic ecotoxicity of the rinse aids which are currently not covered by "European Ecolabel".

TH 332

Characterisation of dissolved organic carbon in effluents and the assessment of its overall benefits in mitigating environmental impacts from metals

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Dissolved organic carbon (DOC) is known to form complexes with metals which can markedly reduce the free concentration of the metal and mitigate toxicity. Biocatalysed Ligand Models (BLMs) for metals include speciation calculations of DOC with the metal ions, with increasing DOC concentrations usually providing a significant reduction in the toxicity of the metal.

BLMs assume a composition for the DOC in terms of the ratio of humic and fulvic acids. These default DOC characteristics work well for natural waters with generally good humic or fulvic acids. The DOC in effluents will, therefore, almost certainly interact with metals in a different manner to that predicted by BLMs and so provide greater protection against toxic effects of metals. About 50% of effluent DOC has been shown to be relatively quickly degraded and therefore not likely to be captured, though not completely, the observed spread in observed values. Such modelling predictions can complement existing monitoring data and fill gaps for data-poor chemicals. The application of BLMs to the dissolved metal speciation analysis of effluents provides the opportunity to identify and prioritise potential organic chemicals of concern whose characterization is required to improve our understanding of the effects of dissolved organic carbon in effluents.

TH 333

Integrating sewage treatment plant monitoring and modelling to optimise prioritisations of chemicals of concern and assess environmental risks

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Assessment of the environmental impact of organic chemicals released via sewage treatment plant (STP), prioritising pollutants of concern and assessing their risks for the aquatic ecosystem entail key scientific challenges for regulators. From the EU perspective, such challenges are common to the chemical legislation, (e.g. REACH regulation, Biodical Product Directive and the water legislation (e.g. Urban Water Treatment and Water Framework Directives)). In chemical risk assessment, the exposure of the aquatic ecosystem to organic chemicals released via STPs is calculated. In two steps, first, local and regional scale emissions to sewage are estimated from consumer use data; then, the fate in a generic STP is calculated using the multimedia box model SimpleTreat. Default calculations are based on conservative (worst-case) assumptions.

In a recent study, was carried out for two chemicals of concern, LAS and triclosan, to evaluate the existing modelling framework applied to regulatory chemical risk assessment in the EU and to explore synergies with the monitoring and risk assessment activities under the Water Framework Directive. Inhabitants of organic chemicals released via sewage treatment plant (STP), prioritising pollutants of concern and assessing their risks for the aquatic ecosystem entail key scientific challenges for regulators. From the EU perspective, such challenges are common to the chemical legislation, (e.g. REACH regulation, Biodical Product Directive and the water legislation (e.g. Urban Water Treatment and Water Framework Directives)). In chemical risk assessment, the exposure of the aquatic ecosystem to organic chemicals released via STPs is calculated. In two steps, first, local and regional scale emissions to sewage are estimated from consumer use data; then, the fate in a generic STP is calculated using the multimedia box model SimpleTreat. Default calculations are based on conservative (worst-case) assumptions.

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TH 335

Anaerobic biodegradation of PCBs in a grass cut batch reactor
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Due to properties such as high Kow values chlorinated compounds including PCBs, dioxins or chlorinated pesticides in vegetation can lead to bioaccumulation in livestock and in the food chain. Hence, the remediation of these compounds in the environment is an important factor for human health. The degradation of the persistent Polychlorinated Biphenyls (PCBs) under anaerobic conditions in sediments and sewage sludge is described in the literature [1,2]. The potential for degradation in an anaerobic grass cut batch reactor has not been performed before and is investigated in this work. Therefore two series of batch experiments in laboratory scale (0.5 L to 1.5 L of volume) were performed under mesophilic conditions.

The first experimental series was performed at low natural, i.e. not spiked concentration level of Elbe riverside grass and sludge samples at 27 °C for 315 days. This first, explorative experiment showed ambiguous results for the degradation of the 6 indicator PCBs (PCB No.: 28, 52, 101, 138, 135, 180). Concentrations of the lower chlorinated PCBs decreased whereas the concentrations of the higher chlorinated PCBs were found to be stable at 5200 µg/kg dry weight sewage sludge.

For the second experimental series 6 PCBs (No.: 28, 52, 101, 138, 135, 180), a technical mixture of PCBs (Aroclor 1260) and the pesticide Endrin were added in high concentration to the batch experiments (33 µg per compound, respectively 100 µg of Aroclor 1260). In this second experiment different initial weights of grass cut from the same field were used as a base to determine PCB degradation rates. For the determination of degradation rates experimental times for these batches vary between 30 and 120 days. Compound concentrations were measured by GC-EC. Methane and carbon dioxide concentrations (measured by FTIR) in the gaseous phase of batch experiments were used as an indicator for biological activity. Results from the second batch experiment, concerning PCB-degradation rates and their impact on the carbon production kinetics due to different dry mass productions, are discussed on the poster.

References

TH 336

Removal of nutrients by immobilized microalgal beads in a continuous flow system
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Using immobilized microalgae in contaminant removal is an emergent method in recent environmental studies. As is well known, phytoplanktons use nitrate (N) and ortho-phosphate (P) during the photosynthesis process for production. In this study, a diatom “Phaeodactylum tricornutum” was immobilized in 3.5 % sodium alginate solution and hardened with 4% calcium chloride (cation solution) and introduced into a continuous system to remove nitrate and ortho-phosphate. Daily samples were taken from the system and analysed by UV-Vis spectrophotometer (Chebiox Optimum-one) to determine the removal efficiency of the nutrients by the algal beads. The cell numbers in the beads were also determined by counting in a Coulter Counter system during the experimental period. The blank beads were also run in the system and subtracted from the total removal of the nutrients to detect the net removal by the algae. The system was operated as six separate runs with usage of the same algal beads by starvation of three days at each time to increase the removal efficiency of the system. It was observed that the algal beads remove approximately 50% and 40% (average values of net removal by the algae) of the P and N respectively, considering the inflow concentrations of 1000 mg/L of P and 3000 mg/L of N. Disadvantages of this method are indicated as the release of the microalgae out of the beads during the experiment and disintegration of the algal beads over a long term run.

TH 337

Meta-analysis of diesel production in terms of life cycle GHG emissions and energy consumption: comparison and case study of Spanish refineries
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When performing the life cycle assessment (LCA) of petroleum products, life cycle inventory data are generally global compilations and they are not partitioned into sub-processes, but handled as a black box. Several products with different characteristics and uses are usually obtained from oil refining process (olefins, propane, butane, gasoline, kerosene, diesel, paraffin, asphalt, etc.). Allocation of proportional impacts of energy consumption and emissions for each product is a difficult task because many of them are correlated. Therefore, energy consumption and emissions are allocated according to the final product distribution. The most allocation methods used for petroleum products are based on economic content, according to the ratio of value content of each product.

This study compile the results of several studies of diesel production in European and American processing plants in terms of GHG emissions and energy consumption. Furthermore, this study is recent and based on case studies from refineries in order to obtain more adjusted and accurate results, as well as the possible partial subdivision of the system as a solution, according to ILCD handbook recommendations for allocation procedures.

TH 338

Towards transparent and relevant use of energy use indicators in LCA studies of biofuels
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The use of energy has led to resource crises during the history of mankind, such as the deforestation of the Mediterranean during antiquity, and of Great Britain before the 19th century, and the oil crisis in the 20th century and continuing. Considering this, the frequent use of the impact category ‘energy use’ in the environmental assessment tool life cycle assessment (LCA) is not surprising. However, in a previous study, some of the authors noted that the term ‘energy use’ was not applied in a transparent and consistent way in LCA studies applied in biofuels. In this life cycle assessment (LCA) of biofuels. In the examined reports and articles, the choice of indicator was seldom motivated or discussed and we observed five inherently different energy use indicators: (1) fossil energy, (2) secondary energy, (3) cumulative energy demand, (4) net energy balance, and (5) total extracted energy. These five energy use indicators were applied to the same cradle-to-grave production system of palm oil methyl ester (PME), giving considerably different output results. This is in itself not unexpected, but indicates the importance of clearly describing, identifying and motivating the choice of energy use indicator. All five indicators can all be useful in specific situations, depending on the goal and scope of the individual study, but the choice of indicators need to be better reported and motivated than what is generally done today. Authors of LCA studies should first define the purpose of their energy use indicator (fossil scarcity, energy scarcity, energy efficiency, cost/benefit comparison) and may then make a motivated choice of the energy use indicator.

TH 339

A meta analysis review: ‘Drop-in’ Biofuels - Life Cycle Assessment, substance flow analysis, material flow analysis and relevant information on an advanced biofuel production sector
A.W.U.A. Boisse Ayre, A. Halog
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The advanced biofuel production sector is enjoying an unprecedented amount of public and private effort in order to remove various financial and technical barriers. Government-sponsored departments, such as the Department of Energy has been championing efforts that ensure that the next generation of biofuels will be regarded as “drop-in”biofuels. According to the Former President, “drop-in”biofuels can either be used directly or blended with their petroleum-derived counterparts. The European Commission on the other hand defines drop-in biofuels on the basis of their energy use indicator (fossil scarcity, energy scarcity, energy efficiency, cost/benefit comparison) and may then make a motivated choice of the energy use indicator.

TH 340

How to assess the data quality of LCA studies - a systematic approach
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The field of biomass is broadly growing, increasing the need for reliable data on the environmental burdens inflicted by the use of the different conversion technologies. A huge number of LCI studies on this topic can be found, however, most of these studies are not directly comparable to each other and their results may vary considerably depending on different data origins, time and geographical background, technologies and system boundaries. It is often unclear how to decide which study is “best suited” for a given case. The objective of this work is to present a guideline that helps compare different LCI studies. In this guideline a systematic approach on the assessment of literature quality is done. In a first step the current “best practice” for modelling an LCI is summarized. By this a reference for the assessment of the data is defined. This reference will identify a

TH 341

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The advanced biofuel production sector is enjoying an unprecedented amount of public and private effort in order to remove various financial and technical barriers. One of these very important barriers is the challenge of developing biofuels that are compatible with existing gasoline, jet fuel and diesel infrastructure. The United States Department of Energy has been championing efforts that ensure that the next generation of biofuels will be regarded as “drop-in”biofuels. According to the Former President, “drop-in”biofuels can be defined as fuels produced from various biomasses which are compatible with the over $9 trillion energy refinery and gas station infrastructure currently available in the United States. According to definitions used in reviewed literature, drop-in biofuels are described by National Advanced Biofuel Consortium of the United States as infrastructure compatible - they can either be used directly or blended with their petroleum-derived counterparts. The European Commission on the other hand defines drop-in biofuels on the basis of the quality specifications (standards) developed by the American Society for Testing and Materials. Numerous LCA works have been conducted concerning what is described as drop-in biofuels. Although this topic of drop-in biofuels is relatively new, literatures regarding LCA of drop-in biofuels are based on the definition provided were available for analysis. A comprehensive overview of the previously conducted LCA studies in this new field of advanced biofuels. Also, important topics concerning this new chapter in the biofuels revolution were delved into. The results of this meta-analysis review will be presented at the SETAC world congress.

TH 342

SETAC 6th World Congress/SETAC Europe 22nd Annual Meeting
In this paper, the authors developed and applied a structured approach, inspired by the meta-analysis concept, to examine literature and identify research thrusts on how to further develop LCA. The procedure consists of four steps: (i) definition of the research question, (ii) carrying out a literature review concerning more than 280 papers - selected from about 2000 articles according to pre-defined criteria - which resulted in the identification of some 60 main methodological topics; (iii) research gap analysis, in which the methodological topics identified in the previous step were compared with the research priorities identified through a users' needs survey; (iv) interpretation of results, in which the results of both the previous steps were evaluated and organized into coherent research thrusts. Overall the analysis delivered two main research thrusts: one devoted to incremental model fidelity of LCA, the other to increase model fidelity. The former is aimed at making knowledge available in easily usable way, while the latter focuses on better describing the complexity of the systems analysed and those interrelations that are really meaningful. Specific research topics were identified for each thrust, which suggests that sophistication and practicability can and should coexist in the same method.

**TH 343**

**Finding LCA research direction with the aid of meta-analysis**

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The guideline was tested on an analysis of LCI studies and data sets of an Organic Rankine Cycle plant for German framework conditions. In a second step on the base of the indicators developed in the first step the available studies will be analyzed. In the last step, the actual states of the data are compared and assessed with the reference. This approach makes it easy to spot and report any shortcomings the studies may have and eventually decide which study should be used for a given problem. The guideline consists of four parts: (i) description of the technology of interest and of available literature; (ii) description of the indicators, the reference values and the available data; (iii) evaluation of the available literature; (iv) recommendation. The guideline was tested on an analysis of LCI studies and data sets of an Organic Rankine Cycle plant for German framework conditions. Using the guidelines data gaps were identified and quantified resulting in a better overall understanding where these gaps came from and how to deal with them. The guidelines allowed for a good comparison on the data quality of the literature. With their use a good overview of the different LCI studies could be achieved and a clear recommendation for data set generation could be given.

**TH 344**

**A web-based approach to handling divergence in LCA**

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The last two decades have seen a profusion of studies in the Life Cycle Assessment (LCA) field, as well as growing interest in this work by parties in business and government. Furthermore, the rapid growth of detailed and constantly updated Life Cycle Inventory (LCI) and Environmentally Extended Input Output (EEIO) databases has led to an impressive set of studies and published information, from which it is often very difficult to elicit conclusive assessments due to conflicting results presented by the authors, although ostensibly the same product is being analysed. At present, a widely discussed approach to handling this situation is some form of meta-analysis. However, it is often difficult to use other studies and approaches, in particular, those that afford solutions that may be available sooner, and also available across a wider range of cases and for a wider range of users.

Our general strategy is to take a more qualitative approach to the problem of divergence or discrepancy in LCA. We think about a web-based toolkit that tries to resolve discrepancies by opening up the information using distributed data. An option for accessing distributed data sources and linking them semantically is the emerging technology called Linked Data. While the primary units of the hypertext Web are HTML (HyperText Markup Language) documents connected by hyperlinks, extending the simple link (which can be seen as the sentence 'has to do with') to meaningful relations (such as 'isObservedOn' [observedEntity]) and discrepancies by opening up the information using distributed data. An option for accessing distributed data sources and linking them semantically is the emerging technology called Linked Data. In this paper a range of historic lifecycle studies of greenhouse gas-equivalent emissions for on and offshore wind farms are reviewed to identify a definitive set of the most current, original, and transparent studies. It begins by briefly detailing the separate components of the wind farm life cycle before explaining the methodology of the meta-analysis and exploring the range of case studies. The paper highlights that ranges of emissions estimates are present for wind power. The paper also suggests that meta-analyses of historic lifecycle studies of this nature help to provide greater advice ensuring comparability, consistency and accuracy for given technologies. The paper then explains some of the factors responsible for the disparity in lifecycle estimates, in particular identifying errors in both the lowest estimates and the highest estimates. It is noted that wind power is not directly emitting greenhouse gas emissions, but rather that lifecycle emissions occur through farm construction, operation and farm decommissioning.

**TH 345**

**Environmental impacts of palm oil biodiesel: A meta analysis**

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In this paper a range of historic lifecycle studies of greenhouse gas-equivalent emissions for on and offshore wind farms are reviewed to identify a definitive set of the most current, original, and transparent studies. It begins by briefly detailing the separate components of the wind farm life cycle before explaining the methodology of the meta-analysis and exploring the range of case studies. The paper highlights that ranges of emissions estimates are present for wind power. The paper also suggests that meta-analyses of historic lifecycle studies of this nature help to provide greater advice ensuring comparability, consistency and accuracy for given technologies. The paper then explains some of the factors responsible for the disparity in lifecycle estimates, in particular identifying errors in both the lowest estimates and the highest estimates. It is noted that wind power is not directly emitting greenhouse gas emissions, but rather that lifecycle emissions occur through farm construction, operation and farm decommissioning.

**TH 346**

**Greenhouse gas emissions from wind power: a critical meta-analysis**

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In this paper a range of historic lifecycle studies of greenhouse gas-equivalent emissions for on and offshore wind farms are reviewed to identify a definitive set of the most current, original, and transparent studies. It begins by briefly detailing the separate components of the wind farm life cycle before explaining the methodology of the meta-analysis and exploring the range of case studies. The paper highlights that ranges of emissions estimates are present for wind power. The paper also suggests that meta-analyses of historic lifecycle studies of this nature help to provide greater advice ensuring comparability, consistency and accuracy for given technologies. The paper then explains some of the factors responsible for the disparity in lifecycle estimates, in particular identifying errors in both the lowest estimates and the highest estimates. It is noted that wind power is not directly emitting greenhouse gas emissions, but rather that lifecycle emissions occur through farm construction, operation and farm decommissioning.

**TH 347**

**The renewable energy directive and cereal residues**

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The Renewable Energy Directive provides a methodological framework for a streamlined LCA that calculates the greenhouse gas (GHG) balance of biofuels in order to determine whether they reach the required 35% GHG reduction threshold. It describes which sources of emissions should be included and describes how co-products and residues can be allocated, however a clear definition of these is lacking. Currently, in order to incentivise biofuel production from second generation sources such as cereal residues and wastes, double credits are to be awarded to these biofuels, and the feedstocks are considered to be available at zero GHG 'cost'. In contrast, converting degraded land or forest to production can potentially offset the system to become a net sequester of CO2eq ha⁻¹ yr⁻¹. Some other cradle-to-grave environmental impacts associated with palm oil biodiesel are acidification, eutrophication, toxicity and biodiversity.

**TH 348**

**Meta-analysis of LCA studies for bio-based polymers: assessing the environmental performance of polyhydroxylalkanoates (PHA) and polylactide (PLA) in contrast to their petroleum-based counterparts**

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The depletion of non-renewable resources plays an important role in present political debates: On the one hand, the depletion of non-renewable resources results in increasing commodity prices and economic dependence. On the other hand, the emission of greenhouse gases causes severe effects on the climate with unpredictable impacts on the human environment. That is why energy from renewable resources as well as bio-based chemicals and materials have attracted great interest.
Polyhydroxyalcanoates (PHA) and polylactide (PLA) are appropriate bio-based substitutes for a variety of previously petroleum-based products. Life Cycle Assessments (LCAs) according to ISO 14040 and 14044 have been applied to compare the environmental performance of these bio-based polymers in contrast to their petroleum-based counterparts. Numerous cradle-to-gate studies have been carried out to analyse the environmental impacts of the production of polymer resins with a preliminary focus on the impacts of climate change and non-renewable energy use. Previous studies indicate a wide range of results and contradictory conclusions due to the consideration of different production processes, methodological choices (e.g. system boundaries, co-product allocation, impact assessment methods) and underlying assumptions. To produce more robust and policy-relevant results than individual LCAs, a Meta-Analysis approach has been developed and undertaken to analyse the outcomes of 25 LCA studies. The underlying studies are quantitatively assessed taking into account the impact categories climate change (measured in metric tons of carbon dioxide equivalents) and non-renewable energy use (measured in megajoules). Relative environmental impacts per metric ton of PHA and PLA are compared with corresponding values for the petroleum-based plastics polypropylene (PP), polyethylene (PE), polyethylene/terephthalate (PET) and polystyrene (PS). Furthermore, differences between the environmental impacts of bio-based and petroleum-based polymers as well as standard deviations are calculated to derive methodological consistent figures.

Results of the Meta-Analysis indicate environmental advantages and disadvantages in both impact categories depending of the selected pair for comparison between bio-based polymers (PHA, PLA) and petroleum-based polymers (PP, PE, PET, PS). Furthermore, the Meta-Analysis reveals that bio-based polymers can help to mitigate climate change and save non-renewable energy.

TH 349  The effect of system boundary and weight along the life cycle factors on the results of a life cycle assessment (LCA) - Electricity generation as example systems
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LCA is a widely used tool for determination of strength and weaknesses regarding ecological aspects of any product or service. It is expected from the scientific-based analysis to deliver robust information, but in fact in literature the results differs significantly for the same product or service. Due to the recognized uncertainty this study addresses the possible deviation of results from literature on electric energy production from different energy sources. The potential deviation could arise from the consideration of different system boundaries (SBs) and the relevance of emission sources along the life cycle. Both could be mainly responsible for the recognized diversity beside others like allocation, cut-off criteria, actuality of literature, etc.

The electric power generation gives a good instance to analyze the impact on the results of the different SBs. For example: the variation between different plant construction demands is often over 80%, but the overall results don’t necessary correlate with this deviation. The change of cement demand for construction by 230%, in the case of electricity generation from coal, induces only 1.7-2.0% difference in GWP of the total system. This is an effect of different proportion of emission sources between the life cycle stages.
The contribution will point out where uncertainties and dependency of the results could arise through the examples of electricity generation from coal(lignite), natural gas, hydro energy, nuclear energy and from wind energy. The whole life cycle of power plant (with fuel upstream), the following system parts and impact categories have been taken into account in order to understand the results of LCAs:
- Construction, fuel upstream, transport, production, operation, deconstruction as life cycle phases
- Construction demand variables (basic construction materials: cement, steel, etc.)
- Fuel demand variables (efficiency factors: fuel purity, thermal efficiency, wind yield, transport, etc.)
- Impact assessment methods (GWP as main LCA output parameters)
The chosen system boundaries and other variables contribute to the varying results of LCA studies for electric energy production. Data from the literature should only be used from reliable sources and after thorough investigation, if the SBs and information of the used variables is well described. Otherwise the unforeseen effect of a data source might lead to false results and recommendations.

TH 350 - Life cycle management (LCM): Success factors and barriers

TH 351  Life Cycle Assessment for end of life computers in Mexico
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The recovery of waste electrical and electronic equipment (WEEE) is an activity that becomes more important every day in Mexico. In 2010 electronic waste generation reached 307,000 tons annually. Of these, 10% is recycled or valorized, 40% remains stored in houses and 50% is sent to final disposal in landfills and open dumps. The aim of this project was to conduct a life cycle analysis using the program Umberto for electronic waste management in Mexico and compared its environmental impacts with those for three proposals for change in the end of life management pattern in order to determine the best option for a national policy. The policy proposals were modeled as follows:
1) Stage with 25% of recovery system, 2) Stage 35% to recovery system, and 3) 0% for disposal in open dumps. As conclusion it was identified to eliminate the use of open dumps for waste disposal in first place, followed by an increase in 35% of the recycling/valorization system.

TH 352 Implementation of an integrated technological-LCA modelling tool within the water industry - a pragmatic contribution to decision-making
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Nowadays, it is expected to take into consideration environmental issues. But it still has to deal with operating costs, sanitary risks, technical feasibility and reliability of designed plants. Therefore, the water industry managers need handy tools and practical methodologies that can provide them a complete set of information for projects under study. A good implementation of such decision supporting tool is obviously a condition to its success.
Within the EVALEAD research project, an integrated technological-Life Cycle Assessment modelling tool has been developed with the software Umberto®. The tool is based on an exhaustive library of unit process models. These models are highly detailed and parameterized, thus precisely describing the energy and mass balances depending on a specific project context. Complementary software tools are directly linked to this purpose, which makes it benefit from previous modelling efforts and specific industry knowledge. For example, numerical climate models are linked to the carbon footprint model of the water industry that takes into account the whole life cycle of a water plant from the material to its final disposal in landfills and open dumps.
Every process unit module generates an engineering design report when placed within a modelling scenario. These reports are spreadsheets containing engineering design data (e.g. pumps power). This information is interesting at the decision stage since it can be made knowing how the process will work on the field. Problematic technological solutions can be avoided whereas convenient technologies will be selected.
A code for sensitivity analysis of the process model parameters is also part of the framework of the tool. The mathematical method followed is the Morris method. It aims at determining the key parameters of the modelled scenario by qualitatively estimating their influence on any of the results (e.g. one selected environmental impact or the operating costs). The designer is expected to understand how the modelling scenario relates to a change on one model parameter. Assuming that the modelling scenario is realistic enough, conclusions can be made on the real plant. This key feature of the tool gives the designers good clues about the future plant functioning and indicates them which are the priority action levers.
The use of the tool in the implementation relies on its convenience on the field, obtained by previously developing it closely with its future users. Not only environmental issues are taken into account but the tool give the whole picture of an industrial project.
The company R&D projects were crucial for developing practical guidelines for the industry. Motivation of the whole supply chain of the companies in the beginning of the project is fundamental. Additional workshops for the whole industry gave important feedback and shall facilitate larger implementation of the guidelines. As many Finnish food companies use carbon footprinting, industry participation is high. The guidelines The project has been carried out as an iterative process between research, companies and other stakeholders. Food industry wide workshops around the guidelines are used to make the guideline more applicable and user friendly for the industry. The EMAF project is in progress with applications in the canned vegetables, wine, pasta, olive oil and coffee supply chains.

In 2009, Pfizer Animal Health (USA) started to apply the Life Cycle Assessment (LCA) methodology to some innovative products, with a first case-study on ImprovacTM, a life cycle thinking applied to an immunological product (vaccine) used for boar taint control in male pigs 1, 2.

The company R&D projects were also tested different data collection tools in R&D projects. This poster presents the results from an LCA case study addressing a growing Danish problem on pesticide contaminated ground water. The conventional Danish way of using pesticides on free groundwater and treating it by aeration and sand filtration, is compared to using slightly pesticide contaminated groundwater and adding treatment by activated carbon filtration and UV-treatment. The scenario of using slightly pesticide contaminated groundwater is chosen as it is a genuine and relevant alternative in the current Danish situation as groundwater wells are closing due to pesticide contamination and clean ground water is becoming scarcer. Besides the comparison, a hotspot analysis is performed in order to identify the dominating environmental impacts in the life cycle of generating drinking water from ground water. This study is part of the research project DWBiofilters (www.dwbiofilters.dk) aiming at improving sand filters for drinking water production by investigating its inherent microbial processes.

TH 354

Development of a new LCA tool for motivation at the initiative of the users - a bottom-up approach

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Many practical LCA tools have been developed before a user group was established. The risk of such a top-down approach is a gap between the tool and the way users want to use it. This however can become a result of a lack of involvement by the users. In the Netherlands, a group of housing associations and building and maintenance companies were looking for means to calculate the environmental performance of planned preventive maintenance of housing, estates and buildings themselves. There are several theoretical approaches available, but no practical calculation tools. Because of this lack of instruments, they set up a development project for a practical calculation tool: the MTT Agrifood Research Finland, Helsinki, Finland


TH 355

Improving Life Cycle Management (LCM) tools for the food industry: a framework of Product-Oriented Environmental Management System (POEMS)

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5The aim of this abstract is to present a LCM tool designed for the agri-food industry, a POEMS framework with a modular structure resulting from the integration of complementary tools: an Integrated Life Cycle Assessment (LCA) and a suitable Environmental Product Label or Declaration (EPLD) (EMAF Project co-funded by the Italian Ministry of Education, University and Research-PRIN 2008TXFBY). In order to successfully apply this framework in the agri-food firms the main sector-specific barriers (SSB) to LCM implementation have been used as starting points to set the success factors (SF), solutions (S) and tools (T) of the POEMS model. In the following the path to the POEMS framework definition is summarized: the path efficiency is enhanced by the fact that each tool can provide multiple solutions to several barriers.

SBR: resistance to change; dispersion of the environment-related information; in Envrl. Management Systems (EMS) little attention is paid to product performances

[AARROWRIGHT]T: spreading an envrl. culture, change and involvement; structural and organized vision of envtl. aspects; internalize product requirements within the EMS

ARROWRIGHT]S: envtl. training and dissemination; EMS; Integrating EMS with a Quality Management System

[AARROWRIGHT]SF: Integrated Environment and Quality Management System

AMS+Integrated EMS+EPLD guidelines=POEMS

The EMAF project is in progress with applications in the canned vegetables, wine, pasta, olive oil and coffee supply chains.

TH 356

Finnish guidelines on carbon footprinting - supporting practical implementation of LCA in the food industry


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TH 357

Life cycle thinking applied to an immunological product (vaccine) used for boar taint control in male pigs

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In the United States (USA) started to apply the Life Cycle Assessment (LCA) methodology to some innovative products, with a first case-study on ImprovacTM, an immunological vaccine (product) for male pigs that, by providing farmers with an alternative way to avoid the problem of boar taint, also allows them to increase the efficiency of male pig production, which may in turn provide considerable life-cycle environmental and social aspects benefits: to avoid physical castration in fact perceived as an animal welfare issue by many in the public sector.

In 2010, after an initial project which included a consistent data collection from the vaccine production plants as well as from farms and slaughterhouses at global level, the first Environmental Product Declaration or EPD on a veterinary product was published by the International EPD System, a well recognised ISO 14025 Program Operator (www.epd-system.org). The results of this project were presented for the first time at the 2011 Annual European SETAC Conference in Milan.

In late 2011, the sample of farms participating in the global survey was extended for the development of the renewed and updated EPD to be published by the end of January 2012. The new data collection work led to the inclusion of a considerable number of representative farms from other countries worldwide.

The analysis provided LCA data to assess possible environmental benefits of the vaccine's application: the reduction of the carbon footprint is a strong perceived advantage for animal welfare and food sector and for this reason, it is the major impact category of interest; other LCA relevant impact categories are presented and discussed to provide a comprehensive view of the life-cycle impacts of the product. The calculated carbon footprint for the Improvac pig system demonstrates a reduction vs. the physically castrated pig system, mostly depending on country specific feed production and slurry management practices. Starting from the feed components, a detailed examination was conducted on the detailed meta-data of the life cycle impact assessment, procedures and technologies. For this reason, the information collected and analyzed in the LCA process provides an important opportunity for swine producers to understand the magnitude of their
carbon footprint and how to potentially reduce it not only through the use of Improvac.

TH589
Pilot test in food sector of product environmental footprint (PEF) Guide developed by European Commission
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In 2011, the Directive General for the Environment (DG ENV) started to work with the Commission’s Joint Research Centre (JRC) Institute for Environment and Sustainability (IES) and other European Commission services towards the development of a harmonised methodology for the calculation of the environmental footprint of products.

The Product Environmental Footprint (PEF) Guide developed by JRC IES has been tested using a limited number of pilot studies representative of a wide variety of goods and services. Pilot tests have been conducted on five Nestlé food and beverage product systems: Nespresso, Parina-Gourmet Pearl Chicken and Vittel products have been quantitatively assessed whereas Nescafé and Kit Kat products have been qualitatively assessed.

The results of Nespresso case study according to PEF Guide are presented and they are compared to the results of the full life cycle assessment compliant with ISO 14040 and ISO 14044 as previously published in 2011. The comparison of the Cycle Inventory (LCI) choices (e.g., electricity mix, LCIs databases (e.g. ecoinvent or European Reference Life Cycle Database (ELCD)) and Life Cycle Impact Assessment (LCIA) methods (e.g. land use, terrestrial ecotoxic and airborne discharges as well as endpoint assessment were compared in the original study whereas they lack in the draft PEF Guide published in November 2011). The results will be used to discuss the degree of alignment of the PEF Guide with ISO 14040 and ISO 14044 as the practical implications of following the PEF Guide as compared to current LCA practice.

The PEF Guide aims at providing detailed technical guidance on how to conduct a PEF study identifying single requirement for each decision point with the objective to increase the comparability of the results whereas LCA used different methodologies provides several alternatives, ranging from very general in the case of ISO 14040 and ISO 14044 to high specificity in the case of the French standard BPX30-323.

The Nespresso pilot test will be presented and shows an example of PEF Guide application used to provide feedbacks about the PEF Guide.

TH579
SETAC's influence on LCAs growth and direction
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The launch of Google labs' Books Ngram Viewer, which allows any user to graph the frequency of occurrence of words or phrases in Google’s database of 500 billion words from 1920 until today, allows for an investigation into the relationships of a number of LCA-related words over time. One combination, “SETAC”/“Society of Environmental Toxicology and Chemistry” and “life cycle assessment”, yielded a very interesting relationship for the years 1980-2008. The “SETAC” acronym first appeared in books in the 1960s. Its relative frequency of appearance grew from approximately 1950 through 2004, showing a tenfold increase. In 1990, SETAC sponsored an international workshop at which the term “life cycle assessment” was coined. Before then, a few practitioners in the U.S. and Europe used different terms such as “Resource and Environmental Profile Analysis” (“REPA”). SETAC established the accepted name (and framework) for life cycle assessment. The occurrence of the phrase “life cycle assessment” in books grew very similarly to the occurrence of “SETAC” from 1970 through 2004. Was this a coincidence or were there activities within SETAC that contributed to this parallel growth? This paper will provide a perspective of the role of SETAC in both NA and Europe had on the development of LCA.
The present work was undertaken to assess the feasibility of cost effective adsorbents: pure fired clay, newly designed fired clay with the polymer addition (5 mass% PEG 600) and bentonite for Zn(II) ion removal from waste printing developer. The adsorption efficiency and distribution coefficient of used adsorbents were determined as a function of adsorbent amount. The results show that newly designed clay adsorbent with polymer addition has great potential (up to 93.5%) to remove Zn(II) ion from waste printing developer.

Acknowledgement: The authors acknowledge the financial support of the Ministry of Science and Technological Development of the Republic of Serbia (Project No. 34014). THPC1-4

Removal of POPs from industrial wastewater using UVC/H2O2 Photolysis J.J. Rueda-Márquez, A. Acevedo-Merino, M.A. Manzano

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In this study UVC-H2O2 assisted TiO2 photocatalytic degradation was applied to remove persistent organic pollutants from industrial wastewater. Experiments were carried out with treated and filtered (0.7 μm) urban wastewater, spiked with AZO Orange II (35mg/l) and 4-Chlorophenol (0.36mg/l). The experimental equipment employed in the assays consists in a tubular reactor of borosilicate glass, (60ml) operating in a recirculating circuit, irradiated with an UVC lamp (18W). The Hydrogen Peroxide (H2O2) in the process was 200mg/l. The catalyst (TiO2) was immobilized on the external surface of a cylinder of frosted glass (40-mm). Experiments have been conducted using a total working volume of 1200ml and a recirculation flow rate of 600 (ml/min). The efficiency of primary degradation was determined by monitoring the process, for AZO Orange II (absorbance 478 nm) and 4-Chlorophenol compounds. Toxicity assays were also carried out with the aim to evaluate the effects by products. An economic study of this process was included in the global analysis.

THPC1-5

Impacts of advanced wastewater treatment on metal speciation and bioavailability M. Constantino, S. D. Comber, M. J. Gardner, M. D. Scrimshaw, A. de Pole

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Increasing pressure to reduce priority chemicals from wastewater treatment effluents is leading to pressure to utilise or consider advanced tertiary treatment options such as UV radiation, filtration, GAC, and ozonation as part of the wastewater treatment process. The use of these adsorptive or destructive methods may, however, increase or leave largely unchanged the concentrations of ligands in effluents that are important for complexing metals and which, consequently, reduce the toxicity potential of metals such as copper and zinc. Since there is not much data on the metal complexing characteristics of effluents before and after tertiary treatment, there is uncertainty in the extent by which tertiary treatment options might impact metal bioavailability. To investigate possible impacts, a chelax colonium ion exchange method was used to assess the effects of GAC, ozonation, and UV radiation in combination with H2O2 on the ligands in sewage effluent that are responsible for complexing copper and zinc. Preliminary results indicate that tertiary treatment options tend to increase the concentrations of metal complexing ligands relative to the concentration of dissolved organic carbon present. This effect was also of greater significance for copper than for zinc. The (ozone treated effluents displayed lower UV absorbances (350nm) in relation to other secondary and tertiary treated effluents, indicating ozonation to have some impact on the concentration of aromatic substances in the effluents, which is consistent with the elimination of humics; however, this did not impact complexation capacity. These findings indicate that advanced tertiary treatments are unlikely to increase the bioavailability of metals in sewage effluents.

THPC1-6

The influence of terminal electron acceptor on the removal of pharmaceuticals in Anaerobic digester sludge J. Campbell, E. May, J. Mitchell, J. Williams

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Within the wastewater treatment process pH and redox conditions fluctuate, and the characteristics of each sludge vary. These changes result in differences in the microbial population present, and variations in how strongly micropollutants adsorb to each sludge. The total removal of micropollutants, the rate of removal, and the mechanisms responsible for removal will vary depending on the redox conditions present. Anaerobic digestion is used for the treatment of 2/3 of municipal biosolids within the UK, and is a growing technology for the treatment of industrial and food waste due to the generation of renewable energy in the form of biogas. Anaerobic digestion is a multi-step microbiological degradation process, and can be performed in a single reactor or in multiple reactors where the hydrolytic fermentation and methanogenic phases are separate. Hydrolysis, acidogenesis, acetogenesis and methanogenesis each occur under different redox conditions, and each is associated with a different terminal electron acceptor (nitrate, sulphate, carbonate and methane respectively). Separating hydrolysis from methanogenesis has been shown to be more efficient for the generation of biogas, however, biodegradability tests performed to determine whether a test substance will degrade under anaerobic conditions are performed under methanogenic conditions only. A test system whereby the redox potential is controlled through anaerobic redox acceptor was calculated through the measurement of redox potential (Eh), the reduction of carbonate, nitrate and sulphate, and the removal of dissolved organic carbon. When it was demonstrated that these conditions could be effectively controlled this test system was applied to the removal of test substances under amended conditions.

Conditions were amended in a batch test and in a serum bottle experiment to measure the total removal and mineralisation of two prioritised test substances that have been identified within the biosolids. The results of these experiments will be discussed and compared with data obtained from biodegradability experiments performed under unamended conditions following guideline OECD 311.

TU 001

Particle size distribution of airborne perfluorinated compounds A. Dreyer1, I. Wemberg1, T. Kirchgeorg1, V. Matthias1

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In recent years, perfluorinated compounds (PFCs), particularly perfluorooctanoate (PFOA) and perfluorooctane sulfonate (PFOS) have been described as compounds of increasing environmental concern and numerous studies were conducted to investigate the environmental distribution and fate of these compounds Besides their transport with ocean currents, atmospheric transport was identified as important (long-range) transport pathway. As the particle size is an important parameter characterizing the fate of atmospherically transported compounds, knowledge about the particle size distribution of particle-bound PFCs is of particular interest. Therefore the objective of this study was to determine the particle size distribution of PFCs in the atmosphere. Particle phase samples were taken in parallel using a cascade impactor with cut-off diameters of 11.4 μm (A4, B4), 3.81 μm (A3, B3), 1.38 μm (A2, B2), 0.46 μm (A1, B1), and 0.14 μm (back-up filter, A0, B0). Each particle size fraction of each sampler was extracted separately using ultrasonication and methanol. Samples were measured by HPLC-ESI-MS/MS. PFC concentrations in particle phase samples (sum of all fractions) were between 0.5 and 2.5 pg m⁻³ of 25 analysed PFCs, 18 could be quantified. These were C4, C6-C8 PFSA, C4-C14 PFCA, PFOSA, MeFOSE and EtFOSE. PFOS and PFOA were observed in highest concentrations (0.17-3.5 pg m⁻³, respectively), followed by

TU 002

Binding and sequestration of perfluorinated surfactants in soil P.A.R. Varela Zarateabloh1, J. Sermers1, W. Amelung1

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Perfluorinated surfactants (PFSAs) produced since the 1950s draw great attention due to their widespread use and increasing occurrence in the environment. Sorption coefficients (Kd) and carbon organic normalized soil adsorption coefficients (Koc) are essential for determining soil adsorption behavior and assessing the risk of transfers of these chemicals from contaminated soils to plants and groundwater. We therefore analysed the international literature for concentrations of perfluorinated octanoic acid (C8F17COOH, C8) in different environmental media (surface water, sewage treatment plants, sediment, and soil) in order to assess the distribution of PFSAs and PFOA between these environmental compartments and compared the results with published experimental sorption coefficients. Experimental log Koc values for PFOA for different soils and sediments available in public literature are remarkably similar with a coefficient of variation of only 18%, which should limit the uncertainty of concentrations in drainage water and groundwater calculated from soil concentrations (average log Koc = 2.9). For PFOA however, published sorption coefficients are sparse and the published information regarding the analogy between sorption of carbamoylated and fluorinated PFCs is controversial (average log Koc = 2.6).

Our review shows that current pattern of environmental PFOA and PFSAs concentrations are strongly influenced by local pollution sources. Nevertheless, we calculated "global" sorption coefficients for PFOA using a median concentration of 275 log Kd concentration of 1.7% equals 4.2. Furthermore, the estimated "global" log Koc were similar to experimental log Koc values found in the literature. The moderate affinity of PFOA to soils, sediments and sewage sludge indicates that drinking water must be considered a potential pathway of exposure of animals and humans to these compounds.

 TU 003

EP06P - Perfluorinated compounds: From emission sources to the place of impact
Perfluorinated compounds (PFCs) present significant research interest in recent years due to the global distribution, persistence, bioaccumulation and potential toxicity of these substances. The fact that PFCs are commonly detected in municipal wastewater treatment plants (WWTPs) indicates their widespread use. For this reason, sorption experiments were performed with eight PFCs belonging to two different classes; perfluorocarboxylic acids (PFCAs) that contain a carboxylic group at the perfluorinated carbon tail (perfluoroundecanoic acid, PFUdA) and perfluorinated sulphonic acids (PFSAs) that contain a sulfonic group (perfluoroctane sulfonamide, PFOSA). At first, sorption experiments were performed to investigate the equilibrium time for each target compound and the role of sludge inactivation on sorption potential of PFSAs. For this reason, samples were taken at different time intervals and PFSAs were detected in dissolved and particulate phase. PFSAs were extracted by solid-phase extraction (dissolved phase) or sonication (particulate phase) and determined using High Performance Liquid Chromatography - Ion Trap Mass Spectrometry (HPLC-IT-MS).

According to the results, Kd values of PFCs were differentiated significantly according to the type of sludge. Moreover, it was shown that both the length of the perfluorocarbon tail and the functionality of the head group can influence the sorption of these compounds to sludge materials. Acknowledgement

"This project was implemented under the Operational Program «Education and Lifelong Learning» and funded by the European Union (European Social Fund) and National Resources - HRAKLEITOS II."

TU 004 Presence and behaviour of perfluorinated compounds in sewage sludge
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Two seasonal sampling campaigns were performed and samples were taken in seven consecutive days in each sampling campaign. The analytes were extracted by solid-phase extraction in wastewater (influents and secondary effluents) and sludge samples, originating from WWTP of Athens (Greece). Two seasonal sampling campaigns were performed and samples were taken in seven consecutive days in each sampling campaign. The analytes were extracted by solid-phase extraction (dissolved phase) or sonication (particulate phase) and determined using High Performance Liquid Chromatography - Ion Trap Mass Spectrometry (HPLC-IT-MS). For this reason, samples were taken at different time intervals and PFCs were detected in dissolved and particulate phase. PFCs were extracted by solid-phase extraction and centrifuging did not have an effect on the PFC elimination. Subsequently, the amount of PFCs accumulated per ton of sludge generated was determined for each WWTP.

According to the use of sludge in each country, the calculated contribution of PFCs to agricultural soils was estimated between 0.06 and 12.88 g/ha month. Finally, the concentrations of PFCs determined in agricultural soils and sludge amended soils as a way to determine the real impact of PFCs in soils. Although there are no legislated limits for PFCs in sludge (Council Directive 86/278/EEC and Royal Decree 1310/1990, regulating the use of sewage sludge in agriculture), its use in agriculture may lead to pollution of groundwater and soils. In Spain, 95% of the sewage sludge is used as fertilizer in agriculture, while in Greece, 98% of the sludge is incinerated or used for landfilling.

TU 005 Occurrence and evaluation of the fate of Perfluorinated Compounds in wastewater treatment plant of Greece
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The aim of this study was to determine the presence of 5 perfluorinated compounds (PFCs), namely perfluorooctanesulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOSA), perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) in sludge and evaluate their transfer to agricultural soils. PFCs were analyzed in sludge from 15 WWTP from Spain and Germany. These WWTP receive both urban and industrial wastewaters. PFCs were detected at 0.28 and 5.15 ng/g dw for Spanish sludge and from 14.2 to 36.0 ng/g dw for German Sludge, with differing concentration patterns of the individual compounds. In addition, the validity of the use of sludge treatments (primary sludge, anaerobic digested and centrifuged sludge) was evaluated and we found that anaerobic digestion and centrifuging did not have an effect on the PFC elimination. Subsequently, the amount of PFCs accumulated per ton of sludge generated was determined for each WWTP. According to the use of sludge in each country, the calculated contribution of PFCs to agricultural soils was estimated between 0.06 and 12.88 g/ha month. Finally, the concentrations of PFCs determined in agricultural soils and sludge amended soils as a way to determine the real impact of PFCs in soils. Although there are no legislated limits for PFCs in sludge (Council Directive 86/278/EEC and Royal Decree 1310/1990, regulating the use of sewage sludge in agriculture), its use in agriculture may lead to pollution of groundwater and soils. In Spain, 95% of the sewage sludge is used as fertilizer in agriculture, while in Greece, 98% of the sludge is incinerated or used for landfilling.

TU 006 Biodegradation of proposed PFOA & PFOS precursors in aerobic batch assays
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Perfluorinated compounds (PFC) are a group of emerging environmental pollutants even though no natural sources of PFC have been proposed. Nevertheless they can be detected in the environment throughout the world. Due to their unique water-, fat- and oil-repellent as well as stain-resistant properties, they are widely used in various industries and commercial products. Some of them are classified as persistent, bioaccumulative and toxic compounds. Hence they display a threat of nature. Potential sources of PFC can be consumer and industrial products as well as manufacturing processes. In some sewage treatment plants worldwide, an increasing mass flow of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) was observed with higher concentrations in the effluents compared to measurements in the influents. This leads to the assumption that there have to be precursors which are biodegraded during the wastewater treatment process. Thus, the aim of this work was the isolation of precursors for PFOA and PFOS by studying of their aerobic biodegradability.

Amongst others perfluorooctanesulfonamide (PFOASA)1, 8.2 terlomic acid (8:2 FTC), 8.2 terlomic acid (8:2 FTOH)1,3, and a technical product containing polyfluoralkylsulfonic acids were chosen to study their fate in aerobic batch assays. The test period was 14 days each at a water temperature of 12.7°C. The activated sludge samples were taken from a municipal sewage treatment plant and the sludge was dosed following the EN ISO 9888 guideline, June 1999, with a 10-times higher phosphate buffer concentration. The water and sludge samples were analyzed using LC-MS/MS and GC-MS. All in all the above mentioned substances degraded to PFOA and PFOS in ranges from 1 to 8 per cent during 14 days. The lowest metabolic rate was monitored for PFOSA. In addition, it was observed that the concentration of some PFCs in effluent wastewater, suggests a possible formation of these compounds within the wastewater stream due to biodegradation of precursor compounds.

TU 007 Identification of the sources of polyfluoralkyl substances (PFAs) in the surface water of Athens
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A survey of the distribution of perfluorinated carboxylates (from C5 to C10) and perfluorinated sulfonates (C4 and C8) in the main Italian river basins have been carried out in 2011 in order to get a reliable picture of the polyfluoralkyl substances (PFAS) contamination and possibly to identify the main sources for the aquatic environment. A monitoring campaign on river Po (north of Italy), the major Italian river which flows in the Adriatic Sea, its tributaries, river Adige, river Tevere, river Arno and river Brenta, have been carried out in different hydrological conditions. A survey has been performed also in transitional coastal areas such as river Po Delta and Lagoon of Venice. Chemical plant discharges and drinking waters present in the same basins were also sampled. Analyses of PFAS were achieved by using an on-line SPE-HPLC-MS-MS system. Recovery for PFAs for all analyses was above 70% at µg/L levels. Limits of detection (LOD) ranged from 0.2 to 2.5 ng/l.
The monitoring campaigns allowed to identify hot spots in the main Italian basins.

Unlike rivers Tevere and Adige which are not significantly impacted, concentrations determined at the basin closure of the river Po are comparable to those measured in the PFAS heavily impacted areas of Northern Europe; PFOS concentrations are low (ranging from < LOD to 2.5 ng/L) while PFPeA is the main compound (about 25 ng/L). Elsewhere at the Tana River, water from the Tana River was confirmed as the main source of the latter molecule. Plant for the production of fluorochemicals, used as intermediates in the polymer synthesis, is a significant source of PFOA and PFBS in the river Brenta which discharges in the Adriatic Sea. Two important textile industrial districts in Italy (counties of Vicenza and Prato) have been also identified as a significant source of PFPeA and PFHxS which are discharged in the rivers Tevere basin and in the Tiber river Arno. These shall be of this kind of industrial process. The same compounds were also measured in the river Adda, an important tributary of the river Po, but the source shall be still to be identified.

The diffusion of these substances in the river has been managed by the几年 had also been detected as an acid source of PFPeA and PFHxS which are discharged in the river Adda. These shall be of this kind of industrial process. The same compounds were also measured in the river Adda, an important tributary of the river Po, but the source shall be still to be identified.

The diffusion of these substances in the river Adda is strongly recommended to achieve such objective, especially for compounds having a log Kow> 3.

For 2009 and 2010, the substance spectrum was clearly dominated by PFOS at average concentrations of about 150-260 ng/g dry weight. Longer chain carboxylates were detected at concentration of about 1-30 ng/g dry weight, whereas the PFHxA, PFHpA and PFOSA were not detected. The dry matter content of the eggs was at around 20%.

For this poster we aim for presenting data in order to form a baseline for the PFC levels in the eggs samples for the years from 2008 to 2011. This will offer the first Tu 008

**PFAA sources to groundwater and drinking water: identification and origin**

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**Tu 009**

Seasonal distribution of perfluorinated compounds (PFCs) in surface water from Elbe River and North Sea, Germany

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Since the ubiquitous occurrence and potential toxicity to human beings, the perfluorinated compounds/PFCs have attracted more concern in the recent years. In 2010, one of the PFCs, perfluorooctane sulinate (PFOS) was added to Annex B of Stockholm Convention on Persistent Organic Pollutants (POPs). Recently, more substitutes, i.e. perfluorooctane sulinate (PFBS) and perfluorooctanoic acid (PFOA), were widely used and the elevated levels have been found all over the world. In this study, four cruises in Elbe River and three cruises in North Sea were conducted throughout the whole year of 2011 to investigate the seasonal distribution of perfluorinated compounds in surface water. Perfluorinated carboxylic acids (PFCAs) and perfluorinated sulfonates (PFSAs) were determined in both particle and dissolved phases in 100 samples. The profile patterns suggested the industrial and urban discharge which were the major source of PFOS in river and coast water.

Tu 010

Occurrence of 14 perfluorinated compounds and other priority and emerging organic compounds in fishes from the Rhone River (France)

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9The Daughter Directive [EQS Directive, 2008/105/CE, EC, 2008] details the application of the Water Framework Directive for the monitoring of priority substances and other pollutants in surface waters; in particular, it requires the implementation of temporal and spatial trend monitoring programs. The use of integrative matrices (biota and sediments) is strongly recommended to achieve such objective, especially for compounds having a log Kow> 3.

The main goal of this study was to obtain data on the occurrence and levels of 34 priority and emerging organic compounds in freshwater fish sampled in the Rhone River. The analyses included 14 perfluorinated compounds (PFC) and also 5 alkylphenols (AP), bisphenol A (BPA), 3 hexahalobicyclooctanes (HBCD), 9 polybrominated dibenzo-p-dioxines (PBDD/F) and 2 compounds, hexachlorobenzene (HCB) and hexachlorobutadiene (HCBD) for which Environmental Quality Standard (EQS) have been set for biota (10 and 55 µg/kg fresh weight -fw- respectively) [E.C., 2008].

Cruises in Elbe River and in North Sea were conducted throughout the whole year of 2011 to investigate the seasonal distribution of perfluorinated compounds in surface water. Perfluorinated carboxylic acids (PFCAs) and perfluorinated sulfonates (PFSAs) were determined in both particle and dissolved phases in 100 samples. The profile patterns suggested the industrial and urban discharge which were the major source of PFOS in river and coast water.

Tu 011

Perfluorinated compounds (PFCs) in peregrine falcon eggs from southwestern Germany - levels, patterns and temporal concentration variations

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As a target species for the peregrine falcon (Falco peregrinus) is capable of accumulating a wide range of persistent pollutants and therefore a valuable object for observation and chemical analysis. The species attracted not only scientific but also public interest, at the present it was at the brink of extinction in Germany and elsewhere through excessive burdens of organochlorine pesticides such as DDT. A network of volunteers in the German state of Baden-Württemberg offered the possibility to collect unfertilized or unhatched peregrine falcon eggs as samples for monitoring contaminants. In the past years, perfluorinated compounds (PFCs), especially PFOS raised scientific and public concern as their POP-like properties became apparent. Therefore, the analyses of PFCs in peregrine falcons' eggs was integrated into the existing monitoring programme.

Sampling were conducted in Baden-Württemberg from 2008 to 2011. About half of the number of the 20-30 egg samples collected per year were analysed for 11 PFCs (4 sulfonates, 6 carboxylates and the perfluorooctane sulfonate). The analysis was performed using cold sample extraction and ion exchange SPE clean-up followed by LC/MS/MS detection at LOQs of about 0.5 ng/g dry weight. For this reason we aim for presenting data in order to form a baseline for the PFC levels in the eggs samples for the years from 2008 to 2011. This will offer the first possibility to establish the temporal concentration variations for PFC in peregrine falcons from Baden-Württemberg.

For 2009 and 2010, the substance spectrum was clearly dominated by PFOS at average concentrations of about 150-260 ng/g dry weight. Longer chain carboxylates were observed at concentrations of about 1-30 ng/g dry weight, whereas the PFHxA, PFHpA and PFOA were not detected. The dry matter content of the eggs was at around 20%. PFOS concentration in the highest contaminated eggs approaches the toxicity threshold (LOAEL 5000 ng/g fresh weight; NOAEL 500 ng/g fresh weight) for PFOS established for chicken eggs. Thus Peregrine falcon eggs may be compromised by PFOS if their sensitivity is similar to the chicken. These findings generally confirm results presented earlier (e.g. Holmström et al., 2010, Sweden).
The white-tailed eagle (Haliaetus albicilla), also referred to as white-tailed sea eagle (WTESE), is a large predatory bird from the Northern part of Eurasia. It is a top predator from the aquatic ecosystem and feeds mainly on marine fish, waterfowl and carrion. Because of its high trophic position, the WTESE is a very interesting biomonitoring species for studying accumulation of persistent organic pollutants (POPs). In this study, we have increased our knowledge on the analysis of the occurrence of perfluorinated aliphatic substances (PFAS) in biological tissues and specifically developed a reliable method to measure PFAS in feathers of this raptor species. Feathers have already been used successfully for monitoring of aquatic heavy metals, and recently also for POPs, but a reliable method for PFAS was not available and needed to be established. The results gained from this research enabled us to monitor endangered raptors without harming the birds and their offspring and to better understand the fate of PFAS in birds.

From Greenland body feathers (n=11) and primary wing feathers (2th, 5th and 8th primary; n=46) and preen oil (n=7) was collected when available in a sufficient amount for analysis. Tissue samples were taken from the Greenland carcasses to analyze for PFAS and POPs. In addition, tail feathers were sampled at active nest sites of WTESE situated in Northern Germany (n=7) in 2009.

For the first time, PFAS were detected in feathers and preen oil of white tailed sea eagles from Greenland and Norway. In the wing feathers from Greenland WTESE, PFOS and PFOA were detected. In some cases, PFNA, PFPeA and PFP were detected in minor concentrations as well. The average concentrations of the primary feathers #2 and #8 were similar. In addition, the body feathers showed similar PFOS levels, but lower PFOA levels.

TU 013
Perfluorinated chemicals in Belgian barn owls (Tyto alba): comparison of levels in feathers and tissues
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Feathers have proven very useful regarding non-destructive biomonitoring of contamination with heavy metals and organic pollutants. For this study, we have investigated perfluorinated chemicals (PFCS) in feathers and tissue of barn owls (Tyto alba), collected in the province of Antwerp (Belgium). A major PFC plant (3M) is located in the close vicinity of the city of Antwerp and levels of PFCs in biota from this area have been found to be very high in previous studies. We analysed levels of PFCs in tail feathers and tissues (liver, muscle, preen gland, adipose tissue) obtained from barn owl road-kill victims (n=15). We used methods for left-censored data to cope with levels below the limit of detection. We aimed to study the main sources for FCs in feathers as levels can both originate from internal sources (via the blood) as from external contamination (via e.g. air, dust).

PFOS was detected in all tissues (median concentration: 135 ng/g in muscle, 305 ng/g in liver, 431 ng/g in preen oil, 203 ng/g in adipose tissue), also in feathers (median 14.7 ng/g, range: 2.2 - 56.6). PFOS levels in feathers and liver tissue were highly correlated (r=0.79, p<0.001), but this was not the case for PFOS levels between feathers and muscle (r=0.15, p=0.47) or between muscle and liver (r=0.46, p=0.08). This may be due to the chemical properties of PFCS which are mainly bind to proteins in the blood, thus reducing the suitability of muscle tissue. PFOS was measured at high levels in the feathers (<14.1 - 670 ng/g), but not in the tissues (more than 50% < LOD). Furthermore, PFOA levels in feathers and liver were not significantly correlated (r=0.17, p=0.57). These results suggest that PFOA may be present on the external surface of the feathers and was not washed off by using distilled water and hexane. External contamination with PFOA is mostly probably originating from the air due to the close vicinity of potential point sources. PFHxS could only be quantified in liver and preen oil. Sporadically, other PFC compounds were detected as well, mostly in liver. Overall, these results indicate that PFOS levels in feathers and liver are highly correlated, while PFOA levels in feathers are probably originating from external contamination. Therefore, the feasibility of feathers for FCs monitoring should be investigated more in depth in the future.

TU 014
Monitoring of perfluorinated compounds
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Because of their persistent and wide ranging application perfluorinated compounds (PFCs) are found as ubiquitous contaminants in aquatic and terrestrial ecosystems as well as in food products. HPLC-MS/MS analysis of animal and non-animal foodstuffs and wild game was performed within the framework of preventative consumer protection.

Fish from regional waters:
Sixteen fish from the Rhine river including eel, perch, roach, tench and catfish were examined for the presence of PFCs. Concentrations of 5.2 µg/kg and 143 µg/kg were detected in muscle tissue as the sum of PFC detected (∑ PFBS, PFPeA, PFHxA, PFHxS, PFHpA, PFOA, PFOS, PFNA, PFDA, PFDS) in muscle from a Rhine river including eel, perch, roach, tench and catfish were examined for the presence of PFCs. Concentrations of 5.2 µg/kg and 143 µg/kg were detected in muscle tissue as the sum of PFC detected (∑ PFBS, PFPeA, PFHxA, PFHxS, PFHpA, PFOA, PFOS, PFNA, PFDA, PFDS) in muscle tissue of wild perch from the Rhine river.

Wild boar:
PFOS and PFOA concentrations were measured in 506 muscle tissue samples and 529 liver samples from wild boar. The arithmetic mean of PFOA concentrations detected in muscle tissue was 1.38 µg/kg whereas the mean PFOA concentration was below the LOQ. In liver tissue the mean PFOA concentration was 4.02 µg/kg (Maximum value 45 µg/kg) (1).

Foodstuffs:
Measurements of 82 samples of French fliers showed PFC concentrations above the LOD in 3 samples. No concentrations above the LOD were detected in 30 samples of ice cream, 14 samples of whole milk, 19 samples of carrots or 16 samples of grains. A total of 84 samples of ocean fish, farmed fish, seafood, fish in packaged salads and canned tuna were tested for the presence of PFC. No PFOS were detected in 82 of the samples. Two carp from fish farms had 2 and 14 µg/kg, respectively in muscle tissue.

(1) T. Stahl, S. Fahl, K. Failing, J. Berger, S. Georgi, H. Bruunn, Article title: PFOA and PFOS in Liver and Muscle Tissue from Wild Boar in Hesse, Germany, Arch Environ Contam Toxicol, DOI: 10.1007/s00244-011-9726-3

TU 015
Development of a pharmacokinetic model (PK/ PBPK) for assessment of infant exposure to PFOS and PFOA for health risk assessment
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Perfluorinated compounds (PFCs) are very stable compounds with a lot of industrial application, but also very persistent on the biota and the environment. Among them, PFOS (perfluorooctane sulfonate) and PFOA (perfluorooctanoic acid), have a long persistence in the human body (4-6 years). This persistence creates an important concern among the scientific community and the health authorities. In fact, PFOS was listed under the Stockholm Convention in May 2009 as a persistent organic pollutant (POP), while PFOA is a serious candidate to enter that list. The main target organs of accumulation are blood and breast milk. Thus, PFCs can be a risk for adult population and for those resulting from a low change in each parameter value.

TU 016
Acute toxicity of perfluorinated compounds to two kinds of cladocerans
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Due to their unique properties, poly- and perfluorinated compounds (PFCs) have been manufactured and used during the past 50 years in a variety of industrial and commercial products, such as household surface finishes, food packaging, water- and stain-resistant materials, and fire-fighting foams. PFCs were released to the environment during production, usage and disposal. PFCs tend to persist in surface waters. Therefore their toxicity to aquatic organisms is of particular concern. Serving as a food source for fish, invertebrates and other aquatic organisms, cladocerans are one of the key trophic elements of aquatic ecosystems. In addition to their ecological significance, cladocerans have the advantages of being useful as test organisms due to their short life cycle, their ease of laboratory culturing, their limited space and water volume requirements, and their sensitivity to chemicals. Cladoceran species are therefore widely used in aquatic toxicology. Among freshwater cladocerans, Daphnia magna is probably the most commonly used test organism in ecotoxicological studies. Some toxicity tests have been performed on cladocerans for perfluorooctanoic acid (PFOS) and perfluorooctanoic acid (PFOA) or their salts.
Because of their global distribution, environmental persistence and potential risk to human beings and aquatic organisms, PFCs are of particular concern for research and regulatory communities. However, insufficient toxicity data are available to accurately assess their possible environmental hazard. Therefore, the acute toxicity of seven poly- and perfluorinated carbonyl acids and alcohols on two cladocerans, Daphnia magna and Chydorus sphaericus, was evaluated in the present study. The adverse effects of these PFCs on these two cladocerans decreased with increasing functional groups of compounds with the same carbon chain length. The acute-toxicity values were determined to be 95% during the test, therefore the test was considered to be valid.

TU 017
Perfluorooctanoic acid toxicity in zebrafish (Danio rerio)
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Perfluorooctanoic acid (PFOA) is a common surfactant with wide use due to its unique nature, and it has been detected as a contaminant in soil, air, water and biota. Previous studies have shown that PFOA has detrimental effects on different life stages in zebrafish (Danio rerio).

We have evaluated the effects of PFOA toxicity covering different life stages of zebrafish through three tests that were based on OECD guidelines. In the Fish Embryo toxicity (FET) test, fertilized embryos were used to calculate effective concentrations (LOEC and NOEC) based on early life stage lethal and sub-lethal endpoints. Based on the FET test, a Fish Sexual Development Test (FSDT) was conducted and effects on vitellogenin (VTG), body and liver somatic indices and gonad histopathology including sex ratios were evaluated. A reproduction test (Fish Screening Assay: FSA) was also performed where effects on reproductive parameters like spawning, fecundity and fertility rate were evaluated, as well as effects on histopathology, liver enzyme activity VTG-levels and key gene expression levels in the adult fish.

TU 018
Structure–activity relationship of four perfluorinated compounds based on early developmental effects in the zebrafish
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Perfluorinated compounds (PFCs) are a group of anthropogenic chemicals containing diverse functional groups and chain lengths. Their chemical structure gives them unique properties which resulted in massive production and the use of these compounds in several familiar products since the 1950s. However, these unique properties also cause them to be persistent and bioaccumulating explaining their presence in wildlife, humans and the environment worldwide. Despite the global occurrence of PFCs, the toxicological information on these chemicals is still incomplete and insufficient to assess their environmental impact and structure–activity relationship. In the present study, the developmental effects of PFOA (perfluorooctanoic acid, C8), PFOAP (perfluorooctanoic acid, C8), PFPE (perfluorobutane sulfonate, C4) and PFBA (perfluorobutanoic acid, C4) were evaluated in zebrafish embryos (Danio rerio) during 120 hours post fertilization (hpf). The different chain lengths and functional groups of the selected compounds made it possible to determine the structure–activity relationship of these compounds. PFCs with longer chain lengths (C8) tend to be more toxic than PFCs with shorter chain lengths (C4). Conversely, perfluorinated compounds with the same chain length but different functional groups (C8) isomerise in the body and liver somatic indices and gonad histopathology including sex ratios were evaluated. A reproduction test (Fish Screening Assay: FSA) was also performed where effects on reproductive parameters like spawning, fecundity and fertility rate were evaluated, as well as effects on histopathology, liver enzyme activity VTG-levels and key gene expression levels in the adult fish.

TU 019
Embryotoxic effects of perfluorooctanoate sulfonate compounds in sea urchin Paracentrotus lividus
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Our environment has been affected by increasing concentration of organic and inorganic pollutants from anthropogenic sources. Perfluorinated compounds are important source of pollution and they are major risks for the aquatic ecosystems. Perfluorooctanoate sulfonate (PFOS) and Perfluorooctanoic acid (PFOS) are both industrially synthesised perfluorinated chemicals and they are produced in substantial amounts. They are found widely in surface water and aquatic sediments. In this study, the comparative embryo toxicity of perfluorinated compounds (C4, C5, C6, C7, C8) and commercial PFOS was examined on embryos of the sea urchin Paracentrotus lividus. Results were evaluated by observing larval malformations, development arrest and embryonic/larval mortality. The results indicated that, low concentrations of these chemicals generally caused malformations in the seafood. It was observed that high concentrations (10 mg/L) of PFOS and PFPOA (perfluorooctanoic acid, C8) caused developmental arrest and embryonic/larval mortality. As a result, we conclude that PFCs have a toxic effect on the early life stages by perturbing teratogenic systems.

In conclusion PFOS and PFBS present a major threat to the normal development of P. lividus in the environment, so that it has its ecological importance due to the hazard at population level considering the cumulative effects of other environmental pollutants.

TU 020
Ecotoxic findings for ammonium perfluorohexanoate
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Ammonium perfluorohexanoate (APFO) has long been used for polymerization of fluororesins and rubber. There are many reports on the hazards of perfluorooctanoate (C8).

Accordingly, its replacement substances have been examined. Perfluorooctanoate (C6) does not disperse from a rodent’s body and perfluorobutyrurate (C4) disappears rapidly from primates and rodent’s prime tissue.

The toxicities of both substances are low. It is considered because they do not accumulate in the body. The accumulation property in the body is considered to have a correlation with the partition coefficients. Accordingly, we examined the correlation between the partition coefficients and effects on Daphnia magna. Also, we studied the effects of C6, which is available for industrial use, on development of fertilized eggs of rainbow trout.

The relation between LogPow of perfluorinated carbonyl (PCAs=C4, C5, C6, C7, C8) and immobility was observed. For C4 and C5,Baseline immobility rate became 0.5% in 24 hours, While C6 reached 100% in 48 hours, the immobility immobility rate and immobility rate was same for C6 and C7 at the same level. For PFCAs, no correlation between the carbon number and immobility was observed. In fish early life stage toxicity test of C6, hatching success in the control group was 74%, satisfying the validation criterion for hatching success (>66%). The NOEC and LOEC for post-hatch larval survival until Day 28 were both considered to be equal to or greater than 10 mg/L.

For fish total lengths, the NOEC and LOEC determined on Day 28 post-hatch were 10 and >10 mg/L respectively. For fish dry weights, the NOEC and LOEC determined on Day 28 post-hatch were 10 and >10 mg/L respectively. All validity criteria were satisfied during the test, therefore the test was considered to be valid. C6 proved to have no impact on fish in an early life stage toxicity test.

Industrially, C6 is easier to produce. It can also be used for polymerization, therefore, it is considered to be a good replacement substance.

TU 021
Determination of perfluorinated compounds in cord blood samples by an on line method: turbulent flow chromatography LC-MS/MS
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The PFCs are perfluorinated compounds that have remained attached to proteins. Toxicity studies in mammals revealed they can disrupt different metabolic activities. Early exposures have been studied and different authors have reported the transference during breast feeding or during pregnancy. This work presents the preliminary results of a cord blood study in Catalonia (Spain) for 18 PFCs in 163 cord blood samples. The PFCs were a group of compounds that have remained attached to proteins. Toxicity studies in mammals revealed they can disrupt different metabolic activities. Early exposures have been studied and different authors have reported the transference during breast feeding or during pregnancy. This work presents the preliminary results of a cord blood study in Catalonia (Spain) for 18 PFCs in 163 cord blood samples.

The purification process were used 2 TurboFlow columns Cyclone and C18 XL (Thermo Fisher Scientific).

The mixture of PFCs standards used was: MXB (13 perfluoroacids and 4 perfluorosulfonates) and perfluorooctanesulfonamide (PFOSA) from Wellington Laboratories Inc., Franklin, MA (Thermo Fisher Scientific, San Jose, CA), coupled to Thermo Scientific TSQ Vantage mass spectrometer (Thermo Fisher Scientific, San Jose, CA).

A high performance liquid chromatography system was used: XEVO TQ (Waters, Manchester, U.K.), coupled to Thermo Scientific TSQ Vantage mass spectrometer (Thermo Fisher Scientific, San Jose, CA).

The analysis consists in, internal standard addition, protein precipitation with acetonitrile and centrifugation followed by the analysis using turbulent flow chromatography couplet to tandem mass spectrometry (LC-ESI-QqQ-MSMS). The slanted solvent in consisted water pH 3.4 (HFO) at turbulent flow of 1.5 m/min. The loop elution volume of the optimized method was 250 µL. Transfer was performed using water pH 3.4 (HFO), methanol (20:80) and water pH 3.4 (HFO), methanol (70:30) at flow of 0.2 m/min. Separation was achieved using a LC-column Hypersil GOLD (50 x 3) (Thermo Scientific) at turbulent flow chromatography.

The results were evaluated by observing larval malformations, development arrest and embryonic/larval mortality. The results indicated that, low concentrations of these chemicals generally caused malformations in the seafood. It was observed that high concentrations (10 mg/L) of PFOS and PFPOA (perfluorooctanoic acid, C8) caused developmental arrest and embryonic/larval mortality. As a result, we conclude that PFCs have a toxic effect on the early life stages by perturbing teratogenic systems.
TU 021

Plastic debris and toxin releases in the Pacific Ocean

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Plastics comprised the majority of collected waste in beach cleanups in 2006, 2007, and 2008. In California, Washington, Oregon, and Hawaii the five most common plastic debris items on beaches are cigarette filters, food wrappers and containers, beverage caps and lids, bags, and food service items, e.g., cups, plates, and cutlery. The majority of plastic items are made from four common plastics: polyethylene, polypropylene, polystyrene, and PET, accounting for 75% of the plastic debris. Pre-consumer materials are not accounted for but account for significant amounts of plastic in the oceans from storm run-off and industrial areas. The fate of plastics in the oceans can lead to fragmentation and result in small plastic particles that can degrade and release toxic chemicals such as phthalates, flame retardants, BPA, antimony oxide, heavy metal niks, and styrene monomer as the plastics break down. Plastics can accumulate toxins floating in the oceans from persistent organic pollutants (POPs). POPs can include DDT, hexabromobenzene, polychlorinated biphenyls (PCBs), polymeric aromatic hydrocarbons, among others.

TU 022

Micro-plastics in the marine environment - a global assessment

J. Kershaw1, H.A. Leslie1
CEFAS, Lowestoft, United Kingdom

Institute for Environmental Studies (IVM), VU University, Amsterdam, Nederland

GESAMP has set up a new Working Group entitled ‘Sources, fate and effects of micro-plastics in the environment - a global perspective’. With multi-agency support and with a multi-disciplinary membership, it is reviewing a wide range of information about the supply of plastics and microplastics to the ocean, and the biological, chemical and physical processes controlling fate and effects of both microplastic particles and micro contaminating transport, and. It will provide an evidence base for use by policy makers, regional bodies a other stakeholders, and help to develop research priorities. The poster will describe the Terms of Reference, work programme, membership and intended outcomes of the group, and will issue an invitation to SETAC Europe participants to become involved in this initiative.

TU 024

Micro marine litter under the marine strategy framework directive - science and policy

G. Lindqvist, F. Galgani1, S.S. Sadri1, R.C. Thompson
European Commission Joint Research Centre, Ispra (va), Italy

Plymouth University, Plymouth, United Kingdom

Microplastics are plastic debris smaller than 5mm. They can be found on everything from micro-fibers in clothing to microbeads in skin cleansers and others personal care products. Many countries have reported that 90% of their microplastic load comes from personal care products. Microplastics have been recently incorporated into the emerging pollutants due to their wide distribution in marine and coastal environments all over the world, as well as their persistence and hazard to the wildlife. Moreover, they have high abundance, diverse sources, and high capacity of distribution. In addition to other sources, microplastic (< 5mm) debris is frequently used in skin cleansers and others personal care products and it is possible that different species of plastic can have distinct environmental impacts. Due to their abundance, they can be used as a biological indicator to assess the health of the environment. The global plastic is estimated to be 310 million tons per year. The aim of this study is to study the spatiotemporal abundance of microplastic debris in ocean surface waters and our preliminary investigation of microplastic contamination in the marine environment.

TU 025

Using the continuous plankton recorder to determine the abundance of microplastic debris in the subsurface marine waters

S.S. Sadri1, M. Edwards2, R.C. Thompson
University of Plymouth, Plymouth, United Kingdom

Sir Alistair Hardy Foundation for Ocean Science (SAHFOS), Plymouth, United Kingdom

Fragmentation of plastics debris into “microplastic” pieces is an emerging issue of concern. Our knowledge of distribution and accumulation of microplastic is patchy and in order to quantify and monitor the distribution and in particular temporal trends there is a need for a broad sampling programme and standardised methods. The aim of this research is to study the spatiotemporal abundance of microplastic debris in ocean surface waters and our preliminary investigation of microplastic contamination in the marine environment.

TU 026

Microplastics in personal care products from Brazil: is this source relevant to the aquatic contamination?

G. Fillmann, F. Poleza
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Plastics have recently been incorporated into the group of emerging pollutants due to their wide distribution in marine and coastal environments all over the world, as well as their persistence and hazard to the wildlife. Moreover, they have high abundance, diverse sources, and high capacity of distribution. In addition to other sources, microplastic (< 5mm) debris is frequently used in skin cleansers and others personal care products. In order to catalog monomers into polymers and give it different properties. Some of these additives have been associated with carcinogenic and endocrine disrupting effects. Moreover, due to its hydrophobic nature, plastic debris can be a hazard to marine animal species because of accumulation of organic contaminants. An important hazard are the persistent organic pollutants (POPs), which do not completely dissolve in water and do not degrade into non-hazardous compounds. As a result, these pollutants bioaccumulate in the food chain and therefore can be transferred to higher levels in the food chain. For example, polychlorinated biphenyls (PCBs), has been detected in marine fish and other marine species and has been associated with many health impacts on both wildlife and humans. This study focuses on the important hazard of persistent organic pollutants after ingestion by marine animals. In order to get more insight in the bioaccumulation potential of these persistent pollutants, we compared plastic-water partitioning, a simplification of the partitioning of plastic additives in the gastric fluid, with ocean-water partitioning. The outcomes will be discussed within the framework of the current knowledge gap and we will describe challenges for future research on this topic.
Another important result obtained was the absence of food in the specimens that showed a high number of plastic debris. Floating debris more thanbé on the sea floor. The second type of plastics found in the specimens were fragments; moreover, in some specimens, we found little amounts of foamed and fragment user plastics. Debris physical characteristics such as weight, length, hardness, and colour were also noted.

The main sources of marine debris are litter from ships, fishing and recreational boats, and garbage carried into the sea from land-based sources in industrialized and highly populated areas. The effects of marine debris on marine wildlife are widespread and negative, impacting marine education, physiology-level effects, and reduced fitness, reproductive failure, changes in community structure, and threats to the overall health of marine species. The occurrence of marine debris is of particular importance because of the lack of log Kpw data for a wide array of plastics. A logical next step is to use log Kow to generate log Kpws through the use of the molecular ion.

This finding is of particular importance because the lack of log Kpw data for a wide array of plastics. A logical next step is to use log Kow to generate log Kpws through the use of the molecular ion. log Kow may act as a surrogate for estimating log Kpw, which could allow for assessment of availability based on the product of some chemicals and plastics.

Marine debris is proven to have a widespread negative impact on marine wildlife, including physiology-level effects and reduced fitness, reproductive failure, changes in community structure to direct death following blockage of intestinal tract or entanglement. Marine debris is proven to have a widespread negative impact on marine wildlife, including physiology-level effects and reduced fitness, reproductive failure, changes in community structure to direct death following blockage of intestinal tract or entanglement. Marine debris is proven to have a widespread negative impact on marine wildlife, including physiology-level effects and reduced fitness, reproductive failure, changes in community structure to direct death following blockage of intestinal tract or entanglement. Marine debris is proven to have a widespread negative impact on marine wildlife, including physiology-level effects and reduced fitness, reproductive failure, changes in community structure to direct death following blockage of intestinal tract or entanglement.

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The southern hemisphere’s elevated UV light exposure encourages the year-round use of UV protective chemicals (UV filters and UV light stabilizers) in personal care and plastics applications. UV filters and preservatives are known to be hormonally active in vitro and/or in vivo, raising concerns of possible endocrine disrupting effects in the environment. There is little published data of occurrence of those compounds in Australian aquatic environments. This study is the first investigation of UV protective chemicals in environmental waters in Victoria, specifically in one of Melbourne’s estuaries. Water samples were taken from four sites (A – D). Screened compounds included 11 UV filters and 14 UV stabilizers, 12 preservatives and the metabolite, and one fragrance, including commonly used compounds in Australia such as 4-MBC, EBMC, octocrylene, UV-328, HEBCB, 2-phenoxyl ethanol, methyl paraben, and propyl paraben. Water samples were extracted for polar and relatively non-polar compounds using two different types of solid phase extraction methods: Oasis HLB (Waters Corp.) for polar compounds, Empore C18FF (3M) for relatively non-polar compounds, then analysed by GC-MS, achieving a detection limit of 10 ng/L. Samples from the screened compounds. Sites A, B, C, and D had similar compound profiles. Sites B, C, and D were the most different contaminant profiles, with very high concentrations of the screened compounds. Site D had a very different contaminant profile, with very high concentrations of the screened compounds. Sites A, B, C, and D are all different from each other, with the highest concentrations observed in Site D.

Increased attention is currently directed towards potential negative effects of pharmaceuticals and other micro-pollutants discharged into the aquatic environment via municipal wastewater treatment plants (WWTP). The aim was to investigate the presence of pharmaceuticals in sewage treatment plant samples in the Netherlands and to compare concentrations between WWTPs. The methodology was based on LC-ESI-MS/MS with multiple-reaction monitoring and stable-isotope dilution analysis. The study was conducted in two phases: first, a screen of 14 pharmaceuticals was carried out, and second, a more detailed analysis of the 7 most abundant pharmaceuticals. The results showed that the presence of pharmaceuticals in sewage treatment plant samples varies significantly, with some WWTPs having high concentrations of certain pharmaceuticals, while others have very low or undetectable levels.

Pharmaceuticals are used in high quantities in our society. They can be excreted unchanged and/or as active metabolites in urine and feces, and directly conveyed to wastewater treatment plants (WWTPs). If they escape degradation during wastewater treatment, they finally end up in surface water. The present study aimed for the first time to study the occurrence and fate of several selected classes of pharmaceuticals in the most inhabited and industrialized area in Italy (urban and suburban area around Milan). The investigation was conducted using a suite of analytical methods sensitive, reliable and robust is an essential step for the characterization of emerging substances in sludge.

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for treatments. These drugs are excreted mainly via urine. As a result, they may reach the environment after waste water treatment, trough yellow water used as a fertilizer or by direct discharge. There is limited information on the fate of antimicrobials in the environment. It is believed that some of these drugs are rather persistent due to their organohalogen moieties. Hence, the fate of these drugs in the environment might be a subject of concern.

To provide methods to analyze antimicrobial drugs in blood and urine has been published. However, only two methods have been published to analyze a few antimicrobial drugs (amoxicillin and ciprofloxacin) in human blood and urine. For that reason, the first multi-residue method for the analysis of antimicrobial drugs and their metabolites in human blood has been developed. The analytical process combines SPE with LC-MS/MS and can be further developed to analyze soil samples. The presented method can be used to describe environmental fate profiles of antimicrobial drugs in the environment.

TU 043

Quantification of pharmaceuticals and endocrine disruptors in river sediments: development and validation of a QuEChERS based extraction


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Accessing exposure concentrations can be challenging for the analyst as environmental concentrations and toxicological or eco-toxicological effect induced quantities are often very low in comparison to matrix capacities. Triclocarban is a well-known antibiotic and is one of the most common additives in personal care products. The present work describes a new extraction method known as Quick Easy Cheap Effective Rugged and Safe (QuEChERS) for the extraction from solid matrices, including sewage sludge and sediment. The method was validated with a certified reference material and the obtained results were compared to those obtained with a previously published method. The developed method is highly efficient and robust, and can be used for the quantitative analysis of a wide range of pharmaceuticals and endocrine disruptors in environmental samples.

References

The experimental concept is validated in a small flume that allows the simulation of different hydraulic conditions in the hyporheic zone. Under abiotic conditions, we applied a concept of screening for water-sediment transformations in a laboratory test are also discussed to assess how such a test might be performed. For both situations, case studies will be presented to highlight some of the challenges present in advancing these further.

TU 046 Water-sediment biodegradation: challenges in modeling and screening for pharmaceutical transformation products
F. Ericson
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The current OECD 308 test is a water-sediment simulation test that is typically conducted over a 100–200 day period. It is intended to estimate the parent half-life in the water phase, sediment phase and collectively in the total water-sediment system; determine the distribution and mass balance of the residues in the test system; as well as assess the transformation and bioavailability over the study period. Given the length and cost of this test protocol, an improved reduction in sample size and associated costs associated with conducting the test, it is often desired that a more rapid screen for assessing the potential transformation of pharmaceuticals would be available. Such information would be helpful in developing the ERA testing strategy especially when the identification of a key transformation product would be helpful early on in the risk assessment process. Screening for transformation products identified in the OECD 308 study and compares these to what may be predicted in an expert system to understand how selective the predictions may be and what additional information might be helpful in making a predicted pathway more realistic. Challenges in screening for water-sediment transformations in a laboratory test are also discussed to assess how such a test might be performed. For both situations, case studies will be presented to highlight some of the challenges present in advancing these further.

TU 047 A comparison of fish bioconcentration factors for several pharmaceutical compounds obtained using the reduced sampling method
E. Ericsson
Pitzer In, Groton, United States of America

Understanding whether an active pharmaceutical ingredient is likely to be taken up by the aquatic environment by fish and bioaccumulate has triggered the need to conduct bioconcentration studies in fish. Such studies are typically considered appropriate for pharmaceuticals having a logD value > 3 and required, as per the EMA Guideline, for pharmaceuticals having logD values > 4.5. The standard OECD Guideline 305 includes an exposure (uptake) phase followed by a post-exposure (deposition) phase typically equal to 60% of the uptake phase. During the uptake phase, ranging between 14 and 60 days, water and fish samples are analyzed periodically until steady state has been established and the depuration phase may be initiated. During the depuration phase, analysis of water and fish samples continues until a plateau has been reached. Based on the sampling schedule outlined in the guideline, >100 fish per study may be required to determine a kinetic bioconcentration factor (BCF). In a effort to reduce the number of fish required to obtain a BCF, an approach to estimating the aquatic bioconcentration factor using reduced sampling has been developed (Springer, et al,2008). This reduced sampling approach aims to estimate BCFS using a minimum number of sampling time points and therefore a reduced number of fish. The goal of this project is compare the BCFS of several active pharmaceuticals obtained through standard OECD 305 test methods with those BCFS determined using the approach of estimating aquatic bioconcentration factors using the reduced sampling method.

TU 048 Waterborne beclomethasone dipropionate affects fish while beclomethasone is not taken up
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Glucocorticoids are steroid hormones, playing important roles in several aspects of vertebrate physiology. The synthetic corticosteroid beclomethasone has anti-inflammatory actions as well as an effect of increasing blood glucose levels. It is marketed as the prodrug beclomethasone dipropionate (BDP) which is metabolized into the monopropionate (BMP) and free beclomethasone in humans. A recent publication demonstrated effects of waterborne BDP (1 µg/L nominal concentration) on plasma glucose levels in fish. Although levels of beclomethasone and its lipid esters in effluents or surface waters are not known, it can be assumed that most of the consumed products are metabolized into the less lipophilic forms before reaching the environment. We have therefore compared the potential of beclomethasone and BDP to bioconcentrate and to affect the physiology of exposed fish. Controlled flow-through studies with rainbow trout over two weeks to up to 0.65 µg of beclomethasone/L did not result in measurable plasma levels. Exposure to 0.65 µg BDP, on the other hand, led to accumulation of both beclomethasone, BMP and BDP in plasma, indicating a considerably more efficient uptake of the more lipophilic prodrug as well as metabolism within the fish. Accordingly, exposure to 0.65 µg, BDP significantly increased blood glucose levels, in agreement with previously published data. Furthermore, we could demonstrate a parallel increase in catalase activity in liver tissue, while exposure to beclomethasone had no effect on these endpoints. We are currently screening for beclomethasone, BMP and BDP in sewage effluents and surface water.

TU 049 The degradation of antidepressant pharmaceuticals in aerobic sludge
M. Carney Almroth, S. Strell
The College of Wooster, Wooster, United States of America

The antidepressant pharmaceuticals sertraline and venlafaxine are common contaminants in both aquatic and terrestrial environments and are reported to produce adverse effects on a range of aquatic organisms. A key point of entry of pharmaceuticals into the environment is through wastewater treatment. To learn whether microbial communities in wastewater sludge have the ability to degrade sertraline and venlafaxine and, thus, potentially reduce their environmental loads, microcosms containing aerobic sewage were spiked with deuterated sertraline and venlafaxine. Samples collected over 36 days were analyzed for the depletion of the added pharmaceuticals by microwave assisted extraction followed by liquid chromatography tandem mass spectrometry (LC/MS/MS). Municipal aerated wastewater sludge was found to degrade sertraline and venlafaxine by over 90% over the course of 36 days, whereas no change in the added sertraline and venlafaxine concentrations were observed in abiotic control microcosms.

TU 050 Time trend of cyclic volatile methyl siloxanes in Baltic herring
L. Förlin, L. Förlin
Stockholm University, Stockholm, Sweden

Cyclic volatile methyl siloxanes (cVMS) were studied in herring from the Swedish environmental sample bank. Fish from a site from the Baltic Proper southeast of Stockholm (Landsoft) and from the northern part of the Bothian Bay (Harjutajen) were analysed. Skinless dorsal muscle samples from six individuals were pooled. Two pooled samples were analysed from each site for each second year from the period 1989-2009. Octamethylcyclotetrasiloxane (D4), decamethylcyclopentasiloxane (D5) and dodecamethylcyclohexasiloxane (D6) were analyzed. The D5 concentrations were of the 50 ng/l lipid weight, while the concentrations of D4 and D6 were lower and frequently below the MDL. The concentrations were generally lower at the beginning of the period and highest around 2005-2007. There were no marked differences in concentration in the second period.

TU 051 Degradation studies of the ionophores lasalocid, monensin, narasin, and salinomycin
Cyclic volatile methyl siloxanes (cVMS) were studied in herring from the Swedish environmental sample bank. Fish from a site from the Baltic Proper southeast of Stockholm (Landsoft) and from the northern part of the Bothian Bay (Harjutajen) were analysed. Skinless dorsal muscle samples from six individuals were pooled. Two pooled samples were analysed from each site for each second year from the period 1989-2009. Octamethylcyclotetrasiloxane (D4), decamethylcyclopentasiloxane (D5) and dodecamethylcyclohexasiloxane (D6) were analyzed. The D5 concentrations were of the 50 ng/l lipid weight, while the concentrations of D4 and D6 were lower and frequently below the MDL. The concentrations were generally lower at the beginning of the period and highest around 2005-2007. There were no marked differences in concentration in the second period.

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Abiotic and biotic transformation studies were conducted on four isoprenoid anti-nociclidals: lasalocid, monensin, narasin, and salinomycin. Abiotic studies focusing on hydrolysis and photolysis were conducted following international OECD guidelines. Hydrolysis was observed under acidic conditions for narasin, monensin and salinomycin, while photolysis occurred under all conditions. wavelength, so that photodegradation of more polar compounds, such as noranacin, narasin and salinomycin can be discarded. Biotic degradation studies were conducted in lab-scale bio-reactors inoculated with Nocardia extruded soil bacterial communities. In addition, during the work with these very lipophilic anti-nociclidal agents, it was observed that adsorption to analytical equipment was highly relevant to assess under acidic conditions.

Abiotic transformations of the ionophores, the soil bacterium Nitrosomonas europea was used as a screening tool for transformation product toxicity. This effect-directed study was conducted by exposing bacteria to the mixture of ionophore degradates.

**TU 052**

Formation and structure elucidation of stable transformation products of pharmaceuticals in the water cycle

M.H. Lamoree, L. Arpin-Pont, T. Bajou, T. Haddad, T. Vasconcelos, P. Roche, V. Boireau, A. Hebert, B. Roig, T. Monger, K. Kümmerer

**TU 053**

Predicting environmental concentrations of carbamazepine and oxcarbazepine and their main metabolites in a coastal system

H. Fenex, L. Arpin-Pont, A. Vanhoucke Brunier, D. Munaron, A. Frundini, S. Chiron, H. Buzdinski, D. Hellairie-Buye, M. Mathieu, C. Boillot, E. Goeméz

**TU 054**

Fate of anti-diabetic drugs: gliclazide, glibenclamide and glipizide in soil environment

W. Mrozik, J. Stefanska

**TU 055**

Evaluation of pharmaceuticals and personal care products focused on anthelmintics in human-waste, sewage, hospital wastewater, livestock wastewater and receiving water


**TU 056**

Degradation of antibiotics by photocatalysis on immobilized titanium dioxide

A.C. Lange, A. Jørgensen, K. Krogh, P. Arnoux, O. Zahrn

**CNRS, Nancy Cedex, France**

Antibiotics are micropollutants which release in the aquatic environment has been a subject of concern for several years as they can give rise to two problems: i) they can have a direct effect on bacteria, either those involved in wastewater treatment (activated sludge, biofilms) or those present in natural aquatic environment where they contribute to river ecosystems; and ii) they can also promote the development of antibiotic resistance genes between bacterial species, including those pathogenic to man and animal. Most antibiotic are non biodegradable and an advanced physicochemical process should be applied for their elimination. There are several such processes but photocatalysis is often proposed as it can use part of the solar spectrum as an energy source and is reagent free. However most of the works described in literature are based on titanium dioxide slurries. After treatment these nanoparticles should be recover which is not easy. One solution to this problem is photocatalyst immobilization. However immobilized photocatalysts are generally less efficient than suspended photocatalysts as less surface can be activated. Within this framework tests
of photodegradation of two antibiotics often observed in the environment: a veterinary drug, tylosin (916 g/mole, pKa = 7.1) and a human drug sulfamethoxazole (253 g/mole, pKa = 5.7). Two photocatalysts (titanium dioxide) have been used: PC500 (Millenium) and P25 (Degussa). Two modes of immobilization have been tested: on a glass plate in the lab for both photocatalysts or on cellulose fibers for PC500 only (Ablstrom, Pont-Evêque, France). Antibiotics degradation was monitored by UV-Visible spectrometry and HPLC. End products (organic carbon and nitrogen species) were also quantified. Degradation was observed, P25 being more efficient than PC500. Besides the mode of immobilization, other parameters have been investigated such as pH, position of the lamp, flowrate and antibiotic initial concentration.

TU 057

Direct and indirect photolysis of human metabolites of antibiotic sulfamethoxazole

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Environmental Chemistry Laboratory, Lausanne, Switzerland

Environmental Chemistry Laboratory, EPFL, Lausanne, Switzerland

Both direct and indirect photodegradation processes have been reported to be important removal mechanisms of sulfamethoxazole (SMX) in the environment. However, most of SMX is metabolized in human and animal organisms, yet their environmental fate is not known. In this study, we assessed the direct and indirect photodegradation kinetics of SMX at 3 different pHs of 5 human metabolites of SMX, namely, nitro-SMX, nitroso-SMX, acetyl-SMX, hydroxyl-SMX and SMX-glucuronide. Similar to SMX, all metabolites were photolabile, however, with the exception of SMX-glucuronide, half-lives were all greater than that of the parent compound. The protonation state affects absorbance of the photodegradation and degradation rate. Slopest direct photolysis rates were observed at environmentally relevant pH 8.4, where the anionic form of the compounds predominates, except for SMX-glucuronide. The faster degradation of direct photolysis to the overall photolysis was found to be greatest for nitro-SMX (70% in presence of 10 mg/L humic acid). Experiments conducted in lake water (1.19 mg/L NO2, 2.43 mg/L TOC) showed degradation rates comparable to humic acid experiments. Furthermore, we examined the occurrence of SMX and metabolites in the proximity of a wastewater discharge in Lake Geneva, Switzerland. Two human metabolites of SMX, acetyl-SMX and SMX-glucuronide were regularly detected in wastewater effluent and lake water samples, in concentrations lower than that of the parent compound.

TU 058

Ubiquitous distribution of sulfamethoxazole in tropical Asian and African waters

H. Takada, A. Shimizu, T. Koike, A. Takeshiya, N. Nakada, S. Suzuki

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Human and veterinary antibiotics have been widely detected in municipal and agricultural wastewater and receiving waters. Antibiotics are biologically active and their ecological impacts have been of concern. Especially, induction of antibiotics resistance is of great concern. Very limited information is available on antibiotics in tropical waters. Infectious disease is more spreading and more percentage of people suffer the disease in tropical area. This is mainly due to climate conditions (hot and wet) favorable for the incubation of vector microorganisms and insufficient sewer and water supply systems.

TU 059

Environmental fate, occurrence and toxicity of the antiparasitic pharmaceutical toltrazuril

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Toltrazuril, an organohalogenic endoparasitic pharmaceutical used in the acute and prophylactic treatment of livestock such as poultry, piglets, sheep and cattle against coccidiosis. It is metabolized through stepwise sulfoxidation resulting in pharmacologically active metabolites. Hence toltrazuril is excreted as the parent compound and as two active metabolites; toltrazuril sulfoxide and toltrazuril sulfone, mainly via feces. The massive use of other anticoccidial drugs has resulted in increasing resistance of the parasites [1] as a result the use of toltrazuril is expected to be escalating.

Already in 2003, Boxall et al. [2] expressed concern about this compound and considered, it as a high-priority drug with respect to especially environmental and toxicological concerns. However, today still little is known about its environmental occurrence, fate and toxicity in the open environment. In 2008, concerns were raised by Germany during the Marketing Authorization approval of a tozamac compound, [3]. Toltrazuril and its metabolites may present a risk to the environment due to toxic effects on terrestrial plants and due to a risk for groundwater contamination caused by pesticide application on agricultural fields.

Analytical methods utilizing LC-MS/MS have been developed to quantify toltrazuril and metabolites in aqueous matrices using solid-phase extraction (SPE) and in solid matrices using pressurized liquid extraction (PLE). These methods are applied in this work to determine the occurrence of toltrazuril and its metabolites in drainage water, upper and lower water and from agricultural fields amended with manure containing toltrazuril. Furthermore, the developed methods have been applied to determine the fate of toltrazuril and metabolites in different abiotic processes such as hydrolysis and photolysis. Toxicity was assessed by performing acute growth inhibition tests on Selenastrum Capricornutum (freshwater algae, ISO guideline 14442), cyanobacteria (OECD guideline 201 and acute immobilisation tests Daphnia Magna (freshwater water flea)).

TU 060

The impact of carbamazepine on concentrations of acridine in river systems in Northern Germany


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Carbamazepine (CBZ) is a pharmaceutical product which belongs to the dibenzepine group. Due to high usage of the substance, concentrations found in the effluent of waste-water treatment plants (WWTP) ranged from 100-630 ng/L. In river waters, CBZ concentrations from 30-1100 ng/L were found. A toxicological important concentration level was found in river systems in Northern Germany, relative high concentrations of up to 55 ng/L for CBZ and up to 320 ng/L for CBZ. Surprisingly, concentrations ratios of ACB to CBZ in different rivers were found to be similar. Based on these results experiments were conducted to explore if concentrations of ACB in river water were influenced by degradation reactions of CBZ. Monitoring studies were taken between November 2011 and March 2012. Water samples from the River Lippe were taken in November in a water section of 7.6 km. Samples were filtered (glass filter 1.6 μm) and immediately enriched on SPE cartridges (Lichrolut EN, Merck). A fractionation on the SPE-cartridge was performed using different pH-values. Extracts were concentrated to 0.5 ml by using a rotary evaporator and analyzed by LC-MS/MS (Agilent 6410). Detection levels were 4% for ACB and 70% for CBZ. Photolysis experiments were performed with CBZ artificial and natural water samples (River Fuhse) using a Xe-light source with a 290 nm optical filter.

Seasonal concentration levels and ratios R for both compounds in rivers and WWTP, photolysis experiments and a model are presented on the poster to discuss the impact of degradation reactions of CBZ on concentration levels of ACB in river systems.
The Environmental Risk Assessment (ERA) of pharmaceuticals mainly considers the aquatic compartment, since the majority of active pharmaceutical ingredients (APIs) are hydrophilic. With more than 80% of APIs being chemical substances, the concentration of PCMs in the aquatic environment is a major concern. The concentrations of AHTN and HHCB in environmental samples, ranging from 0.1 mg/L to 147 mg/L (HHCB) and 0.01 mg/L to 385 mg/L (AHTN), are alarming. Therefore, a spatial and temporal risk analysis for the Molgora aquatic ecosystem is performed by comparing the Predicted No Effect Concentration (PNEC) water and PNEC sediment, following sludge application and potential chemical residues in soils. The model results show that risks exist in the Molgora aquatic ecosystem, showing that the concentration of AHTN and HHCB is above the predicted no-effect concentration (PNEC) in both soil and water. The potential risks have been evaluated with modelling techniques contained within the European Commission’s technical guidelines, and where input parameters are not available, estimation methods have been adopted. The assessment highlights the relative risk of each of these emission routes and how uncertainty in key parameters can affect the outcome. The present study has shown that the potential risks for AHTN and HHCB in the Molgora aquatic ecosystem are significant, and further research is needed to mitigate these risks.
Do pharmaceuticals with evolutionary preserved drug-targets pose a greater environmental risk? S.M. Furuhagen, A. Fuchs, E. Lundström, E. Gorokhova, M. Breitholtz

Swedish Foundation for Strategic Environmental Research, through the MistraPharma research programme.


Sweden.

Supporting information: The results of this study were further analyzed using the R programming language. The analysis was performed on a dataset containing information on the production of APIs (active pharmaceutical ingredients) for roughly 60% of all products (7836) that were sold on the Swedish market in 2010. The dataset includes information on the production site for APIs for APIs that were manufactured in Sweden, as well as information on the country of origin of the APIs for APIs that were imported.

The dataset was compiled to study the environmental impact of APIs, with a focus on pharmaceuticals and their metabolites. To accomplish this, the dataset was analyzed to identify the production sites of APIs for APIs that were sold on the Swedish market in 2010. The analysis was performed on a dataset containing information on the production of APIs (active pharmaceutical ingredients) for roughly 60% of all products (7836) that were sold on the Swedish market in 2010. The dataset includes information on the production site for APIs that were manufactured in Sweden, as well as information on the country of origin of the APIs for APIs that were imported.

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molecules are mainly antidepressants (fluoxetine, sertraline, paroxetine, fluvoxamine, citalopram, clomipramine, amitriptyline, mianserin, milnacipran, duloxetine, venlafaxine) but also antipsychotic drugs (clozapine), cough suppressant/halucinogen drug (dextromethorphan) or beta-blocker (propranolol). But these molecules have the common property to play directly or indirectly a role on the serotonin transporter and/or serotonin receptors. The 14 molecules were tested for their ecotoxicological effects using chronic and acute bioassays on the cladoceran Daphnia magna. Additionally to these conventional bioassays, a novel bioassay was developed using primary cell culture of hemicysts from the marine gastropod abalone (Haliotis tuberculata). This assay was used in order to address the question of pharmacological effects in a marine species. The acquired data were used to build quantitative structure activity relationship (QSAR) modeling in order to (1) determine if the chemical properties of the molecules can explain their toxicity, (2) identify the mode of action of the selected pharmaceuticals.

TU 079
Environmental effects of anticholinesterasic therapeutic drugs on a crustacean species, Daphnia magna
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The environmental presence of pharmaceutical drugs is nowadays an important field of toxicology, since the presence of such residues can cause a series of deleterious effects on exposed biota. This study assessed the ecotoxicological effects of two anticholinesterasic therapeutic drugs, neostigmine and pyridostigmine in Daphnia magna. This evaluation was conducted in static and flow-through systems and in different concentrations of the two compounds. The pharmacological effects of neostigmine and pyridostigmine derive from their capacity to induce a reversible inhibition of cholinesterase activity, and have thus been used to test the human disease myasthenia gravis. We observed alterations at both the whole-individual (primary effect) and cell level (secondary effect) from different concentrations of the two compounds. The pharmacological effects of anticholinesterasic therapeutic drugs are discussed in terms of possible ecological effects of environmental relevant concentrations of these substances on wildlife. We advocate that the presence of pharmaceuticals in aquatic environments and can co-occur with psychiatric pharmaceuticals it is important to assess this possible interaction to play directly or indirectly a role on the serotonin transporter and/or serotonin receptors. The 14 molecules were tested for their ecotoxicological effects using chronic and acute bioassays on the microalgae Nitzschia sp. and the brown alga Fucus vesiculosus.

TU 097
Acute and chronic tests of Tamoxifen and its metabolites on Daphnia pulex
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Drugs administered in humans are eliminated through the excreta in either intact or metabolized form. As other drugs, chemotherapeutic drug residues were measured in wastewater and nitrate exuviae effluents. They reach continuously the environment where they have the potential to persist. Consequently, their prolonged presence in surface water exposes the fauna and flora to potential adverse effects.

Tamoxifen is a synthetic non-steroidal anti-estrogenic analog inhibiting competitively estrogen receptors. This drug is mostly metabolized into metabolites such as Endoxifen and 4-hydroxy-tamoxifen (4-OH-Tam). It was recently discovered that the pharmacological activity of those two metabolites are more potent than the original molecule in vitro. As no literature exists on acute and chronic effects of these metabolites on aquatic organisms, Daphnia pulex have been exposed to Tamoxifen and its two metabolites in acute and chronic bioassays. In acute tests, the concentrations that induced an effect on 50% of the tested organisms (EC50) were quite similar for Tamoxifen and 4-OH-Tam, i.e. 0.52 and 0.60 μg/ml respectively. Even if endoxifen showed higher EC50 (1.09 μg/ml) signs of distress were observed on daphnids exposed to low concentrations of this molecule (0.79 μg/ml) as lethargy compared to the control. On-going chronic tests will determine whether the side effects reported during acute tests are observed on Tamoxifen and its two metabolites. In particular, whether the EC50s (24h) are placed individually, increasing concentrations (between acute NOEC/100 and acute NOEC) until juvenile instar is reached. The number of neonates produced by each mother, as well as any kind of other stress signs, is recorded for 21 days, and the viability of the neonates is also evaluated. Such tests should give a better assessment than acute tests of the potential ecotoxicological impact of Tamoxifen and its metabolites on aquatic ecosystems.

TU 080
Calmodulin inhibition as a mode-of-action of antifungal imidazole pharmaceuticals in non-target organisms: implications for mixture toxicity assessment
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Achilles tendon is not addressed in current regulation of pharmaceutical chemicals, several theoretical models have been developed and applied to predict mixture toxicity in environmental research. The Concentration addition (CA) model describes the mixture toxicity of components with similar mode of action (MOA).

Imidazoles are primarily known as antifungal substances interfering with synthesis of ergosterol in fungi. However, imidazoles are also competitive antagonists of calmodulin (CaM). CaMs is a calcium binding protein expressed in all eukaryotic cells, where it participates in many signaling pathways (e.g. nitric oxide signaling), thereby affecting many different cellular functions, particularly neuromuscular systems. Since arthropods are unable to synthesize sterols relying on dietary sources, the sterol synthesis inhibition is not likely a primary mode of action. Here, we hypothesized that exposure to imidazoles disrupt CaM-dependent nitric oxide synthesis in microcrustaceans. Further, assuming CaM inhibition to be the primary MOA for these substances, we evaluated CA model as a tool for assessing mixture toxicity of imidazoles.

We vision of Clinical Pharmacology assessing single and combined effects of four imidazoles (econazole, ketoconazole and terconazole) in adult specimens of the crustacean Nitocra spinipes (Copelopa, Harpacticoida). The mixture was tested using fixed ratios of each individual substance (LC50 value). This exposure resulted in a calculated median lethal concentration (based on Toxic Units) of 0.86 (95% CI: lower 0.74; upper 1.01), which shows that the mixture displays concentration additive toxicity. According to the CA model. In conclusion, CaM inhibition as a mode-of-action of antifungal imidazole pharmaceuticals in non-target organisms:

TU 081
Behavioral and physiological responses to pharmaceutical exposure in Gammarus spp. and Fucus vesiculosus
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Gammarus spp. and Fucus vesiculosus are two foundation species of the Baltic Sea. These species inhabit the littoral community and are thereby exposed to substances released in coastal areas. In this study both species were exposed to three concentrations of two pharmaceuticals, ibuprofen and propranolol. Both physiological and behavioural parameters were estimated to examine potential effects in the organisms. Respiration, feeding rate, activity with and without predator cues by a Multispecies Freshwater Biomonitor (MFB)[TRADMARK] were estimated for Gammarus spp. and gross production to respiration ratio (GPR) and chlorophyll fluorescence for F. vesiculosus. Propranolol did not affect any of the measured parameters of Gammarus spp, significantly and only slightly affected the algae. The strongest effect was related to activity of Gammarus spp measured by the MFB[TRADMARK], and results showed that propranolol decreased the activity. The addition of predator cues into the exposure mixture water increased the activity in all treatments, but the gammarids could not compensate for the reduced activity caused by the pharmaceutical. The feeding rates of Gammarus spp. exposed to propranolol were more than two times higher in all concentrations compared to the control. Also the algae was more affected by propranolol measured as lowering of GPR. All data indicate that with both behavior and biomass Gammarus spp. in combination with the stress responses in the algae, might cause unexpected indirect and cascade-effects which have implications on the littoral communities.

TU 082
Acute effects of psychiatric drugs on D. magna under insecticide exposure
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The rates of production, release and use of pharmaceuticals and of psychiatric drugs in particular is expected to increase in the next 10 to 50 years for several reasons, and so is the loading into the environment. In recent years, there has been a growing concern about ecotoxicological risk of these psychiatric drugs that interact with the central nervous system (CNS) and the antidepressant and antipsychotic therapies which inhibit the re-uptake of serotonin. Indeed, these compounds have been detected in many countries in sewage treatment plant effluents, surface waters, seawaters, groundwater and some drinking waters. However, little is known about effects of the interactions between psychiatric pharmaceuticals and other substances like neurotoxic pesticides. Because neuroactive insecticides like are usually present in aquatic environments and can co-occur with psychiatric pharmaceuticals it is important to assess this possible interaction to play directly or indirectly a role on the serotonin transporter and/or serotonin receptors. The 14 molecules were tested for their ecotoxicological effects using chronic and acute bioassays on the microalgae Pseudokirchneriella subcapitata and the crustacean Daphnia magna. Additionally to these conventional bioassays, a novel bioassay was developed using primary cell culture of hemicysts from the marine gastropod abalone (Haliotis tuberculata). This assay was used in order to address the question of pharmacological effects in a marine species. The acquired data were used to build quantitative structure activity relationship (QSAR) modeling in order to (1) determine if the chemical properties of the molecules can explain their toxicity, (2) identify the mode of action of the selected pharmaceuticals.
Assessing the environmental hazard of mixtures of pharmaceuticals: combined acute toxicity of fluoxetine and propanolol to the crustacean Daphnia magna

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The aim of the present work is to evaluate the acute toxic response of the crustacean Daphnia magna exposed to individual pharmaceuticals and mixtures. We tested fluoxetine, a selective serotonin reuptake inhibitor widely prescribed as antidepressant, and propanolol, a non selective β-adrenergic receptor-blocking agent used to treat hypertension. EC10 values and their 95% confidence limits were determined according to OECD 202 and ISO 6341 guidelines. Less than 24 h old daphnias were exposed for 48 h. Six replicate vessels with five individuals per vessel were tested at each treatment level. Some chemicals were first tested separately; estimated EC50 were 7.0 mg/L for propanolol and 7.8 mg/L for fluoxetine. Toxicity of binary mixtures was then assessed using a fixed ratio experimental design. Five concentrations (from 0.5 to 2 total toxic units) and 5 percent ratios of each compound were tested. The results showed a significant deviation from the CA model that indicated antagonism. Concentration-response curves for the individual chemicals were shifted to the right, while for the mixture they were shifted to the left.

TU 084
Assessing health status of rudipatypus philippinarum exposed to caffeine, carbamideasein, ibuprofen and novobiocin using the neutral red retention assay

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Despite the fact that pharmaceuticals have been detected in the environment at the µg L-1 to ng L-1 range, it has been demonstrated they can cause adverse effects at environmentally relevant concentrations. To detect possible adverse effects of a contaminant in the environment, standardized short-term, sensitive and low-cost methods are usually applied to estimate chronic toxicity against organisms. Lysosomal membrane stability (LMS), has been successfully applied as a screening tool to determine the health status of a large range of organisms. The feeding style and habitat of the manila clam (Rudipatypus philippinarum) make this species vulnerable to organic contaminants bound to water and it has been widely used in ecotoxicological studies. LMS was evaluated in clams' haemolymph by the neutral red retention assay (NRRA). Clams were exposed in the laboratory to concentrations of caffeine (noxious stimulant), diclofenac (antiinflammation and mood stabilizing), ibuprofen (non-steroidal anti-inflammatory drugs) and novobiocin (antibiotics) during 35 days in a semi-static 48 h renewal assay. Filtered sea water was spiked every 2 days with caffeine (0.1, 5, 15, 50 µg L-1), diclofenac (0.1, 1, 10, 50 µg L-1), carbamideasein (0.1, 1, 10, 50 µg L-1). Stock solutions of pharmaceuticals were prepared in DMSO (0.001%) to ensure solubility. Test with this solvent was undertaken to ensure no solvent effect. Results showed that neutral red retention time (NRRT) measured at the end of the bioassay was significantly (p < 0.05) reduced (50 %) when exposed to environmental concentrations of pharmaceuticals (caffeine = 15 µg L-1; ibuprofen = 5 µg L-1; carbamideasein = 1 µg L-1; novobiocin = 10 µg L-1). Results showed dose-dependence effect of pharmaceuticals (p<0.05). Clams analyzed after exposure to 10, 15 and 50 µg L-1 were considered to present a diminished health status (NRRT < 45 min) (p<0.05). LMS appears to be a sensitive tool that enables evaluation of the health status of clams after exposure to concentrations of selected pharmaceuticals under laboratory conditions and could thus be used as a biomarker for pharmaceutical contamination in aquatic environments.

TU 085
Cytogenetic effects induced by cocaine on the freshwater bivalve Dreissena polymorpha

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In recent years a group of diverse bioactive chemicals covering pharmaceuticals and active ingredients in personal care products (PPCPs) has raised concern of public health. Antibiotics are suspicious environmental contaminants as they are biologically active substances. Drugs, which have specific modes of action, may probably cause adverse effects both on the ecosystem and the food chain. Up to now, only a few ecotoxicological studies for the assessment of the environmental risk of antibiotics and their metabolites are available. In Germany, the human macrolid clarithromycin is widespread present in macrolid clarithromycin is widespread present in macrolids and has been detected in surface waters and has been found in concentrations up to 0.3 g/L. In some studies ecotoxicological effects of clarithromycin on aquatic organisms are published. Unfortunately, most of these findings are not valid according the the Technical guidance document (TG) of the Commission EU. M. Parolini et al. assessed the acute effects of clarithromycin, using the toxicity data obtained for Daphnia magna immobilization test, Microtox has been used to assess acute toxicity of representatives of several groups of pharmaceuticals and personal care products. In addition to conventional acute ecotoxicological tests, selected chemicals have been tested for specific effects mediated by estrogen and/or androgen receptors. Cytotoxicity and specific activities have been determined by in vitro reporter-gene bioassays with mammalian cell lines and recombinant yeast strain. The results show differences among ecotoxicological effects of selected pharmaceuticals and personal care products on the representatives of different trophic levels also depending on their structure, mode of action and how observed data deviates from the CA (Concentration Addition) or LA (independent Action) models, and tests if significantly better descriptions of the observed data can be achieved using a set of deviation functions. These functions allow a differentiation between synergetiam and antagonism, along with deviations based on the dose-level and concentration additivity assumptions. The concentrations were set to 0, 2.5, 50, 75, 250 and 500 µg/L. This analysis showed a significant deviation from the CA model that indicated antagonism. Tested compounds were much higher than those detected in the environment; however these results are to be considered as a first step in an ongoing project aimed at assessing chronic ecological effects of selected pharmaceuticals and personal care products (PPCPs) on the freshwater bivalve Dreissena polymorpha.
action and physical-chemical properties. Next to this, endocrine-disruptive activities have been observed for a few of the tested PPCPs. The obtained data indicate which of these substances should be prioritized for further investigation.

TU 090

Effects of chronic exposure to pharmaceuticals on aquatic biota: an experimental study

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Purifying techniques at sewage treatment plants are constantly being improved to remove more and more compounds from effluent water but despite this a lot of pharmaceuticals still pass the plants into the surface waters. These substances can affect the aquatic environment, but there is limited information on the effects of these compounds on aquatic organisms.

TU 091

Toxicity of Ciprofloxacin and Sulfamethoxazole on marine biofilm communities

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Ciprofloxacin (CIP) and sulfamethoxazole (SMX) are antibiotics that are extensively used worldwide. Both compounds are applied in fish and shrimp farming practices, and are not readily decomposed. Their detrimental effects have been studied in acute and chronic exposure experiments, but more information on chronic effects is available. From a previous monitoring it became apparent that STP effluents are contaminated with high concentrations of CIP and SMX, which can have adverse effects on aquatic organisms.

TU 092

An automated respirometer for measuring activated sludge respiration rates in OECD Method 209

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The activated sludge respiration inhibition test (OECD Procedure 209) is used to assess the inhibitory effects of a substance on the respiration of the heterotrophic population of sewage microorganisms found in the activated sludge sewage treatment process. The original OECD guideline for the test was first issued in 1984 and remained unchanged until the 2007 revision. We have introduced several modifications to the test design to improve the statistical basis of the test results. Changes introduced in the new guideline included an increase in the level of replication of test and control mixtures to allow the determination of the No Observed Effect Concentration (NOEC) of a substance, a requirement of the updated OECD guideline. Changes included an increase in the level of replication of test and control mixtures to allow the determination of the No Observed Effect Concentration (NOEC) of a substance.

TU 093

Evaluation of the potential risk due to exposure of children to allergens during bath

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The use of personal care products is a common practice in developed countries. This brings as consequence a frequent exposition to chemicals likely to be damaging for human health, particularly in the case of babies and children. Fragrances are a group of chemicals incorporated in most cosmetic and other personal care products including baby care ones. The Scientific Committee on Consumer Products (SCCP) has identified 26 of these substances as likely to cause contact allergies. Among products for baby care, both washing and bathing products such as baby lotions and bubble baths show the highest percentage of contact allergy, contaminate the water and can therefore penetrate and irritants and allergens to penetrate.

TU 094

Comparative biomarkers responses of zebrafish life stages exposed to oxytetracycline and amoxicillin

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Pharmaceuticals are widely used compounds and many of them will eventually end up in the aquatic environment where they might affect various organisms. Two commonly used antibiotics that have been shown to be active in the aquatic environment are oxytetracycline and amoxicillin. These antibiotics are used as growth promoters or to treat bacterial diseases. Their excessive application has become a threat for both human and environmental health. Considering this scenario, our study aims at assessing sublethal effects of AMX and OTC in embryos and adults of zebrafish. To achieve these objectives a battery of biomarkers were analysed in adults (liver, head, muscle, gill tissues) and embryos (whole body homogenates) exposed to these chemicals. Representative biomarkers include a broad range of metabolic pathways such as the metabolic pathways glutathione-S-transferase (GST), lactate dehydrogenase (LDH), and catalase (CAT). The observed effects on CAT activity in embryos were more pronounced than in adults.

TU 095

Gemfibrozil and naproxen biodegradation in a river water ecosystem

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Incomplete removal during wastewater biological treatments is the main source of natural surface water contamination by pharmaceuticals. Degradation of a chemical in the aquatic
ecosystem depends on a variety of factors, including compound properties and environmental factors and above all the presence of a natural microbial community able to degrade it via metabolic and/or co-metabolic pathways. Although pharmaceutical and therapeutic products are widely found in the natural environment, the ecological effects on receiving ecosystems remain largely unknown.

Naproxen, a nonsteroidal anti-inflammatory drug and gemfibrozil, a fibrate drug used as lipid regulator, have been found in several natural waters. They were also found in influent-effluent from a municipal waste water treatment plant inside the city of Rome in and in the receiving River Tiber. For this reason we studied the degradation of these pharmaceuticals in microcosm studies using natural river water. The biotic and abiotic degradation (in terms of the disappearance of the 50% of the initial concentration) of naproxen and gemfibrozil were evaluated in microbiologically active river water and in sterilized one. Moreover, the degradations of naproxen and gemfibrozil were also evaluated in microcosms simultaneously treated with both pharmaceuticals in order to evaluate if their co-presence could affect their environmental fate and the degradation activity of the microbial community. The overall results show that both pharmaceuticals were biodegraded. Gemfibrozil (DT50 > 70d) was more persistent than naproxen (DT50 = 27 d). In the presence of Naproxen the degradation of Gemfibrozil slowed down and its persistence increased to more than 70%.

TU 096

Determination of emerging substance as human waste indicator in the Danube River samples
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Caffeine, methylxantine derivative, is a pharmacologically active substance which stimulates the central nervous system, increases heart rate, dilates blood vessels and works as a weak diuretic. It is present in human sewage effluent, natural-sewage effluent and surface waters. The objectives of this study were to determine caffeine presence in the Danube River samples and to evaluate its stability during two months storage of samples on 4°C. Analysis was performed by solid-phase extraction (SPE) followed by developed reversed phase high performance liquid chromatography (RP HPLC) method. The chromatography was using a Zorbax Eclipse XDB-C8 column (150 mm x 4.6 mm, 5 µm particle size) at 25°C, with a mobile phase of 0.1% THF in water (pH 3.8) - acetonitrile (85:15, v/v). The flow rate was 1 mL/min, and detection by DAD at 273 nm. Samples were collected in July 2011 on seven different locations of the Danube River on a territory of Novi Sad, Serbia. Caffeine amount ranged 0.84 ng/L on the 1st day and 0.52 ng/L on the 30th day after sample collection. On the 60th day after sampling caffeine was under the limit of detection in all water samples. Presence of caffeine confirmed the existence of human water in the Danube River. Highest values were obtained in sample collected from location near the water supply source “Ratno ostrovi”, Novi Sad. Obtained results due to caffeine amounts significantly decreased during two months storage of samples on 4°C most likely due to its degradation.

The work was supported by Ministry of Education and Sciences, Republic of Serbia (ID46009) and NATO Science for Peace Project 'Drinking Water Quality Risk Assessment and Prevention in Novi Sad municipality, Serbia' (SEPESAPF 9984087).

TU 097

The effects of ibuprofen exposure on fathead minnows (Pimephales promelas)
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Ibuprofen has been widely used in water supplies and over-the-counter medication, treating pain, inflammation and fever by reducing the level of prostaglandins through non-selective inhibition of the enzyme cyclo-oxygenase (COX). COX exists in two isoforms; the constitutively expressed COX-1 and the inducible COX-2. In order to evaluate whether pharmaceuticals pose any environmental risk to aquatic wildlife, we are testing the hypothesis that any potential effects will be related to the Mode-of-Action of the drug and will be seen at plasma levels in non-target organisms similar to human therapeutic levels. We have identified the COX-1, COX-2a and COX-2b genes in the fathead minnow (Pimephales promelas). To assess the uptake and effect of ibuprofen exposure, fathead minnows (Pimephales promelas) were exposed in a flow through system. Four fish were kept per replicate at 1, 2, 4, 8 and 16 hours/year-exposure. Gills, livers, gonads, gut, heart, liver, muscle and brain were collected to determine the effects (if any) on COX gene expression. RNA isolated from tissues was reverse transcribed to cDNA and amplified by qPCR using specific primers to the COX genes and reference genes (18s and β-actin). Initial results indicate changes in COX gene expression following ibuprofen exposure.

Plasma and water samples were also collected to determine ibuprofen concentrations in the fish and the exposure water, using mass spectrometry. This confirmed that fish were exposed to ibuprofen concentrations close to nominal (105 ± 2.6 and 302 ± 49 µg/L, respectively). Analysis of the plasma revealed uptake of ibuprofen to be up to 9-fold higher than the nominal concentration with concentrations of 500 µg/L higher than the nominal concentration observed. The uptake of ibuprofen was noted between individual fish in the high concentration group (range 120-700 fold), and current work is focused on relating this to changes in COX gene expression.

TU 098

Large-scale spatial-temporal modeling of historical pesticide applications
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With increasingly more detailed data and faster computers, it becomes easier to model pesticide mass loadings into aquatic systems at a high resolution with temporal variability at the landscape and regional scales. A large-scale, four-year, multi-source and multi-scale correspondence analysis of pesticide data was conducted to quantify spatial and temporal mass loadings of pesticides into tributaries to the Sacramento River, San Joaquin River, and Bay-Delta estuary California. The aim was to guide future risk assessments for sensitive and endangered species. As part of this project, ten years of daily mass loadings were simulated for 40 chemicals in a 164,000 km² area of California’s Central Valley. Environmental fate and transport models were developed for each of the 40 chemicals. Modelled loadings were represented in the simulations included fruit, vegetable, grain, nuts, rice, landscape maintenance, and structural applications. Approximately 9,115,000 pesticide applications were represented in the simulations, accounting for a total mass of 9,279,000lbs of active ingredient for the 40 chemicals. Approximately 14.2% of the applied amount was predicted to reach surface waters via runoff, erosion, drift, and discharge. The runoff from agriculture accounted for over 86% of the masses losses. Erosion and drift from agricultural applications accounted for approximately 3.0% and 4.4% respectively of all mass loadings. Another 4.3% was predicted to discharge and run off from rice paddies. Urban runoff accounted for less than 1 percent.

TU 100

Modelling the seasonal cycle of POPs in soil, vegetation, and cow milk from a high altitude pasture in the Italian Alps
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Pollution in soil, vegetation, fodder, milk and feed from dairy cows that graze on a high altitude plateau in the Italian Alps has been measured during the past season. We followed the seasonal cycle of some obsolete pesticides (DDT and its isomers and metabolites, HCH and its isomers, HCB) of some congeners of polychlorinated biphenyls (PCB) and some congeners of brominated flame retardants (PBDE) during several pasture seasons that, at those altitude, last typically from June to September. Soil act as the main repository compartment with a high dynamic role because consistent concentration changes were observed over relatively short periods (few months). Typically POPs have DT50 = 27 d higher than the nominal concentrations. Variation in ibuprofen uptake was noted between individual fish in the high concentration group (range 120-700 fold), and current work is focused on relating this to changes in COX gene expression.

TU 101

Fate and behavior of pesticide in US soil: use of kinetic modeling to assess environmental relevance of metabolites
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In the European Regulatory context of inclusion of active substances in the positive list of Regulation (EC) N° 1107/2009, authorizing their use as pesticides, studies conducted in US are usually not recommended because of significant differences in experimental design, soil specificities and objectives when compared to OECD guidelines. However when a US soil metabolism study (conducted according to US-EPA guideline i.e. OPPTS 835.4100 using US soils) was conducted and submitted as part of the EU dossier, Regulatory authorities may ask for clarifications on soil metabolites, even formed under the specific conditions of this study type.
The objective of this work is to present a case study where apparent conflicting results were obtained between US-type soil metabolism and EU-type soil metabolism studies. In the US study, additionally to one major metabolite M, two metabolites (m1 and m2) were considered to be formed directly from the parent in the metabolic pathway proposed by the laboratory in amounts continuously increasing up to around 7% of the applied radioactivity until the end of the one year incubation. These results were consistent with the studies where only M was identified. The kinetic optimization with ModelMaker software and statistical analysis of the data according to the recommendations of the FOCUS Kinetics Workgroup (2006) were performed.

In both studies investigated that, using a new metabolic pathway, this optimization of kinetic data leads to an acceptable error. Therefore, these soil metabolites were found not to be environmentally relevant according to EU guidance. This justifies the need to perform additional kinetic investigation of the metabolism of pesticides so as to set up properly the degradation pathway.

TU 102

Determination of plant uptake factors for pesticide fate modelling


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The plant uptake factor (PUF) is defined as the concentration of a compound in the solution taken up by the roots divided by its concentration in the soil porewater. The PUF is therefore an important parameter for a realistic leaching assessment. PUF values have been experimentally derived for four substances covering a wide range of polarity (ionic, polar, medium polar, lipophilic) in three different crops (Tomato, Wheat, and Maize). In the kinetic experimental set-up intact plants were exposed between 8 and 11 days to a nutrient solution (pH 6) spiked with the radio-labeled test compound. Volume uptake and concentration in the nutrient solution were measured regularly over the experimental period. By sealing the test vessel it was assured that the only loss processes were from the system for water and chemical was plant uptake. As a result of the study, the PUF was always well above the FOCUS default value of 0.5 (FOCUS, 2009). Generally, a small variation between plant species was observed. The experimental results could be verified with a simple plant uptake model. The data on PUF show that the use of the FOCUS default of 0.5 is a very conservative approach in terms of leaching assessment. For the test compounds exhibiting ionic properties results obtained in three diverse crops representative for cereals, small grains and vegetables all measured PUF values were well above 0.5. It is expected that these ionic uptake values can be generalized to other compounds within the same range of polarity, as the plant uptake model successfully applied to confirm these values only uses generic compound parameters as input (e.g. lipophilicity).
The general outline of the project and results of Work Package 1 (Evaluation of the FOCUS surface water modelling concept with respect to representativity and protection of the included scenarios for German conditions in comparison to the current assessment methods in the German national authorization procedure) will be presented.

TU 107
Impact of recent EFSA guidance on soil degradation rates and environmental exposure modelling
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2Regulation of agrochemicals under the EU Regulation 1107/2009 requires a lot of challenges and numerous guidance documents have been recently issued, thanks to EFSA for the harmonisation and consistency of the national studies. In the presented study, the methodology of the derivation of kinetic parameters linked to the leaching parameter (Koc) is probably the most advanced in the Regulatory arena world-wide. This poster is dealing with the estimate of DegT50 which has to be used not only for the soil exposure assessment but also for the assessment of potential leaching to groundwaters and surface waters. The aim is to investigate the variability of calculated degradation parameters and to be well known but the assumptions made during this process can appreciably affect the results. Usually a minimum of four laboratory studies are required to estimate the dissipation pattern in soils. If the degradation half-life (DegT50) in top soil at 20°C at pH = 2.25 exceeds 60 days additional field dissipation studies need to be conducted. In the proposed poster, we will show for an existing substance how the methodology is being used (according to the new EFSA (2010) guidance) to derive the DegT50 and we will discuss the impact of this new guidance on the results and on exposure estimation.

TU 108
How reliable is the predicted leaching of pesticides into Groundwater? - Validation of the FOCUS groundwater model PELMO 4 for use in the German national registration process
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In the registration procedure in Germany the risk assessment for the leaching potential of plant protection products into groundwater is based on modelling results using simulated leaching concentrations of the FOCUS Hamburg scenario from the latest version of the FOCUS PELMO model (tier 1, 2). Dependencies of pesticide sorption and degradation data from different soil properties as well as the parameter variability are considered in endpoint selection for modelling, which is in line with the FOCUS recommendations. The measured leachate concentrations for active substances and/or metabolites from outdoor lysimeter studies are accepted as higher tier endpoints in the risk assessment and overestimated predictions from simulation runs (tier 3). This is generally justified by comparable soil and climate conditions in the Hamburg scenario as compared to the field studies, but the assumptions are still not validated under realistic conditions. However, the implementation of the new FOCUS PELMO model in the German authorisation procedure in combination with the adapted selection of modelling endpoints requires a validation of the national tiered approach. In a current research project, predicted and measured leachate concentrations from modelling and field studies are compared for active substances and their metabolites. Preliminary results are presented and lead to discussions about the reliability of the predicted potential leaching behaviour of pesticides into groundwater in Germany. Further investigation is planned on the critical points, how the short duration of lysimeter studies in combination with a single application finally affects the prediction of the leaching potential. In this methodology of tier 3 simulations with FOCUS PELMO was chosen to derive degradation and sorption parameters for selected substances and allow a model based extrapolation of the lysimeter results to different conditions, e.g. longer investigation period, multiple application, different application rates and crops. The outcome of the analysis shall indicate under which conditions lysimeter studies can be evaluated as endpoint or as process studies. A proposal, how inverse modelling of lysimeter results can be adequately considered for future regulatory decision making, is thought to be useful with respect to further harmonisation between member states in the EU.

TU 110
The impact of the rainfall criterion in the new EFSA soil persistence guideline on the results of field dissipation trials
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In the new EFSA guideline on soil persistence (EFSA, 2010) it is intended to exclude loss processes on the soil surface (photolysis, volatilisation) for the derivation of field half-lives of pesticides. As a pragmatic approach, it is proposed that only sampling points after 10 mm cumulative rainfall should be used to derive DT50. While this rainfall criterion is intended to ensure that processes on the surface are not taken into account for kinetic evaluation of field studies, there is no clear scientific basis for the selected 10 mm cumulative rainfall criterion. We therefore evaluated which impact the selection of this criterion has on the kinetic analysis based on field studies from different locations across Europe and for different substances. Of those studies which could be evaluated according to the new guidance, a substantial fraction showed different results (DT50) depending on the selected rainfall criterion (e.g. 5 mm, 10 mm, 15 mm, etc). While in some cases only the resulting DT50 varied according to the applied rainfall criterion, in other cases the actual DT50 was not evaluated anymore. We also show that the impact of the rainfall criterion on the resulting DT50 depends on both the study location within Europe and the time of application. These results show that the selection of the rainfall criterion can have a pronounced effect on the results of field studies. Hence, this criterion needs to be chosen with care. Studies on the speed of movement of pesticides in the soil, depending on substance and soil specific properties and rainfall, may help to show if the currently proposed value of 10 mm is reasonable.

TU 111
InversePELMO: a specific software to perform inverse modelling simulations with FOCUSPELMO 4
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In the assessment for authorisation of plant protection product its leaching behaviours is an important factor to protect the groundwater. In this context the sorption to soil (Parameter: Koc) and the degradation (Parameter: DT50) are processes that must be taken into account. Recently, the new FOCUS groundwater group suggested a third method of the PELMO model setting in FOCUS 2006. The idea is to analyse outdoor lysimeters, using the inverse modelling method that allows the estimation of Koc and DT50 parameters within a single step. For this procedure an optimisation tool, the program PEST (Model Independent Parameter Estimation), has to be combined with a leaching model (here: FOCUSPELMO 4). The aim of inverse modelling simulations is to find those Koc and DT50 values that could describe the outdoor study data of field studies with the recorded data in experiments. Therefore all data of a lysimeter study are used to vary the input parameters Koc and DT50 until the leaching model shows the same results as the experiment. Generally, 2 steps have to be conducted when performing inverse modelling simulations. Firstly, the hydrology in soil is optimised, followed by the optimisation of pesticide fate. The software InversePELMO is able to provide both processes and likely behaviour of the results. InversePELMO has also a built-in module to perform standard statistical tests to check the quality of the optimisation such as the determination of the ‘FOCUS error’ at which the chi² error passes as described in FOCUS (2006). It was also tested that PEST works under all relevant windows systems (XP, VISTA and 7) in a 32 bit as well as 64 bit version. The results of InversePELMO can be used to make predictions about the likely behaviour of future studies (e.g. rainfall, temperatures, percolate, and substance fluxes) therefore all data of a lysimeter study are used to vary the environmental conditions (e.g. different climate), parameters of the lysimeter results to a different situation with respect to the application pattern of the substance (e.g. change of the rate), parameters of the lysimeter results for a refined standard tier 1 simulation.
full-field environmental programme is barely affordable for a new active ingredient let alone for a single formulation. Simulation models are the primary basis for regulating pesticides against ground and surface-water protection standards, but the current models cannot explicitly represent plants or their roots, or the effects of formulations and formulation placement strategies (e.g. slow-release microcapsules and seed treatments). Other models exist that represent individual components of the system in a more satisfactory way.

Current models used for pesticide registration within the EU are 1-dimensional and have a simplified representation of root development and uptake of pesticides. Conversely, plant growth and uptake models can have sophisticated representation of plant processes, but often do not consider pesticide dynamics. An ongoing project has created a conceptual framework for representing local pesticide concentrations in the whole soil-plant system, and will next produce a spatially-explicit simulation model. By relating local concentrations of pesticides to product efficacy, it will be possible to use the model to design better active ingredients, formulations and placement strategies. The new model will also enable the environmental benefit of advanced formulations and placement strategies to be quantified in a cost-effective way for the first time. This presentation will introduce the project to the scientific community, overview results from the first year of work, and discuss anticipated outcomes and the potential benefits to the scientific and regulatory communities.

The project co-funded by the Technology Strategy Board, the Department for Environment, Food and Rural Affairs (DEFRA), and the Biotechnology and Biological Sciences Research Council (BBSRC).

TU 112

Last advances and perspective for a better risk assessment of the tropical use of Protection Plant Products in France

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Risk assessment of water contamination required prior the pesticides registration for French overseas territories is currently conducted using tools and guidance documents established for EU context although the agro-pedoclimatic conditions and transport of pesticide in these territories underlines that (1) a minimum of four scenarios (2 soils: and col and nitsol and 2 crops: banana and sugar cane) would be necessary for the risk assessment of the main uses of the French overseas territories and (2) the models to be used for predicting transport of pesticide have to account for preferential flow and specific redistribution of rainfall by crops canopy for banana. For water surface contamination, the module for surface water fate would likely be initially simplified to a simple static receiving water body of dimensions defined consistently with French overseas territories and protection goals. Finally, the main features of two models currently under test: representing surface and subsurface flow of water and pesticides in banana crops on tropical volcanic soils are summarized and the schedule of a 2 year research project (2012-2014) to adapt them for regulatory purposes introduced.

TU 113

Simulation of the herbicides flufenacet and metazachlor in a lowland catchment with the model SWAT - A sensitivity analysis

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Spatial differentiation is a topic of increasing interest within ecological risk assessment (ERA) and Life Cycle Assessment (LCA). A key issue to be addressed in the impacts the different methods used by models and corresponding impact factors is the level of spatial detail required and uncertainties related to the use of generic impact factors where the exact location of the activities is unknown. For freshwater ecotoxicity evaluations were performed in order to assess the relative influence of scale in calculation of LCA characterization factors, comparing them with the result of site specific risk assessment. In this work, we applied the spatial differentiated multimedia model MAPPE in order to highlight the site variability, such as USEtox ERA results are calculated following a site-specific ecological risk assessment procedure that integrates in the assessment the spatial distribution of aquatic ecosystem. ERA results at different scale present higher variability: key drivers of variation and relevant differences in addressing spatial differentiation will be presented and discussed. Key driving forces for spatial differences were identified and discussed.

TU 116

Combination of SFA and multi-media fate modeling to assess the consequences of global trade and informal recycling of WEEE in China

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Spatial differentiation is a topic of increasing interest within ecological risk assessment (ERA) and Life Cycle Assessment (LCA). A key issue to be addressed in the impacts the different methods used by models and corresponding impact factors is the level of spatial detail required and uncertainties related to the use of generic impact factors where the exact location of the activities is unknown. For freshwater ecotoxicity evaluations were performed in order to assess the relative influence of scale in calculation of LCA characterization factors, comparing them with the result of site specific risk assessment. In this work, we applied the spatial differentiated multimedia model MAPPE in order to highlight the site variability, such as USEtox ERA results are calculated following a site-specific ecological risk assessment procedure that integrates in the assessment the spatial distribution of aquatic ecosystem. ERA results at different scale present higher variability: key drivers of variation and relevant differences in addressing spatial differentiation will be presented and discussed. Key driving forces for spatial differences were identified and discussed.

References:

TU 117

Modelling the environmental fate and effect of organic bulk emissions from industrial effluents in LCA

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Modelling the environmental fate and effect of organic bulk emissions from industrial effluents in LCA

C.E. Raptis1, A. Koehler2, R. Jurasek1, S. Hellweg1

The flow of obsolete electric and electronic devices is constantly growing, according to a prediction of Zoeteman et al. (2010) by 3 to 5 % each year. It is suspected to add up to a volume of 20 to 50 million tons every year (Bridgen 2005). A large amount of waste electric and electronic equipment (WEEE) containing a variety of hazardous substances such as PBDE and Pb is shipped overseas to China, India and Western Africa for recycling. In these countries, WEEE is often processed by “informal recycling” without proper equipment for metal extraction, and labor safety. Thus it heavily affects the health of workers and people living in the vicinity, as well as the environment.

In order to quantify mass flows of WEEE from the developed to developing states, and assess the impact of these transports on local scale, substance flow analysis (SFA) followed by multi-media fate modeling were applied.

In the frame of the SFA the following information was gained:

a) Global transportation routes and mass flows of WEEE
b) Data on the composition of typical e-wastes exports with regard to the European WEEE-Directive categories
c) Chemical composition of the single categories with a special focus on lead and bромinated flame retardants (PBDEs and TBBPAs)
d) Estimated emissions of Pb and PBs to the environment as a consequence of different informal recycling techniques.

In a second step, results from the SFA were used to a feed multi-media fate model that was applied to assess the environmental distribution of the selected hazardous substances and to perform an estimation of human and environmental risk. For this, Guiyu region in China was chosen as a local case site as it is one of the largest informal recycling areas.

References:

TU 118

Globally applicable, spatially explicit assessment of non-toxic air pollutants regarding health impacts due to ozone

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1. Introduction
This poster presents intake factors (f) and characterization factors (CF) regarding human health effects for the pollutants NMVOC, NOx and SO2 accounting for health impacts due to ozone. Research on life cycle impact assessment (LCIA) for transboundary pollutants has been reviewed and it is suggested that spatially differentiated fat modelling is crucial. The present work aims to fill the gap of consistent global modelling by developing an approach to derive globally applicable and spatially explicit values, and to suggest guidelines by a factor of 10 or more.

2. Materials and Methods
Within the ongoing EU-funded project LC-IMPACT (2010-2012) the “Development and application of environmental Life Cycle Impact Assessment Methods for imProved sustAnibility characterisation of technologies” is pursued. Within the area of “Non-toxic pollutant impacts” the objective is to develop globally applicable, but spatially explicit, LCIA methods and characterization factors.

Within the TM5-FASST modelling framework, the world is divided into 36 regions. Each region serves as a source region. Population data and concentration response functions are applied in order to calculate the f’ and relevant diseases. Finally, the health impacts are weighted in order to get DALYS per unit of emission, and different external cost estimates, by including and excluding equity weighting.

3. Results
A detailed comparison will be made between f’s derived by the TM5-FASST model and by the EcoSenseWeb integrated assessment tool in order to assess the inherent uncertainties and implicit variability in the estimates. f’s and CFs are calculated for several countries and larger regions. Finally, f’s and CFs suggested in different LCIA methods have been compared with the findings of this work.

Acknowledgements
The author thanks the colleagues of the LC-IMPACT and the European Union for funding. The author thanks the JRC-ISPIRA, Institute for Environment and Sustainability (IES), Climate Change Unit (CCU) for kindly making the global scale assessment based on the TM5-FASST tool possible.

TU 119
Environmental impacts of thermal emission to freshwater: Spatially explicit fate and effect modelling
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Power production is a crucial sector causing heavy impact on freshwater bodies by releasing enormous amounts of heat in once-through cooling systems. So far only few approaches have addressed impact on aquatic environment related to this issue and there is no study providing fate and effect model for assessing the impacts on a spatial explicit level and broad coverage. We started our research based on a detailed study assessing impacts of thermal emissions from different sizes of power plants in Switzerland and extracted the most sensitive parameters to derive a generic model of combined fate and effect model for the US. We created a 0.5 arc degree grid accounting for water temperatures, river flow, river width, flow velocity and distance to sea in order to model fate and effect of thermal emissions from different sizes of power plants. Various data sources are tapped and different interpolation methods are applied to cover points without measured data, allowing accounting for uncertainties. We further investigated uncertainties of the characterization factors by varying input parameters and the model assumptions, including the assessment of the affected species. The thermal impacts show significant spatial variability depending on the water body where the cooling water is discharged and the amount of heat released, because the impacts are non-linear. Furthermore this project illustrates how fate and effect model can be integrated to improve the assessment of spatially differentiated impact assessment considerably.

TU 120
Including the influence of worldwide crop cultivation on ecosystem services in life cycle assessment
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Land use is increasing worldwide leading to changes in the ecosystem. To measure changes allows for quantification of the impact that each land use activity causes to the environment. This can be achieved through the quantification of changes in ecosystem services. Ecosystem services include carbon sequestration, nutrient cycling, erosion regulation and biotic production potential. The goal of this research is to develop indicators that estimate changes in ecosystem services due to changes in selected land use activities namely, cultivation of rapeseed, soybean and sugarcane, on a global scale. In Life Cycle Impact Assessment (LCIA) these indicators are known as characterization factors (CFs). This research focuses on SFs and also SFs that can be used for global characterization. The cultivation of the crops is simulated using the Environmental Policy Integrated Climate model (EPIC). EPIC is a spatial and temporal agri-environmental model which simulates the biophysical impacts on homogeneous response units characterized by altitude, slope and soil class. Inputs for EPIC simulations include weather and soil profile data, and information on land use, land cover, and crop management. By simulating processes of crop growth, water and nutrient cycles, EPIC produces, among its outputs, estimates of crop yield, sediment transportation and soil carbon sequestration. The characterization factors will be aggregated to country or biome level. Comparisons will be made between results from different spatial aggregation levels, and different management systems regarding input of fertilizer or irrigation.

RA02P - Approaches for comparative hazard and risk assessment of chemicals

TU 121
Health risk assessment of chlorpyrifos with rice farmers in Vietnam
T. Phung, D. Connell, M. Chu, G.M. Miller
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Vietnam is an agricultural developing country with over 80 per cent of workers employed in agriculture, mainly rice farming cultivation. Farmers use back-pack reservoirs with hand pumps to apply pesticides, but their knowledge of safety in pesticide application is low. Chlorpyrifos is the most common organophosphate insecticide registered for agricultural use in Vietnam, but health risk assessment of chlorpyrifos use has not been carried out and limited investigation in Vietnam and other developing countries. The objective of this study is to evaluate the health risk of chlorpyrifos exposure to a typical group of rice farmers after application in Vietnam, using a probabilistic approach. Biological monitoring of rice farmers was used to estimate chlorpyrifos exposure from all pathways during application. Urine samples (24 h) were collected from farmers (18 men 1 day prior to application and over 5 days post-application, and then analysed for TCP, the main metabolite of chlorpyrifos, using HPLC-MS/MS. Urinary TCP levels were converted into an absorbed daily dose (ADD) of chlorpyrifos for each farmer. The health risk of chlorpyrifos exposure for the rice farmers was characterised by comparing exposure doses (ADD) with acute guideline doses for chlorpyrifos used by USA and Australian agencies.

Post-application chlorpyrifos ADD of farmers varied from 0.4-94.2 µg/kg/d, with a 50th percentile exposure level of 8 µg/kg/d which was about 80-fold higher than the 50th levels were converted into an absorbed daily dose (ADD) of chlorpyrifos for each farmer. The health risk of chlorpyrifos exposure for the rice farmers was characterised by...
A health assessment in Perm, an industrial city in European Russia, has been performed using the WHO methodology. The findings indicate spatially differentiated environmental exposure in Perm children (99.4%), and all of the 809,000 Perm adults are at an unacceptable carcinogenic risk. The main risk factor is inhalation exposure. The presence of chronic health effects among the city population is at an unacceptable environmental risk for respiratory, eyesight, hematological and immune disorders as well as central nervous system impairments. More than 173,000 Perm children (99.4%) and all of the 809,000 Perm adults are at an unacceptable carcinogenic risk. The main risk factor is inhalation exposure. The presence of the above mentioned risks has been proven by the identification of contaminants in the blood of the exposed subjects and the deterioration of laboratory, clinical and functional health parameters. We have revealed a true relationship between elevated blood levels of acetaldehyde, formaldehyde, manganese, nickel, chromium, etc. and blood, immune, hematological and organ other health endpoints. We have determined reference levels for the risk of contamination. We suggest that priority environmental health assessments (i.e., acetaldehyde - 0.049 mg/dm³, formaldehyde - 0.059, benzene - 0.0013, manganese - 0.039, chromium - 0.021, nickel - 0.075 and chloroform - 0.0021 mg/dm³). We have identified NOEL values in the air: N₄ - 0.00009 mg/m³, Cr - 0.0001, Mn - 0.00003, formaldehyde - 0.003, acetaldehyde - 0.002, benzene - 0.03 mg/m³; chloroform reference dose in drinking water is 0.004 mg/l. We suggest that priority environmental health assessments (i.e., acetaldehyde and acetate) cause 3,246 additional new cases of respiratory diseases. The total economic damage for respiratory diseases is € 1.3 million per acceptable year. Metal concentrations can be reduced by reaching established industrial emissions of 19 industrial companies, using traffic optimisation and clean fuel and improving the water supply system quality and water treatment.

TU 124 Snail watch: a tool to assess the risk of metal transfer taking into account their bioavailability
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Current evaluation of soil quality, generally based on physico-chemical characteristics, does not integrate the biological aspect and so the risk of metal transfer to organisms.
The tool and the soil quality assessment allows evaluating the bioavailability of metals and then their risk of transfer.
The aim of this study is firstly to determine the internal concentrations of reference (CIRef) of metallic contaminants (Cd, Pb, As, Cr, Cu and Zn) in Cantareus aspersus snails. Then, CIRef are used to identify abnormal metal transfer to snails. Secondly, to estimate the soil characteristics influence on metal accumulation using multivariate equations. Our objective is to evaluate the risk of Transfer of MEtals (ERITME) to snails to determine management priorities that are largely transferred, not based on total metal soil concentration but on a biological risk

ERITME tool, based on CIRef, allows to highlight the risk of transfer of each metal to snails. Then, CIRef are used to identify abnormal metal transfer to snails. Secondly, to estimate the soil characteristics influence on metal accumulation using multivariate equations. On these basis, our last objective is to establish procedure to Evaluate the RIsk of Transfer of MEtals (ERITME) to snails to determine management priorities that are largely transferred.

EQS derivation for metals in EU and USA: a comparison using copper
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Environmental Quality Standards (EQSs) are a key tool under the Water Framework Directive (WFD) to help assess the chemical status of water bodies. However it is important that EQSs are developed for substances that pose the greatest risk to the aquatic environment, and that emerging contaminants are adequately considered. Various methods for prioritising chemicals have been described, incorporating both exposure and effects. Approaches that prioritise on the basis of risk often require significant inputs, even a draft EQS, or detailed exposure modelling. We describe a simple approach to prioritisation that requires only modest inputs and assigns chemicals to different risk categories.

Unlike more sophisticated schemes, this method does not require a draft EQS in order to prioritise chemicals. Rather, it categorises chemicals in terms of their likely (or actual) environmental occurrence based on use and monitoring data, and the hazard they pose to aquatic life, based on persistence, bioaccumulation and toxicity criteria.

Classification based on exposure and hazard are then combined and chemicals assigned to risk categories. Those assigned to the highest risk category are taken forward as potential candidates for EQS development.

Almost a third of the chemicals considered could not be assigned a risk ranking due to a lack of data. This is of particular concern for emerging contaminants where both hazard and exposure data are often extremely limited. Lack of exposure or hazard data contributed equally to the assignment of ‘Insufficient information’. Predictive tools such as QSARs or ‘read across’ techniques may have a useful role in filling some gaps in hazard data. Gaps in exposure data may be filled by gathering monitoring data; in this respect the tool has helped identify monitoring needs that may lead to identifying future EQS candidates.

The prioritisation methodology is not suitable for metals and other inorganic chemicals because of biases in the way that fate and behaviour are dealt with e.g. measures of degradation and bioaccumulation. A separate approach for such chemicals may need to be developed.

Finally, we have briefly reviewed the output of the scheme because this can help introduce relevant new data or information about significant trends in likely exposure (e.g. planned restrictions on use) that will affect the chemical’s priority.

TU 126 Klimisch 2.0 - raising the bar to increase the scientific quality of environmental risk assessments
1Swiss centre for applied ecotoxicology, Dubendorf, Switzerland
2ECT Oekotoxikologie GmbH, Flörsheim, Germany
3CEHTRA, Lyon, France
4Royal Institute of Technology (KTH), Stockholm, Sweden
5Federal Environmental Agency (UBA), Dessau or Berlin, Germany
6German Federal Environment Agency (UBA), Dessau or Berlin, Germany
7Wca environment, Oxfordshire, United Kingdom
8Environment Agency of England and Wales, Oxfordshire, United Kingdom
9Economic research and advisory service, needed to complement European legislations and regulations, e.g. REACH, EMEA or the Water Framework Directive.
10Criteria developed by Klimisch et al. (1997) are widely used to assess data quality. This assessment relies heavily on the completeness and quality of the data set and concerns the expert judgement, which is sensitive to scientific background variations. Assessments based on the tool could lead to incorrect conclusions and may underestimate risks in the environment or lead to unnecessary risk mitigation measures being introduced.

Several recent studies (e.g. Duchiemin et al. 2010, Durou et al. 2011, Junghans et al. 2011a,b, Agerstrand et al. 2011a) have shown that the Klimisch system is not accurate and that the scientific background consistency between different risk assessors. This presents a general problem in the data quality evaluation of all chemicals, and is not limited to specific substance groups.

We therefore recommend to amend the Klimisch system by adding a scoring system for the criteria for reliability and relevance of the data, to ensure a more consistent evaluation amongst assessors. The detailed methods developed by Kusterer et al. (2009, 2010) and Agerstrand et al. (2011b) provide a useful basis for refining the quality assessment criteria and could be adapted for all substance groups. Additionally, the assessment should also consider if a critical study is plausible in the context to the whole dataset. To test plausibility, we propose that critical information distributed across different studies should be evaluated with a weight of evidence assessment, e.g. Gross et al. (2011).

In conclusion, we propose a more structured reliability and relevance evaluation of critical ecotoxicological studies together with a plausibility assessment based on a weight of evidence approach for the whole dataset. This should increase the scientific quality of environmental risk assessments of substances, e.g. in Environmental Quality Standard (EQS) derivation according to the Technical Guidance Document for EQS (European Commission 2011). This should be accompanied by the provision for guidance for different interests from science, hazard assessment and regulation. However, we recognize that the weighting assigned to criteria might vary between different chemical assessment regulations.

TU 127 EQS derivation for metals in EU and USA: a comparison using copper

We present actual time trends and levels for PCDD/F and dl-PCB in breams from seven major rivers in Germany between 2003 and 2008. Levels are notably going down parameter groups concentrations are at a level which is of long-term concern for environmental safety as well as human health perspective, e.g. compared against actual for PCDD/F concentrations but for dl-PCB there is a non-uniform overall picture showing rather a baseline than a clear decrease at fairly high levels. Generally, for both domains, in example for medical decision-making, there are only few attempts to apply CEA to testing in toxicology. These studies share the assumption that information gains from testing, measured in terms of a test's predictive performance, are known. The predictive performance of testing methods is, however, uncertain, irrespective of what type of testing method (e.g. a “gold standard” in vivo test, an in vitro test, or a “non-testing” method) is used. Our study, therefore, moves beyond existing deterministic CEA modelled in toxicology by developing a stochastic approach to CEA that accounts for the uncertainty about the quality of test information. The aim is to allow for a more robust and transparent evaluation of testing methods and strategies both within and across endpoints. This guides decision-makers in coherently selecting the testing method or strategy that provides the highest information gains per unit of cost. Another contribution of the study is to offer a critical synopsis of data and research needs in order to apply our approach to various endpoints and to make it operational in the regulatory context of REACH.

TU 129
IFRA Environmental Standards: risk and hazard assessment update for 2012
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The use of the International Fragrance Association’s (IFRA) Environmental Standards (ES) serves as a benchmark for in-vitro testing of fragrance materials. The International Fragrance Association (IFRA) is a worldwide organization that represents the fragrance industry. Through its member companies, IFRA is responsible for ensuring that fragrance materials are safe to use and do not pose any threat to the environment. IFRA is the leading organization for the development, maintenance, and dissemination of global fragrance industry environmental standards. The Environmental standards define risk assessment criteria for fragrance materials in three different trophic levels: algae, invertebrates, and fish. Once the risk assessment criteria are established, the information gained allows the fragrance industry to develop a list of fragrance materials that are acceptable for use. The approved fragrance materials can then be used in the production of fragrances for consumer products, such as soaps, perfumes, and cosmetics. The Environmental standards are designed to ensure that fragrance materials do not pose any threat to the environment, and that they are considered safe for use. The Environmental standards are regularly updated to reflect the latest research and developments in the field of environmental science and toxicology. The updated Environmental standards for 2012 include new criteria and updated existing criteria, as well as expanded coverage for different trophic levels. The updated Environmental standards will help ensure that fragrance materials are manufactured, handled, and used in a manner that is consistent with the latest scientific understanding and best practices. The updated Environmental standards will also help to improve the environmental safety of fragrance materials, and to ensure that they are used in a manner that is consistent with the wishes of consumers and stakeholders.
An environmental specimen bank (ESB) is an archive for biological samples that can be used to perform (traditionally chemical) analyses to obtain information about long-term variability and temporal trends in the chemistry of the biota and the ecosystem quality. Aware that chemical endpoints alone are not enough for ecosystem health assessment, the Biscay Bay Environmental Biospecimen Bank (BEEBB) was designed including specimens for biological endpoints, say biopisies for histophatology/immunohistochemistry, cryo-specimens for molecular/cellular analysis, and dried mineralized tissues (shells/otoliths) for biometric determinations. Banking methods and specimen sampling and processing are being adapted for these needs. In a first practical application, a retrospective study was performed using the ‘ Mussel Shell Section’ of the BEEBB (2001–2010) to look for differences in how substances accumulate in D. polymorpha and D. bugensis.

Recently research has also shown that fertile hybrids between D. polymorpha and D. bugensis are possible in the wild – making biomonitoring even more difficult. Due to different filtration rates, it must be assumed that accumulation in both species is also different, which is why D. bugensis and hybrids of both species have to be excluded from the results of monitoring studies using D. polymorpha for them to be comparable. Investigations into the current significance of the zebra mussel in long-term monitoring projects and environmental specimen banking programmes in the German ESB show that the zebra mussel provides this makes clear that, although in both species is also different, which is why D. bugensis and hybrids of both species have to be excluded from the results of monitoring studies using D. polymorpha for them to be comparable.

Thus, the most important task concerning D. polymorpha as a biomonitoring tool is to:
- find out how substances accumulate in D. polymorpha and D. bugensis,
- develop a method to differentiate unequivocally between both species for large samples.

In summary, the development of Mussel Shell Sections in environmental specimen banks is highly recommended as they may offer an excellent opportunity for retrospective monitoring after low cost processing and storage. In addition, our results also suggest that mussel watch monitoring programs and ESB archives should be based on the basis of samples of same-age rather same-length mussels. This study was supported by the Government of the Basque Country through E-GORKITZEN project.

TU 135 Using banked seabird eggs for determining geographic patterns of trace elements in marine regions

J. Yang & Luis C. Davis

TU 136 Specimen security in long term specimen banking - zebra mussel example in the German ESB

W. C. Davis, R. Klein, H. Weinfurtner, R. Klein, K. Tarricone, S. Vander Pol, K. Fritsche

TU 137 Organic compounds in suspended particulate matter - results from the German environmental specimen bank

K. Weinfurtner, C. Schroeter-Kermann, M. Ricken

TU 138 Standardized freshwater mussel watch for monitoring of aquatic environments: implications and possibilities

Y.-J. Yang

TU 140 The impact of high water discharges on sediment quality in the Elbe estuary

S. Heus, J. Angelstorf, M. Kortzwit, P. Hsu

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TU 123 The impact of high water discharges on sediment quality in the Elbe estuary

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TU 123 The impact of high water discharges on sediment quality in the Elbe estuary

S. Heus, J. Angelstorf, M. Kortzwit, P. Hsu

HAW-Hamburg, Hamburg, Germany
Contamination of the Elbe estuary with particle bound compounds mostly (with the exception of TBT which had its source in the Hamburg Harbour) derives from “areas of risk” upstream of Hamburg such as the Czech Republic for organic contaminants like HCH, HCB, PCB, DDX and TBT, the tributary Mulde for As, Dioxins and HCH, and the Saale for a number of heavy metals like Cd, Hg, Cu, Zn, and Pb. The major transport of contaminants happens during periods of high water discharge, when historic contaminated soil or sediment in the catchment are flushed downstream. The distance of transport is determined by the discharge rate and the position of the source. For some compounds, the yearly load of particle bound contaminants is transported during a few days to a few weeks (Hesse, Krüger et al. 2008). Up to now, the impact of contaminants on the quality of sediments in the estuary as a consequence of a high discharge event, however, has not been very well investigated.

The largest part of the Elbe estuary is influenced by the Hamburg Harbour, which is the second largest port in Germany (about 100 km upstream of the mouth of the river). Even though the river downstream of Hamburg has been maintained as a deep water navigation channel, 94 % of the area is ecologically protected by FFH and Birds directive. Some of the ecologically valuable freshwater wadden areas are close to Hamburg, and at the mouth of the Elbe the river widens to a large marine wadden area which is a feeding and nesting site of many bird and fish species.

In order to assess the impact of a high water discharge situation on the sediment quality of ecologically important wadden areas, freshly deposited sediment (FDS) was sampled during normal and high water discharges at two freshwater mudflats close to Hamburg and at two places near the mouth of the Elbe close to the North Sea. Chemometric analyses were used to investigate the sampling data in relation to the sampling time and location and to detect possible differences in either sampling site. An extreme high water event in January 2011, however, led to an increase in contamination in freshwater as well as coastal mud flats. Especially high was the increase of the uppermost “Heuckenlock” which is of particular ecological importance. Ecotoxicologically, little effect could be measured and it needs to be clarified how bioavailable the historic contaminants still are after their transport downstream the Elbe River.

**TU 141**

**Toxicity of suspended matter and sediments in relation to contaminant load and expected effects of climate change on European rivers**

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**Deltas, Delta, Nederland**

Climate change may not only affect river water discharges in terms of water quantity, but also in terms of water quality. During flooding periods, for instance, higher water discharges may cause a dilution of normal pollution levels, while on the other hand, higher discharges may also result in an increased mobilization of polluted sediments and in surface run-off from possibly polluted flood plains and inundated urban areas. During high water episodes huge increases of contaminant fluxes may be recorded. Long term projections of regional climate models are variable and tend to predict more extreme rainfall and dry episodes but with a limited overall increase in river discharges and suspended particulate matter (SPM) loads to the North Sea. To study the possible impact of climate change on the quality of urban and coastal waters, a battery of in vitro bioassays was applied to determine the toxicity profiles of environmental samples collected during climate change related events. SPM and sediment samples were collected in rivers from Norway, Sweden, Denmark, Germany, and The Netherlands during periods of dryness, flooding and extreme run-off. In addition, passive sampling was performed using silicone rubber sheets to evaluate the effects on dissolved contaminants. Extracts from SPM and passive samples were tested for respiratory toxicity (Microtox), dioxin-like activities, (anti)androgenic, (anti)estrogenic, and thyroid hormone-like activities, and for mutagenicity. Variable patterns of both increased or decreased toxicity in relation to contamination levels were noted being in line with the expected variations of sediment properties. The results will be discussed within the context of the marine environmental quality status of the North Sea, and also with respect to the impact of climate change on European rivers.

**TU 142**

**The effects of CO2 leakages from marine stable geological formations on the mobility and availability of metals**

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Carbon dioxide capture and storage (CCS) in marine sub-sea geological formations, is already contemplated in international conventions as a mitigation measure to reduce the concentration of CO2 in the atmosphere. Although this technology is currently considered to be technically feasible there is lack of information on the environmental impacts. Seapores is a concept, in which a consortium in the sediment, sedipore pore water, sediment-water interface and finally in the water column. Increase in acidity will lead to several biogeochemical alterations that can result in detrimental effects in the ecosystem. Changes in the solubility, speciation, mobility and bioavailability of metals is expected as a direct result of pH decrease.

Laboratory-scale experiments were performed, involving direct release of carbon dioxide into sediment, inside non-pressurized chambers, in order to provide data on the possible effects of CO2 leakage from geological storage sites on the fate of several metals. Marine sediments from two contaminated sites located in the south of Spain were collected for several chemical methods were carried out. In the beginning and end of the experiment for meta-analysis. The results revealed that mobility of metals from sediment to water columns depended on the site, metal and time. Metals concentrations generally increased with time of exposure to CO2 injection. Within the metals tested zinc, copper, cobalt, lead and iron were most greatly influenced by acidification.

**TU 143**

**Changes on the biogeochemistry of synthetic surfactants from river to marine sediments**

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Aquatic systems are subjected to the influence of both urban and industrial wastewater discharges, which are among the main sources of organic contaminants. Due to their extensive use in a wide variety of applications, significantly high concentrations of surfactants can be found in wastewater, and also in rivers, bays, lakes and estuaries. Laboratory experiments were performed in order to study the biodegradation of surfactants once anoxic depths are reached, which can happen within a few millimetres to centimetres depending on the aquatic system. In this work we have studied the diagenetic fate of the most commonly used surfactants: alcohol polyethoxylates (AEOs) and nonylphenol polyethoxylates (NPFOs), both non-ionic, and alkylbenzenesulfonates (LAS) and alkyl ether sulfates (AES), both anionic. Their concentrations in sediment and pore water were determined along the sedimentary column by sampling cores in three different aquatic systems from SW Spain: the salt-marsh environment of the Bay of Cádiz, the middle stretch and the estuary of the Guadalfe River, and the Bornos water reservoir. Surface water and sediment distributions were observed according to the respective uses, production volumes and physico-chemical properties of each surfactant. Levels of non-ionic (up to 12 mg/kg) were twice as high as those for anionics near industrial areas and ports, whereas the opposite was found near urban wastewater discharge outlets (up to 18 mg/kg). The most remarkable result was that sulfophenyl carbonylic acids (SPC), LAS degradation products, were identified in anoxic pore water. However, this was observed only in marine, and, to a minor extension, estuarine sediments. No SPC were detected in sediments from freshwater systems. The presence of sulfate-reducing bacteria in marine sediments (or absence in freshwater environments) seems to be strongly related to the degradation process. On the other hand, no changes in the average length of AEO and NPEO etheroxylates chains were observed along sediment cores from any type of aquatic system, suggesting that their biodegradation is very limited in anoxic conditions. This may be directly related to their lower bioavailability and more restricted mobility and bioavailability of surfactants in marine systems as compared to freshwater environments.

**TU 144**

**Historical trend and pollution assessment for selected trace elements in sediment cores from the Orbetello lagoon (Tuscany, Italy)**

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Heavy metal enrichment in sediment may be due to both natural and anthropogenic contribution, which may be recognized by studying the concentration profiles along the sedimentary column. Besides, heavy metal contribution due to heavy metal in the sediment was carried out in the Orbetello lagoon (Tuscany, Italy). The lagoon is located within a volcanic area, characterized by hydrothermal ore deposits and natural positive geochemical anomalies for some heavy metals may occur. Consequently, the correct interpretation of natural and anthropogenic enrichment is a main issue for a correct environmental impact assessment. In this work, selected trace elements (As, Cd, Cr, Cu, Hg, Pb, and Zn) were unified in two different sediment cores (OR96 and OR99) for each element using local background concentrations. The determination of Cd, Cu, and Zn concentrations demonstrated in both the cores an upper anthropogenic enrichment referable to the last half of the 20th century, while Pb contamination was found to begin earlier, during the first half of the last century. In spite of considerable EFs showed in lower levels of core OR96 were interpreted as the results of increased contribution from the Albegna River catchment, whereas the opposite was found near urban wastewater discharge outlets, for As, Cu, and Zn contents. In conclusion, concentrations excess in few cases the limits adopted by international sediment quality guidelines. As regards Hg concentration, a recent contamination, referable to the last few decades is clearly distinguishable only in one core. Conversely, a marked Hg positive geochemical anomaly dated around 1850 present in both the cores was considered as a result of specific anthropogenic activity related to the industrialization process in the region, which started in the mid-nineteenth century. On the contrary, the significative enrichment recorded for As was considered as the results of increased contribution from the Albegna River catchment, whereas the opposite was found near urban wastewater discharge outlets. Seepage is likely to create a considerable pH decrease in the sediment, sediment pore water, sediment-water interface and finally in the water column.

**Rapid contact kinetic assay with Vibrio fischeri in the assessment of small streams sediments in the Czech Republic**

P. Masner, J. Kuta, J. Klánová, L. Bláha
TU 146

**Influence of feeding type and behaviour on whole sediment ecotoxicity with the oligochaete Lumbricus variegatus**

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**Lumbricus variegatus** were exposed for 28 days to 0, 180, 560 and 1800 µg Zn g−1 sediment and received 2 feeding regimes. The partitioning of Zn between sediment, pore water and overlying water was enhanced by a 2-year equilibration period. Feeding regimes used in the toxicity tests were (i) food (Urtica-cellulose) spiked into the sediment with an equivalence of 10% of the pre-exposed worms' body weight (4±2 g), and (ii) Biochemical investigations and the micronucleus assay with erythrocytes was done using synchrotron radiation based confocal micro X-ray fluorescence (XRF). The results show that in worms fed via the sediment, Zn is mainly associated with epidermis and the gut wall. This indicates that Zn bioaccumulation between two feeding regimes, biological responses were only noted in worms fed via the sediment. The lack of toxicity in the TetraMin treatment was attributed to selective feeding on TetraMin and to daily feeding regime, which promoted the organisms to spend less time in the sediment thus reducing Zn exposure. Significant Zn bioaccumulation not accompanied with biological effects at 1800 µg g−1 suggests internal detoxification or other regulation mechanisms. In the Sed+ treatment, significant biological effects not accompanied with Zn bioaccumulation were observed at 180 and 560 µg g−1. Feeding inhibition resulting from an avoidance reaction to contaminated food/sediment or different mechanisms of toxicity due to dietary Zn, were assumed to be the causes. The internal Zn distributions were analysed using synchrotron radiation based on micro X-ray fluorescence (XRF). The results show that in worms fed via the sediment, Zn is mainly associated with epidermis and less with the gut wall. It is, however, equally present in gut wall and epidermis and worms fed TetraMin. This supports the assumption of feeding inhibition due to avoidance behaviour toward contaminated sediment/food. The XRF data also show that at 1800 µg g−1, Zn was mainly distributed in the epidermis and sub-epidermis of L. variegatus, confirming the role of dissolved Zn as the predominant exposure route when SEMZn-AvS=0.

TU 147

**Toxicity of organic micropollutants in the Yangtze Three Gorges Reservoir - MICRO TOX**

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**East China Sea Fisheries Research Institute, Shanghai, China**

**DESY, Hasylab, Hamburg, Germany**

The characteristics of the Three Gorges Reservoir can be described by the high concentration of pollutants in the river water and overlying water was enhanced by a 2-year equilibration period. Feeding regimes used in the toxicity tests were (i) food (Urtica+cellulose) spiked into the sediment with an equivalence of 10% of the pre-exposed worms' body weight (4±2 g), and (ii) Biochemical investigations and the micronucleus assay with erythrocytes was done using synchrotron radiation based confocal micro X-ray fluorescence (XRF). The results show that in worms fed via the sediment, Zn is mainly associated with epidermis and the gut wall. This indicates that Zn bioaccumulation between two feeding regimes, biological responses were only noted in worms fed via the sediment. The lack of toxicity in the TetraMin treatment was attributed to selective feeding on TetraMin and to daily feeding regime, which promoted the organisms to spend less time in the sediment thus reducing Zn exposure. Significant Zn bioaccumulation not accompanied with biological effects at 1800 µg g−1 suggests internal detoxification or other regulation mechanisms. In the Sed+ treatment, significant biological effects not accompanied with Zn bioaccumulation were observed at 180 and 560 µg g−1. Feeding inhibition resulting from an avoidance reaction to contaminated food/sediment or different mechanisms of toxicity due to dietary Zn, were assumed to be the causes. The internal Zn distributions were analysed using synchrotron radiation based on micro X-ray fluorescence (XRF). The results show that in worms fed via the sediment, Zn is mainly associated with epidermis and less with the gut wall. It is, however, equally present in gut wall and epidermis and worms fed TetraMin. This supports the assumption of feeding inhibition due to avoidance behaviour toward contaminated sediment/food. The XRF data also show that at 1800 µg g−1, Zn was mainly distributed in the epidermis and sub-epidermis of L. variegatus, confirming the role of dissolved Zn as the predominant exposure route when SEMZn-AvS=0.

TU 149

**Toxicity of persistent organic micropolllutants from Baltic Sea sediments in the fish embryo test and the EROD assay**

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The Baltic Sea, one of the largest brackish water bodies in the world, is considered to be an exceptionally sensitive and endangered marine ecosystem. The average residence time of Baltic Sea water ranges between 25 and 50 years, thus facilitating the accumulation of pollutants in sediment. For a deeper insight into the ecotoxicological effects of persistent pollutants in sediments, biological test systems were applied with exhaustive as well as mild sediment extracts. Extracts from PLE and mild methanol/water extraction, were investigated for their dioxin-like activity and their embryotoxic impact on the development of zebrafish (Danio rerio) embryos. PLE extracts were considered to represent the whole toxic potential and the mild methanol/water extracts to contain rather bioavailable pollutants. Applied biotes were the fish embryo test in 5% well plate and the trout liver microsomal system (RTL W1 cells). Results extracts in contrast to the PLE extracts, which gave strong embryotoxic potential. Results on the EROD inducing potential indicated dioxin-like activity for all investigated sampling sites. PLE extracts showed clearly higher dioxin-like activity than mild methanol/water extracts. The study revealed an ecotoxicological burden for all Baltic Sea sediments. Especially the Eastern Gotland Basin, the São Francisco River and the affinity of polluted, but according to the methanol/water extracts, this pollution is not readily available for developing fish embryos. However, the ability of the mild extracts to resemble the bioavailable fraction might be limited. For a comprehensive ecotoxicological assessment it is necessary to thoroughly investigate the bioavailability and to identify the causative pollutants by chemical analyses.

TU 150

**Identification of hazard factors and ecotoxicological risk classes of sediments from the Tietê River Basin (Brazil)**

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The Tietê River, selected in this study as an example for a highly contaminated river system, is located in the most important economical center in Brazil, São Paulo state. The Tietê River is the fourth longest river from South America and the longest that runs entirely in Brazil. Although is a very important river, there are diverse anthropogenic activities, such hydroelectric plants, metal manufacturing industry or agriculture that have impact on these ecosystem. The objective of this study is to evaluate the impact of different classes, which may cause various toxic effects to aquatic biota. Biological assays thus serve as a complementary tool in the effect-based monitoring of water or sediment quality. In the present study, we investigated 25 localities from two different regions in the Czech Republic. Sediment samples from each locality were repeatedly collected for two years with the main goal to compare outcomes of chemical and biological/ecotoxicological analyses. Chemical analyses assessed levels of toxic metals, PAHs and POPs, whereas AhR-mediated toxicity was assessed using the luminescence bacterium Vibrio fischeri. We have observed, however, strong differences between both studied regions in the Czech Republic as well as between different sampling periods. Statistical analyses repeatedly revealed relatively pronounced differences between chemical contamination data and toxicity, while white total organic carbon (TOC) appeared to be related to observed toxic effects. The present study has shown successful application of the kinetic V. fischeri test in the effect-based monitoring of sediments demonstrating thus complementarity of both chemical and ecotoxicological data.

TU 151

**Acute sediment toxicity assessment in the river São Francisco, Brazil**

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**São Francisco River Basin Project, Fortaleza, Brazil**

**Danio rerio** gave strong embryotoxic potential. Results on the EROD inducing potential indicated dioxin-like activity for all investigated sampling sites. PLE extracts showed clearly higher dioxin-like activity than mild methanol/water extracts. The study revealed an ecotoxicological burden for all Baltic Sea sediments. Especially the Eastern Gotland Basin, the São Francisco River and the affinity of polluted, but according to the methanol/water extracts, this pollution is not readily available for developing fish embryos. However, the ability of the mild extracts to resemble the bioavailable fraction might be limited. For a comprehensive ecotoxicological assessment it is necessary to thoroughly investigate the bioavailability and to identify the causative pollutants by chemical analyses.

The Tietê River is the fourth longest river from South America and the longest that runs entirely in Brazil. Although is a very important river, there are diverse anthropogenic activities, such hydroelectric plants, metal manufacturing industry or agriculture that have impact on these ecosystem. The objective of this study is to evaluate the impact of different classes, which may cause various toxic effects to aquatic biota. Biological assays thus serve as a complementary tool in the effect-based monitoring of water or sediment quality. In the present study, we investigated 25 localities from two different regions in the Czech Republic. Sediment samples from each locality were repeatedly collected for two years with the main goal to compare outcomes of chemical and biological/ecotoxicological analyses. Chemical analyses assessed levels of toxic metals, PAHs and POPs, whereas AhR-mediated toxicity was assessed using the luminescence bacterium Vibrio fischeri. We have observed, however, strong differences between both studied regions in the Czech Republic as well as between different sampling periods. Statistical analyses repeatedly revealed relatively pronounced differences between chemical contamination data and toxicity, while white total organic carbon (TOC) appeared to be related to observed toxic effects. The present study has shown successful application of the kinetic V. fischeri test in the effect-based monitoring of sediments demonstrating thus complementarity of both chemical and ecotoxicological data.

**SETAC 6th World Congress/SETAC Europe 22nd Annual Meeting**

**322**
by means of chemical and ecotoxicological approach the toxicity of the sediments of this river, and their elutriates, in a region downstream Três Marias reservoir, in a site near a processing industrial plant. For this, a battery of three laboratory bioassays, using two cladoceran (Daphnia similis and Ceriodaphnia dubia) and one amphipod (Hyalella azteca) species, was used to assess the toxicity. 12 different metals (Al, As, Ba, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, and Zn) and the different geochemical sediment fractions (toasses) were assessed (first steps of the sequential extraction procedure) in order to establish the potential effect of the industrial plant. The effect of sediment metal contamination was assessed applying multivariate techniques. The results show elevated concentrations of Zn, Cd and Pb that involve an important potential risk on the aquatic environment. The sediments affected by the industrial plant presented high levels of toxicity, although the hydrodynamic of the river plays an important role in the metal distribution and consequently in the toxicity of the sediments.

TU 152

Eco-toxicological assessment of sediments from rivers impacted by a petroleum refinery

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Eco-toxicological studies are important for evaluating the effects and mechanisms of action of toxic agents in different environments. Aquatic sediments have a high potential for accumulating pollutants. As pollutants may become available in certain environmental conditions, the sediments can also become a potential source of contamination to water bodies and therefore their effect should be considered and avoided. The aim of this study was to evaluate the eco-toxicological potential of sediment samples from three rivers impacted by a petroleum refinery, by means of Neutral Red assay (cytotoxicity), EROD assay (CYP1A induction potential), the sediment contact with fish embryo (genotoxicity and teratogenicity) and chemical analyses, among other approaches, these results must be associated, in order to obtain a comprehensive evaluation of the eco-toxicological situation of these water bodies. Results are presented.

TU 153

Seasonal variation of toxicity and genotoxicity of sediments samples of the Ensenada de la Paz, B.C.S. México

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In this paper was carried out a qualitative assessment of toxic and genotoxic effects of sediment collected at 8 locations in the Ensenada de la Paz, B.C.S., in 2 contrasting seasons summer and winter of 2010, using a battery of biological tests with organisms of different trophic levels and the SOS-Chromotest microbioassay. Compounds with toxic and genotoxic effects were detected in 5 locations, located in the Canal de la Paz, near the termoelectric power station and the Pichilingue nacy. LC50 and genotoxicity values were obtained, indicating the presence of toxic compounds at sites near Punta Prieta and Cisneros, sediment toxicity decreases with increasing distance from these points. This fact possibly indicates a contribution of harmful compounds probably from Punta Prieta and La Paz city to the Bay of La Paz. This type of analysis is essential to identify areas of risk in studies of environmental analysis.

TU 154

Toxic effects of sediments from a semi-arid coastal system, influenced by a gold ore mine

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An intense industrial activity has been taking place in Wallonia (Belgium) since the Middle Ages. The proximity to major waterways has enhanced the industrial development and provided an accessible aquatic environment. Sediments are known for their ability to trap pollutants and release these substances years or even decades after their initial discharge. In Wallonia, a large number of coal mining areas have been closed down, which resulted in the Braginskii model of acid mine drainage phenomenon resulting from the oxygen in contact with ore. In opposite, Palhal mine never faced flooding events, which may explain the higher toxicity of the samples collected there. Our study highlights the usefulness of using an ecotoxicological approach to help the prioritization/scoring of the most critical areas impacted by deactivated mines. Results of the 2011 monitoring program will also be presented.

TU 156

Eco-toxicological assessment of contaminated rivers as a proxy for the water framework directive: an acid mine drainage example

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Metal contamination of freshwater water bodies results from mining activities or deactivated mines is a common environmental problem in Portugal. Despite authorities recognised this problem, the establishment of the list of contaminated sites is still pending. The results showed that the Braginskii model of acid mine drainage phenomenon resulting from the oxygen in contact with ore. In opposite, Palhal mine never faced flooding events, which may explain the usefulness of the samples collected there. Our study highlights the usefulness of using an ecotoxicological approach to help the prioritization/scoring of the most critical areas impacted by deactivated mines.

TU 157

Assessment of effects of agro-chemicals use in ecological status of Kilombero Flood Plain, Ramsar site

S. F. Materu, H. S. Heise

TU 157

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S. F. Materu, H. S. Heise
The project's further objectives comprise the assessment of human and environmental risk due to pesticide exposure, the communication of these risks to farmers and inhabitants living in the area and development of management recommendations for a more efficient and less environmentally adverse use of this Ramsar site.

TU 158
Heavy metal pollution assessment in sediments of the Nemrut Bay, Turkey
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Sediment forms an important part of the aquatic environment and provide habitat to benthic organisms. However, poor water quality has been linked to contaminated sediment most of which consists of complex materials transported within river or deposited on river bed. Sediment has been identified as major transporter and sequester of fluvial contaminants such as heavy metals, most especially the fine sediment. At present, there are no environmental quality standards (EQS) for bed sediments or fluvial contaminants. Sediment and soil was sampled in the Nemrut Bay, a lagoon in Turkey, and compare the concentration of selected heavy metals between different compartments such as suspended sediment, bed sediment, bank sediment and the water column of Ravensein River. Sediment (bed and bank) and water samples were collected from Ravensein River over a period of 12months. Sediment samples were tested for heavy metal concentration using the aqua regia, sequential extraction using a 6hour extraction technique proposed by Maiz et al. (1997).

TU 163
The first sight into contamination of Polychlorinated biphenyls and Polybrominated diphenyl ethers in sediments of Tam Giang-Cau Hai Lagoon, Central Vietnam
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Rapid economic development and urbanization growth in Vietnam have made this country become an important subject for extensive studied dealing with environmental pollution recently. So far, there has been no information on PBDE contamination in Central Vietnam and the information about PCBs sources and levels is limited. Tam Giang-Cau Hai Lagoon lies along the coastal line of Thua Thien-Hue Province, Vietnam. Due to recent industrial and economical growth in this region, large amount of untreated wastewater and industrial wastewater is discharged to the river system, which causes adverse environmental consequences and increased health risk for local communities. In this study, the contamination status, distribution and congener profiles of PCBs and PBDEs in surficial sediment of Tam Giang-Cau Hai Lagoon were investigated. PCBs and PBDEs were detected in all sediment samples with mean concentrations of 0.19 and 0.56 ng/kg dw, respectively. The highest concentrations of both contaminants were observed downstream at the river mouths, indicating the river flow as a main source of pollutants into the lagoon system. The similarity of PCB congener distributions in sediments presented the presence of a unique source over the entire study area, probably connected to local use of old electrical equipments containing polychlorinated biphenyls.
low chlorinated PCB formulations. Atmospheric transport & post depositional processes might modify to some degree the fingerprint of PCB inputs to the environment favouring the predominance of 3, 4 & 5 chlorinated congeners. The PBDEs profile in sediment was relatively uniform, with decaBDE as the dominant congeners, followed by nona- and octaBDEs, indicating DecaBDE as the major technical mixture in consumer products in this region. In general, the levels of PCBs and PBDEs in lagoon sediments were low, compared with those reported in sediments of other rivers in developed countries. This may reflect a limited usage of PCBs and PBDEs in this region. Comparing to sediment quality guidelines currently used around the world, present PCB sediment concentrations of Tam Giang-Cau Hai Lagoon does not constitute a threat to environment. Nevertheless, the first time detection of PBDEs in the lagoon-river system might be an indicator of enhanced recent human pressure that suggests the need for a monitoring plan to prevent the possible dangerous worsening in the near future.

RA07P - Environmental problems of estuaries

TU 166

Distribution character and potential risk of PCBs and phenols in surface water from 22 tributaries and mainstream in middle reaches of Yangtze River

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47 surface water samples were collected from 22 tributaries and mainstream of the Yangtze River from Chongqing to Yichang. The contents of 28 PCB congeners and 15 phenolic compounds in the above water samples were determined by GC-MS. Results show that some location of the Yangtze River has been polluted by PCBs and phenols. Three and 4 chlorinated PCBs and 3, 4, 5 chlorinated phenols are the most predominant congeners in the samples from the Yangtze River. PCBs, 28, phenol, o-cresol, and 2-nitrophenol are the most predominant compounds in the samples from tributaries, PCBs, 28, phenol, o-cresol, and 2-nitrophenol are the most predominant in those from mainstream. The measured level of PCBs in the samples from the tributaries and the mainstream were 20.7 ngL-1 and 13.25 ngL-1, and the measured level of phenols in the samples from the tributaries and the mainstream were 127.90 ngL-1 and 31.05 ngL-1. The PBDEs levels in each sample from the tributaries and the mainstream were not detected. The compared PCBs and phenol levels in paints and phenol levels in the samples are far above those in the Chinese drinking water guideline values. The concentrations of PCBs and phenol compounds in the samples were in the same order of magnitude of those reported on lower levels in European and American countries, which show that potential risk are negligible due to PCBs and phenol compounds contamination in these samples.

TU 167

Measuring trace labile metals in the Pasig River water using DGT technique: an application for an effective water resource management

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Pasig River is an important water body in Manila, Philippines. This is a busy river greatly influenced by urbanization. It is an estuary in nature as it is in between a bay (Manila Bay: west) and lake (Laguna Lake: east). The water quality is a main concern. From being in a state of biologically dead, rehabilitation is applied to raise it to Class C. Efforts are still on going. An efficient water quality monitoring technique and assessments are necessary. This research made use of the current available technique called passive sampling. DGT technique was used to study the labile trace metals (Cu, Co, Ni, Cu, Zn, Cd and Pb). The time of sampling campaigns captured the ENSO phenomenon (El Niño: Period 1, La Niña: Period 2 and in between summer and rainy seasons: Period 3). From these periods, DGT-labile metal concentrations had been computed. Multivariate analyses composed of Principal Component Analysis (PCA) and Factor Analysis (FA) were employed. This is to be able to identify the parameters that play a part more in each period. The cumulative percentages of the total variance are as follow: 89.3% for Period 1; 87.11% for Period 2; and 81.25% for Period 3. Correlations among the parameters had been achieved as well. Percent concentration of each element for site were determined. Scores were given and ranking was then supplied. Based from the ranking, sites that contribute more of the selected parameters were identified. For Periods 1 and 2, highest contributing sites are near to upstream. While Period 3, highest ranking is near at the downstream. From this analysis, we can therefore locate the sites that can give a significant concern and priority attention. Fluxes (in kg d-1) were provided as well. Period 2 having the highest flow gave the highest fluxes per site.

TU 168

Dioxin-like compounds in Portuguese estuaries: levels and patterns in superficial sediments

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Persistent compounds such as polychlorinated dibenzo-p-dioxin (PCDD), polychlorinated dibenzofuran (PCDF) and dioxin-like polychlorinated biphenyl (DL-PCBs) may enter the estuarine system through terrestrial deposition, riverine runoff and direct release from human activities. In the aquatic environment these contaminants strongly adsorb to suspended particles and tend to accumulate in underlying sediments which constitute long-term reservoirs and secondary sources. Contaminated sediments can therefore represent a significant risk to aquatic life and human health and the loss of natural and economic resources. The aim of this research is to evaluate the sediment contamination of Portuguese estuaries by PCDD/Fs and DCB-PCBs. Seven estuaries systems were selected along the Portuguese coast: Lima, Ria de Aveiro, Mondêgo, Tagus, Sado, Mira and Ria Formosa. At each estuary, superficial sediments (0-10 cm) were collected at various locations in the intertidal mudflats. Samples were analysed by high-resolution gas chromatography/high-resolution mass spectrometer (HRGC/HRMS) to determine the concentration of seventeen PCDD/Fs and twelve DCB-PCBs. Results show that PCDD/Fs and DCB-PCBs concentrations are variable not only between estuaries but also within each estuary. In general, the highest values were found at sites near large populations and industrial complexes (e.g. Tagus, Ria de Aveiro and Sado). The lowest PCDD/Fs and DCB-PCBs values were measured in Ria Formosa, a protected area with unique wetland habitats. OCDD is the most abundant PCB congner in all the samples but PeCDD or PeCDF were the major contributors to WHO-PCDD/F-TEQ2005. For DL-PCBs, PCB 118 was the dominant congenor while PCB 126 was the major contributor to WHO-PCDD/TFQ-TEQ2005 in all the analysed sediments.

TU 169

Environmental monitoring and assessment of Terminos Lagoon, Mexico

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Terminos Lagoon is an estuary in the Gulf of California, Mexico, with the largest fresh water runoff in Mexico (35% of the total), and the second largest in the Gulf of Mexico. It is near of one of the main oil drilling areas in Mexico and there are many industrial facilities associated with the oil industry affecting the region. As an aim of this research is to evaluate the sediment contamination of Terminos Lagoon by PCDD/Fs and DCB-PCBs. Sediment samples from Terminos Lagoon were collected at five sites along the main lagoon axis and the results were then compared with those obtained in the Freshwater River. Some of the main industries in Terminos Lagoon are steel, cement, shipyard, etc. Monitoring stations were located near the industrial facilities and near the river mouth. A number of pollution sources were identified and the most important of them were: sewage, diesel, fishmeal, petrochemicals and pesticides. The results show that PCBs and Dioxin-like compounds in Terminos Lagoon are not in the same order of magnitude of those reported on lower levels in European and American countries, which show that potential risk are negligible due to PCBs and phenol compounds contamination in these samples.

TU 170

Chemical and biological assessment of metal pollution in the Urdaibai Reserve of the Biosphere (UNESCO) using oysters as sentinel


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Oysters have been widely used as sentinel organisms in order to determine the presence of pollutants and their effects in coastal and estuarine environments. In the present work we have studied the oyster (Crassostrea gigas) as a sentinel organism in the Urdaibai Biosphere Reserve (Urdaibai). Oysters were collected in 7 sites at different seasons along 2010. Together with oysters, water and sediment samples were also collected. The concentration of 14 elements (Al, As, Cd, Co, Cr, Cu, Fe, Mg, Mn, Ni, Pb, Sn, V and Zn) was determined. Cell and tissue level biomarkers and histopathological alterations were also observed. High Cu concentrations were found in the water column but tissue concentration was not high in oysters. Heavy metals distribution was observed in metallothionein in the oyster. In general, a moderate high Pb concentration was found in oysters but not in water. Preliminary data in sediments indicated higher values of Cu and Zn in Mundaka. Regarding cell and tissue level biomarkers, no significant differences were observed comparing the sites. Occasionally, Arteaga presented symptoms of atrophy in the digestive diverticula and in the basal lamina, indicating some metal exposure in the Urdaibai. A significant increase in the BSD volume density was observed in parallel with an increased metallothionein content. In conclusion, the results confirmed that the Urdaibai Reserve of the Biosphere presents low-to-moderate levels of metals both in oysters and waters, with only minor biological effects in oysters. It is worth noting that, however, seasonality may play a relevant role in environmental metal levels, bioaccumulation and the biological responses of oysters against environmental insult.

Acknowledgements: This work has been fully supported by the UNESCO Chair of the UPV/EHU through the UNESCO 09/23 project and by the UPV/EHU through the Consolidated Research Groups (Ref: GIC07/026-IT-939-07).
Overall, the integrated watershed-receiving water model performed very well. The integrated model was able to recreate a wide range of dynamic loading within the inlets, to include FC kinetics (CH3D-FC). The integrated model was used to simulate the release, transport, and fate of FC loading from watershed pour points corresponding to stream mouths, stormwater outfalls, waste water treatment plant discharges, and shoreline drainage areas. A total of 20 simulation scenarios were run to verify model performance. The utility of this type of analysis is essential to identify areas of risk in studies of environmental analysis.

The change in salinity on metal speciation, metal biouptake and toxicological effects was studied under controlled conditions in a series of structurally and functionally different freshwater communities. The results were compared with information available from data bases and literature to explore whether general concepts such as the free metal ion activity model and major ion competition effects used to describe metal uptake and toxicity remain valid across estuarine gradients and biodiversity. Using a dynamic modelling approach the effects of changes in physical and chemical conditions on metal speciation, biouptake and toxicological effects have been analysed and simulated across species diversity. For some metals, such as cadmium; where a strong metal speciation effect is observed a species sensitivity distribution analysis shows a decrease in metal toxicity moving from freshwater to higher salinity environments. However, this is not the case for a metal such as copper and in any case the effect is considerably less that what would be expected on the basis of the changes in the metal ion activity.

The integrated watershed-receiving water model performed very well to include FC kinetics (CH3D-FC). The integrated model was used to simulate the release, transport, and fate of FC loading from watershed pour points corresponding to stream mouths, stormwater outfalls, waste water treatment plant discharges, and shoreline drainage areas. A total of 20 simulation scenarios were run to verify model performance. The utility of this type of analysis is essential to identify areas of risk in studies of environmental analysis.

The effect of changes in salinity on metal speciation, metal biouptake and metal toxicity was studied under controlled conditions in a series of structurally and functionally different freshwater communities. The results were compared with information available from data bases and literature to explore whether general concepts such as the free metal ion activity model and major ion competition effects used to describe metal uptake and toxicity remain valid across estuarine gradients and biodiversity. Using a dynamic modelling approach the effects of changes in physical and chemical conditions on metal speciation, biouptake and toxicological effects have been analysed and simulated across species diversity. For some metals, such as cadmium; where a strong metal speciation effect is observed a species sensitivity distribution analysis shows a decrease in metal toxicity moving from freshwater to higher salinity environments. However, this is not the case for a metal such as copper and in any case the effect is considerably less that what would be expected on the basis of the changes in the metal ion activity.
Several laboratories from academia, industries and government participated in an interlaboratory ring test organized by the German Federal Institute of Hydrology. The ring test aimed at i) investigating the practicability and reproducibility of the sediment contact test, ii) validating the chosen endpoint, and iii) determining the response range of the test but also provide valuable data for population-level models. Results for HgTOT were generally in line with published values for Laranjo Bay. Organic mercury was the most abundant of the species in the superior organisms (always ≥57%). The diverging patterns of HgTOT and HgORG distribution are discussed.

Test results for L. gibba were in line with published values for Laranjo Bay. In order to examine the trophodynamics of HgTOT and HgORG in a coastal lagoon, suspended particulate matter (SPM), sediment, seston, phyto- and zooplankton agglomerates, Crangon crangon, Pachymedus sieboldii, Liza aurata, Arterna boyeri and Dicentarchus labrax were sampled. Sampling took place near the mouth of the two major freshwater sources (Vouga and Aveiro rivers) to the lagoon. Vouga River runs in a narrow channel, with steep margins. Its watershed receives run-off from agriculture, livestock grazing, urban areas, and industry. Laranjo Bay (a depositional area) receives the Aveira, which has been conveying industrial discharges, particularly an effluent from a mercury cell chloride plant (from the 1950s until 1994). From the estimated 33t of mercury dispersed into the lagoon, the majority (81%) is associated with the sediments in Laranjo Bay. By determining the position of each of the sampled compartments in the local food webs, using GC-IRMA (Organic mercury in tissues, PACS-2 for sediment) were used in the QC/QA process. A significant negative correlation (Pearson Product Moment correlation, P<0.05) and a very strong positive correlation (Pearson Product Moment correlation, P<0.0001) were found for Laranjo Bay, between HgTOT and δ15N, and HgTOT and HgORG, respectively. No other significant correlations were established.

Acknowledgement: U.F. on behalf of the participants of the international ring test.

This study was carried out in the scope of the project "NISTRACKS - Processes influencing the invasive behaviour of the non indigenous species Corbicula fluminea (Mollusca: Bivalvia) in estuaries - identification of genetic and environmental factor key-factors" funded by the Portuguese Foundation for the Science and the Technology (FCT) (PTD/ACAC/AMB/10212/2008) and FEDER COMPETE funds (FCOMP-01-0124-FEDER/080565). Ph Vilares had a grant in the scope of the project and C. Oliveira had a PhD grant from FCT (SFRH/Bd/84232/2010) funded by national funds of the MCTES and FEDER European funds (POPH-QREN-Tipologia 4.2.).
of 9 ha-1. For each species, two sets of plants were grown: total aboveground plant biomass was assessed at four weeks after exposure for the ST plants (first set) and again for the LT plants (second set) when the controls began natural senescence (7-23.5 weeks post-spray depending on species). To assess recovery over time, measurements of maximum plant height were taken weekly for all species using the LT plants. Reproductive parameters were also recorded for 13 species. Inhibition concentrations (IC50) was calculated for ST and LT biomass and for LT reproductive parameters. ST biomass was found to be the most sensitive measure of IC50 for nine species and LT reproduction for three; IC50s could not be predicted for five species (no effect). Delays in flowering time were apparent for several species. Twelve species had early delays in growth as compared to the controls at doses of 7.4% or less, two species were affected at higher doses (14.5% or 55%) while three species (all grasses) had no reductions in height. Two species were affected at doses of 7.4% or less, three fully recovered within an avg. 6.7 weeks post-spray, six recovered up to doses of 14.5% (avg. 6.5 weeks) and three up to doses of 28.2% (avg. 12.3 weeks). Though an overall trend towards recovery was also noted for reproductive parameters (4 spp. recovered, 3 remained the same, 3 unaffected at any dose), rates of recovery did not follow those observed for height. Delayed growth and flowering was observed at doses less than known drift rates of 10% over exposed and exposed to these rates were often observed for over time. While recovery did occur in this greenhouse experiment, it may alter the natural species composition in exposed areas. This community approach is not considered in risk assessment.

TU 185

Effects of agrochemicals on macrophyte community structure and quality in a Canadian agricultural watershed

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Macrophytes occupy healthy riverbanks and lakeshores. Unfortunately, macrophyte diversity, particularly diversity of submerged species, appears to have declined in some North American and European ecosystems during the last century. In agricultural watersheds, streams are intimately connected with croplands and the health of macrophyte communities may be compromised by increased levels of disturbance and exposure to agrochemicals such as nutrients and herbicides in areas of high-intensity agriculture. This study was designed to identify the effects of herbicides from the South Nation Watershed located throughout the St. Lawrence River watershed, a sparsely populated agricultural watershed comprising 3919 km² in Eastern Ontario, Canada. The sites varied in terms of their contamination with nitrate and the commonly used herbicide atrazine, with mean spring maximum in-stream concentrations of 6600 μg/L and 1.36 μg/L respectively. In-stream concentrations of nitrate and atrazine were strongly correlated. Over 200 macrophyte species were identified along stream banks and within the stream channels. Sites surrounded by high levels of agriculture tended to have a higher percentage of non-native species, suggesting that native species are less long term across the watershed. A decline in the quality and conservation values of macrophyte communities was observed along a gradient of nitrate contamination.

TU 186

The effect of five sulfonyl-urea herbicides to aquatic macrophytes: implications of results from outdoor growth inhibition studies for the risk assessment

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The sulfonyl-urea herbicides (SU) are the most widely used herbicides in agriculture. In an attempt to identify an aquatic test organism and a most sensitive species to herbicides, multiple species data provided arguments to lower the assessment factor due to increased realism and lower uncertainty. The example of sulfonyl-urea herbicides (SU) outlined here shows that herbicides from this group, acting on the same or a similar target, can be used for further testing. Over a period of four years Smithers Viscient (sponsored by Bayer CropScience) generated macrophyte data for five different SU herbicides. In each study 9 to 10 species from a variety of taxonomic groups were exposed in artificial outdoor ponds for 6 to 8 weeks. Each treatment was slightly adjusted based on experiences gained from former tests. Due to these changes, the data obtained are applicable to (1) comparisons of species sensitivities within one test substance and (2) comparisons between the test substances. Numbers of replicates were 4 in the controls and lowest concentrations, 3 at medium, and 2 at the highest concentrations (combined NOEC-ECx-design). A dose-response was observed in most species. Due to variation among replicates, the EC50 is regarded as more reliable than the NOEC. As plant length could not be assessed in all species, the EC50 was calculated for each treatment and the EC50s were compared across species. The objectives of multi-species testing are (1) to derive a species-sensitivity distribution (SSD) and (2) to identify a most sensitive species. Lemma is the standard aquatic test organism and among the most sensitive species to herbicides. Multiple species data provide arguments to lower the assessment factor due to increased realism and lower uncertainty. As plant length could not be assessed in all species, the EC50s were calculated for each treatment and the EC50s were compared across species.

TU 187

Ecological functions of plant growth regulators in the stability of agroecosystems

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Tolerance of the system “soil-plant” in agroecosis is a key condition of high yield. These functions in soil are accomplished mainly by humus component, and in the plant - by complex of biologically active compounds. Regulatory role in the resistance and protection of agroecosis is studied in the example of chloridechloro (CCLC) and phytohormones: 24-epibrassinolide (EPBL), gibberellins (A3). Their functioning and efficiency in “soil - plant” system is connected with a series of abiotic (temperature, nutrient elements, etc.) and anthropogenic (organic pollutants, etc.) variable factors. The complexity of agro-ecological and ecological studies presupposes the widening of methodological approaches. The wide use of bio-testing methods for summary characterization allowed the revealing of protective effects of CC, EPBL, A3, of the which are widely used in the practice of agriculture. The protective effect peculiarity of the practice of agriculture is studied at a high load of agrochemicals by chemical means of plant protection. It with the reduction of total toxicity in soil, root system, in plant and reproductive organs were revealed during using CCC, EPBL, A3, which are the widely used in the practice of agriculture. The protective effect peculiarity of the practice of agriculture is studied at a high load of agrochemicals by chemical means of plant protection. It with the reduction of total toxicity in soil, root system, in plant and reproductive organs were revealed during using CCC, EPBL, A3, which are the widely used in the practice of agriculture. The protective effect peculiarity of the practice of agriculture is studied at a high load of agrochemicals by chemical means of plant protection. It with the reduction of total toxicity in soil, root system, in plant and reproductive organs were revealed during using CCC, EPBL, A3, which are the widely used in the practice of agriculture. The protective effect peculiarity of the practice of agriculture is studied at a high load of agrochemicals by chemical means of plant protection.
Both surface water and sediments were extremely acidic at Água Forte stream, with pH values <2.92 for surface water and <3.12 for sediment samples. Surface water at Roxo stream presented pH values >7.26, apparently not affected by the confluence of the Água Forte stream, but the same was not true when considering the pH and other characteristics of the sediments. Ecotoxicological bioassay (luminescence inhibition of Vibrio fischeri and 48-h immobilization/mortality assay with Daphnia magna) were conducted in water samples extremely toxic, with very EC50 values. Although high As, Cu, Pb and Zn concentrations were found at Água Forte stream, the same was not true in Roxo stream. Trace element content in water, sediments and Scirpus holoschoenus samples was analyzed and correlated in order to ascertain if this particular macrophyte, which seems adapted to the extreme conditions found at Água Forte stream, can be potentially used for metal removal in constructed wetlands to treat AMD.

TU 191

Species-specific responses to zinc in Lemnaeae: zinc storage and impacts on photosynthesis along frond developmental gradients

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Lemnaeae are used to represent all macrophytes in standard aquatic toxicity testing, with protocols allowing for the use of different species. Recently, differential sensitivity in Lemnaeae species to zinc, based growth and chlorophyll-a fluorescence parameters, has been reported. Chlorophyll-a fluorescence is an effective tool for sensing and measuring the effects of contaminants on the photosynthetic apparatus of experimental organisms. This study investigates how frond age and developmental stage, as well as zinc accumulation and storage, determine the impact of zinc on Lemnaeae. The maximum quantum efficiency of photosystem II, FV/Fm, the effective quantum efficiency, Y(II), and photochemical quenching, qP, were measured in mature and young fronds as well as a developmental gradient within Scirpus. Zinc accumulation and storage were quantified in the soluble and bound fractions in the plants were also measured after seven days. L. punctata and L. minor accumulated more zinc in their tissues than L. gibba. Partitioning of zinc in L. minor was notably different from the other two species, zinc was stored mainly in roots and the bound-fraction. FV/Fm and Y(II) in young fronds were more severely impacted by zinc than in mature fronds in all species. However, younger proximal sections of L. punctata fronds were more impacted than older distal frond sections compared to more homogenous impact in single Lemna fronds. Single colony, time-point or leaf-zone analyses may not show the full biological picture of the impact of a toxicant, especially not in L. punctata. Therefore, selection of Lemnaeae species and developmental stages of fronds should be given careful consideration when using chlorophyll-a fluorescence for assessing chemical impact of toxicity in Lemnaeae.

TU 192

Alleviative effects of magnesium on copper rhizotoxicity to grapevine: macroscopic and microscopic point of view
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Magnesium deficiency is a serious problem in viticulture, and with the increased production of magnesium deficient vineyards, this becomes even more critical. Magnesium is required by grapevine for its growth and development and plays a significant role in the development of new shoots. In this study, the effects of magnesium on the growth inhibition effects of Cu to grapevine roots were examined. Magnesium was applied to grapevine plants at different levels, and the root system was evaluated. The results showed that the addition of Mg increased the Cu concentration in roots, but reduced the Mg concentration in the shoot. The results also showed that the addition of Mg increased the Cu concentration in roots, but reduced the Mg concentration in the shoot. The results also showed that the addition of Mg increased the Cu concentration in roots, but reduced the Mg concentration in the shoot. 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The toxicity of the ion nanomaterials to aquatic and terrestrial plants

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Phytoextraction of PhACs (PhACs): The environment have recently been acknowledged to potentially constitute a health risk terrestrial and aquatic ecosystems and thus ultimately for humans. The occurrence and fate of selected human PhACs belonging to different therapeutic classes (non-steroidal anti-inflammatory drugs, anti-epileptic, contraceptives and β-blockers) have been detected in many countries in sewage treatment plant effluents, surface waters, seawaters, groundwater and some drinking water. The toxicological effect of even low concentrations of PhACs on non-target organisms, such as aquatic macrophytes has so far received little attention. In nature aquatic organisms are constantly exposed to xenobiotic compounds that cause the overproduction of oxidants or reactive oxygen species (ROS) resulting in oxidative stress. Therefore, we have investigated the detoxification enzyme glutathione S-transferases (GST) in the plant extract to metabolize PhACs in vitro and the results showed the inhibition of GST activity under the influence of the used PhACs. The data of the peroxidase (POD) and catalase (CAT) suggests that PhACs do not directly cause oxidative stress by an increase in ROS production. Due to increased ROS accumulation PhACs may be selectively toxic to some organisms leading to ecosystem alterations.

TU 196

Selection of suitable aquatic plants for phytoremediation of arsenic-contaminated water

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The work presented here is part of a longer on going study about the metals and metalloids accumulation in aquatic plants of uraniferous geochemical province of Central Portugal. It is oriented for the use of these plants as indicators of metal contaminated waters and their potential use in phytoextraction. In submerged and free-floating plants the concentrations of As were much higher than in emergent plants, with the exception of Oenanthe crocata. The highest concentrations of As were found in the submerged species Callitriche brunia (436.92 mg/kg DW), Callitriche stagnalis (354.03 mg/kg DW), Callitriche hamulata (160.37 mg/kg DW), Ranunculus trichochilus (268.53 mg/kg DW) and Ranunculus pelatus (103.98 mg/kg DW), in the free-floating plant Lemna minor (279.42 mg/kg DW), and in emergent plant Oenanthe crocata (157.94 mg/kg DW). The measured concentrations in the emergent plants, such as Apium nodiflorum, Typha latifolia, and Juncus effusus were significantly lower when compared with the previous species, even in the rhizome/roots. Other metals, such as Cu and Zn, are also accumulated by plants from the Callitriche family, namely, Cu by Callitriche verta and Cu and Zn by Callitriche stagnalis with maximum concentration values of 132 mg/kg and 1395 mg/kg in dry biomass, respectively. The abundance of Callitriche stagnalis and several heavy metals at the same time made the plant our first choice for rhizofiltration methodologies development.

TU 198

Genetic variation in metal-tolerant Silene vulgaris clones

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Silene vulgaris is a facultative metallophyte with multiple co-tolerance to heavy metals, capable of colonizing contaminated sites due to its fast and vigorous growth by producing seeds and rhizomes. In order to evaluate its potential for the purposes of phytoamelioration, genetic approaches are required to uncover the allelic variation at both Mendelian and quantitative genes. Analytical tools based on the identification of useful genetic diversity are needed for plant genotype selection aimed at enhancing metal remediation efficiency.

This study considers the genetic relationships among different S. vulgaris clones. Fourteen clones from ten populations collected from Madrid (Spain) were analysed using chloroplast DNA (cpDNA) polymorphisms. Ten primers pairs chloroplast SSR loci were tested and 3 of the 10 primer pairs revealed the existence of intraspecific length polymorphisms. The intergenic spacer between the trnH and psbA genes was ampliﬁed with the primers trnHJCUG and psbA. All PCR products a major robust band per primer pair in all samples studied. Two size variants were detected for ccmp1 (120 and 121pb), two for ccmp4 (113 and 114pb), five for ccmp2 (190, 191, 192,193 and 198pb) and six for trnHpsbA (328, 338, 339, 354, 355 and 357pb).

Regarding haplotype diversity, ten unique cpDNA haplotypes were identified and seven of them were private, being found in only one population. Despite de limited number of clones examined, a considerable intraspecific polymorphism was detected and can be explained by S. vulgaris out-crossing breeding system. Conservation of genetic resources in this allogamous species requires maintenance of the genetic diversity within each clone to avoid inbreeding depression and loss of rare alleles.

TU 199

Biosorption of Pb by Chlorella vulgaris (Chlorophyceae) at laboratory scale

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In the present study the biosorption capacity of Chlorella vulgaris (Chlorophyceae) to remove Pb at laboratory scale was analyzed. The microalgae were harvested in experimental growth phase, centrifuged and resuspended twice in ultrapure sterile distilled water. After measure of algae concentration, we used three real concentrations of Pb+2 (Pb(NO3)2: 1.951 [C1], 2.826 [C2] and 4.830 [C3] mg/L with their respective controls, all in triplicate (50 mL-1). The vessels were maintained in an incubation chamber under controlled temperature (23±1°C), continuous illumination (3000 lux) and daily shaking. At 10 and 30 min, 1, 2, 4 and 24 hours of exposure, they were centrifuged for 10 min at 3000 rpm, separating the supernatant from the pellet of algae. Both matrices were analyzed by atomic absorption spectrophotometry. For each time and concentration, we calculated the % of removal, the concentration factor (CF= [metal algae] / [metal water]) . Pearson correlations were performed to relate the concentration of Pb accumulated by C. vulgaris and the remaining in the supernatant.

The correlation coefficient (r) was calculated as -0.849, p<0.0001; r = -0.814, p<0.0001; r = -0.880, p<0.0001 in C1, C2 and C3 respectively. C. vulgaris is efficient to reduce Pb concentrations from the order of grams to mg/L, even after 12 and 24 h in C3. After 12 h, we observed desorption of Pb, with concentrations ranging from 2.62 mg/L to 2.58 mg/L between 12 h and 24 h in C2. In C3, 3.27 mg/L and 3.66 mg/L were performed to relate the concentration of Pb accumulated by C. vulgaris and the remaining in the supernatant.

Regarding the % of removal, the concentration factor (CF), and the correlation coefficient (r) were calculated as -0.849, p<0.0001; r = -0.814, p<0.0001; r = -0.880, p<0.0001 in C1, C2 and C3 respectively. C. vulgaris is efficient to reduce Pb concentrations from the order of grams to mg/L, even after 12 and 24 h in C3. After 12 h, we observed desorption of Pb, with concentrations ranging from 2.62 mg/L to 2.58 mg/L between 12 h and 24 h in C2. In C3, 3.27 mg/L and 3.66 mg/L were performed to relate the concentration of Pb accumulated by C. vulgaris and the remaining in the supernatant.

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during years 2009, 2010 and 2011. The concentration of Se in water from all locations did not exceed 0.2 µg L⁻¹. *Fontinalis antipyretica* took up Se in the range between 343 - 3039 ng Se g⁻¹ (on dry matter basis; DM). The Se content varied, depending on the location and season. The highest content of Se was measured in the stream of Zerovnicba that flows through agricultural area with pastoral farming, the value being 3039 ± 170 ng Se g⁻¹ (DM). The amount of insoluble Se compounds after enzymatic hydrolysis, using Protease (XIV) was around 75%. In soluble Se compounds only traces of Se (IV) and Se (VI) were found. No other Se compounds (SeMet/Cys, SeMet) were detected.

**TU 202**

The organic matter contribution of salt marsh vegetation to coastal wetlands ecosystems: a case study in Jiangsu, China

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Stable isotope techniques and different calculation models were used to analyse the potential sources of sediments organic matter in the core area of primary wetland and to calculate the contribution of salt marsh vegetation. By using multiple resources linear mixing model and the Euclidean distance model, we can conclude that micro-algae and Spartina alterniflora are the main contributors, under the assumption that the b°C value of micro-algae is -23°, the average contribution rate of micro-algae is 40%, which is the main contributor to the salt marsh wetland ecosystems in northern Jiangsu. The contribution rate of Spartina alterniflora to its marsh is 56% and to the intertidal is 57%. By comparing the two quantitative models, we can find that the Euclidean distance model would overestimate the contribution of incidental resources and average the resource of high contribution rate.

**TU 203**

Genotoxicity study on Vicia faba L. grown on natural and spiked contaminated soils

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Contaminant bioavailability and toxicity vary among soil types and may depend on soil properties and on contaminants characteristics. Metals contamination could have different potential risks depending not only on the total content but on their bioavailability. Operationally, metal bioavailability is often evaluated by chemical extractions characterizing different chemical forms. The use of plant bioassay may be an amenable tool to screen the phytotoxicity of contaminated soils measured from the root-tissue.

In this work different soils contaminated by Boron (B) were studied in relation to plant bioavailability and toxicity. B is an essential micronutrient for plants and generally is absorbed from soil in the form of boric acid. Previous studies demonstrated that both excess or deficiency of B can affect normal plant development. Naturally B polluted soils and artificially contaminated soils were characterized by the occurrence of cytogenetic abnormalities. Our results revealed that different sources of water pollution depending on the characteristics of field could show similar results in some biomarkers in situ but integrating data with field results and WQI it could be possible to develop a methodology that could be applied to other ecosystems and highlight possible areas of concern.

**TU 204**

Acute and chronic in vitro bioassays vs. autochthonous plants used as sentinel: comparing genetic biomarkers as tools in ecological risk assessment in Del Plata basin

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Del Plata basin is the fifth largest river basin in the world. The area’s surface is 4 million km² and contains a variety of habitats characterized by different environmental and biological resources. These resources are shared by Bolivia, Paraguay, Brazil, Uruguay and Argentina.

The lack of wastewater treatments from 100 million inhabitants is the main source of chemical and biological pollution that impact on all tributaries and affects negatively to the aquatic environment.

The concentration of Se in water from all locations did not exceed 0.2 µg L⁻¹. A new Biocide Regulation (BP Reg) is proposed and will likely come into force during 2013. Environmental and human health risks are evaluated before a product may be authorised and sold on the European market. The concentration of Se in water from all locations did not exceed 0.2 µg L⁻¹. A new Biocide Regulation (BP Reg) is proposed and will likely come into force during 2013. Environmental and human health risks are evaluated before a product may be authorised and sold on the European market. The concentration of Se in water from all locations did not exceed 0.2 µg L⁻¹.

**TU 205**

Can we possibly derive environmental quality benchmarks for chemical mixtures?

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In practice, chemical pollutants are indeed coexisting in the aquatic environment. For example, many antifouling biocide residues are often detected as a cocktail in water and sediment samples collected from coastal environments. Based on literature review of documented studies on the combined ecotoxicity of antifouling biocides, we found that both additive and synergistic effects together account for 80% of all cases in which about 35% cases are synergistic. To allow more accurate risk assessment of concurrently occurring chemicals, there is a need to develop environmental quality benchmarks (EQBs) for their mixtures.

In this work, we will introduce and discuss several possibilities of deriving EQBs for chemical mixtures. First, if all components in a chemical mixture are known to share a similar toxic mode of action, it is possible to explore the use of existing dimensional species sensitivity distribution (m-SSD) approach. Second, if the mixtures contain chemicals with different toxic modes of action, it can be assumed that the combined toxicity of the mixture would follow a simple concentration addition model, and the concept of toxic equivalency quotient (TEQ) could be applied to derive EQBs based on lethal and/or effect concentrations expressed in terms of TEQ and/or TEQ concentration. This method has been applied to polychlorinated biphenyls, dioxins and dioxin-like compounds, and chlorinated polycyclic aromatic hydrocarbons. For example, the Cu-ZnPT mixtures showed a strong synergistic toxic effect to all test organisms. We have developed a new method to assess the ecotoxicity of chemical mixtures.

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even in data poor situations. The evaluation of the frameworks provides estimates of how protective and conservative they are in realistic regulatory assessments for both human health and environmental risk assessment.

The various frameworks and decision trees are easy to apply to refine risk assessment for higher biological organization, i.e. easier to apply to environmental risk assessment than to human health risk assessment. Suggestions on how to prioritise refinement efforts in the product dossiers should be included in forthcoming guidance.

TU 207

PDPP+ - an appropriate method to assess the risk for mixtures under REACH?

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According to REACH chemicals substance need to be registered at the European Chemical Agency in Helsinki. For hazardous substance produced in amounts above 10 t/y the manufacturer or importer of the substance has to conduct a risk assessment and document the assessment in a chemical safety report (CSR). Operational conditions (OC) and certain premises are met, e.g., chemicals are true congeners, are metabolized and detoxified by the same biological processes, produce the same spectrum of biological effects by a reverse reaction of photosynthetic electron transfer, the DF inhibition reflects inhibition of photosynthetic activity that is necessary for growth. Therefore the DF is a special type of luminescence; it detects the growth of only those cells that have photosynthetic capability. Since the DF originates from re-oxidation of chlorophyll by a reverse reaction of photosynthetic electron transfer, the DF inhibition reflects inhibition of photosynthetic activity that is necessary for growth. Therefore the DF is a potential indicator of the influence of chemical substance of algal growth in a shorter time than the conventional 72 hours growth inhibition test (e.g. TG201).

In addition, the intensity of DF shows a time decay curve. Chemical exposure changes the dye curve to patterns that provide insight into the mechanisms of action, and also has potential for application to the identification of contaminants in mixtures. We discuss characteristics of the evaluation of the influence of chemicals (herbicide, other chemicals and mixtures) on algae by both the DF inhibition and analysis of the DF decay curves (1) and compare the detection characteristics of DF and other rapid estimation methods, including chlorophyll fluorescence-based photosynthetic activity measurement (PAM), and Microtox®. A common rapid bioassay that uses luminescent bacteria to evaluate the primary sensitivity between photosynthetically and non-photosynthetic microbial bioassay.

TU 211

Species sensitivity distribution for the prediction of herbicides mixtures toxicity on benthic diatoms

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Coastal zones of lakes could be contaminated by a cocktail of substances coming from urban discharges or diffuse watershed run off. This type of contamination especially concerns micro pollutants such as pesticides. Benthic diatoms, which are a major component of the aquatic diatom flora, are sensitive to the presence of sublethal concentrations of substances that could interact together to affect the diatoms (Habitat Risk Assessment; Species Sensitivity Distribution (SSD) models are partly used to extrapolate protective concentrations for a community exposed to a single or a cocktail of contaminants. To predict the toxicity of a mixture, two concepts are used depending on the mode of action of the mixture components (Concentration Addition _CA, or Independent Action_ IA). The main objective of the study was to assess $b$ if SSD (using CA or IA models) were reliable in terms of toxicity prediction of herbicide mixture on benthic diatoms and $z$ if this SSD could be used as a management tool for aquatic ecosystems. As a first step, eleven species of benthic diatoms were exposed to 4 herbicides, separately (diuron, isoproturon, terbutryn, atrazine), in 96h monospecific growth inhibition tests.
Finally, we compared the toxicity thresholds predicted by CA and IA models to the measured toxicity thresholds. We also assessed the species ranking between the mono herbicide SSD curves and the mixture SSD curves.

TU 212
Effects of Atrazine and 2,4-D mixtures on Lemna minor
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Thailand agriculture is very important in terms of the economy. Pesticides are therefore widely used in Thailand and this usage is increasing. As a wide range of pesticides is used in Thailand, aquatic bioassay will be exposed to a mixture of compounds. In order to understand pesticide impacts, it is therefore important to understand the potential toxic interactions of pesticides in use in Thailand. The aim of the present study was therefore to test the interactive effects of two herbicides, atrazine and 2,4-D, on a monocotyledonous species (Dichloroacetic acid) and also to determine the acute toxicity of the different taxonomic groups to the herbicide mixtures.

The effects of atrazine and 2,4-D on their own and in mixture was assessed using OECD method 221. For the single compound studies, the effects of a range of concentrations of pesticide on the growth of L. minor were studied. For atrazine the test concentrations were 0.05, 0.1, 0.2, 0.4 and 0.8 mg·L⁻¹ and 2,4-D were 5, 10, 20, 30 and 40 mg·L⁻¹. For the mixture studies, the herbicides were added at 2 μg·L⁻¹ with 10 μg·L⁻¹ of Dichloroacetic acid. The test was carried out in 200 ml of aerated and illuminated distilled water at 25 ± 2 °C.

The results from the single substance studies showed that atrazine was more toxic to L. minor than 2,4-D. Due to the low toxicity of 2,4-D, it was absorbed through the leaves and translocated to the meristems of the plant in dicots and it does not affect monocots which may explain the low toxicity to L. minor. The studies into the combination effects of atrazine and 2,4-D on L. minor clearly showed that the two compounds interact in an antagonistic manner. The antagonism has been found to occur more frequently in mixture where the herbicide mixture belongs to different chemical groups and monocot species.

In terms of this mixture study, the results showed that the interaction between atrazine and 2,4-D was antagonistic. These results are re-assuring and indicate in terms of impacts on aquatic macrophytes in Thailand, mixture effects are less than additive. If additivity is assumed for risk assessment purposes for macrophytes in Thailand, then this should be protective. Work is ongoing using a wider range of pesticides and test organisms.

TU 213
Predictive mixture toxicity assessment of pesticides in Swedish surface waters
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It has been demonstrated that combined effects of chemical mixtures give rise to stronger toxic effects than any of the compounds applied individually. The Scientific Committee on Health and Environmental Risks (SCHEER) has recently put forth concentration addition as a conceptual basis for the determination of environmental quality standards for mixtures. In this study we have predicted the risks from pesticide mixtures within Swedish surface waters using the concentration addition concept. Data from the national pesticide monitoring program in Sweden has been combined with experimental data from the US EPA's database for single chemical toxicity and predicted toxicity to QRA's to determine the risks from pesticide mixtures in Swedish surface waters close to agricultural areas. The Swedish monitoring program has been taking samples in six different locations since 2002 and currently analyses the samples for more than 80 compounds, out of which 78 has been detected. All and all 751 weekly samples have been analysed bringing the total number of analyses performed close to 60,000. The abundance of information enabled the study of not only the individual site risks, but also the risks from specific chemical groups. Among the total of compounds, the average false negative rate when ignoring mixture effects as well as the sensitivity of the risk assessment to different ecotoxicological data has been determined. The results show that the average risk quotient of the mixtures from the six different sites range between 2.3 and 18.9, thus calling for additional assessments. The study also show no effect on risk from season implying that potential for recovery from pesticide stress is very limited. Finally the high ratio between predicted risk of the mixture and the average risk of the individual substances clearly demonstrates the need for going beyond the standard compound-by-compound assessment.

TU 214
A proposal for considering mixture toxicity with EQS benchmark checking
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Environmental quality standards (EQS) are used under the EU Water Framework Directive to determine the chemical status of a water body. At present, compliance with EQS is mainly assessed for single substances. Although there is a growing body of evidence from mixture toxicity studies indicating that this method may underestimate the toxicity of the chemicals present in a water body, as the effect of mixtures has been shown to be higher than the highest single substance effect in the majority of cases. This propensity to underestimate potential effects of mixtures is underlined by a recent review published by kortenkamp and co-workers. Two approaches have been proposed to date to account for mixture toxicity in assessing the chemical status: (i) application of a default assessment factor of 100 as used for EQS derivation by RIVM (NL) and (ii) application of mixture toxicity models based on species sensitivity distributions (SSD). The latter method predicts the 'multi substance potentially affected fraction' (MSAF) of species proposed by Posthumah and co-workers. In this paper we propose a third approach for cases where the EQS was not derived from SSD for all mixture components, which allows for more accurate assessment of environmental mixtures even where there is incomplete SSD information. The approach is based on the identity of the mixture and the potency of each taxonomic group and can be combined with the mixture cumulative ratio (MCR) approach recently proposed by Price and Han. It will also take into account the fact that specifically acting substances will only be specifically toxic to some taxonomic groups while exerting baseline toxicity to other taxonomic groups. This novel approach will be illustrated using case studies based on real monitoring data and published EQS values. The everyday applicability of the approach will be discussed along with the decrease in uncertainty that it achieves when assessing the chemical status of water bodies containing more than one substance of concern.

TU 215
Increasing the number of data points does not necessarily reduce the probability of erroneously conclusions about interactive effects in mixture toxicity experiments
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The number of mixture toxicity studies is increasing exponentially. Developing requirements in regulatory risk assessment are further fueling the need to gain more knowledge about mixtures, mixture experiments and the subsequent data analysis. In particular, little attention has been given to the choice of an appropriate experimental design for a given reference model (e.g. independent action and concentration addition). Indeed, it has been shown that some experimental designs might not be able to detect (false negative) or erroneously conclude (false positive) deviations from a reference model. In this study, we simulated experimental data from a full factorial and equitox design and subsequently tested if these data deviated significantly from the concentration addition reference model. Experimental data were simulated for synergistic, antagonistic and additive mixtures. We then determined false positive and false negative rates for each experimental design. The number of data points, the lowest concentration of each chemical and the step size between two subsequent concentrations were varied. Results demonstrated a marginal increase in false positive rates with increasing number of design points. This contrasts with the general belief that adding design points will reduce the false positive rate. Varying the two other parameters resulted in a significant decrease in false positive rates. An optimal combination of these two parameters leads to the lowest false positive rates for a given design.

In conclusion, this study shows that an optimal experimental design for mixture toxicity focuses on optimizing the lowest tested concentration and the concentration step size rather than increasing the number of design points. Furthermore, datasets based on suboptimal or imperfect designs lead to erroneous conclusions and care should be taken in analyzing and evaluating such datasets.

TU 216
Proposed PAH relative potency factors will greatly increase risks at all sites with PAH mixtures
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The United States Protection Agency (USEPA) is proposing to modify the approach that it has been using since 1993 to evaluate polycyclic aromatic hydrocarbon (PAH) mixtures. While USEPA previously considered seven PAHs to have carcinogenic potential, the proposed approach increase the number to 26. In addition, many PAHs are being assigned a Relative Potency Factor (RPF) that is greater than 1 relative to benzo[a]pyrene. Several proposed RPFs are greater than 10, including benzo[c]fluoranthene (20), dibenz[a]pyrene (30), and benz[a]acectylidene (60). If this approach is adopted, it will be necessary to quantify all 26 compounds in media at contaminated sites, despite the potential lower concentrations of some of these compounds. In addition, it may be necessary to re-open and reassess sites that have already received regulatory closure. However, there are many scientific criticisms of the proposal. Most importantly, No Weight of Evidence Evaluation was performed. Second, USEPA assumed that all PAHs act by a similar mode of action with no importance. USEPA also failed to evaluate the derived RPFs using cancer response data from real world complex mixtures, such as coal tar. This paper summarizes the scientific arguments against this proposal. The proposed RPFs are based drug carcinogenic risk observed when the interactions between components are inherently taken into account in mixture studies. Lastly, there were many technical problems with proposed RPFs; many RPFs were based on a single study or “low confidence” studies; some RPFs were based on in vitro assays; some RPFs were derived from studies with no confirmation of the chemical identity of the test substance; some RPFs were based on studies with unusual modes of administration, such as long implantation; and many studies exceeded the Maximum Tolerated Dose. This paper presents the proposed approach to evaluating PAH mixtures and discusses key scientific criticisms.

TU 217
Derivation of environmental risk limits for polycyclic aromatic hydrocarbons (PAHs) based on internal residues
E.M. J. Verbruggen

SETAC 6th World Congress/SETAC Europe 22nd Annual Meeting

333
Polycyclic aromatic hydrocarbons (PAHs) are substances that have both natural and anthropogenic origins. They can be formed as a result of combustion, and are constituents of many petroleum products as well. Environmental risk limits (ERLs) were derived for 16 PAHs that were also considered in the European Risk Assessment Report (ERAR) and high-level, worst-case contamination scenarios.

It can be assumed that toxicity of all PAHs is similar and possibly caused by narcosis. The toxicity of different PAHs differs only as a consequence of different environmental distribution and accumulation potential. The sum of the internal concentrations of different compounds gives rise to the same effect as that of a similar concentration of an individual compound. This is referred to as concentration additivity. This concept has been successfully applied before for total petroleum hydrocarbons (TPH) and will be investigated here for PAHs.

All ecotoxicity data were collected and carefully evaluated for their usefulness and reliability. To calculate the total internal residues, pore water concentrations were calculated from sediment, by considering partitioning between organic carbon and water. From water concentrations, the internal residues were calculated using a partition coefficient between the membrane and water.

From all chronic toxicity data collected, a set of no observed effect residues (NOERs) for 54 species was obtained that showed no significant effect of exposure to PAHs. In the comparison between arctic and temperate species and between the individual PAHs, which consist of the assumed that indeed accumulation from (pore) water is the determining factor for toxicity. On basis of these data, a species sensitivity distribution (SSD) was constructed, which appeared to be very similar to the SSD for TPH, suggesting a similar mode of toxic action. To derive a value for a generic ERL, an assessment factor of 5 has been applied to the HCS to account for the potential of certain PAHs to exert a high acute toxicity through phototoxicity.

For the PAHs it is confirmed that the equilibrium partitioning method is a useful method in setting quality standards. Because toxicity is driven by equilibrium partitioning, tested . In addition to calcein-AM, also assays with rhodamine B, supposedly a substrate of P-gp but not MRP, were performed . Most tested pollutants had an equal or decreased efflux activity . Next, joint effects were modeled using the independent action and concentration addition concepts . Reversin 205 and MK 571 showed a distinctive dye for P-gp and MRP activity along with the specific inhibitors Reversin 205 for P-gp and MK571 for MRPs . Thus, a calcein-AM uptake assay was applied to study single transporter activity is present in D . magna and that this may play an important role in its tolerance to environmental contaminants .

The Simulated Earthworm Gut (SEG) is an in-vitro test that can be used to estimate the bioaccessibility of contaminants found in soil. The main objective of this research is to validate the SEG as an indicator of soil bioaccessibility for soil contaminated with petroleum hydrocarbons (PHCs). Current practices for determining site-specific toxicity limits can be expensive and time consuming. By validating an in-vitro toxicity test such as the SEG, site specific remedial objectives can be determined faster and at a lower cost. To validate the SEG, we compare the toxicity of six PHC contaminated soils for three invertebrate species (mite, collembolan and earthworm) against the bioaccessible estimate obtained from the SEG. Furthermore, due to the lipophilic nature of hydrocarbons we compare SEG bioaccessibility with and without the addition of a lipophilic sink to see which model better characterizes in-vivo exposure.
TU 223
Prediction of mixture toxicity for metals in soil: a reality-check
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Today, safety levels for chemicals and their mixtures are based predominantly on assessments carried out on individual substances. However, mixture toxicity is an upcoming issue in the regulatory area because of growing concern about the potential adverse effects of interactions between substances when present simultaneously. Only a few models are available so far to predict mixture toxicity (dose/concentration addition and independent action), and dose/concentration addition seems to be commonly selected as a default for assessment of mixtures in higher tier testing of mode of action and mode of effect. This paper aims to: (i) present a regulatory framework for assessing the ecological effects of naturally occurring elements, as such, in soils may not be straightforward, however. For several metals, the predicted no-effect concentrations are close to their natural background concentration in soil, and adding the potential effect of several metals may lead to over-protective risk assessments. This paper presents an overview on some case studies of risks in uncontaminated natural soils. Consequently, a reality-check is carried out on the use of common models for assessing the mixture toxicity of metals in soils and the selection of the number of metals to be included, based on exposure data for several metals in arable land and grassland soils across Europe (data from the GEMAS project). The distribution of the predicted total risk ratio across arable land or grassland in Europe is evaluated with respect to the mixture model applied, the number of metals included, the incorporation of bioavailability corrections, etc.

TU 224
Toxicological evaluation of chemical mixtures posing hazard to human and environment
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Exposure to certain chemical mixtures found in our environment can occur in different forms, with regard to reason of the contact and composition of the chemical mixture. Beyond all doubts is the fact that the chemical risk assessment, due to higher and more contaminated environment with multi-component chemical substances, plays crucial role in toxicology and ecotoxicology. This paper presents the most important issues concerning toxicology of chemical mixtures, with reference to an experimental design and special attention paid to the types of study methods, mainly acute and chronic studies, as well as legal aspects relating to European regulations connected with REACH and CLP.

TU 225
Assessing human health risk from farmed milkfish consumption: considering toxic interaction among arsenic, copper, and zinc mixture
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Various studies indicated that a strong association between cultured fish and waterborne metals of arsenic (As), copper (Cu), and Zinc (Zn) in coastal areas of Taiwan region. Generally, the impact of mixture toxicity of metals on the aquatic ecosystems is higher than that of single metal. The purpose of this study was to assess the human health risk for different metals (Cu, As, Zn), by gavage, for 28 days. Control groups were exposed to saline or DMSO as vehicle. The following end points were examined: liver weight, morphology, histology as well as liver enzymes activities (aspartate aminotransferase-AST, alanine aminotransferase-ALT and γ-glutamyltransferase-γ-GT). Study was approved by Ethical Committee of Medical Military Academy (No. 9687/11).Liver weight increased in all groups comparing to controls. Interestingly, the highest increase was seen in Cd groups (20-42%), than in BDE209 group (28%), while in mixture groups it ranges between 96 and 115%. Morphological changes in liver were not observed while histological analysis indicated degenerative changes in hepatocytes, hyperemia, vascular bleedings and disruption of vascular membranes. Average histological scores on scale from 0 to 5 were: 0.13, 1.26, 2.26, 3, 3.4, 2, 2.03 and 2.26, for control, BDE2091000, BDE2091000+Cu2, BDE2091000+Zn7, BDE2091000+CuZn, BDE2091000+CuZn and BDE2091000+CuZn, respectively. Our results indicate that As, Cu, and Zn mixture exposure may pose potential non-carcinogenic risk to human consuming farmed milkfish. The present interaction risk assessment provides an illustration for assessing the potential threat to human health posed by the mixture toxicity of metals from seafood consumption.

TU 226
Whether BDE209 interacts with Cd hepatotoxicity?
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During the last ten years, mixture toxicology has undergone a remarkable and productive development. In fact, combined toxicity, which more accurately represents real environmental exposure, may still be missed in the demonstration of toxicologically relevant effects. The aim of this study was to examine whether decabromodiphenyl ether (BDE 209) influences cadmium (Cd) hepatotoxicity:Wistar rats (200-240 g) were exposed orally to BDE 209 (1000 mg/kg/bw), Cd (2.5, 7.5 or 15 mg/kg/bw) or their three combinations, by gavage, for 28 days. Control groups were exposed to saline or DMSO as vehicle. The following end points were examined: liver weight, morphology, histology as well as liver enzymes activities (aspartate aminotransferase-AST, alanine aminotransferase-ALT and γ-glutamyltransferase-γ-GT). Mortality (data from the GEMAS project). The distribution of the predicted total risk ratio across arable land or grassland in Europe is evaluated with respect to the mixture model applied, the number of metals included, the incorporation of bioavailability corrections, etc.

TU 227
Waste recovery - a special treatment under REACH
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According to a manufacturing process is considered any production or extraction of substances in the natural state. This includes chemical modification as well as mechanical processes. Although the entry products at recovery companies are mainly waste (covered by the Waste Regulation), the status of the end products might "cease to be waste", and thus fall under the REACH regulation, and thereby having a major impact on the legal obligations of the recovery operator. However, under certain conditions recovery operators can benefit from recovery exemption by applying Article 2.7(d) of the REACH regulation. As the end products at recovery plants are often complex mixtures containing substances whose presence is not always intended, the process of substance identification is challenging. Each compound in the mixture has to be identified as either substance (mono-constituent, multi-constituent or UVCB), or impurity.

One is established that Art.2.7(d) can be used to avoid fulfilling certain obligations, such as the derivation of the classification and mixtures, the notification of substances, the preparation of Art.2.7(d) dossiers (substantiating the application of the exemption article) and the development of safety data sheets. Obviously, little information is available on the recovery itself due to the often changing composition, nor on the impurities due to limited access to the raw data as recovery operators are not participating in SIEFs or consortia. This lack of data influences the derivation of C&L of the mixture since this will often be derived based on the impurities' classification alone (e.g. summation method). Furthermore, with the exemption from registration, the recovery operator is not required to perform an exposure and risk assessment.

One should stimulate the re-introduction of former waste products on the market, because this contributes to the recycling of natural resources and the products may have economic benefits in the time of raising commodity prices. Nevertheless, sufficient efforts should be made to assure safe use of these, potentially heavily classified, mixtures. In addition, the hazard and risk assessment should be performed in such a way that overestimation due to the application of conservative assumptions and worst-case scenarios is avoided. This concerns among others address related to metal-based waste products, some may also apply to other types of recycling industries.

TU 228
Toxicity evaluation of disperse red 1 textile dye using freshwater organisms from different trophic levels - a PNEC proposal
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Azo dyes have been found in surface water especially because of textile production; however data about ecotoxicity of dyes are scarce in the literature. Commercial azo dyes are mixtures of a main dye, surfactants and other synthesis impurities. The commercial dye Disperse Red 1 containing 60% of the main dye N-Ethyl-N-(2-hydroxyethyl)-4-[(4-nitrophenylazo) aniline, CAS number 2872-52-8, was obtained by PCIL industries Ltda, Brazil. This product is used for dying synthetic fibers. Previous data showed the main compound for the responsible dye toxicity at least for Daphnia. This same dye was found in an effluent and a receiving water sample collected in Americana region, São Paulo Brazil. The aim of this study was to compare the results of ecotoxicity of the commercial dye Disperse Red 1 obtained for organisms from different trophic levels. For this purpose, a Photobacterium (luciferase) assay for acute life test and chronic tests, the NOEC (72h) found for Photobacterium phosphoreum was 0.1 ppm and the NOEC obtained for Ceriodaphnia dubia in a reproduction inhibition test (8 days) was also 0.1 ppm. For the secondary consumer Hydra attenuata, the NOEC obtained was 1 ppm in a reproduction inhibition test (7 days). For planarian and fish, only acute tests were performed. For Girardia tigrina newborns the EC50 (96h) was 80 ppm and for fish (Danio rerio, larvae, 96h), it was >50 ppm. This dye also showed mutagenic activity in the Salmonella/microsome assay but did not present estrogenicity in a two-step assay. Based on the NOEC (N-Ethyl-N-(2-hydroxyethyl)-4-[(4-nitrophenylazo)aniline of 0.4 ppm, considering that this compound would be responsible for the toxicity of the commercial product. This value was based on the lowest NOEC 0.1 ppm (chronic assay P. subcapitata and C. dubia) divided by an assessment factor of 10 because no chronic assay for fish is available and additional 10 because of its mutagenic potential. More studies are being conducted to verify the mutagenic effect of this product in microcrustacea as well as monitoring studies in river waters that receive textile discharges to determine exposure concentrations. Partly supported by Ministry of Science project Hl46009
The biocide activity of the cationic polymer polydiallyldimethylammonium chloride (polyDADMAC) against the Asian clam has been previously demonstrated. In this study, enzymes can with regard to their ecotoxicological profile be grouped in proteolytic and non-proteolytic enzymes. Within these two groups read-across can be applied.

The use of LCA for the support of public decisions has contributed to the increased attention to the quality of data reported by LCA studies. In many cases the result of an analysis is of crucial importance and the quality of the data is decisive for the outcome. The quality of the data depends on the effort made to collect and manage the data. As the LCA model is built on the data, the quality of the result is directly linked to the quality of the data. In this study, different types of uncertainty for water consumption impacts are analyzed and combined on the endpoint level, showing how uncertainty can be propagated within the model. The average k-values (dispersion factor denoting the 95% confidence interval if the median is divided (lower bound) and multiplied (upper bound) by k) was equal to 2.76 on the midpoint level and 18.1 on the endpoint level. The aggregation from watershed to country level resulted in an average uncertainty of k=19.2 for the endpoint level.

Most LCIA methods do not provide uncertainty information to be coupled with uncertainty of LCI. Furthermore, regionalized differences are often not properly addressed, which can lead to incorrect LCI data being used in the model. This study focuses on the quantification and propagation of uncertainty in regionalized impact assessment. The objectives of this study are to develop and evaluate a partial least squares-based integrated addition model (PLS-IAM) for not only to overcome the multicollinearity problem which can be occurred between the two independent variables, CA and IA, but also to combine them into the integrated addition model by using the latent variable. In this study, the PLS-IAM was validated by different datasets on mixture toxicity. The results showed that the prediction capability of the PLS-IAM outperformed reference models, the CA, IA, and IAM based on ordinary least squares.
We present the result of the analysis for the pesticide Lindane. The overall variability of the removal rate from air is up to 5 orders of magnitude, mainly driven by four out of standard deviation is propagated using tailor series. This method has been implemented in a real case where decision needed to be made between three building projects. The - data for which more than one value is available. (multiple sources and conflicting information)

Our practical experience and ideas, related to management of these uncertainties in USEtox model will be presented. Possibilities must be given to each user to view, add, or revise the documentation of a specific parameter. Reporting an error in a parameter value also have to be easy, as well as the determination of the validity of each parameter value.

In the last two decades LCA-methodology development has made immense progress. We meanwhile have a solid LCA frameworks. ISO 14044 describes the procedures to in approaches to reduce the uncertainty, database documentation, substance coverage, as well as user interaction are key issues.

In the field of LCA, the issue of uncertainty generates a growing interest. Although this issue has not yet been systematically addressed in existing databases and models, it neither can be neglected, nor addressed too simply. Although uncertainty has partly been quantified in USEtox model, several questions remain open to date. A significant share of this uncertainty arises in model itself, based on the relationship between the data and the intended reality being modeled. As regular users of the USEtox model, we identify the following sources of uncertainties:

- substance for which no data is available, or missing input parameter value
- parameters for which only an inappropriate or inaccurate value is available

Given the relative complexity of the mathematical model, uncertainty propagation has been performed using a numerical method. Well known monte-carlo simulation has been applied to calculate the variability of the input parameters (substance data and landscape model). This approach allows us to describe statistical properties of a characterization factor value, based on input data uncertainties. It can also be used to study parameters sensitivity.

In order to account the fact that uncertainty in USEtox database cannot be fully captured within the input parameters variability, other approaches have been studied, which aims at reducing uncertainty.

In approaches to reduce the uncertainty, database documentation, substance coverage, as well as user interaction are key issues. The determination of the true value for a parameter requires research, experiments and therefore time. Involving stakeholders, discussing and finally deciding on a consensus, so has the current model been built, so the database should be.

Possibilities must be given to each user to view, add, or revise the documentation of a specific parameter. Reporting an error in a parameter value also have to be easy, as well as the determination of the validity of each parameter value.

Our practical experience and ideas, related to management of these uncertainties in USEtox model will be presented. Those approaches have been implemented in a web application prototype that allows uncertainty calculation and documentation completion.

In the field of LCA, the issue of uncertainty generates a growing interest. Although this issue has not yet been systematically addressed in existing databases and models, it neither can be neglected, nor addressed too simply. Although uncertainty has partly been quantified in USEtox model, several questions remain open to date. A significant share of this uncertainty arises in model itself, based on the relationship between the data and the intended reality being modeled.
Urban background levels of novel brominated flame retardants in ambient air in Southern Bavaria, Germany
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After the technical penta- and octabromodiphenyl ether mixtures (PBDE) were banned in the European Union in 2004 and debrominated diphenyl ether is no longer permitted in electrical and electronic equipment since 2008, there is an increasing demand of 'novel' brominated flame retardants. At present, little is known about the concentrations of these substances in ambient air. Therefore, ambient air was collected between March and September 2011 at the urban background air monitoring station of the Bavarian Environment Agency Augsburg, Germany.

Halogenated flame retardants (HFRs), which are applied to reduce the inflammability of various consumer products have been industrial chemicals of growing worldwide environmental significance. The majority of HFRs are bromine-containing products, including the so-called polybrominated diphenyl ethers (PBDEs), which were widely used as flame retardants in the 1990s, and early 2000 which are known to be harmful. Due to their ongoing banishment since the early 2000s, the industry shifts towards alternative non-regulated non-PBDE BFRs.

The Biological Reserve of Atol das Rocas shelters the largest seabird population of Brazil and despite being considered a remote area due to its distance from the mainland, this area is not exempt from the influence of anthropogenic agents, such as persistent organic pollutants (POP) that even has caused the decline of populations of several species and a wide range of parameters and pollutants. In this work, we show the seasonal variation of aryl hydrocarbon receptor (AhR) mediated effects, anti-/estrogenicity and anti-androgenicity. These parameters were assessed using in vitro reporter gen assays based on mammalian cell lines. This research was supported by GACR P503/10/P249 and CETOCOEN (CZ.1.05/2.1.00/01.0001).

Air pollutants and their effects described to produce many toxic effects including endocrine disruption. Evaluation of such types of effect cannot be based only on data from chemical analyses. That shows the importance of incorporation of specific bioassays into evaluation part of the air pollution monitoring programs. The utility of these methods in monitoring of atmospheric pollution levels has been shown previously. It is known that levels of pollutants in atmosphere are closely related to type of pollution source and a season period. In our study, we focused mainly on the latter factor. Air samples were collected for one year at a traffic-burdened urban site in Brno (Czech Republic) and a village site about 8 km from Brno city to address the influence of city agglomeration as an air pollution source on the surrounding area. The samples were analyzed for a wide range of parameters and pollutants. In this work, we show the seasonal variation of aryl hydrocarbon receptor (AhR) mediated effects, anti-/estrogenicity and anti-androgenicity. These parameters were assessed using in vitro reporter gen assays based on mammalian cell lines. This research was supported by GACR P503/10/P249 and CETOCOEN (CZ.1.05/2.1.00/01.0001).

Seasonal variation of specific toxic effects of organic air pollutants from year-long sampling campaign in Brno-Jihlava region
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1University of Toronto Scarborough, Toronto, Canada
2Environment Canada, Downsview, Canada
3Aboriginal Affairs and Northern Development Canada, Whitehorse, Canada
4Soils collected at several elevations on five mountains and on the northern Pacific Coast of North America were analyzed for 15 Polycyclic Aromatic Hydrocarbons (PAHs), 72 Polychlorinated Biphenyls (PCBs), 42 Novel Brominated Flame retardants, and 24 Dechlorane compounds. Air pollutants and their effects described to produce many toxic effects including endocrine disruption. Evaluation of such types of effect cannot be based only on data from chemical analyses.

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Profiles and cold trapping of polycyclic aromatic hydrocarbons and polychlorinated biphenyls in Brazilian Column mountain soils
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1University of Toronto Scarborough, Toronto, Canada
2Environment Canada, Downsview, Canada
3Aboriginal Affairs and Northern Development Canada, Whitehorse, Canada
4Soils collected at several elevations on five mountains and on the northern Pacific Coast of North America were analyzed for 15 Polycyclic Aromatic Hydrocarbons (PAHs), 72 Polychlorinated Biphenyls (PCBs), 42 Novel Brominated Flame retardants, and 24 Dechlorane compounds.
3. Results and discussion

3.3. Effect of canopy

The atmosphere into the forest system. Previous studies have focused on the atmospheric deposition and atmospheric-surface exchange of semi-volatile organic contaminants (SOCs) along the mountain forest and clearing. Forest is regarded as a global sink of semi-volatile organic contaminants (SOCs). The so-called "Forest filter effect (FFE)" may be an important driver that transfers SOCs from one location for which 13 years of data were available. Differences between the first year and subsequent years were observed with time ($p = 0.69$, $p < 0.1$).

To determine a suitable constraint on departure height of endpoints when assigning potential sources, a 7 cell departure area was defined as the "emitting" cell and the six cells adjacent to it. Using forward trajectories it was determined that after four time steps, 87% of trajectory endpoints were outside of the departure area, which includes points from trajectories that double-back into the departure area. At the fourth step, the boundary of the forest was defined by 778,000 m from the source. This is consistent with previously reported results of 10% to 20% of endpoints being within the 7 cell departure area.

Lastly, a significance criterion was derived by assuming that when assigning potential source regions to a measurement only departs from a perfectly round airshed represent points in air masses that received contaminant from emissions in that cell.

4. Conclusion

1. Introduction

2. Materials and methods

3. Results and discussion

3.1. Concentrations

The average concentrations of total PAHs (ΣPAHs) and polycyclic aromatic hydrocarbons (PAHs) were usually not included amongst the group of compounds defined as "persistent organic pollutants (POPs)" due to their lower reactivity, they are a subject to long-range transport (LRAT) and can pose significant health risks. As such, they are among the pollutants most commonly monitored in the atmosphere.

3.1. Effect of canopy

Most of the values for the atmospheric measurements were between 1 and 3, with an average of 2 reported. These results are consistent with previous PAH emission inventories and highlight the potential impact of continental PAH sources in China, India and Africa on the global marine atmosphere.

TU 246

The spatial distribution and potential sources of polycyclic aromatic hydrocarbons (PAHs) over the Asian marginal seas and the Indian and Atlantic Oceans (L. Xu, Z. G. Zhang, A. D. Guardo, K. C. Jones, T. Li, N. L. Nizzetto, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou, China)

1. Introduction

2. Materials and methods

3. Results and discussion

3.1. Concentrations

The average concentrations of total PAHs (ΣPAHs) and polycyclic aromatic hydrocarbons (PAHs) were usually not included amongst the group of compounds defined as "persistent organic pollutants (POPs)" due to their lower reactivity, they are a subject to long-range transport (LRAT) and can pose significant health risks. As such, they are among the pollutants most commonly monitored in the atmosphere.

3.1. Effect of canopy

Most of the F/C values in the atmospheric measurements were >1 from active samples, however, F/C values were generally <1 in the PAS samples, which could represent for a lower sampling rate of PAS in the forest because of lower wind speed. As shown in Figure 2, log F/C and log KOA showed different correlations in the gaseous (green line) and particle-bound (red line) phases.

4. Conclusion

The filter effect of canopy was observed alone the Mont Mars and higher factors was related to the pristine environments. The fine and ultrafine particles are of special concern as they can penetrate the lungs to the greatest extent and even enter blood stream. A presence of the particulate matter in ambient air (especially of the particles with less than 10 µm in diameter) has a negative impact on human health as it can induce various respiratory diseases. For this reason, further studies are needed to assess the impact of PAHs on human health.

TU 247

PAHs along a mountain forest and clearing: the effect of canopy

X. Liu, Z. G. Zhang, A. D. Guardo, K. C. Jones, T. Li, N. L. Nizzetto, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou, China

1. Introduction

2. Materials and methods

3. Results and discussion

3.1. Concentrations

The average concentrations of total PAHs (ΣPAHs) and polycyclic aromatic hydrocarbons (PAHs) were usually not included amongst the group of compounds defined as "persistent organic pollutants (POPs)" due to their lower reactivity, they are a subject to long-range transport (LRAT) and can pose significant health risks. As such, they are among the pollutants most commonly monitored in the atmosphere.

3.1. Effect of canopy

Most of the F/C values in the atmospheric measurements were >1 from active samples, however, F/C values were generally <1 in the PAS samples, which could represent for a lower sampling rate of PAS in the forest because of lower wind speed. As shown in Figure 2, log F/C and log KOA showed different correlations in the gaseous (green line) and particle-bound (red line) phases.

4. Conclusion

The filter effect of canopy was observed alone the Mont Mars and higher factors was related to the pristine environments. The fine and ultrafine particles are of special concern as they can penetrate the lungs to the greatest extent and even enter blood stream. A presence of the particulate matter in ambient air (especially of the particles with less than 10 µm in diameter) has a negative impact on human health as it can induce various respiratory diseases. For this reason, further studies are needed to assess the impact of PAHs on human health.
This paper reports on seasonal and spatial variability of size-specific particle-gas partitioning behavior of selected groups of legacy (dioxins and furans, pesticides) and emerging (brominated and fluorinated) pollutants. Samples have been collected from the urban and rural sites in the Czech Republic for the period of one year (October 2009 - October 2010) using a high volume air sampler equipped with a six-stage (≤ 0.49 µm; 0.49-0.95; 0.95-1.5; 1.5-3.0; 3.0-7.2; 7.2-10 µm) cascade impactor collecting particulate phase and polyurethane foam (PUF) disks collecting the gas phase.

TU 251
Potential input of organic pollutants to the Mar Menor lagoon: estimation of seasonal air concentrations using passive and active air samplers
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A significant fraction of organic pollutants is transported in air and can be transported far from their sources associated to particulate material or dissolved. Pollutants are widely applied for agricultural treatments and poly cyclic aromatic hydrocarbons are formed as consequence of urban, transport and industrial activities. Mar Menor lagoon is the ending point of drainages from a large agricultural area where a variety of pesticides are used. This lagoon is surrounded by several villages and that have, especially in summer, an intense touristic activity. There is also a military airport close to the lagoon and this area is influenced by a very industrialized pole, which is located at 20 km south.

There were not previous data of pesticides and PAHs concentrations in air of in this area. In order to estimate the levels of organic pollutants in air and the potential atmospheric input in Mar Menor lagoon, passive samplers consisting of polyurethane foam (PUF) disks housed in chambers were deployed at six sites around the basin of this lagoon. Replicate at each point and calibration with a DIGITEL active sampler (at one point) equipped with a PUF module are used to improve the confidence of the determination levels and to estimate the sampling ratios for the different detected species.

PUF samples have been extracted with hexane using a pressurized liquid extractor. The extract was concentrated and was analyzed gas chromatography with mass spectrometry. The quantification limits were lower than 10 ng/mL for the majority of the considered analytes. This method has been validated for more than 80 organic pollutants and polycyclic aromatic hydrocarbons and up to 23 have been identified. PUF samples from active and passive samplers. The range of estimated air concentrations is very wide (10 pg/m³-2 ng/m³), and depends on the specific compound, as consequence of the proximity of sources and environmental variables.

TU 252
Biomonitoring of polycyclic aromatic hydrocarbons by pine needles - analytical alternatives and levels in Europe
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Technological University of Crete, Chania, Greece

The monitoring of pollutants is a crucial step to assess their environmental exposure to organisms. In general, this task is performed in their own habitat (sediments, soil, water or air), but biomonitoring offers the possibility to estimate the multi-route uptake of contaminants. Given its worldwide presence, adequate characteristics and low availability costs, vegetation has been chosen as a passive sampling device since the 1960s, allowing the passive sampling of a wide range of compounds (especially of atmospheric origin). PAHs are transported into the plant by the rainwater or by the air, they are prone to partition into the waxy layers of plants and trees (mostly on the leaves) or, in the case of the heavier PAHs, to be deposited as particles in the surface. PAHs are widespread carcinogenic and mutagenic contaminants with natural and anthropogenic sources mainly associated to combustion processes.

In the present study, the pine needles were used as the target compounds of their lipidic structure a hard task and led to the development of multisite extraction methods in the last 20 years. This means that biomonitoring studies using these methods demand for reliable extraction and clean-up procedures, which have been suffering continuous development to reach increasingly lower limits of detection associated with sharper chromatographic resolution. The main objective of this work was the systematic study of several extraction methods, ultrasonic assisted extraction, microwave-assisted extraction, accelerated solvent extraction, solid-phase microextraction and hollow-fibre liquid-phase microextraction) prior to a complementary clean-up step when needed were studied for 16 PAHs in pine needles. In concomitance, the patterns and sources of contamination were assessed and compared in sampling sites from Portugal, Spain and Greece.
The environmental health decline and the loss of organism diversity of South Florida (USA) ecosystems have been attributed to nutrient inputs from nearby urban and agricultural areas. The agricultural pesticide use may also challenge these ecosystems. One possible agricultural pesticide release to the atmosphere after application which can be enhanced in this region due to the calcareous soils, frequent rainfall, and high humidity and temperatures. A study was conducted to examine the atmospheric fate of the widely-used insecticide endosulfan. Air samples were collected over a five-year period (2001 to 2006) at a site within the agricultural community of Homestead, Florida. Concentrations of endosulfan were measured in nearby Biscayne Bay and Everglades National Parks (NPs). Endosulfan emissions from agricultural areas around Homestead appeared to influence air concentration observations at the NP sites. During an intensive sampling campaign, the highest total endosulfan concentrations at the NP sites were observed on days when air parcels were predicted to move from Homestead towards the sampling locations. The α-endosulfan fraction (α/(α+β+γ)) was used to examine the contribution of pesticide drift versus volatilization to the overall air concentration. The fraction that has an α fraction of approximately 0.7, whereas volatilization is predicted to have an α fraction of 0.9. The median fraction observed at Homestead during periods of high and low agricultural activity was 0.84 and 0.86, respectively, indicating that drift contributes to the atmospheric concentration. The median fraction at Everglades NP was 0.88 and 1.0 during high and low agricultural activity, respectively, and at Biscayne NP was 1.0 year indicating air concentrations are primarily influenced by regional volatilization. The near-irreversible isomerization after application of β-endosulfan to α-endosulfan also influences the value of the α fraction.

**TU 257**
Raman microscopy as a tool to examine agricultural sources of PM10
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EMISSIONS OF DCX, AN AIRBORNE-TRANSPORTED, PHOSPHATASE INHIBITING, AND NEUROTOXIC COPPER CONTAMINANT FROM PRECIPITATION IN AFRICA'S GREAT COMORAL RIVER BASIN

A langmuir-hinshelwood fit of atmospheric reactions of OH radicals with semivolatile, aerosol-borne compounds in chamber experiments
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A number of semivolatile compounds and proxies of environmental compounds, such as oleic acid, long-chain alkanes, polycyclic aromatic hydrocarbons, plasticizers, PCBs, brominated flame retardants, and various pesticides, were measured. The isomers and congeners were examined in the gas phase and some of them in the adsorbed state as thin films or sub-monolayers on appropriate solid materials in either flow reactors or aerosol chambers, by exposing them to OH radicals or ozone at known levels.

In this work, we applied both mechanisms in the analysis of the reaction of aerosol-borne terbuthylazine with OH radicals in our simulation glass-smog chamber. Home made silica particles were used as carrier material. Compared to previous <10 nm particles (Aerosol 200), these larger particles (diameter about 160 nm) have less tendency to agglomerate. Compared to previous studies, a negative correlation with OH concentration was found for the second order reaction rate constant. At relatively low OH concentrations, a positive correlation could be explained by the Eley-Rideal mechanism, while the Langmuir-Hinshelwood mechanism is more appropriate to explain concentration-time dependencies. Because the adsorption could be affected by gas-particle equilibria, results from different experimental setups (e.g. Chamber experiments and flow tube experiments) are assumed to be different.

A comparative analysis of semivolatile compounds emitted in the EU within the infrastructure EUROCHAMP-2. We also acknowledge former support by the Umweltbundesamt, the companies CIBA-Geigy (now Syngenta), Bayer and BASF and by the EU in the project MOST.

**TU 259**
Analysing PBDE in house dust samples with the TSQ Quantum Ultra XLS GC-MSMs in EI-SRM mode and GC-MS negative chemical ionization in SIM; a comparison of two analyzing techniques
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3Polybrominated diphenyl ethers are a class of compounds used as flame retardants in a wide variety of household apparatus and furniture.
4 Certain congeners have been banned completely and are currently on the list of the Stockholm convention on persistent organic pollutants. (1,2)

An even greater concern about the health risks being exposed to these class of compounds and one of the sources of human intake is next to nutrition, inhalation of indoor air and house dust.

In this application, a comparison is made between two analytical techniques; GC-MS-MS and GC-NCI-SIM, evaluating detection limits, repeatability and selectivity in matrix. A broad range of PBDE was analysed, ranging from tri- up to deca BDE, together with another class of brominated flame retardants such as decabromodiphenylethane (DBDPE), tetrabromobisphenol (TBB), and 1,2,3,5,6,7,8,9,10 Hexabromocyclododecan (HBCD).

**TU 260**
Human exposure to flame retardants in different occupational settings from Pakistan
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Flame retardants (FRs) are widely used in a variety of consumer products, such as plastics, textile coatings, electrical appliances and printed circuit boards to inhibit the development of fires. Studies have shown that these chemicals can leach out into the environment. In order to investigate the presence of FRs in the specific occupational settings, human exposure to FRs, were collected from dust, serum, and urine samples from individuals working at electronics and textile market in Pakistan, United States.

Polybrominated diphenyl ethers (PBDEs), novel brominated FRs (NBFs), hexabromocyclododecane (HBCD) and organophosphate FRs (OPFRs) were quantified in dust, serum, and urine samples. FRs were extracted from dust, serum, and urine using solid-phase extraction (SPE). In dust and serum extracts, PBDEs and NBFs were analysed by gas chromatography (GC) coupled to mass spectrometry (MS) operated in electron capture negative chemical ionization (EI-NCI) and negative chemical ionization (NCI) modes. OPFRs were analysed by GC-MS/MS in electron impact (EI) mode. The separation and determination of α- and γ-pyrene and β-pyrene were achieved using liquid chromatograph (LC) coupled to triple quadrupole MS system operated in the negative electrospray ionization (ESI) mode. OPFR metabolites were analysed in urine using LC-MS/MS in negative ESI mode. Generally, PBDEs were found to be the major components in FRs present in the dust, serum and urine samples from the studied area.

PBDE and OPFRs were also found to be occupationally exposed to various FRs, with probably indoor dust ingestion and air inhalation as a major source of exposure. Correlations were performed between the levels of FRs in dust and serum or between dust and urine samples. For workers, using the 5th, median and 95th percentile concentrations in dust samples different exposure scenarios were calculated via dust ingestion. Exposure scenarios were calculated assuming 100% of intake dust, a 10 h/day working shift, 70 kg body weight (bw), mean dust ingestion (1.25 mg/hr) and high dust ingestion (3.13 mg/hr). Exposure assessment values were lower than RfD values. Human exposure to FRs seems to originate from a combination of different sources, including indoor dust ingestion and air inhalation from a larger number of occupationally exposed workers are necessary for a more complete assessment of human exposure pathways to these environmental contaminants.

**TU 261**
Use of volatile organic compounds (VOC) in consumer products and comparison between the European and US reactivity models for assessment of exposure
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Use of volatile organic compounds in consumer products and comparison between the European and US reactivity model for assessment: the environmental impact of Volatile Organic Compounds (VOCs)’s is their ability to react with NOx in the lower atmosphere in the presence of sunlight and heat to produce ground-level ozone, also called summer-smog. Summer conditions favour the formation of ground-level ozone primarily because of increased ultraviolet radiation, temperature and low wind speeds. The reactivity potential of VOCs in Europe is defined as Photochemical Ozone Creation Potential (POCP); developed by Derwent et al (1994). POCP is an estimate of the reactivity potential of VOC’s is the Maximum Incremental Reactivity (MIR); developed by Carter et al. (2006). MIR’s and POCP’s both measure the reactivity towards ozone production of a given VOC. The MIR scale is reported as the mass of additional ozone produced per mass of VOC reacted. POCP’s report the additional ppb of ozone produced by an additional emission of that VOC, expressed relative to that produced by the same emission of ethylene as reference.

International consumer companies with global brands have the challenge to meet all aspects of regulatory requirements to decrease their impact of VOC’s. Some examples include...
Distribution of linear and cyclic volatile methyl siloxanes in indoor air samples and implications for human exposure

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Cyclic (D3, D4, D5, D6) and linear (L2-L5) volatile methyl siloxanes are widely used in personal care products and cosmetics, as well as in industrial applications (biomedical products, surface treatment agents, plasticizers and construction materials). These compounds are of environmental concern due to their volatility, persistence and tendency to bioaccumulate.

The purpose of this study was to investigate their occurrence and distribution in indoor air environments, including domestic (i.e. bathrooms, living rooms, boy/girl rooms) and non-domestic (i.e. offices, schools, restaurants, hospitals) environments. An extensive indoor air sampling campaign was performed contemporarily in the UK and Italy, between May and August 2011. Indoor air samples (n = 100) were collected on adsorption Tenax GR cartridges (60/80 mesh, Markes) using conventional portable air sampling pumps (i.e. GilAir3, Gilian- Sensydine), operating at a flow of about 120 mL min-1. Sampling cartridges were desorbed using the Automatic Thermal Desorber UNITY2 coupled to a GCMS. The total concentration of total siloxanes found was 1206 ng m-3 in Italian and UK samples, respectively. Cyclic volatile methyl siloxanes (in particular D3 and D5) accounted for ~90% of total siloxane concentrations. The highest siloxane concentrations were found in bathrooms; in particular, D5 represented the principal compound probably due to its dominant presence in most of hair-care products, cosmetics, medicines and cleaning agents. Personal lifestyles and everyday-life behaviours (e.g., selection of products, frequency of application, amount applied) had a determinant effect on the amount of total siloxanes found in both Italian and UK adult and living rooms. No significantly different concentrations were detected in different indoor residential environments. The daily inhalation exposure (DIE) to cyclic and linear volatile methyl siloxanes was also evaluated.
option of using alternative fuels in cement plants working with the Best Available Technologies (BAT).

TU 267

Should the neighbourhood of cement plants be concerned when alternative fuels are used?
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In recent years, co-combustion of alternative fuels in cement plants has become an increasing practice in many countries. The benefits associated to the replacement of fossil by alternative fuels are well known. The use of sewage sludge or RDF (Refuse Derived Fuel) is a not negligible contribution to the environmental and energy goals. However, the effect of the use of RDF in cement kilns is not known. In the present work, the result of a 3-year campaign (2008-2011) environmental monitoring campaign around a cement plant located in the metropolitan area of Barcelona (Catalonia, Spain) was presented. The aim of this study was to evaluate the potential changes in the environmental levels of metals and polychlorinated dibeno-p-dioxins and dibenzofurans (PCDD/Fs) in the vicinity of a cement plant before and after using sewage sludge as alternative fuel. The concentrations of PCDD/Fs and metals were determined in different soil, herbage and air samples surrounding the cement factory before and after the partial fuel substitution. The potential changes on the health risks for the population living around the area were also assessed.

In general trend was non, no statistically significant differences in the pollutant values were found between the 2 scenarios (before and after the partial fuel replacement), with the exception of a few significant decreases in some metals. Besides, the carcinogenic and non-carcinogenic risks due to the exposure to metals and PCDD/Fs were below the national and international safety limits.

TU 268

Environmental impact of mechanical-biological treatment systems. Human health risks of chemical and microbiological pollution
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²To investigate the temporal and seasonal trends of chemical and microbiological pollutants near a MBT plant (Ecoparc-2) in Montcada i Reixac, (Barcelona, Catalonia, Spain). To evaluate the influence of the MBT plant on the surrounding air and water bodies.

Due to legislative, environmental, economic, and social limitations, the identification of sustainable disposal pathways for the management of municipal solid waste (MSW) is a very challenging task. The mechanical-biological treatment (MBT) approach presents many advantages in comparison to other waste management possibilities. However, adverse health effects related to this practice are not negligible. In this regard, such as volatile organic compounds (VOCs), are generated during waste composting and similar processes. Some of these contaminants can be the cause of a variety of infectious diseases, as well as allergies and toxic effects or generating malodorous and hazardous properties. In 2010, a program was initiated to monitor air levels of VOCs and microbiological pollutants near a MBT plant (Ecoparc-2) in Montcada i Reixac, (Barcelona, Catalonia, Spain). In this study, we present the results of the monitoring carried out over a period of 3 years (2010-2012). The main objectives of this study were to: identify the presence of VOCs and microbiological agents in the air surrounding the MBT plant, assess the environmental impact of the MBT plant, and propose measures to improve the health conditions of the population living near the MBT plant.

TU 269

Environmental risk management in confined spaces. A study case of an archive like a model of indoor environment involved with biodeterioration
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²Ca' Foscari University of Venice, Venice, Italy
³To investigate the potential interaction between the MBT plant and the environment in terms of microbial and chemical pollutants.

Historically, indoor environments have been identified as a significant source of microorganisms and bacteria that can cause health problems for their occupants. The Historical Archives, where cellulolytic microfungi and bacteria find a comfortable environment for their development, are of particular interest in this sense. In the present work, the result of a 3-year (2008-2011) environmental monitoring campaign around a cement plant located in the metropolitan area of Barcelona (Catalonia, Spain) was presented. The aim of this study was to evaluate the potential changes in the environmental levels of metals and polychlorinated dibeno-p-dioxins and dibenzofurans (PCDD/Fs) in the vicinity of a cement plant before and after using sewage sludge as alternative fuel. The concentrations of PCDD/Fs and metals were determined in different soil, herbage and air samples surrounding the cement factory before and after the partial fuel substitution. The potential changes on the health risks for the population living around the area were also assessed.

In general trend was non, no statistically significant differences in the pollutant values were found between the 2 scenarios (before and after the partial fuel replacement), with the exception of a few significant decreases in some metals. Besides, the carcinogenic and non-carcinogenic risks due to the exposure to metals and PCDD/Fs were below the national and international safety limits.

TU 270

Persistent organic pollutants (POPs) in ambient air, human breast milk and edible fish - a potential for health risk in Ghana
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Levels of persistent organic pollutants (POPs) in rural and urban background air of southern Ghana were measured in 2008 using polyurethane foam (PUF) disks passive air samplers (PUF) (referred to as PUF disk samplers). The objective of this study was to quantify the levels of POPs in air in and to establish their baseline information for future monitoring and trend studies. This is the first comprehensive study reporting on levels of POPs in background or ambient air in Ghana covering the coastal zone and the middle belt. POPs in pooled and individual human breast milk samples collected from lactating mothers countrywide were also determined using a high-resolution gas chromatography interfaced with a high-resolution mass spectrometer (HRGC-HRMS). This constitutes the first comprehensive nationwide human breast milk study of assessing risks of HCHs for the general population of Ghana. The results of the study showed that the general population of Ghana is widely exposed to POPs although the current levels are generally low. POPs measured in selected edible fish from three freshwater bodies, namely Lake Volta, Lake Bosumtwi and Weja Lake in Ghana shows that there is a potential health risk from POPs for the general population of Ghana because fish is one of their important protein sources.

TU 271

Toxicity screening of fine particles by a novel microbial test battery
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Toxicity screening of fine particles by a novel microbial test battery.

Toxicity screening of fine particles by a novel microbial test battery.

Burning of wood for heating purposes has become extremely popular worldwide due to the increasing costs of fossil fuels. Claimed as renewable energy source, wood has often been ignored as a source for fine particles causing toxic effects. Rapid reproducible and validated biotests for toxicological characterisation of such particles exist neither for cells nor for microorganisms. Thus there is a need for established microscale toxicity screening of unknown combustion born particles. Here, we present the results of two ISO standardised bacterial contact assays and one yeast biotest modified for the use with fine dust. Having different endpoints these tests provide a toxicological “fingerprint”. In order to account for bioavailability of contaminants adsorbed on surfaces of fine particles, such tests were used as a whole not as extracts. Particle tester was smattered electrostatically from different furnaces in the flue gas channel. Suspended in water, vortexed for 1 min, and ultrasonicated for 15 min samples were applied in a concentration range of 0.001 - 1.0 mg/mL. Particle sizes (5-10 µm) in these suspensions were measured by dynamic light scattering. The control contained no particles, solely deionized water.

Growth in the aerobic Arthrobacter globiformis contact assay was determined via dehydrogenase activity (DHA). Genotoxicity was determined via Umu-Test using a genetically modified Salmonella strain. The Yes-Test was employed to determine potential estrogenicity of particle samples. Contrary to FP A, FP B exhibited cytotoxicity between 0.1 and 1 mg FP/mL. High contents of Zn supposedly caused cytotoxicity in B. FP A was slightly genotoxic (+9) at 1 mg/mL and potentially estrogenic. Besides PAs, other heterocyclic compounds might have caused this result. Further investigations are under construction. These preliminary results suggest suitability of endpoints determined in the modified tests for risk assessment of fine particles.

TU 272

Airborne particulate matter induced pro-inflammatory effects and oxidative stress in A549 cells
S. Michael, M. Montag, W. Dott

SETAC 6th World Congress/SETAC Europe 22nd Annual Meeting

343
The objective of this study was to compare the toxicological effects of different source-related particles in regard to their chemical composition. In this context we investigate reduced desorption into the human digestion juice. We conclude, that currently bioavailability of PAH from soils and sediments rich in coal, char coal and soot (sand), 10.2% ±5.4 (clay), 3.5% ±3.2 (peat) and 0.2% ±0.1 (char coal) may be.

The results show that the different geosorbents impact bioaccessibility as expected from the aqueous phase. Pyrene-D10 often showed highest bioaccessibilities: 45.5% ±11.1.

Apart from the classic gaseous pollutants airborne particulates continue to pose a significant threat to human health worldwide. It is generally known that sorption of PAH in the aquatic environment depends on the type and amount of organic carbon present [3], however, it is unclear if this is also the case of airborne particulates. The study was performed in natural environment.

In order to obtain results focusing on bioavailability faster, chemical methods are being developed to predict the amount of contaminant that can be taken up by a specific organism. Suitable methods have to simulate the respective exposure pathways and represent the bioavailable fraction of the contaminant. Extraction procedures for mineral hydrocarbons were regarded with respect to their suitability for simulating the bioavailable fraction for soil organisms. As effect parameter parameter the reproduction activity according to OECD Test Guideline 222 was selected. The test was performed in eight sandy soils that had been contaminated with mineral oil for many years. The results obtained in the earthworm studies were compared with the concentration of the mineral hydrocarbon contamination using different extraction procedures: (I) total content using exhaustive extraction (C10 - C40 fraction); (II) fraction of C10-C22 performing exhaustive extraction; (III) water based extraction - shaking procedure (IV) water based extraction - column procedure (V) water based extraction - use of an extra solid phase: HPCD.

In the present study, the reproduction activity according to OECD Test Guideline 222 was selected. The test was performed in eight sandy soils that had been contaminated with mineral oil for many years. The results obtained in the earthworm studies were compared with the concentration of the mineral hydrocarbon contamination using different extraction procedures: (I) total content using exhaustive extraction (C10 - C40 fraction); (II) fraction of C10-C22 performing exhaustive extraction; (III) water based extraction - shaking procedure (IV) water based extraction - column procedure (V) water based extraction - use of an extra solid phase: HPCD.

The best relation between an increased concentration of contamination and a reduced habitat function was detected for the C10-C22 fraction of the HPCD-extraction.

Some values surpass the National Guidelines for pesticides in freshwaters, pointing out the need of controls in addition to the evaluation of damage to aquatic biota.

The aim of this study was to develop a sensitive Gas Chromatography tandem Mass Spectrometry (GC-MS) method for the quantification of the most widely used pesticides at environmentally relevant concentrations and (b) test this method with water samples collected from the Suquía River, Córdoba, Argentina. Simulated soils and sediments have triggered a surface area in Argentina in the general use of pesticides, which are spread across soils containing both surface and ground-

Impact of geosorbents on bioavailability of polycyclic aromatic hydrocarbons to humans by oral uptake

In the present study the reproduction activity according to OECD Test Guideline 222 was selected. The test was performed in eight sandy soils that had been contaminated with mineral oil for many years. The results obtained in the earthworm studies were compared with the concentration of the mineral hydrocarbon contamination using different extraction procedures: (I) total content using exhaustive extraction (C10 - C40 fraction); (II) fraction of C10-C22 performing exhaustive extraction; (III) water based extraction - shaking procedure (IV) water based extraction - column procedure (V) water based extraction - use of an extra solid phase: HPCD.

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Relations with the C10-C40 fraction of the HPCD-extraction and with the C10-C22 fraction of the exhaustive extraction were less pronounced. No relation was observed for the C10-C40 fraction of the HPCD-extraction. It is generally known that sorption of PAH in the aquatic environment depends on the type and amount of organic carbon present [3], however, it is unclear if this is also the case of airborne particulates. The aim of the study is to show differences in bioaccessibility of PAH from single commonly occurring geosorbents. The results are expected to lead to a better understanding of variations in PAH bioaccessibility in natural site samples.

In this study, the geosorbents sand, clay, peat and char coal, which had been characterized in various previous studies, spiked with 16 deuterated EPA-PAH, were extracted with benzene and analysed by gas chromatography-mass spectrometry. The aim of the study is to show differences in bioaccessibility of PAH from single commonly occurring geosorbents. The results are expected to lead to a better understanding of variations in PAH bioaccessibility in natural site samples.

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In the present study the reproduction activity according to OECD Test Guideline 222 was selected. The test was performed in eight sandy soils that had been contaminated with mineral oil for many years. The results obtained in the earthworm studies were compared with the concentration of the mineral hydrocarbon contamination using different extraction procedures: (I) total content using exhaustive extraction (C10 - C40 fraction); (II) fraction of C10-C22 performing exhaustive extraction; (III) water based extraction - shaking procedure (IV) water based extraction - column procedure (V) water based extraction - use of an extra solid phase: HPCD.

The best relation between an increased concentration of contamination and a reduced habitat function was detected for the C10-C22 fraction of the HPCD-extraction.

Relations with the C10-C40 fraction of the HPCD-extraction and with the C10-C22 fraction of the exhaustive extraction were less pronounced. No relation was observed for the C10-C40 fraction of the HPCD-extraction. It is generally known that sorption of PAH in the aquatic environment depends on the type and amount of organic carbon present [3], however, it is unclear if this is also the case of airborne particulates. The aim of the study is to show differences in bioaccessibility of PAH from single commonly occurring geosorbents. The results are expected to lead to a better understanding of variations in PAH bioaccessibility in natural site samples.

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The best relation between an increased concentration of contamination and a reduced habitat function was detected for the C10-C22 fraction of the HPCD-extraction.

Relations with the C10-C40 fraction of the HPCD-extraction and with the C10-C22 fraction of the exhaustive extraction were less pronounced. No relation was observed for the C10-C40 fraction of the HPCD-extraction. It is generally known that sorption of PAH in the aquatic environment depends on the type and amount of organic carbon present [3], however, it is unclear if this is also the case of airborne particulates. The aim of the study is to show differences in bioaccessibility of PAH from single commonly occurring geosorbents. The results are expected to lead to a better understanding of variations in PAH bioaccessibility in natural site samples.

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The best relation between an increased concentration of contamination and a reduced habitat function was detected for the C10-C22 fraction of the HPCD-extraction.

Relations with the C10-C40 fraction of the HPCD-extraction and with the C10-C22 fraction of the exhaustive extraction were less pronounced. No relation was observed for the C10-C40 fraction of the HPCD-extraction. It is generally known that sorption of PAH in the aquatic environment depends on the type and amount of organic carbon present [3], however, it is unclear if this is also the case of airborne particulates. The aim of the study is to show differences in bioaccessibility of PAH from single commonly occurring geosorbents. The results are expected to lead to a better understanding of variations in PAH bioaccessibility in natural site samples.
Reduced (e.g., historical pollution), sediments can become a secondary source to their surrounding environment. As a result of the challenges encountered when attempting to predict contaminant bioavailability and mobility, gauging the risk posed by these contaminated sediments remains challenging.

In an effort to control and reduce the impact of contaminated sediment on ecosystems and human health, a risk assessment guideline tool for contaminated marine sediments was developed and evaluated using a validation study. In many real-life scenarios, overestimating the risk posed by these sediments as a result of much stronger partitioning to organic phases in the sediment than commonly assumed. Therefore tools to estimate contaminant bioavailability in sediments, bioaccumulation potential and risk of transfer to the overlying water fase are needed. This test can be used to predict the potential bioavailability of contaminants from historically polluted sediments using simple sorption models and from freely dissolved pore water concentrations measured with passive sampling. Freely dissolved pore water concentrations were measured in batch experiments in the laboratory using low density polyethylene (LDPE). In vivo exposures were carried out using Nereis virens and Hinia reticulata.

**TU 281**

**Bringing (bio)accessibility extraction to the next level - combining mobilisation medium and infinite absorption sink**

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**Soil bioaccessibility extraction techniques are generally simple dissolution experiments, where the fraction of compounds that is transferred from the solid to the medium is measured and considered to be bioaccessible. However, such techniques can lead to an overestimation of bioaccessibility, since they do not account for the consumption of contaminants by either the intestinal tract or the colon. It is therefore crucial to develop practical bioaccessibility extraction approaches that combine both mobilisation and consumption processes. The mobilisation medium can be chosen to either maximize desorption without attacking the matrix or even to simulate the relevant organism conditions. A sorbit sink can act as an infinite diffusion sink for continuously removing the mobilized contaminants from the medium.**

In the analysis of the non-accessible PAH fraction, the absence of pronounced ageing effects in PAH-spiked, aged soils was noted. After 56 days of desorption time, a distinct ageing effect was observed in PAH-spiked, aged soils, which was not found in non-aged soils.

**References**


(2) Gouliarmou, V.; Smith E.C.K.; de Jonge L.W.; Mayer, P., Measuring binding and speciation of hydrophobic organic chemicals at controlled freely dissolved concentrations and without phase separation, SUBMITTED.

**TU 282**

**Is there sufficient ‘sink’ in current bioaccessibility determinations of organic pollutants in soils?**

C. D. Collins1, M. A. L. Kendler2, P. Mayer2, V. Gouliarmou

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2University of Reading, Reading, United Kingdom

**Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous environmental organic pollutants, a number of which are known carcinogens. Soils are the major environmental sink for PAHs and it has been estimated that over 90% of the U.K. PAH burden resides in soil. Total pollutant concentration is frequently used in the assessment of risk posed by contaminated land to human health. However, it has been widely established that such an approach may significantly overestimate the amount of pollutant absorbed by humans resulting in an overestimation of risk. One main pathway for human exposure to contaminated soils is direct ingestion as a result of hand-to-mouth activity. To address a number several in vitro physiologically-based extraction tests have been proposed for metal and organic pollutants. In recent work we developed a colon extended physiologically-based extraction test (CBPET), this enhanced the bioaccessibility of PAH compared to a two compartment, i.e. stomach and small intestine, model. Whereas the current work was to combine the CEPET bioaccessibility test with a charcoal contaminant trap in order to maintain a full diffusion gradient for, P. Mayer et al. (2011).**

**Bioavailability studies: the last available tools for evaluating PAH risks realistically**

B.H. Magee, G.C. Hoeger

ARCADIS, Chelmsford, United States of America

**Polycyclic aromatic hydrocarbon (PAH) risk assessment is currently overly conservative in the U.S., with Screening Levels that are orders-of-magnitude below anthropogenic background in most urban areas. Additionally, the United States Environmental Protection Agency (USEPA) is proposing to increase the Relative Potency Factors (RPFs) for 7 PAH and to increase the number of carcinogenic PAHs with RPFs from 6 to 26. Several proposed RPFs are 10x or greater including dibenzo[a,l]anthracene (10x), benzo[a]pyrene (20x), dibenzo[a,h]pyrene (30x), and benzo[e]pyrene (60x). If this approach is adopted, human health risks from exposure to PAHs will increase considerably, and risk-based clean-up levels will drop to below background even for commercial/industrial receptors and a 1x10-4 risk level. It is clear from the literature that the mammalian bioavailability of PAH from weathered soils/sediments is considerably less than 100%. Agencies in the U.S. have increasingly rejected the use of bioavailability adjusted screening level studies for PAHs over the past years. The literature, USEPA has recently supported a policy of performing in vivo bioavailability studies of site-specific media impacted by complex organic compounds. The authors have designed such an in vivo study and are seeking its regulatory approval for execution in 2012. This paper will summarize literature bioavailability results for PAHs and discuss methodological issues regarding the on-going study, which is a robust, internally consistent animal bioavailability study with site specific media.**

**Polycyclic aromatic hydrocarbons (PAH) are priority pollutants of soil and groundwater in many countries. Prolonged contact time of PAH and soil constituents may lead to potential risk assessment tool. To evaluate PAHs and risk assessment of sites of PAH contaminated soils. PASSAGE**

**TU 284**

**Desorption-resistant fraction in PAH-contaminated soils: aged spiked soils can not represent historically contaminated soils**

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1University of Natural Resources and Life Sciences Vienna, Austria, Tulln, Austria

2CSIRO, Adelaide, Australia

**Aarhus University, Department of Environmental Science, Roskilde, Denmark**

**Polycyclic aromatic hydrocarbons (PAH) are priority pollutants of soil and groundwater in many countries. Prolonged contact time of PAH and soil constituents may lead to potential risk assessment tool. To evaluate PAHs and risk assessment of sites of PAH contaminated soils. PASSAGE**

**TU 285**

**Highways versus pipelines - modelling the contributions of two fungal transport mechanisms to efficient bioremediation**


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**Based on experimental studies, two fungus-mediated transport mechanisms have been suggested to facilitate bacterial degradation of organic soil contaminants: bacteria may use liquid films around fungal hyphae for quick dispersal ('fungal highways'), and fungi may take up and translocate contaminants through their mycelial network ('fungal pipelines'). Both mechanisms promise to enhance the bioavailability of contaminants to degrading bacteria. However, a comparative study of their respective**
efficiency in increasing biodegradation performance, and its dependence on environmental conditions, has hitherto not been conducted. Using a microbial simulation model, we therefore investigate bacterial degradation performance in response to networks that either act as bacterial dispersal vectors (‘highways’) or as contaminant translocation vectors (‘pipelines’) or as a combination of both. We analyse biodegradation improvements compared to the situation without networks, and systematically test a variety of spatially homogeneous and heterogeneous PAH distributions. In turn, we investigate whether the association between bacteria and fungi is sufficient to enable a combination of both mechanisms. We therefore conclude that ‘fungal highways’ as well as ‘fungal pipelines’ should be considered for developing novel bioremediation strategies based on fungus-mediated transport. Future experimental studies should focus on detection and appropriate stimulation of the two mechanisms in typical bacteria-fungi associations in contaminated soils.

TU 286

Influence of rhizosphere oomycte mycelia on bacterial biodegradation of phenanthrene present in nonaqueous-phase liquids (NAPLs)

E. C. Congiu, J. J. Ortega-Calvo

Instituto de Recursos Naturales y Agrobiología, Sevilla, Spain

We have developed a new combination of analytical techniques (synchronous fluorescence spectrometry, scintillation counting) to establish the dynamics of pyrene and other PAHs in the aqueous phase of soils with P. oligandrum mycelia. We suggest that fungal growth on biodegradable NAPL mixtures may promote the bacterial colonization of the NAPL/water interface, possibly by promoting cell adhesion and/or causing interface destabilization, thus increasing the bioavailability of PAHs for bacteria.

TU 287

Sunflowers in rhizoremediation: a possible alternative for improving the bioavailability of PAHs in soils

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The study was performed on sunflower seeds in greenhouse experiments under laboratory conditions. The results indicate that the establishment of an appropriate chemical activity gradient is critical for a positive or negative influence of HS on biodegradation.

TU 288

Combining synchronous fluorescence, liquid scintillation and passive dosing for studying the bioavailability of pyrene in the presence of dissolved humic substances

C. E. Congiu, J. J. Ortega-Calvo

Instituto de Recursos Naturales y Agrobiología de Sevilla, Sevilla, Spain

We focus in modulating the deposition and motility of degraders in porous media as a bioavailability-promoting strategy. The positive effects of - often energy-consuming mobilization approaches in bioremediation depend on the efficiency of bacterial movement in porous media, which is often restricted by high deposition rates and adhesion to soil surfaces. Besides, adhesion to surfaces may be sometimes beneficial in promoting biodegradation of slowly-desorbing chemicals. In well-controlled batch systems, we assessed the influence of 14C-labeled PAHs present in soil. Desorption kinetics of 14C-labeled PAHs from soil were performed by Tenax solid-phase extraction and compared to mineralization kinetics by a PAH-degrading soil bacterium (Mycobacterium gilvum VM532) in the presence of sunflower root exudates. Results indicated that the promising effects of biodegradants on biodegradation were accentuated in soils exhibiting a slow-desorption profile. Given the biodegradable and nonionic nature of biodegradants, their use constitutes a promising alternative for promoting bioavailability of this ‘resistant’ fraction in a sustainable way.

TU 290

Bacterial taxa and sustainable remediation: effects on bacterial dispersal

C. J. S. Jimenez-Sanchez, J. J. Ortega-Calvo

Institute of Natural Resources and Agrobiotechnology of Sevilla (IRNASA), Sevilla, Spain

We focus in modulating the deposition and motility of degraders in porous media as a bioavailability-promoting strategy. The positive effects of - often energy-consuming mobilization approaches in bioremediation depend on the efficiency of bacterial movement in porous media, which is often restricted by high deposition rates and adhesion to soil surfaces. Besides, adhesion to surfaces may be sometimes beneficial in promoting biodegradation of slowly-desorbing chemicals. In well-controlled batch systems, we assessed the influence of 14C-labeled PAHs present in soil. Desorption kinetics of 14C-labeled PAHs from soil were performed by Tenax solid-phase extraction and compared to mineralization kinetics by a PAH-degrading soil bacterium (Mycobacterium gilvum VM532) in the presence of sunflower root exudates. Results indicated that the promising effects of biodegradants on biodegradation were accentuated in soils exhibiting a slow-desorption profile. Given the biodegradable and nonionic nature of biodegradants, their use constitutes a promising alternative for promoting bioavailability of this ‘resistant’ fraction in a sustainable way.

TU 291

Behavioural responses of Tetrahymena pyriformis exposed to microgradients of hydrophobic organic chemicals

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Biochemical changes of microorganisms may reveal subterfuge adverse effects of hydrophobic organic chemicals. Using them as an endpoint requires, however, that the organisms can be observed microscopically during exposure. We therefore applied passive dosing on microscope slides as a new experimental platform to study the effect of selected polyaromatic hydrocarbons (PAHs) on the behaviour of the ciliate Tetrahymena pyriformis. Motile cells and organisms that are able to sense chemical signals may direct their movement along concentration gradients of a chemical, a behaviour known as chemotaxis. T. pyriformis was therefore exposed to various PAH-gradients and the swimming behaviour of the cells was then recorded under infra-red light illumination. Trajectories of the cells were obtained using an automated cell tracking software and were subsequently analyzed for chemotactic effects by statistical measures. The Taylor model, which mathematically describes the scale-dependent transition from ballistic to diffusive movement, was used to obtain first motility parameters such as the tumbling frequency and effective swimming velocity to evaluate changes in the swimming behaviour of the cells. The results did not reveal chemotactic behaviour of T. pyriformis in the concentrations gradients of the compounds tested. However, motility behaviour was affected at levels that were about two orders of magnitude below the reported effective chemical activity causing 50% lethality, emphasizing that behavioural responses are a sensitive endpoint in toxicity testing.

TU 292

Sorption of ionized and polar contaminants to natural dissolved organic matter

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Concentrations of dissolved organic matter (DOM) have been rising in the environment over the past decades due to climate change and decreases in acid rain. The transport potential of DOM can be altered by DOM concentrations in surface water. It is therefore relevant to gain more insight into the mechanisms of organic contaminant sorption to DOM. In this study, the interactions between polar organic contaminants (neutral and ionized forms) and DOM were studied to assess the
influence of charge and molecular structure on the sorption process. Representative emerging contaminants were selected, covering hormones, pharmaceuticals, personal care products, and pesticides. Batch sorption studies were conducted with natural DOM-containing water samples obtained from Finland, United Kingdom, and the Netherlands and by using polycarbonate syringes to determine aqueous contaminant concentrations. The DOM samples were characterized by chemical and physical fractionation methods to elucidate the charge and hydrophobicity of the DOM and to determine the sorption to both DOM and polystyrene. Positively charged compounds showed a strong pH dependent sorption to DOM, whereas the neutral forms were the most important species responsible for sorption to polystyrene. Negatively charged compounds showed the lowest affinity to both DOM and polystyrene. For most neutral compounds investigated, the water phase represented a more favorable medium compared to DOM. The obtained results may increase our knowledge of the sorption of polar organic contaminants to DOM, which is currently based on only limited data.

TU 283

Binding can increase the mobility of hydrophobic organic compounds
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2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) as a representative of hydrophobic organic compounds (HOCs), frequent anthropogenic environmental pollutants comprising also many other pesticides and many other compounds. TCDD can be very important mechanism of toxicity for so called “dioxin-like” HOCs. Natural organic matter (NOM), being naturally occurring compounds (up to 50 mg/L in waters), occurs together with HOCs in contaminated water.

TU 284

Dynamic passive dosing for studying microbial PAH degradation: a comparison of experimental and model results
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TU 285 Enhanced mass transfer of hydrophobic organic compounds from NAPLs into the aqueous phase by dissolved organic carbon
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Hydrophobic organic compounds (HOCs) are often found as mixtures in the form of non-aqueous phase liquids (NAPLs). Due to their hydrophobic nature, the HOCs preferentially remain in the NAPL with slow mass fluxes into the aqueous phase. However, since water dissolved HOCs play a key role in diffusive uptake into organisms, microorganisms using HOCs as a source of carbon and energy face a large reservoir of inaccessible food in the NAPL which is often reflected in slow bioremediation of NAPL contaminated sites. Interestingly, mobile “colloidal-like” phases can contribute to diffusive mass exchange processes between surfaces and the bulk aqueous phase, a phenomenon termed enhanced or facilitated diffusion. Therefore, this study investigated the role of dissolved organic carbon (DOC) in enhancing the mass transfer of hydrophobic organic compounds from NAPLs into the aqueous phase above that attributable to dissolved molecular diffusion alone. In controlled experiments, mass transfer rates were increased by up to a factor of four in the presence of DOC, with the greatest enhancement being observed for the most hydrophobic compounds and highest DOC concentrations. These increases could not be explained by dissolved molecular diffusion alone, and point to a parallel DOC-mediated diffusive pathway. The nature of the DOC-mediated diffusion pathway was investigated using DOC concentration diffusion-based models, and found to increase with DOC concentration and compound sorption. For “super”hydrophobic compounds this pathway could both dominate but also increase mass transfer rates by orders of magnitude, even at environmental DOC concentrations. This has important implications for their bioremediation, as well bioconcentration and toxicity.

TU 296

On the effect of vitamins and nutrients on the solubilization of petrodiesel/biodiesel blends in water
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The solubility of minerals in the aqueous solution of non-electrolytes is largely assumed to exhibit the “salting out” or “salting in” effects in which the aqueous solubility of non-electrolytes is decreased or increased upon the addition of salts. Pioneering investigations by Svecsekmova [1] and later by Carter and Hardy [2] among others, resulted in semitheoretical relationships that describe the dependence of the solubility of non-electrolyte solutes on salts concentrations. We conducted equilibration experiments of petrodiesel/biodiesel blends (B0, B20, B40, B60, B80, and B100, where B100 is 100% biodiesel) in water in the presence and absence of standard vitamins and nutrients used for bacterial growth studies. The solubility of aromatic compounds was found to be in agreement with the salting out effect in the presence of the added nutrients. The solubility of aromatic compound in N-alkanes, however, complex behavior was found to be significantly enhanced (p < 0.005), up to 4-fold in the presence of the fatty acid methyl esters (FAMEs) and the vitamins and nutrients medium, compared to FAMES and deionized water alone. A similar observation was made by Baker [3] regarding the effect of salts on solubilization of the alkanes and aromatic compounds in the presence of fatty acid soap solution. They reported that, in the presence of soap solution, the solubility of the n-alkanes in dilute fatty acid soap is markedly higher and that of aromatic hydrocarbons is lower. These observations are found to contribute significantly to the bioavailability of the n-alkanes in the water column. Biodegradation studies conducted in our laboratory showed significant enhancement for the microbial utilization rates of the n-alkanes in the petrodiesel/biodiesel blends, which we interpret to be due to the increase in aqueous concentrations of the n-alkanes in the presence of the FAMES and nutrients.

References
solutions were irradiated by sun light in quartz tubes for up to 3 days. Photo-degradation of TCDD studied by in vitro assay (based on the H4IIE-luc transgenic cell line) was observed, but both TCDD alone and TCDD in mixtures with low concentrations of NOM (up to 10 mg/L) were photo-degraded in almost the same half-lives. High NOM concentrations (25-150 mg/L) have significantly extended the half-lives of TCDD photo-degradation, probably due to filter effect of more coloured solutions. Supported by project PETOCDEN (European Regional Development Fund no. CZ.1.05/2.1.00/01.0001).

**TU 298**

Influence of sorption on biodegradation of secondary alkane sulfonates (SAS) in marine sediments

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Coastal areas are often influenced by wastewater discharges from surrounding populations. Surfactants, with a worldwide production over 10 million tons per year, are among the organic contaminants showing highest concentrations in wastewaters. Some studies have addressed the interaction of these wastewater pollutants with environmental matrices, such as sediments and surface waters, but the role of biodegradation processes or their dynamic changes in the marine environment is not yet well known.

Iodinated X-ray contrast media (X-RCM) occur in concentration ranges of several hundred ng/L in many surface waters used for drinking water production. To clean up surface water, sustainable water treatment techniques like riverbank filtration or artificial groundwater recharge (AGR) are used, but some X-RCM like amidotrizoic acid are known to be very persistent. Due to the sorption tendency of X-RCM [1], their fate is rather related to biodegradation, as proved by the detection of metabolites reported in literature [2]. To simulate the process of AGR, the fate of six iodinated X-ray contrast media octyl-substituted acid, isoxeol, isomeanol, isomaditrizoic acid and iodipamide was studied during percolation of a sandy gravelly substrate in a column percolation experiment using filtered surface water from the Rhine. The question of interest was whether elevated DOC would improve or impair the removal of X-RCM during the column passage. Therefore, filtered Rhine water used for column percolation was spiked with concentrated aqueous saccharose solution to achieve elevated DOC and to simulate the pollution of the Rhine with low molecular organic compounds, e.g. from food industry and animal accidents. Weighted composite samples of column influent and effluent were analysed for X-RCM and DOC and treatments with and without saccharose amendment.

Moderately elevated DOC (1.3-fold of background) stimulated isoxeol removal, but for most X-RCM there was no effect. In contrast, twenty-fold elevated background DOC impaired the removal of most X-RCM, while there was a tendency towards higher DOC load, as the fate of isomaditrizoic acid was reported to depend on site-specific redox conditions at several field sites in literature [1].

Regarding the removal of X-RCM, moderate pollution of surface waters with low molecular organic compounds can thus be compensated by natural water treatment like AGR, but excess pollution will reduce the cleaning capacity of the systems and must be avoided.

**Literature:**


Acknowledgement: We thank IWBI Basel for funding and support.

**TU 301**

Effect of pH and electrolyte concentration on soil adsorption of pesticides

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The Japanese Positive List System for Agricultural Chemicals was implemented in 2006. Under this system, the uniform limit was set at 0.01 mg/kg for agricultural chemicals for which maximum residue limits (MRLs) have not been established. Since then, several vegetable crops at levels above the uniform limit, and the distribution of these crops has been prohibited. One of the reasons why the limit has been exceeded is that succeeding crops are contaminated by pesticides remaining in the soil. Assuming that these pesticides in the soil are taken up by plants via the soil solution, an understanding of the soil-water distribution of the pesticides is important to predict crop pesticide residues. Soil adsorption of nonionic pesticides is strongly influenced by soil organic matter content. However, there is little information available on the influence of soil pH and electrolyte concentrations, changed by chemical fertilizer treatment, on pesticide adsorption. We therefore used batch experiments to investigate the effects of these factors on the distribution coefficient for adsorption (Kd) of about 30 pesticides. We used buffer solutions (pH 3, 5, 7, 5 and 9) and CaCl2 solutions (0.01, 0.1, and 1 mol/L) and compared with different organic matter contents. Each soil was shaken with an aqueous solution containing 0.1 mg/L of pesticide at a soil-to-solution ratio of 1 to 5, with a 24-h equilibration period for all experiments. Increasing the CaCl2 concentration from 0.01 to 0.1 mol/L had no significant effect on soil adsorption of pesticides, but the Kd values with 1 mol/L CaCl2 solution were slightly higher than those at the other two concentrations. Pesticide adsorption has been reported to be pH-dependent. In general, Kd values were negatively correlated with pH levels, and the rate of Kd change, calculated by dividing the Kd values at pH 3 by those at pH 9, was greater in the case of soils with higher organic carbon contents and of pesticides with higher octanol/water partition coefficient (log Kow). The results suggest that the hydrophobic interactions between pesticides and soil organic matter are influenced by pH levels. Further, it is implicated that crops can take up the pesticide from soil at high pH compared with at low pH.

**TU 302**

Relationships between soil adsorption of pesticides and pesticide/soil properties

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The positive list system for pesticide residue in food, such as crops, was applied in Japan in 2006. For pesticides for which maximum residue levels were not set, the residue levels in food must not exceed 0.01 mg/kg (uniform limit), Pesticides, which are applied to foliage and soil at the crop cultivation, remain in soil after harvest, and pesticides remaining in soil may contaminate the succeeding crop. Pests, for which growing cycle is short, are rotated in Japan. Therefore, the residue levels of some pesticides in succeeding crops have exceeded 0.01 mg/kg in Japan. To prevent excess of the residue level 0.01 mg/kg in the succeeding crop, the succeeding crop must be cultivated in consideration of bi(1) the physicochemical properties of pesticides applied to the preceding crop, 2) the soil properties affecting the pesticide residue in soil, and 3) the pesticide’s uptake into the succeeding crop.

The succeeding crop may take up the pesticide in soil solution from the root or stem as a kind of a pesticide’s uptake into the crop. Data on the distribution of a pesticide in soil/solution (pesticide soil adsorption) is important for assessing the risk of pesticide contamination of the succeeding crop. Soil adsorption of nonionic pesticides

348

SETAC 6th World Congress/SETAC Europe 22nd Annual Meeting
is influenced by organic carbon content in soil, however, there are few investigations on influence of pesticide and soil properties except organic carbon content on the adsorption of pesticide in soil.

The present study conducted batch experiments with approximately 30 pesticides and 7 soils in Japan to determine their soil adsorption coefficients (Kd values). The results of relationships between Kd values and pesticide/soil properties will be presented.

**TU 303**

Leaching of aged DDTs and current use pesticide residues in undisturbed soil columns: non-ionic surfactant and carboxylic acids effects

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Soil pollution by Persistent Organic Pollutants such as DDTs (p,p′-DDE and its metabolites p,p′-DDE and p,p′-DDE) represents a continuous source to the environment. As a consequence of their high persistence DDTs occur up to 60 cm on agricultural soils. The Current Use Pesticide (CUP) endosulfan is characterized by its high lipoviscous potential, which makes it susceptible to soil-irrigation or irrigation events as well as plant growing may modify pesticide availability and leaching. Surface waters receive discharges from industrial, urban and agricultural uses that will account for a variety of compounds such as surfactants, cottons and dissolved organic carbons. This work studies the vertical distribution and movement of aged DDTS and endosulfan in undisturbed soil columns irrigated with: 1-Control (riverine water), 2-Tw-80 (riverine water + Tween 80 0.5 cmc), and 3-acids (riverine water + sodium citrate and sodium oxalate, 0.05 M).

Experiments were carried out with 13 x 30 cm soil columns taken from Aridisol soils from a fruit field in Patagonian, Argentina. Columns were saturated with distilled water and solutions (4L) were added under saturated condition. One L leachates (n=4) were collected for pesticide residues analysis. After elution, columns were dried (24 h), opened and sampling on 5 cm sections. Pesticide desorption was performed by batch technique and residues analysis. 24 h dry weight in control, Tw-80 and Acids, respectively. Under all conditions pesticide levels decreased concomitantly with depth and sand increase. In control and Acids, p,p′-DDE and p,p′-DDE desorption from soil was greater than in Tw-80 (p<0.05). Under control or Acids, o-endosulfan was the main compound on the first elution volume and p,p′-DDE started to lixivate after 2 L while for Tw-80, DDE represents the main elution in all eutunations.

**TU 304**

Sorption of cationic organic compounds to soil as the sum of soil components

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Many emerging contaminants are strong bases that under environmental conditions mostly occur as cationic species. The environmental fate of these compounds depends on their affinities to natural organic matter, soil, sediment and dissolved colloids. Since both natural organic matter and clay minerals are negatively charged substrates, both sorption types are well known to bind organic contaminants, but it is not clear to what extent each type contributes in natural soils. Using a customized dynamic HPLC column retention method, we studied the sorption of a set of organic cations to soil components, such as natural organic matter (NOM, Pahokee peat) and pure clay minerals (smectite, illite).

In addition, experiments were carried out to investigate the influence of different soil properties on the sorption behavior of different cationic compounds. The results show that the sorption behavior of different compounds as well as the influence of different soil properties on the sorption behavior of different compounds depends very much on the chemical properties of the compounds which are target for the sorption to natural soil.

**TU 305**

Degradation of UV filters in sewage sludge by the lignonolyllic fungus Trametes versicolor and study of the 4MBC degradation process in liquid medium

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Sunscreens agents, also known as UV filters, have become very popular chemicals since they were shown to have a protective role against photaging, photocarcinogenesis and photoimmunosupression promoted by UV sun radiation. These compounds are extensively used in personal care products but are also present in a wide variety of industrial goods such as paints, paints, or plastics to prevent photodegradation of polymers and pigments. UV filters can enter the environment through the liquid effluent of wastewater treatment plants (WWTPs) but also absorbed in the sludge due to their high hydrophobic character, and later spread on agricultural fields. A solid-state treatment of wastewater produced by fungi Trametes versicolor is reported in the present work as feasible to degrade them in a range from 87 to 100%. This experiment is the first step of any future fungal treatment, essential to prove that the elimination is only due to the action of the fungus and not of other microorganisms as the sludge was previously degraded.

Degradation studies of 3-(4'-methylbenzylidene) camphor (4MBC) in liquid medium were also done in particular and complete removal was achieved in less than 24 h. The main metabolites identified and the first steps of the transformation pathway were elucidated: a mono- or di-hydroxylation by cytochrome P450 and the subsequent conjugation with a pentose. These results support the extended hypothesis that conjugation processes constitute one of the defensive mechanisms that fungi activate against toxic hydroxylated compounds.

**TU 306**

Concentration levels of phthalates in water and sediment samples from Nadela river basin, Vojvodina region

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Phthalates belong to the group of dominant industrial pollutants and are ubiquitous overspread class of compounds with low water solubility/high fat solubility and low volatility. Due to their low water solubility, the phthalates hydrolyse relatively slowly, but the actual dynamic rate varies according to temperature, concentration and solution medium. Among the phthalates diethyl phthalate (DEP) and dibutyl phthalate (DBP) are the predominant congeners in many environmental samples, especially in soils. For the highest concentrations of DEHP are found in products for flooring, foil and plastic-coated fabrics. Phthalates are also included as plasticisers for binders in different kinds of paint and adhesives. Within the Project the concentration levels of phthalates in water and sediment from Nadela River were determined. Nadela basin is situated near city of Pancevo, Vojvodina region, and is covered by numerous industrial sites and can represent the significant source of these pollutants. This field survey was done in 9 sampling sites in the catchment area of the Nadela in the early spring 2009. The laboratory work was supported by Ministry of Education and Science, Republic of Serbia (III46009 and TR43041).

The work was supported by Ministry of Education and Science, Republic of Serbia (III46009 and TR43041).
TU 308
Polycholoro-dioxins, furans and biphenyls in fish, crabs and clams from the San Jacinto River Waste Pits, TX
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Fish, crabs, and clams were collected from the San Jacinto River waste pits, a superfund site in Houston, TX and analyzed for polychlorodibenzo-p-dioxins, polychlorodibenzofurans (PCDD/DFs) and dioxin like polychlorobiphenyls (dl-PCBs). Sample preparations comprised of tissue homogenization, enhanced pressurized liquid extraction (PLE), derivatization, liquid-liquid extraction, concentration, and gas chromatography/mass spectrometry. Data were corrected for recovery losses by use of an internal standard. Analyses were carried out using gas chromatography negative chemical ionization mass spectrometry. The method detection limits ranged from 2.0 to 10 pg/g ww in tissues. Ten out of twelve priority dl-PCBs (Identified by World Health Organization, 2005) were measured with concentrations ranged from 2.0 to 948 pg/g WW. Average PCDD/Fs concentrations were at least an order of magnitude higher than that of PCDD/Fs. Average PCDD/Fs fish tissue concentrations were at least an order of magnitude than that of crabs and clams. TEQanalyses were found to be at least 25X higher than TEQdioxins. Biomagnifications studies and Biota Sedimentation Accumulation Factors were also calculated.

TU 309
Effect of humic substances on remediation of soil: phosphogypsum mixtures
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3Phosphogypsum (PG) is produced as a result of production of phosphoric acid. Due to high content of nutrients (calcium, phosphorus and sulfur) it is sometimes used as a fertilizer for poor unfruitful soils. But besides nutrients, PG also contains toxic impurities, such as fluorine, strontium and some others. One of contemporary approaches to reduce the ecotoxicity of polluted soils and soil PG treatments is to add phosphogypsum mixtures of phosphogypsum and humic substances (HS). The objective of this study was to evaluate the detoxifying ability of a number of plant species towards PG applied to model soils mixtures. Model soil (MS) contained (wt, %) 20% of kaoline, 10% of peat and 70% of sand with particle size 0.2-0.4 mm (ISO 11268-1). PG was carefully mixed with MS at concentration 3.3 and 7.5 wt. %. Humates from humic acid preparations were added to a concentration of 0.005 and 0.020 wt, %, respectively. The ecotoxicity was evaluated in water extracts using three species of test-organisms from different taxonomic groups: microalgae Scenedesmus quadricauda (increase of cells population growth, 72h), crustaceans Daphnia magna (mortality, 96h), and higher plants Sinapis alba (root elongation delay, 120h). Toxic parameters (EC50, median PG concentration that caused a 50% test-reaction reduction, and NOEL - no observed effect level - the PG-concentration that caused test-reaction reduction below the toxic level) and detoxification indexes D were calculated. Analyses of average detoxification indexes D (averaged over three test-organisms) showed that influence of humates depended both on PG concentration and humates' nature. Thus, application of PG at concentration 7.5 wt. % was toxic for all the test-organisms at all preparations and humates were not able to decrease the toxicity. At lower rate of PG (3.3 wt. %) some humates decreased the toxicity (D = 0.5-0.8), whether other did not. Among all humates tested the highest detoxifying ability was observed for ornamental potato, from peat and BC-PG from coal. For these humates EC50 and NOEL values increased in 1.3-1.8 times for D. magna, in 1.6-2 times for S. alba for 0.005 wt. %, humates content.
Acknowledgement - This research was supported by Russian Federal Science (GK 02.740.11.0693), Russian Foundation of Basic Research (project 10-04-01681)

TU 312
Birds versus crops: A GIS-based procedure to identify specific combinations
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Regulation (EC) No 1107/2008, applied from 14 June 2011, requires new data protection rules for both active substance and product data and, for the first time, includes data protection for extension of authorisations to minor uses. Moreover, rules for either avoiding duplication or sharing tests and studies involving vertebrate data have been included. Arinam, a particular study, introduced new vertebrate data sharing provisions which allows Member States to use vertebrate studies on behalf of prospective applicants if an agreement with the holder of the authorisation cannot be reached.
Considering birds, the species currently used in risk assessment are the ones considered the most sensitive to all pesticides. This approach, which can be considered a good model approach, could be useful to introduce new vertebrate data sharing provisions which allows Member States to use vertebrate studies on behalf of prospective applicants if an agreement with the holder of the authorisation cannot be reached.
In this work a realistic approach has been developed to correlate the avian population at local level, derived from a monitoring survey, with the land-use (Corine land-cover) and the relative pesticide treatments.
A GIS analysis was performed to identify peculiar combinations crop/bird species in order to determine which species is most likely to be exposed to a specific active substance.
The area considered was the North of Italy characterised by an intensive agriculture and a consequently high load of pesticides. These results could be a useful tool to address the uncertainty associated to the bird risk assessment.

TU 313
Toxicity of sludge water treatment station for aquatic invertebrates
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The water treatment stations (WTP) are worldwide operating in order to treat and deliver potable water from untreated river water. A large quantity of sludge is generated in the water treatment process, which contains suspended solids, bacteria, heavy metals and others toxic substances present in the untreated water. The amount of sludge generation in treated water is directly proportional to the amount of treated water, a WTP that treat 1500 L/s of water generates approximately one ton of sludge/day, which contains many toxic substances such as copper, lead, zinc, arsenic, cyanides, heavy metals and others toxic substances present in the untreated water. Copper and cyanides are dangerous to aquatic organisms, both in the environment and in the laboratory for fish and experiment. The method detection limits ranged from 2.0 to 10 pg/g WW in tissues. Ten out of twelve high priority dl-PCBs (Identified by World Health Organization, 2005) were measured with concentrations ranged from 2.0 to 948 pg/g WW. Average PCDD/Fs concentrations were at least an order of magnitude higher than that of PCDD/Fs. Average PCDD/Fs fish tissue concentrations were at least an order of magnitude than that of crabs and clams. TEQanalyses were found to be at least 25X higher than TEQdioxins. Biomagnifications studies and Biota Sedimentation Accumulation Factors were also calculated.

TU 314
Inhibition of the fatty acid synthesis in chlorophytes by triclosan - a metabolomics approach
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Triclosan is an antimicrobial substance which is used in many pharmaceutical and personal care products such as soaps, toothpaste and mouthwash. -Because of this broad use, triclosan is continuously excreted into the environment which may have negative effects on aquatic organisms. In the present study, the effect of triclosan on the freshwater green alga Scenedesmus quadricauda was investigated. In order to study the effect of triclosan on cellular metabolism, a metabolomics approach was used. The alga was exposed to increasing concentrations of triclosan for 14 hours to derive concentration-dependent changes in metabolites and to be able to compare these changes to phenotypic observations (inhibition of cell reproduction and detect stress responses using biomarkers of effect in the freshwater pulmonate snail Physa acuta exposed to copper sulfate in laboratory conditions. A 14-28 days chronic test was conducted using adult snails in 5 different copper concentrations showing that reproduction was impaired as the concentrations increased. Biomarkers activity (e.g. AChE, GST and CAT) and energy reserves were determined and correlated with reproduction. As expected the energy cost allocated to the detoxification process was one of the reproduction impairment causes.
Aqueous snails, like Physa acuta, have proved to be good test organisms to assess the presence of chemicals in the environment as they have proven to be very sensitive to exposure.

TU 315
Inhibition of the fatty acid synthesis in chlorophytes by triclosan - a metabolomics approach
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Triclosan is an antimicrobial substance which is used in many pharmaceutical and personal care products such as soaps, toothpaste and mouthwash. Because of this broad application it has been detected in streams, seawater and sediments in concentrations up to 0.007 µmol L-1 [Singer et al., Environ. Sci. Technol., 2002.; In a prior study Franz et al., Environ. Sci. Technol., 2008. observed that chlorophytes are one of the most sensitive organisms affected by triclosan in the range of environmental concentrations. This raises the question of metabolic pathways affected by triclosan in chlorophytes. We used an established metabolic approach to analyse the effect of triclosan on the fatty acid synthesis pathway in the freshwater green alga Scenedesmus. This study was conducted using adult snails in 5 different copper concentrations showing that reproduction was impaired as the concentrations increased. Biomarkers activity (e.g. AChE, GST and CAT) and energy reserves were determined and correlated with reproduction. As expected the energy cost allocated to the detoxification process was one of the reproduction impairment causes. Aquatic snails, like Physa acuta, have proved to be good test organisms to assess the presence of chemicals in the environment as they have proven to be very sensitive to exposure.
TY 316 Morphometric and biochemical evaluation in gills of Lepomis gibbosus, after acute exposure to several xenobiotics (pesticides, deterrents and pharmaceuticals)

T. A. Feckler

TU 317 Oxidative stress and higher level effect of engineered nanomaterials in the nematode Caenorhabditis elegans: functional toxicogenomic approach

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Toxicogenomics is increasingly used in ecotoxicology but the challenges of these technologies are inferring biological importance from the data. To deal with this problem, integrated pathway and network analysis are being applied as they give a better understanding of biological effects at multiple levels. This systemic approach is particularly interesting for investigation of chemicals of which mode of actions are less characterized, such as, nanomaterials. Despite the recent increase in research on the toxicological effects of engineered nanomaterials (ENM), this area still exist, especially in the relation between higher level effects and the mechanism of toxicity. Current mechanistic studies on ENM have reported oxidative stress as one of the most important mechanism of toxicity. In this study, to understand the relationship between higher level effect of ENM and mechanism of toxicity, functional toxicogenomic analysis was conducted in the nematode Caenorhabditis elegans. Survival and viability of C. elegans were first examined in worms exposed to silver nanoparticles (AgNPs) and multi-wall carbon nanotubes (MWCNT). Subsequently, mechanism of toxicity was investigated using microarray followed by gene ontology (GO) and pathway analysis. Finally higher level effect of altered genes and pathways selected as mechanisms of toxicity was investigated using functional genomics tools such as, loss of function mutant or RNAi of genes involved in these pathways. Their responses were compared with those of wildtypes.

TY 318 Biomarkers evaluation on the pearl oyster Pteria sterna (Gould, 1851) in The Ensenada de la Paz B.C.S., Mexico

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The gill is an important respiratory organ in the Pacific Horseshoe Baja California Sur, México, due to a lack of studies related to to determine their response to xenobiotics in this study an evaluation of 4 biomarkers: respiration rate, ON index, oxidative stress and AChE activity were carried out in the gill tissue of pearl oyster, from the cultivation vivero, to detect presence of toxic and genotoxic substances, and to evaluate the use this biomarkers as reliable tool in environmental biomonitoring studies. Adult oysters (5.15 ± 0.38 cm) were collected in the months of June (2010) and summer (2010) in the bed, located near to the Pichilingue harbor. Samples of tissue gill, was disintegrated; oxidative stress was determined as malondialdehyde (MDA) concentrations; and AChE inhibition by means of the Ellman technique. The results indicated that not significant differences in index O: N, the degree of oxidative stress and AChE activity among the organisms collected in summer and winter were detected, but significant differences exist in the oxidative stress rate, and AChE inhibition being the pearl oyster collected in Pichilingue and the organisms exposed to toxic metals. It is evident that these biomarkers are a good tool in environmental biomonitoring studies.

TY 319 Physiological and biochemical biomarkers in the catarina scallop Argopecten ventricosus (Sowerby, 1842), as tools to Monitor in the Ensenada de la Paz B.C.S., Mexico

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The catarina scallop constitutes an important fishing resource in B.C.S., Mexico state, due their production to decreased 86%, in this paper, an evaluation of 5 biomarkers: respiration rate, feeding rate, O. N index, oxidative stress and genetic damage in the scallops, obtained from the in the cultivation nursery of UABCS and CICIMAR was done, to detect the presence of compounds with toxic and genotoxic effects and evaluate the use of these biomarkers as a reliable tool in environmental monitoring studies. Adult clams were collected (15 to 20 individuals) (50 cm in size and 25 g in weight) for 3 years for the evaluation of biomarkers. The biomarker data were integrated for calculation of BRI (Biomarker response index) to establish the biological health of the scallops collected at each site. Significant differences in feeding rate, index O: N, the degree of oxidative stress and genetic damage among the organisms collected in summer and winter were detected. The organisms collected in summer had higher levels of lipid peroxidation (LPO, g L-1) and a higher number of cells with genetic damage (24%) compared with the results obtained in winter (9.076 ± MDA g-1 and 15.8% damaged cells). According to the mean values of BRI most degraded site was CICIMAR-IPN. The previous results are consistent with the levels of pollutants recorded in areas where clams were collected. It is clear that the battery of biomarkers used is a useful tool for environmental biomonitoring studies.

TY 320 Relationship between exposure duration, mortality, bioaccumulation and physiological parameters in glochidia (larvae) and juvenile freshwater mussels exposed to copper II.

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Species richness and population density of freshwater mussels Unioidea have declined substantially throughout North America. Surveys have revealed that environmental pollution is a factor that hampers the survival of these species and that this process is particularly evident in the life cycle of the freshwater mussel. In this project, we aimed to characterize the acute (96 h) and chronic (28 days) sensitivity in newly released glochidia larvae (L. cardium) and 6 months old juvenile (L. siliquosa) freshwater mussels exposed to copper and understand the toxic mechanisms(s) of action. Dissolved EC50 and EC20 for glochidia larvae was 22.7 and 9.7 µg Cu/L, respectively. These values indicated that L. cardium are protected by the BLM-based acute WQC 2.3 µg Cu/L, but under protected by the hardness-based WQC 113.11 µg Cu/L. Glochidia copepod uptake and accumulation indicate that there is a biosorption process based on physicochemical interactions between metal and functional groups of cell membrane which can damage at the cell surface. Our results also showed a decrease in whole body sodium concentration. However, in the increase in the amount of Reactive Oxygen Species followed a decrease in Total Oxidative Scavenging Capacity and a decrease in Lipid Peroxidation. Most striking in the chronic experiment was the reduction of whole body sodium content and inhibition of Na+ K+ ATPase, indicating copper toxicity for mussels chronically exposed is a consequence of an ionoregulatory disturbance. In contrast to the acute experiment, redox differences showed significant differences between control and copper exposed mussels, but a lipid peroxidation could be observed in an chronic. These results account our results, mechanistic of copper acute toxicity for these sensitive mussels seems to be different to the chronic ones. This difference can be related to the type of exposure and/or to physiological specific aspects of different life stages.

TY 321 Cryptic lineages - are they comparable in their sensitivity towards chemical stress?

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The term "cryptic lineages" covers taxa that exhibit genetic differences but an at least superficially morphological and equal species thus are misleadingly classified as a single nominal species. Although a well-known concept in evolutionary genetics since decades, its relevance in an ecological toxicological context has only poorly been investigated. However, there is an urgent need for an ecotoxicological assessment of cryptic complexes as the genetic differentiation between lineages often reaches magnitudes similar to those between species. Thus, deviations regarding behavioural and physiological endpoints within cryptic lineage complexes are conceivable.
Accordingly, the present study investigated two cryptic *Gammarus fossarum* lineages - namely type A and type B - for differences in their sensitivity towards chemical stress. Two size classes of each cryptic lineage type were exposed to different concentrations of the fungicide tebuconazole or the insecticide thiacloprid in six independent experiments. The feeding rate on leaf discs was determined after seven days of exposure as a measure of sensitivity.

The transcriptional analysis revealed that meta-analysis of the cryptic lineage type A compared to type B (*n=16; p<0.0001)*, by comparing the results of all bioassays, Discrete meta-analyses for each of the substances tested, showed a similar tendency, however, results were statistically significantly only for tebuconazole (*n=8; p<0.0001)*. This deviation in sensitivity between lineages is new due to the minor consideration of the cryptic lineages concept in the field of ecotoxicology. Hence, further studies should address the sensitivity to other stressors, by also considering ecological aspects like the physiological fitness, of a broader range of cryptic complexes. Nonetheless, genetically distinct lineages may confound the results of ecotoxicological tests, as indicated in the present study, and should thus be interpreted with caution.

**TU 322**

**Status of PAHs in greater Johannesburg area and possible sources**

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The presentation gives an overview of the status of the presence and levels of PAHs in greater Johannesburg area. Although many studies of persistent organic pollutants such as polycyclic aromatic hydrocarbons (PAHs) and persistent organic pollutants (POPs) have been carried out in South Africa, the study on PAHs in Johannesburg is still having a lot of gaps. The presentation gives an overview of the status of the presence and levels of PAHs in water and sediments in rivers and dams in greater Johannesburg area. The common PAHs found and their concentration levels are presented. The levels of PAHs in water and PAHs in sediments. Detailed information of the possible sources of PAHs is given and how these sources impacts aquatic ecosystems in the studied area. Finally, the overview of PAH status in South Africa urban environment is given.

**TU 323**

**Linking transcriptome to phenotype: response of a mouse liver cell line to Benzo(a)pyrene**

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The aim of the systems biology initiative, “From contaminant molecules to cellular response: system quantification and predictive model development”, is to build a model of interactions between cells and the toxic chemical Benzo(a)-Pyrene (BaP). As part of this initiative, we aim to identify the regulation of genes by BaP in a time and concentration dependent manner, to identify potential biomarkers for BaP exposure, and to predict the response of cells to different BaP concentrations. Functional analysis was done using the DAVID gene ontology web tool. Genes were mapped to known pathways using Ingenuity Pathway Analysis software (Ingenuity® Systems, www.ingenuity.com). Networks derived from the genes highly correlated to valproate exposure were analysed by the same software. Metabolomic analysis was performed on the aqueous fraction of methanol/chloroform extracted samples on Brucker Avance 500MHz spectrometer at FHB-NMR Centre, University of Birmingham. Eawag experiments were performed on Hepa1c1c7 as a cellular model to identify cell-BaP interactions and advance mechanistic understanding and predictability of the multiple toxic responses. Exposure to BaP has been linked to the activation of several genes involved in pro-inflammatory processes, such as inflammatory cytokines. However, the present study is multidisciplinary and involves conventional toxicology, transcriptomics, proteomics, metabolomics and bioinformatics. The transcriptome analysis in Hepa1c1c7 was chosen as a cellular model to identify cell-BaP interactions and advance mechanistic understanding and predictability of the multiple toxic responses. In a first step, two concentrations (30 nM and 5 µM) and four time points (2, 4, 12 and 24 h) were used for comprehensive transcriptome analysis. The results show a small number of genes being regulated at late time points for the high concentration. Genes like Cytp1a1, Tiparp and Nqo1 are regulated early for both concentrations whereas Aldh3a1, well known to act against oxidative stress, is only regulated at the higher concentration. Toxicological, chemical viability, detection of ROS formation and lipid droplets were determined. There was a significant reduction of the cell viability but only after 48 hours at 5 µM BaP. Hypoxia and oxidative stress is one process network strongly regulated after 12 hours of BaP exposure. Using using microarray and mass spectroscopy data, we have identified a network of genes, the metabolite production is already observed after 4 hours of exposure to high BaP whereas no response is observed for the low BaP concentration. However, at 24 hours, ROS appears to be produced even for the low BaP concentration. Gene expression after 12 hours of 5 µM BaP exposure moreover shows genes related to lipid metabolism. Indeed, lipid body staining using nile red revealed significant changes in lipid droplet morphology already after 4 hours. We conclude that the low BaP concentration induces a small gene response, that, together with biochemical defense mechanisms, helps the cell to return to its initial state. However, the high concentration causes strong pathway regulation and cellular dysfunction accompanied by early ROS production and lipid droplet modification.

**TU 324**

**Insights into the effects of silver by transcriptomics and proteomics in Chlamydomonas reinhardtii**

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Silver is an important industrial material and its usage is increasing continuously. It is used for its antibacterial and biocidal properties and in catalysis. The presentation will give a brief overview of the effects of silver on Chlamydomonas reinhardtii. Silver induces a downregulation of nuclear proteins. Metabolite analysis was performed that the most significantly regulated transcripts are those of metabolic pathways of photosynthesis, tetrapyrolle synthesis, mitochondrial electron transport, protein transport and oxidative stress response. Similarly, the proteome profile showed these biological processes being significantly regulated indicating that silver affects key functional pathways in C. reinhardtii. The regulation of several transcripts/proteins involved in the photosynthesis and ATP synthesis could be corroborated with inhibition of photosynthetic protein complexes. This study is multidisciplinary and involves conventional toxicology, transcriptomics, proteomics, metabolomics and bioinformatics. The transcriptome analysis in C. reinhardtii was chosen as a cellular model to identify cell-silver interactions and advance mechanistic understanding and predictability of the multiple toxic responses. The analysis of the transcriptome and proteome not only gives an insight into the mechanism of toxicity of silver but also by linking them to ecologically relevant phenotypes, a better ability to predict environmental risk.

**TU 325**

**An integrative approach to understanding the response of Caenorhabditis elegans to valproate exposure**

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C.elegans has been extensively used to study the effects of chemical exposure, aging, pathogenicity and reproductive development. With a well annotated genome, widely characterized cell line maps, ease of making knockouts, availability of mutants and short life span, it is a good model system to study the effect of chemical exposure on the organism and population level. Integration across various levels of biological organization, molecular, cellular and organismal, is required to draw conclusions on impacts in populations, communities and ecosystems [1].

Our research deals with the analysis of silver induced alterations in gene and protein expression in the algae Chlamydomonas reinhardtii and anchoring of these changes to specific phenotypes. This study is multidisciplinary and involves conventional toxicology, transcriptomics, proteomics, metabolomics and bioinformatics. The transcriptome analysis of silver induced altered expression was analysed using C. reinhardtii whole genome microarray. The global protein profile of silver exposed C. reinhardtii (5h exposure time) was done by Multidimensional Protein Identification Technology (MudPIT) which consists of 2D-IC and mass spectroscopy. The transcriptome analysis determined that the most significantly regulated transcripts are those of metabolic pathways of photosynthesis, tetrapyrolle synthesis, mitochondrial electron transport, protein transport and oxidative stress response. Similarly, the proteome profile showed these biological processes being significantly regulated indicating that silver affects key functional pathways in C. reinhardtii. The regulation of several transcripts/proteins involved in the photosynthesis and ATP synthesis could be corroborated with inhibition of photosynthetic protein complexes. This study is multidisciplinary and involves conventional toxicology, transcriptomics, proteomics, metabolomics and bioinformatics. The transcriptome analysis in C. reinhardtii was chosen as a cellular model to identify cell-silver interactions and advance mechanistic understanding and predictability of the multiple toxic responses.

**TU 326**

**Development of a resource for the collection, analysis and integration of ecotoxicologically-related high throughput data**

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In environment, the presence of chemical pollutants or climate changes can induce organism responses at the cellular and molecular level. Besides more traditional analysis systems like RT-qPCR of biomarkers, researchers can nowadays benefit of high throughput technologies (i.e. microarray, deep sequencing, 2-DE) that allow very large scale investigation. Data deriving from these technologies are often snapshots of the changes induced by the presence of environmental variations. Management, analysis and interpretation of the massive data obtained from high throughput technologies can be quite challenging and requires bioinformatics skills still beyond the possibilities of many laboratories focused on “wet biology”. Moreover all these results are poorly informative if considered separately and do not offer an exhaustive overview of the real cellular response and of changes in gene expression. Indeed they do not consider the relation between mRNA level, protein concentration and metabolic level which are known to poorly correlate. Finally it would be very useful to compare the biological effects induced by the same environmental stress on different organisms in order to draw a more comprehensive overview.

Here we propose a web based system that works as a centralized resource for the collection, analysis and integration of ecotoxicology related high throughput data. The platform integrates data from external resources such as specialized databases (ie. genomic databases, metabolic pathways, Gene Ontology) . We have benchmarked our platform with data obtained by high throughput analysis techniques- microarray and 2-DE - applied on the social amoebae Dictyostelium discoideum after treatment with several doses of mercury. We show the advantages of using our system which allows the comparison of the results obtained from the two techniques, effective tools for the visual inspection of data and integrates data from external resources such as specialized databases (ie. genomic databases, metabolic pathways, Gene Ontology).
TU 329
On the appropriateness of using the common mixture toxicity models CA and RA on species sensitivity distributions: a theoretical approach
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Environments are not only exposed to single substances but typically to mixtures. Therefore it is of great importance to assess the ecological risk not only by substance but also for mixture effects. Several models are typically used to predict mixture toxicity: the concentration addition (CA) or (dose addition) and the response addition (RA) (or independent action) models. Their adequacy to predict mixture toxicity of similarly acting compounds (CA) and dissimilarly acting compounds (RA) for single species was already shown during the last decades. To assess the risk of chemical mixtures to ecosystems, these two models have also been proposed to be applied on single species sensitivity distribution (SSD) curves to derive a multi substances potentially affected fraction of species (msPAF). Usually, this is done in two steps: (i) the CA model is applied on individual SSFs of similarly acting compounds and then (ii) the RA model is applied on the predicted SSFs by CA between groups of similarly acting compounds. However, as mentioned above the validity of mixture models were already shown for single species when applied on single dose-response curves and not on multi species SSFs. For a validation of this approach, one should therefore apply the mixture models for each species, then construct the mixture SSD to calculate the msPAF and compare it with a msPAF derived by applying the mixture models directly on the SSDs. This approach is however rarely done because the information on the whole dose response-curves of each single species for all substances is needed and this information is poorly available. In this study, we highlight the difference between (SSD combination with CA/RA models) and (single species mixture assessment followed by SSD construction) to derive a msPAF. To compare the two methods we calculate msPAF with different cases, varying the EC50s and the slopes of the individual dose response curves.

The results show that the predictions with CA are quite similar between the two methods and small differences can be explained by the goodness of fit of SSDs and the species tolerance correlation among substances. However, the application of RA may result in a differing msPAF between the two methods. Finally, we define cases in which the two methodologies give similar results and for which the use of CA and RA directly on SSDs to predict the risk of mixture compounds is appropriate.

TU 330
Estimating inter-individual sensitivity from survival data using a mechanistic model
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In the literature, there are two main alternatives to model mechanistically dose-survival relationship in ecotoxicity tests. Effects are related to a concentration of concern, for instance body concentration, and either individuals have different concentration thresholds to death, or individuals have equal probability to show an effect, with dying organisms just being the “ unlucky” ones. A general framework to unify both approaches has recently been proposed but only special cases could be confronted to actual data. We used such a unified model to analyse four datasets. We showed the possibility to estimate properly the toxicity parameters together with inter-organisms differences of sensitivity and thresholds for different experimental settings (i.e. increasing concentration for birth, induction, or both). This is done in a Bayesian framework with Markov Chain Monte Carlo techniques. We validated the procedure in a Monte Carlo simulation study.

TU 331
Incorporating data quality scores and acute-to-chronic ratios in the construction of SSDs
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The species sensitivity distribution (SSD) approach is in principle an alternative to the assessment factor approach for PNEC calculation. However, due to requirements on data quality, exposure assessment is typically restrained to a small number of compounds. One central problem is that commonly many available data are discarded from the analysis for reason of limited validity, endpoint (exclusion of ECx type data) and exposure time (exclusion of acute data).
The objective of the present study was to assess how the SSD approach can be extended to the use of the entire data sets of complex heterogeneous ecotoxicological information containing data quality, acute and chronic values, ECx, EC50, and NOEC values. More precisely, we aimed to provide a method which provides reliable and robust PNEC assessment, which is applicable to wider area of compounds.
For this purpose, we replaced the dichotomous classification of data as either valid or not valid by a system of quality scores which integrates on the inherent experimental and statistical reliability of data and on their biological relevance (organism and endpoint). This system serves as weighting factors of individual data in the SSD analysis. Furthermore, we studied different options of how to incorporate acute values. Different options (of probabilistic Acute-to-Chronic ratios and weighting) for data treatment were integrated in a tool, which allows a generation of SSD functions and estimate uncertainties.
As a result, we calculated the standard SSD function (based on chronic NOECs) only for several real ecotoxicological data sets on compounds fulfilling the strict TGDF/REACH requirements. Subsequently, we applied the developed method using weighting scores and acute to chronic extrapolation to the entire data set and bootstrap subsamples. SSD function obtained for subsamples of the entire data set using different options for data treatment was compared to the SSD based on chronic NOECs. Influences of different options for data treatment and sample size will be discussed with respect to the robustness and reliability of the SSD function and the associated ECx value.

TU 332
Investigating the replacement of NOEC and LOEC values with regression-based ECx values
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Data from chronic toxicity tests have traditionally been analysed by hypothesis test based statistical analysis to obtain a No Observed Effect Concentration (NOEC) and a Lowest Observed Effect Concentration (LOEC). Although a firmly entrenched paradigm, much recent debate has questioned whether these methods are the most appropriate way to analyse data from eco-toxicity studies. As part of this debate the use of ECx values and associated confidence intervals, determined by regression analysis and other modelling techniques, have been investigated by the OECD and others as possible replacement or complementary endpoints and are now included as a requirement in some test guidelines.
For the first analysis of a number of data sets, the work described has shown that it is possible to apply a number of different static regression models to results arising from ecotoxicity tests, and to derive ECx values. The work indicates that, although not consistent for all datasets examined, it is possible to derive ECx values broadly similar to the respective NOEC and LOEC values.
However, a number of issues remain which will be of importance when considering the possible replacement of NOEC and LOEC values with ECx values, including the experimental design. It is thought that current test designs may not necessarily be suitable for data analysis using regression based methods, and that modifications to current protocols may be required to ensure that regression analysis of test data yields reliable and significant results.
The work described has applied regression analysis to a number of simulated dataset which were developed according to differing test designs. This has shown that the experimental ecotoxicity study can have important implications for the results obtained by statistical analysis using regression techniques. In particular, both the estimated ECx values and the associated confidence intervals have been shown to be impacted by experimental design. This could have implications for both the ethical and practical aspects of ecotoxicological testing, when seeking an optimum test design.

TU 333
Statistical approach to select bioindicators for soil monitoring, risk assessment and soil characterization. Results from the French national programme ‘Bioindicators’
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5ADEME, Angers, France
6Arima, Paris, France
7The Radboud FEFSTRA statistical approach (Breiman, 2001), is used to classify, predict and select the best set of explanatory variables in large fields of research. Yet, only few applications were made in environmental research, especially in soil ecotoxicology. The analytical strategy of the French “Bioindicators Programme” (2006-2012) is to (i) measure a large number of bioindicators in contrasted pedo-climatic contexts covering large geographical area with multiple sampling protocols, (ii) measure high numbers of biological and meta-data in a database enhancing data analysis, (iii) develop a data mining of collected data during two years, with the help of a biostatistician team. The main objective is to develop a generalised method for selecting relevant bioindicators with regard to the targets (characterisation, monitoring, risks), (2) to assess risks of soil contamination to ecosystems. Most of the bioindicators are not only exposed to single substances but typically to mixtures. Therefore it is of great importance to assess the ecological risk not only by substance but also for mixture effects. Several models are typically used to predict mixture toxicity: the concentration addition (CA) or (dose addition) and the response addition (RA) (or independent action) models. Their adequacy to predict mixture toxicity of similarly acting compounds (CA) and dissimilarly acting compounds (RA) for single species was already shown during the last decades. To assess the risk of chemical mixtures to ecosystems, these two models have also been proposed to be applied on single species sensitivity distribution (SSD) curves to derive a multi substances potentially affected fraction of species (msPAF). Usually, this is done in two steps: (i) the CA model is applied on individual SSFs of similarly acting compounds and then (ii) the RA model is applied on the predicted SSFs by CA between groups of similarly acting compounds. However, as mentioned above the validity of mixture models were already shown for single species when applied on single dose-response curves and not on multi species SSFs. For a validation of this approach, one should therefore apply the mixture models for each species, then construct the mixture SSD to calculate the msPAF and compare it with a msPAF derived by applying the mixture models directly on the SSDs. This approach is however rarely done because the information on the whole dose response-curves of each single species for all substances is needed and this information is poorly available. In this study, we highlight the difference between (SSD combination with CA/RA models) and (single species mixture assessment followed by SSD construction) to derive a msPAF. To compare the two methods we calculate msPAF with different cases, varying the EC50s and the slopes of the individual dose response curves.

The results show that the predictions with CA are quite similar between the two methods and small differences can be explained by the goodness of fit for SSDs and the species tolerance correlation among substances. However, the application of RA may result in a differing msPAF between the two methods. Finally, we define cases in which the two methodologies give similar results and for which the use of CA and RA directly on SSDs to predict the risk of mixture compounds is appropriate.

TU 334
ET02P - Advanced statistical methods in quantitative ecotoxicology

SETAC 6th World Congress/SETAC Europe 22nd Annual Meeting 353
advanced non-linear regression methods for concentration-response curves in R

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A recent development from the IEAM has suggested to ban the use of traditional no-observed-effect levels (NOELs) and lowest-observed-effect levels (LOELs) as basis for risk assessment and decision making, and instead use curve-fitting for estimation of concentration-response relationships. This should motivate an evaluation of current concentration-response modelling approaches in ecotoxicology, and adoption of new methodologies for curve-fitting that are used in other fields of environmental science.

The Water Framework Directive (WFD) has triggered much research on non-linear relationships between physico-chemical stressors and ecological responses during the last decade. For example, thresholds in stressor-response relationships are particularly relevant for assessment of ecological status of water bodies. Basic statistical methods such as linear regression or ANOVA are not suitable for estimating such relationships. The response may also be more complicated than e.g. a simple sigmoid curve, therefore circular regressions have been used for exploring the shape of the response curve without a priori assumptions. Moreover, we may be interested in estimating an extreme part of the response rather than the average. In this presentation, we give examples of ecological responses to eutrophication and acidification stress in lakes. The ecological responses are univariate indices representing community composition of phytoplankton, macrophytes, macroinvertebrates and fish. Building upon basic linear regression approaches, we will introduce statistical techniques which enable more flexible curve-fitting: (1) Using a non-linear link to the response variable (generalised linear model); (2) Using a piece-wise linear function for the stressor variable (generalised additive model); (3) Analysing a quantile of the response variable (the average of e.g. 90%; quantile regression). All analyses are carried out in the free statistical programming software R.
TU 341
Long-term food-exposure to PCB mixtures induces reproductive and behavioural disruptions in zebrafish
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Polybrominated diphenyl ethers (PBDEs) have been banned for several decades, they are still present in the environment. Field analyses have established correlations between exposure to PBDEs and alterations in fish physiology including reproductive function and behaviour. In the present study, we performed a life-cycle exposure using zebrafish and mixtures representative of some environmental situations in terms of doses, composition and containing mainly non dioxin-like congeners. Exposure was performed through diet which is the main contamination route in the wild. We demonstrated a bioaccumulation of PCBs in males and females as well as a maternal transfer to the eggs.

Several reproductive traits were altered after exposure to a PCB-contaminated diet, including a reduction in the number of fertilized eggs per spawn as well as an increase in the number of poorly fertilized spawns. This was related to modifications of ovary histology revealing a decrease of maturing follicles and an increase of atretic follicles in the ovaries of females exposed to PCBs.

In addition, several behavioural traits were monitored. Fish exposed to the highest dose (equivalent to that found in the Seine Estuary) displayed an increased swimming activity during the last 15 minutes of the night. Fish exposed to an intermediate dose (equivalent to that found in the Loire estuary) displayed behavioural disruption analogous to hyperactivity that showed some similarities to a human behavioural deficit syndrome known as attention deficit/hyperactivity disorder (ADHD), which can be observed in humans after exposure to PCBs.

These results indicated that exposure to PCBs mixtures mimicking some environmental situations, can lead to a dramatic reduction in the number of offspring produced by a female over a lifetime and disrupt behaviour. Potential ecological consequences are discussed with regard to reproduction, fitness and survival.

TU 343
Indirect estimation of population-level effect of pollutants based on tolerance evolution and fitness cost of tolerance
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Tolerance to pollution is one of the most important traits for survival, both in the wild and in the lab. However, the estimation of the population-level effect that corresponds to 1/4 reduction of the intrinsic population growth rate (r) is not trivial. In this study, we estimated the population-level effect that corresponds to the reduction of the intrinsic population growth rate. The indicated level of the population-level effect may have considerably reduced the probability of persistence of the population.

TU 344
Triclosan toxicity: a multi-generational and demographic assessment using Daphnia magna
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Triclosan is a ubiquitous compound in wastewater treatment plant effluents and biosolids and is commonly detected in surface waters throughout North America and Europe. The acute toxicity of triclosan (TCS) toward aquatic organisms has been well studied but information on long-term, low level exposures at environmentally relevant concentrations is lacking. The objective of the present study was to evaluate the toxicity of triclosan in a multi-generational test with Daphnia magna in laboratory exposures. 24-hr old D. magna neonates were exposed to TCS (0.5 to 150 μg/L) in six successive 24-d life cycle tests. Brood randomly collected from 5 replicate beadies within each treatment on day 21 were used to produce the next generation. Survival across the 6 generations exceeded 80% in all treatments across all generations. A slight but non-significant increase in the number of first instar was observed in the 150 μg/L treatment in the first generation but this effect was not observed in the subsequent treatments. Total offspring increased over 21 d and fecundity (average offspring/adult) decreased significantly at concentrations >50 μg/L (NOEC = 10 μg/L) in the first 3 generations but this difference disappeared in the last three generations indicating increased tolerance to TCS. Reproductive demographic data were used to estimate the intrinsic rate of increase (r) and indicated significant declines in r as treatments increased from the three highest treatments based on the first 3 generations but not the last 3 generations. In this study, effects were only observed at TCS concentrations approximately one order of magnitude greater than those found in surface waters, which indicate that the long-term risks of TCS are likely minimal.

TU 345
Assessing the chronic aquatic toxicity of phthalate ester plasticizers
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Phthalates are a class of chemicals consisting primarily of a saturated hydrocarbon chain with a functional group containing two oxygen atoms. The purpose of the present study was to assess chronic effects of phthalate plasticizers on aquatic organisms. Studies show that populations of fish and invertebrates may be adversely affected by exposure to C0 to C4 phthalate esters, but are not adversely affected by exposure to C6 or higher phthalate esters. Secondary endpoints, including molecular, biochemical, and/or histological responses to chemical exposure, do not appear to correspond to primary endpoints of survival, growth and development, or reproductive fitness. A previously published risk assessment for C1 to C4 phthalate esters demonstrated low risks in North American and Western European surface waters. Risk assessments conducted by authorities in Europe with DEHP, DINP, and DIDP have concluded no risks to aquatic organisms due to aequous solubility constraints, low expected water concentrations, and metabolic biotransformation capacity of aquatic systems. Important toxicologic aquatic toxicity studies that have included transgenerational exposure have shown that these assessments and are presented here. The data from the present study, support the earlier risk assessment conclusions. The data also provide further support for a narcosis-related aquatic solubility cutoff at approximately C6 and higher phthalate esters. Finally, for the C1 to C4 phthalate esters, the present study shows that secondary endpoints (e.g., molecular, biochemical, and/or histopathology) to date, provide limited benefit in practical ecological risk assessment of phthalate esters to aquatic species.
Effects of land use and pesticide exposure on hatching characteristics of Daphnia magna ephippia

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Daphnia is a well established model organism and standard test species in ecotoxicology. D. magna reproduces by cyclical parthenogenesis, where environmental cues associated with unfavourable conditions trigger sexual reproduction. In permanent and temporary standing waters, sexually produced encapsulated dormant eggs (ephippia), build up over the years to form a dormant resting egg bank, which is important for long-term survival of the population. Each year a fraction of the dormant eggs hatch from the sediment. Through this benthic-pelagic coupling, structure and function of resting egg banks have important consequences for ecological and evolutionary dynamics of the active populations and communities. To date however, almost no information is available on the effects of pollution on these dormant egg banks.

In this study we investigated the effects of land use intensity and pesticide exposure on hatching characteristics of D. magna ephippia from natural populations. Therefore we sampled dormant egg banks of ponds from sites with varying degrees of agricultural activity (from natural areas to areas with intensive agriculture). In the laboratory hatching experiments were performed, looking specifically at differences in hatching characteristics of D. magna ephippia under optimal conditions and pesticide exposure in relation to historical pesticide exposure.

Is there a potential for wild Daphnia magna populations to undergo selection at conventionally derived effective concentrations of chemicals?

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The genetic variability within a population exposed to stress governs the micro-evolutionary potential of that population to undergo selection and adapt to the stress. However, adaptation caused by natural selection will by definition reduce overall genetic diversity, a process termed genetic erosion. This may result in a cost of tolerence, whereby populations evolved under a certain chemical stressor, may become less tolerant to novel stressors. It is hypothesised that a population under stress exhibits an increase in genetic variation for life history traits relative to a control population. We used the genetic coefficient of variation (CVs) and the broad sense heritability (H2) as measures for genetic variability for micro-evolutionary responses in wild populations exposed to copper and zinc, as model toxicants. Life-table experiments with concentrations of copper and zinc close to the conventionally derived geometric mean NOEC values (50 µg Cu/L, 428 µg Zn/L) were conducted with 8 Daphnia magna populations collected from lakes under ponds across Belgium, with monitored Cu and Zn levels. Additional full dose-response experiments were carried out with the most and least sensitive populations. Our results indicate that several fitness traits have the potential to respond to natural selection and genetically adapt, but that this depends strongly on the population and the exposure treatment considered. In long-term multi-generational exposures this may result in shifts in genotype frequencies and reduction of genetic diversity.
webs linking primary producers to consumers. The negative effects on Daphnia are well understood; toxic cyanobacteria affect growth, survival and reproduction. However, one possibility to ameliorate toxic effects is to biodoxygenate MC by conjugation to glutathione via glutathione S transferase, thereby reducing toxicity and aiding excretion. This process is thought to underlie the ability to withstand MC in Daphnia and could explain the enhanced tolerance found in the offspring of Daphnia exposed to live cyanobacteria.

In this study, multigeneration exposures were conducted, we exposed the parental generation to MC-LR for 1 or 7 days and determined the enzyme mediated tolerances to MC in their offspring, by assessing the acute effect of MC-LR on biotransformation, antioxidant and energy metabolism enzyme activities, and b) through 21 day chronic toxic effects studies on Daphnia, including their tolerance to the same concentration of MC-LR and PCBs. Seven day exposure of the parental generation to MC-LR induces higher activity of glutathione S transferase and malate dehydrogenase in the offspring and enables it to increment the catalase activity when challenged with the toxin. In offspring from the 1 day exposed parental generation those effects were less pronounced or not visible. Offspring from 7 day exposed parental generation suffered from larval developmental delay when exposed to MC-LR whereas the offspring from 7 day exposed mothers show higher survival. Higher survival of the offspring is correlated with the elevated activity of glutathione S transferase, malate dehydrogenase and catalase, suggesting maternal transfer of activation factors.

These maternal or trans-generational or maternal effects provoked by a natural toxin in a very important freshwater herbivore which may explain the observed acquisition of enhanced tolerance over generations through a biochemical perspective.

TU 354
Is there a functional role of DNA methylation in the stress response? J. N. Meyer
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DNA methylation, the addition of methyl groups on the 5’ position of cytosines in the DNA plays an important role in the regulation of gene expression of eukaryotic cells. Corrective mechanisms for DNA methylation have been performed in many different organisms and plants where DNA methylation in turn correlates with a recent reviewed description in animals. In particular, the effects of mitochondrial DNA damage in the parental generation of transgenerational effects may be repaired in the nuclear genome by nucleotide excision repair. However, nucleotide excision repair proteins are not present in the nuclear genome, so the fate of such DNA damage in the mitochondrial genome is unknown. The effects of such damage are also unknown; we hypothesized that the effects of such damage would be particularly important after early life stage exposure since mtDNA copy number is lowest at that time. Using the nematode model C. elegans, we found that UV-induced photodimers result in lower levels of mtDNA-encoded mRNAs, decreased ATP levels, decreased oxygen consumption, larval growth and survival. Moreover, we found that UV-induced mtDNA damage is slowly removed in a process dependent at least in part on mitochondrial fusion, fission and autophagy. Furthermore, we found that UV-induced photodimers result in lower levels of mtDNA-encoded mRNAs, decreased ATP levels, decreased oxygen consumption, larval growth and survival. Moreover, we found that UV-induced mtDNA damage is slowly removed in a process dependent at least in part on mitochondrial fusion, fission and autophagy. Mutations in mitochondria and fusion and autophagy genes exacerbate the larval arrest, suggesting a potent gene-environment interaction in which the effects of mtDNA damage caused by environmental agents are exacerbated by decreased mitochondrial fusion and autophagy.

TU 355
Is trans-generational PCB transfer a key process for parental detoxification and adaptation in amphipods? R. K. Sundelin, S. S. Sauvé, S. Schatz
1, J. Asselman
1, S. Vandegehuchte
1, M. Vandegehuchte
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To date, reproduction success and reproductive disorders in amphipods have been studied in several marine organisms like fish and amphipods to address the question of the impact of contaminants on exposure with population dynamics. This process was supported by the Spanish research project CTM2008-03492.

Seven day exposure of the parental generation to MC-LR induces higher activity of glutathione S transferase and malate dehydrogenase in the offspring and enables it to increment the catalase activity when challenged with the toxin. In offspring from the 1 day exposed parental generation those effects were less pronounced or not visible. Offspring from 7 day exposed parental generation suffered from larval developmental delay when exposed to MC-LR whereas the offspring from 7 day exposed mothers show higher survival. Higher survival of the offspring is correlated with the elevated activity of glutathione S transferase, malate dehydrogenase and catalase, suggesting maternal transfer of activation factors.

These maternal or trans-generational or maternal effects provoked by a natural toxin in a very important freshwater herbivore which may explain the observed acquisition of enhanced tolerance over generations through a biochemical perspective.
Tributyltin (TBT) is a very toxic compound that was used as antifouling paints biocide during four decades. Due to its environmental toxicity the International Maritime Organization banned its use in marine paint formulations. However, TBT is still introduced into the marine environment, and severe effects caused by it (e.g., pollutant, global change) and to assess potential consequences on population over many generations.

Regarding this background, we adapted a bioenergetic model to study adaptive phenomena in Caenorhabditis elegans population dynamic exposed to a heavy radiotoxic pollutant on population dynamics from individually data. Nevertheless there are only a few datasets and models that account for adaptive phenomena which may appear in a stressed population. The selection pressure exerted by a pollutant is known to amplify the phenomenon of natural selection. It is thus essential to understand and quantify the adaptive dynamics governing populations under stress in order to assess ecological risk.

In this study, TBT-resistant bacteria collected from 7 Portuguese ports (Póvoa de Varzim, Leixões, Aveiro, Figueira da Foz, Peniche, Setúbal and Sines) were isolated in what concerns growth rate in the presence of increasing concentrations of TBT and later identified them by 16S rRNA gene sequencing. Bacterial diversity was also assessed along the costal areas. Bioremediation testing suggested that some TBT-resistant bacteria are able to reduce the toxicity of TBT contaminated waters. Ecotoxicological testing also revealed that the median lethal concentration (LC50) of TBT in Gibbula umbilicalis at 48 and 96 hours was 61.45 µg L-1, and 15.69 µg L-1, respectively.

In this study, we investigated whether genetically adapted clones of Daphnia longispina showed a higher fitness performance under copper exposure, and severe effects caused by it (e.g., pollutant, global change) and to assess potential consequences on population over many generations.

The present study was conducted to test the hypothesis that genetically adapted clones of Daphnia longispina showed a higher fitness performance under copper exposure than acclimated clones. Genetically tolerant and sensitive clones were selected from a reference and a historically exposed populations to an acid mine drainage from an abandoned pyrite mine. Four sensitive and resistant clones from reference and impacted populations were exposed to a range of copper exposure levels and their life history responses in terms of survival, reproduction and population growth rates compared. In another experiment the most sensitive clone was exposed during four generations to the same range of copper concentrations and its life-history performance compared. The genetic differences between the resistant and sensitive clones were that in the polluted environment the resistant clone produced three more offspring per day and had population growth rate 45% greater. In the unpolluted environment, however, individuals from the resistant clone had the lowest reproduction rates. After four generations acclimated individuals from the sensitive clone reproduced earlier, had greater clutches at first reproduction and higher population growth rates than non-acclimated ones but apparently there were no fitness costs. Therefore, our results showed that life history changes due to adaptation and acclimatization were comparable under the polluted environment but not under a clean environment. This results support the view that genetic adaptation is ecologically costly but acclimatization not.
collection has been performed for some years at Angra dos Reis (10 out of 31 stations were close to marinas) and Arraial do Cabo (2 out of 10 stations were close to marinas) in Rio de Janeiro state. These studies used 30 adults of Stramonita haemastoma per site (whenever found). The results for Venezuela showed that the VDSI ranged from 0.22 to 1.86 in areas under the influence of harbors, whereas VDSI values were 3.77 and 4.56 in the marinas. Similarly, RPLI ranged from 0.07 to 5.58 in the harbor areas and were 0.36 and 54.56 to the marinas. In this case, the main source of organotins pollution is clearly the marinas. In the Angra dos Reis study, imposex was detected in 100% of females close to the marinas, and in 5 out of 10 stations the animals previously inhabiting the rocky shores were no longer found. In Arraial do Cabo, two stations nearby a single marina showed an imposex incidence of 4% and 0.01% in 2001, increasing to 83% and 47% in 2008. In this region, another marina located near a small harbor showed imposex incidence of 3% in 2000, whereas no gastropods were found during 2008 sampling. Thus, although the international restrictions on TBT use are apparently reducing the impacts from harbors, these three independent studies at Venezuela and Brazil (Angra dos Reis and Arraial do Cabo) clearly point out that marinas are becoming an important source of TBT pollution. Based on that, a similar pattern is expected to occur in other Latin America coastal areas.

TU 364

Imposex and organotin (OT) levels in Nucella lapillus along the Portuguese coast: a re-survey in 2011
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The use of tributyltin-based antifouling paints (TBT-based AFP) is globally forbidden since the 17th September 2008 by the ‘International Convention on the Control of Harmful Antifouling Systems on Ships’ (AFS Convention). It is therefore important to ensure the continuous monitoring of organotins (OT) in the environment and the recovery of marine ecosystems to evaluate the effectiveness of legislation in reducing TBT pollution. The current work assessed imposex and OT tissue contamination in N. lapillus at 16 sites along the Portuguese coast in 2011. The vas deferens sequence index (VDSI), the female penis length index (FPLI), the relative penis size index (RPSI), the percentage of imposex affected females (%I) and the percentage of sterile females (%S) were determined to assess imposex levels. Additionally, monobutyltin (MBT), dibutyltin (DBT), TBT, diethyltin (DPT), triphenyltin (TPT), monoctyltin (MOT) and diocytin (DOT) were quantified in the soft tissues of females by GC-MS. The OSPAR Ecological Quality Objective (EcoQO) for this species (VDSI < 2) was achieved in 94% of the sampled sites. All surveyed populations presented VDSI values that fall into OSPAR class B (0.3 < VDSI < 2) with one single exception in the South western coast - Zambujeira do Mar (site 15) - also being the only site where steroid females were still recorded. OT concentrations in N. lapillus soft tissues varied between <0.2ng Sn/g and 24ng Sn/g dry weight (dw) for MBT, 2.1 and 30ng Sn/g dw for DBT, 1.0 and 80ng Sn/g dw for TBT, 0.2 and 1.4ng Sn/g dw for DPT, TPT, MOT and DOT concentrations were all below the detection limit. TBT recent inputs were estimated to occur at four sites by the butyltin degradation index (DBI = [MBT]/[DBT]/[TBT]). The temporal trend of N. lapillus imposex was assessed for the period 2000-2011 in order to evaluate the effect of TBT pollution levels in the Portuguese coast.

TU 365

TBT from anti-fouling paints in the environment - an overview of the situation today
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The Baltic Sea is a sensitive brackish water environment where most organisms live at the edge of their distribution area. Pollutants thus mean an extra stress to these organisms. Traditionally anti-fouling paints are based on leakages of biocides, which prevents the attachments of fouling organisms on underwater structures such as a boat hull. The drawback is that the biocides are persistent and that they also affect non-target organisms. The environmental authorities have with time implemented more strict regulations, especially for the paints that may be used on the east coast of Sweden. The use of tin-organic substances were prohibited in 1989 for all boats less than 25 m and no paints based on copper leakage were approved from 2001 and up today no copper paints have been on the market for use on the east coast. In spite of these restrictions much imposex has been found originating from anti-fouling paints along both the Baltic and the east coast of Sweden. Similarly high concentrations are found in harbours for ships. Our investigations show that the highest concentrations are found in boat yards > uptake areas > marinas > natural harbours. 100 µg TBT/kg DW is considered high in many countries and the highest concentrations in boat yards reached 30 000 µg TBT/kg DW. The reason is under laying paint layer being scrapped off.

TU 366

Comparing anadara trapezia exposure, dose and response to metal contaminated estuarine sediments using laboratory and field conditions and resident molluscs
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Establishing relationships between metal exposure, internal dose and associated biological effects for organisms is necessary to understand the fate and effects of metals in the environment.

The accumulation and sequestration of biologically available metals by aquatic organisms, particularly bivalve molluscs, has led to their use as biomonitors of metal contamination. However, a proportion of the inorganic metal that can enter an organism is not available to be sequestered and is precipitated into the tissue. The concentration relationships between exposure and effects at various levels of biological organisation, using traditional approaches, are not well understood. The studies presented here used a variety of exposure approaches, a better understanding of the mechanisms of organism stress responses to metals in ecological systems was gained and the predictive capabilities of ecologic risk assessment improved.

TU 367

Imposex occurrence and the genetic changes in Veined Rapa Whelk (Rapana venosa) from Bohai Bay, China
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In order to assess the present status of organotins (OTs) pollution and the potential ecological risk, biological effects in biota and the contents of OTs in biota and sediments were monitored in 16 marinas and 49 natural harbors in Tianjin city and the neighbor of Bohai Bay, China. Imposex occurrence was found in veined rapa whelk (Rapana venosa) from three sites in Bohai Bay (HH, NPH and DST), ranging from 0% to 12.45% in 2010 and from 0% to 12.50% in 2011, respectively. The chemical analysis results showed that TBT and TPT were the main OTs in tissues and sediments, which can account for the occurrence of imposex. Furthermore, the genomic DNA that was amplified with 8 pairs of fluorescence-labeled primer showed that the amplified DNA was membrane stability was used as a measure of cellular integrity . By identifying relationships between exposure and effects at various levels of biological organisation, using traditional approaches, a better understanding of the mechanisms of organism stress responses to metals in ecological systems was gained and the predictive capabilities of ecologic risk assessment improved.

TU 368

Clam valve rhythm-based online biomonitoring system to detect waterborne arsenic
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In recent decades the amount of pharmaceuticals used and released has constantly increased. One of the main sources of this pollution is through the release of wastewater

Clam valve rhythm-based online biomonitoring system to detect waterborne arsenic

Arsenic (As) usually represents high level in groundwater at southwestern and northeaster coastal areas of Taiwan. The freshwater clam has a high market value and commercially important to Taiwan’s aquaculture. Previous studies indicate that biomonitoring is the scientific technique for detecting environmental pollution situations for presenting the harmful toxic chemical in water. The purpose of this study was to synthesize water chemistry-based bioavailability and valve daily rhythm in Corbicula fluminea to design a biomonitoring system for detecting waterborne As. We integrated valve daily rhythm dynamic pattern and water chemistry-based HIL douse-response model to build in a valometry technique programmatic mechanism, offering a rapid and cost-effective dynamic detection system. We validated the simulated dissolved As concentrations based on valve daily rhythm behavior with published experiment data. The results indicated that the As concentration detection threshold of biomonitoring system was 0.1 µg L⁻¹ and the detection times are associated with the exposure concentrations. This study presents a C. fluminea-based biomonitoring system that can particularly provide the real time transmitted information on the waterborne As activity. This parsimonious C. fluminea valve rhythm behavior-based real-time biomonitoring system presents a valuable feature to promote the automated biomonitoring and offers early warnings on the potential ecotoxicological risks in regions with elevated As concentration.

TU 369

A comparative in situ study on ecotoxicological effects of pharmaceuticals in Ireland, using marine mussels (Mytilus spp.)
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In recent decades the amount of pharmaceuticals used and released has constantly increased. One of the main sources of this pollution is through the release of wastewater
effluent, both treated and untreated, into the aquatic environment. These novel contaminants can be found now through the developed world, including Ireland.

730

TU 370

Chronic exposure of young of the Pacific oyster (Crassostrea gigas) to zinc
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The marine coastal environment is constantly submitted to many sources of releases from human origins, resulting in low concentrations of contaminants and chronic exposure. Hence, to these low doses, the health of marine species is sometimes affected. Because biological mechanisms to respond to acute and chronic exposure may be different, the concentration sensitivity is also different. It is thus a challenge that stakeholders in charge in the environment protection regulation can lean on robust scientific basis addressing the consequences of chronic exposure of species to low doses of pollutants. For long life-span species, investigating chronic exposure means long term experiments with very low concentrations of pollutants. A relative short exposure time of 1 day post-metamorphosis did not induce mRNA expression of the studied target genes when exposure started at the very beginning, it covers the whole lifetime up to the end of the experiment, which is relevant in terms of chronicity. In addition, early stages of development are often more sensitive to population density than adults, so using them for ecotoxicology obviously makes sense. Zinc is an essential trace metal in living organisms but it becomes toxic at high concentration. In marine environments, its concentration is influenced by many human activities, among which the use of antifouling paint and sacrificial anodes. Our study addressed the effects of zinc on Pacific oyster (Crassostrea gigas) spat. Young oysters were exposed to a range of zinc concentrations, added to seawater as ZnCl₂, up to 2 mg.L⁻¹, as of 1 day post-metamorphosis and for 10 weeks. They were fed with microalgae at the same cells concentrations. Zinc was measured in seawater and in oysters throughout the experiment. Survival and growth were monitored on large sample populations to deal with individual variability. A dose-response curve analysis allowed deriving the EC₅₀ for growth. In parallel, target genes analyses included heat shock proteins, metallothionein (MT), detoxication machinery, regulation of oxidative stress and cell cycle. Gene transcriptional expression was quantified by RT real time PCR. Significant change was only detected for MT after 1 week exposure to the highest zinc concentration. However growth was affected as early as a few days of exposure to relatively low dose and turned out to be an earlier and more sensitive marker of the effect of zinc on oyster spat.

731

TU 371

Assessment of sacrificial anode impact by zinc accumulation in oyster Crassostrea gigas: comparison between a long- and short-term laboratory tests

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The summer mortality syndrome which sporadically threatens oyster farming appears to be due to a combination of several intrinsic and extrinsic factors including physiological stress related to reproduction and xenobiotic stress. In this context, terrestrial inputs including pesticides could be involved in oyster mortality events, not as a single causative agent but as additional stressors. The study was carried out in the frame of the European Project Chronoex. The aim of this project was to evaluate the impact of different contaminants (including pesticides) used in the region surrounding the English Channel on the early stages of Crassostrea gigas. Experiments were conducted on oyster spat, in two indoor bioassays and in an outdoor experiment, for 10 weeks. At the end of the experiments, the mortality rate was recorded, and the biocumulation factor (BCF) exhibited values up to 405 in the digestive gland. In contrast, the results obtained through chronic exposure showed a higher BCF (13,397), whereas no mortality was detected. Moreover, zinc was able to modulate immune system activities. Indeed, all of the immune system biomarkers studied, except the number of circulating haemocytes which decreased in both experiments, were stimulated by zinc and inhibited by cadmium. Moreover, in terms of BRD and HSP60 level, the zinc and cadmium experiments did not show statistical significant differences. In the case of MT, exposure conditions did not induce mRNA expression of this zinc biomarker. In the case of cadmium, exposure conditions did not induce mRNA expression of this zinc biomarker. This study confirmed the necessity to monitor this zinc contamination source in marine environments.

732

TU 372

Effect of herbicides on embryo-larval development and metamorphosis in the Pacific oyster, Crassostrea gigas
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The effects of these substances and copper sulphate (used as a positive control) were studied in D-hinged larvae in order to assess their potential embryotoxicity by comparing the percentage of viable embryos and the frequency of metamorphosis. In the metamorphosis assay, a similar result was recorded and, glyphosate, AMPA and mecoprop appeared little toxic (EC₅₀ >100 mgL⁻¹) . Finally, the comparison of different contaminants (including pesticides) used in the region surrounding the English Channel on the early stages of Crassostrea gigas. Experiments were conducted on oyster spat, in two indoor bioassays and in an outdoor experiment, for 10 weeks. At the end of the experiments, the mortality rate was recorded, and the biocumulation factor (BCF) exhibited values up to 405 in the digestive gland. In contrast, the results obtained through chronic exposure showed a higher BCF (13,397), whereas no mortality was detected. Moreover, zinc was able to modulate immune system activities. Indeed, all of the immune system biomarkers studied, except the number of circulating haemocytes which decreased in both experiments, were stimulated by zinc and inhibited by cadmium. Moreover, in terms of BRD and HSP60 level, the zinc and cadmium experiments did not show statistical significant differences. In the case of MT, exposure conditions did not induce mRNA expression of this zinc biomarker. In the case of cadmium, exposure conditions did not induce mRNA expression of this zinc biomarker. This study confirmed the necessary to monitor this zinc contamination source in marine environments.

733

TU 373

Ecotoxicity of nitramines, important transformation products of amines used in carbon capture
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Due to the imminent use of amines in the CO₂ capturing process from gas power stations in Norway, it is anticipated that the inputs of amines and transformation products into the environment will increase. The two main groups of transformation products with the most potential to cause environmental harm have been identified as nitramines and their derivatives, both of which are considered to be carcinogenic. For regulatory and theoretical modelling purposes, these compounds are classified into nitramine compounds, 2-(nitroamino) ethanol (CAS: 74386-82-6) and dimethylnitramine (CAS: 1164-28-7) to be present. However, despite the likelihood of these compounds increasing in the environment, no environmental toxicity data for these compounds currently exists. Therefore, the aim of this work was to provide an environmental risk assessment for potential environmental risk assessment for potential environmental impact of these nitramine compounds taking into account the key trophic groups within freshwater and terrestrial environments. The toxicity assessment was made using a suite of standardised bioassays for the measure of acute and chronic toxicity, which found the EC₅₀ concentration of the selected nitramine compounds to be in the low to mid mg.L⁻¹ range for all aquatic toxicity tests. In addition, the sub-lethal effects of these compounds was also investigated, using in a 3 tiered approach to assess the potential ecotoxicity and carcinogenic effects of these compounds. Overall, data to develop the environmental risk assessment for these future environmental pollutants will be presented.

734

TU 374

Effects of arsenic on physiological parameters of mussels (Mytilus edulis) from the Seldstjørn Estuary (Belgium)
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Mussels are marine organisms widely used as environmental biomonitor, due to the ability to concentrate pollutants in their tissues with minimal metabolic transformations.
TU 376

Marine ecosystem health assessment through the Integrative Biological Index (IBI) in mussels from Portugal NW and Basque coasts

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In order to assess the biological effects of pollution, mussels Mytilus galloprovincialis, were seasonally sampled in seven localities subjected to different levels of pollution along the Portuguese and Basque Coast (NIPC) over one year (April, June, October 2010 and in February 2011); 4 in the NW Coast of Portugal (Vila Chã, São Bartolomeu do Mar, Viana do Castelo and Careço) and 3 in the Basque Coast (Arrietúa, Gorliz, Mundaka). In each locality, a battery of biochemical and cell and tissue-level biomarkers were applied: acetylcholinesterase (AChE) and glutathione S-transferase (GST) enzymatic activity, levels of lipid peroxidation (LPO), lysosomal enlargement (lysosomal volume fraction, LVF), cell cycle (DNA content by propidium iodide staining, PI) and cell type replacement (volume density of basophilic cells, VbRAS) in digestive gland epithelium, and changes in the morphology of digestive alveoli (mean luminal radius to mean epithelial thickness 3L/MB). The IBI index was calculated from GSTs health condition was affected in chronically polluted localities. Star plots accompanying IBI provided complementary information concerning mechanisms of biological response to environmental insult. The NIPC is a high risk area for marine mussels due to intense marine traffic. This is an important integrative field study to understand the present environmental health status and to determine the levels of general stress on local populations which provide reliable assessment of future impacts of pollution. This study was supported by the Government of the Basque Country through a post-doc grant to L. Garmendia (ref. BFI09.244) and K EGOKITZEN project and by the Portuguese Foundation for the Science and Technology and FEDER funds through the project RAMOS (ERA-AMPERA/0001/2007; EU AMPERA ERA-NET, ERAC-CT2005-01615).

TU 378

An improved on-line clam-based behavioral monitoring system allows an approach to estimate dose-response profiles of clams exposed to waterborne copper

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The aim of this study was to develop an improved on-line clam-based behavioral monitoring system. The system included a valvometry apparatus and three kinds of valve-based operant conditioning programs that can offer a real-time and cost-effective method to construct an approach for estimating dose-response profiles of clams (Corbicula fluminea) exposed to waterborne copper (Cu). The valvometric technique can reduce the environmental stress of observed bivalves to promote a measuring precision in the spontaneous status of recording daily valve movements. The clam-based on-line behavioral response monitoring system was used to respectively monitor the valve closure responses of 1. C. fluminea exposed to unmodified copper and various Cu concentrations. In this study, a probabilistic-based approach describing the valve behavioral response of C. fluminea exposed to unmodified copper and Cu was developed. The magnitudes of shell gap of 20 and 50% were respectively adopted as the determining thresholds of the following closing (VC) and siphon extension (VS) patterns to digitize the valve movements in bioassays. The time-varying dose-response profiles (RVC and RSW) based on an empirical three-parameter Hill model. It also allowed the estimation of the integration time-specific EC50 and EC100 values as bioassay approaches. The daily valve opening and closing pattern was characterized by a three-parameter lognormal function. The time-specific EC50 and EC100 values were estimated individually for each of the three clam species. The measured integration time values of 10, 15, 30, 60, 120 and 300 minutes. The results revealed that the RSW-based bivalve behavioral observation has a better sensitive response for detecting a lower waterborne Cu concentration than that of RVC within one hour. The results also demonstrated that the response sensitivity of clams exposed to Cu depended on the initial valve state, the initial valve state of C. fluminea was less sensitive to Cu than that of the initial state of C. fluminea. The results indicated that the present study has shown that the efficiency of Cu dose is dependent on the response sensitivity of clams exposed to Cu and the vegetable behavior. The results also demonstrated that the response sensitivity of clams exposed to Cu depended on the initial valve state, the initial valve state of C. fluminea was less sensitive to Cu than that of the initial state of C. fluminea.
Impact of suspended particles on bioavailability of petrogenic PAH in cod (Gadus morhua), mussels (Mytilus edulis) and passive samplers exposed to produced water

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Caged organisms and passive samplers are routinely used to monitor environmental impact of operational discharges from offshore oil and gas production. Comparison of caged organisms from exposed sites may be required by international and national regulations. In order to investigate the consequences of differences in biological particle density on bioavailability of petrogenic polycyclic aromatic hydrocarbons (PAHs), a laboratory study was conducted in blue mussels (Mytilus edulis) and passive samplers (SPMDs) exposed to PW. Organisms and SPMDs were exposed for 17 days to diluted PW in a continuous flow-through system. The dilution was set at 0.1%, from day 6 until day 10 the flow was set to 0.2% to mimic real field conditions with varying concentration over time. The exposure set up included: a negative control with sea water only, a positive control with diluted PW only and three tanks containing diluted PW and algae mix at low, medium and high concentrations. The following parameters were analysed: PAHs in water; PAH concentrations in SPMD and mussel soft tissues and PAH metabolites in fish. Due to the important role of gills for absorption of waterborne PAHs, a histopathological investigation of fish gills was conducted as a support parameter. The presence of realistic densities of organic particles had only minor impact on the bioavailability of low molecular weight PAHs in fish, mussels and passive samplers. Bioavailability of 3-ring PAHs was only significantly reduced in mussels when algae particle density was high (about 50 000 cells/ml).

TU 382

Estimation of environmental conditions to maximize mussels shell capability in trace metal accumulations
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The estimation of mussels shell capability of concentrate heavy metals was performed by means of a set of laboratory experiments conducted with mussels collected in unpolluted sites exposed to sub-lethal concentrations of a known toxic metal. Multiple cycles of accumulation and depuration were carried out all along the experimental period; the constant monitoring of experimental conditions and periodical metal measurement in shell and tissue samples allowed the individuation of the accumulation and depuration patterns in both Bivalves materials in the selected species. Alternative exposure to contaminated and clean seawater respectively was performed in order to record the different metal concentration trends in shell and soft tissues. In fact it is demonstrated that once the metal is incorporated in the crystalline calcium carbonate lattice, its loss from the shell during mussels lifestage can be considered of no concern; on the other hand it is known that soft tissues are able to release contaminants in response to changes in environmental conditions. The aim was to establish a set of experimental conditions able to optimize metal accumulation in mussel hard parts and to calculate the specific MATC (Maximum Acceptable Toxic Concentration) value. So it was possible to sett physical, chemical and physiological parameters in order to maximize the shell metal content and set the implementation for bioaccumulation studies exploiting mussels metal activity and detoxification mechanisms.

TU 383

The effect of sublethal nickel concentrations on Mytilus galloprovincialis: a multiple biomarker study
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Nickel is a known mammalian carcinogen and mutagen, typically found at low concentrations in the environment (<1 µg l-1), but enriched at coastal locations near nickel mining activities. In exposed water, nickel is bound to humic and organic matter, and is slowly released during the decomposition of these materials. Mussels were exposed to sublethal concentrations of nickel (0-3600 µg l-1) for 5 days. In addition to determining tissue-specific nickel accumulation, the biomarkers analysed were DNA strand breakage (comet assay), induction of micronuclei (a biomarker of effect), histopathology and expression of some nickel accumulated in mussels at low concentrations, in the tissue-specific order bivalve > digestive gland > gills > foot > adductor muscle > mantle. Significant genotoxic damage was observed by both the comet assay and micronucleus test, but only at 3600 µg l-1 nickel. Correspondingly, a semi-quantitative analysis of histopathology in the gills indicated an increase in structural damage at concentrations ≥ 1800 µg l-1 Ni. Quantitative RT-PCR revealed a significant expression of the glutathione-transferase (mGST) and metallothionein (mMT) genes in gill tissue after exposure to 3600 µg l-1 nickel, compared to the controls. Expression of these genes is known to be induced following xenobiotic exposure, especially to metals. The p-glycoprotein (pgp) gene, which has been implicated in multi-xenobiotic resistance (MRX), was markedly overexpressed in all nickel exposed mussels gills, with an increase at expression 18 µg l-1 Ni. These results suggest that nickel exposure at 3600 µg l-1 is genotoxic as well as affecting the genetics of responses to the macrophage (i.e. biomarker of exposure) and tissue (i.e. biomarker of effect) levels. As a result, we recommend that effort is made to accurately quantify nickel concentrations in highly polluted waters near nickel mines (e.g. the New Caledonian lagoon), and that remedative action may be needed if values exceed 3600 µg l-1.

TU 384

Biomarkers responses of the native clam Scrobicularia plana and changes of macrobenthic functional composition in a shallow tidal creek affected by fish aquaculture effluents
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The effects of solid organic wastes from a marine fish farm on sediments were tested using biomarkers in native clam (Scrobicularia plana) as biochemical indicators and macrobenthic community as ecological indicators. The clams and macrobenthic samples were collected in the intertidal sediment in October 2010 from five sites of the Rio San Pedro creek, following a gradient of contamination from the aquaculture effluent to the control site. Phase I and Phase II detoxification enzymatic activities (ethanolamine O-deethylase (AODE), glutathione S-transferase (GST)), glutathione peroxidase (GPX), glutathione reductase (GR) and oxidative stress parameters (Lipid Peroxidation (LPO) and DNA strand breaks) were measured in clams’ digestive gland tissues. Numbers of species, abundance, richness and Shannon diversity indexes were the biodiversity indicators measured in macrofauna. In parallel, redox potential, pH and organic matter in sediment, and dissolved oxygen in the water column were measured in situ. Significant (p < 0.05) increases of GPX enzymatic activity, pH and LPO together with significant (p < 0.05) decrease of oxidative stress indicators were observed in the areas close to the aquaculture effluent. Biomarkers (LPO, DNA, LPO and GPX) were significantly (p < 0.01) negatively correlated with pH, redox potential and dissolved oxygen and positively correlated with organic matter. On the contrary, macrobenthic biodiversity were significantly (p < 0.01) positively correlated with dissolved oxygen and negatively correlated with organic matter. It has been demonstrated that effluents from fish aquaculture activities in Rio San Pedro creek may induce oxidative stress in soft-sediment species which may lead to alteration of the biodiversity and health status of the exposed organisms.

TU 385

Mechanisms of acute toxicity of metals in estuarine and marine invertebrates
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In freshwater invertebrates, acute metal toxicity is generally associated with the disruption of ionic and osmotic regulations. In contrast, the mechanisms involved in acute metal toxicity to marine invertebrates are less well characterized, as most recent information gathered by our research group on the possible mechanisms involved in the acute toxicity of metals in these animals was reviewed. Data on the acute effects of metals (copper, silver, zinc, and nickel) on biochemical and physiological biomarkers in estuarine and marine invertebrates (foraminifers, sea urchins, sea anemones, sea cucumbers, copepods, isopods, shrimps, crabs, and bivalves) were used to review the recent data. Fish models were associated with ionic and osmotic regulation of body fluids (ions and osmotic activity and concentration in vivo and in vitro). In addition, redox potential, pH and organic matter in sediment, and dissolved oxygen in the water column were measured in situ. Significant (p < 0.05) increases of GPX enzymatic activity, pH and LPO together with significant (p < 0.05) decrease of oxidative stress indicators were observed in the areas close to the aquaculture effluent. Biomarkers (LPO, DNA, LPO and GPX) were significantly (p < 0.01) negatively correlated with pH, redox potential and dissolved oxygen and positively correlated with organic matter. On the contrary, macrobenthic biodiversity were significantly (p < 0.01) positively correlated with dissolved oxygen and negatively correlated with organic matter. It has been demonstrated that effluents from fish aquaculture activities in Rio San Pedro creek may induce oxidative stress in soft-sediment species which may lead to alteration of the biodiversity and health status of the exposed organisms.

TU 386

Histotoxic and abiotic factors increase the toxicity of macroinvertebrates contaminated in exposed sea snails
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Histotoxic contamination has received an extensive attention due to its impact on human health and wildlife. Currently, concerns about climate changes and the way they might affect the environment are being more and more studied. Moreover predator-prey relations have been progressively more pointed as stressors. Environmental contamination and bioavailability of invertebrate and abiotic stress co-occur, thus it is important to assess and understand the synergistic or antagonistic effects of these changes (e.g. salinity) and/or predation combined with common environmental contaminants.

Histotoxic responses are signs produced by the predator and that can be detected by the prey, causing stress and consequent fitness costs. In order to measure those costs and evaluate the effects of simultaneous exposure to multiple stressors, the sea snail Gibulla umbilicalis was exposed to increasing concentrations of mercury and salinity and/or predatory risk, simulated by a concentration gradient of kairomones produced by a sea snail predator - sea star. Mortality, feeding rates (indirect measure by post-feeding exposure egestion) and avoidance behaviour were assessed. In the end of the experiments, animals were sacrificed and cholinesterases’ activity and energy reserves were measured. Our results have shown that although responses could be triggered by single stressors, the combination of contaminants with abiotic or predator-specific compounds induces
stronger responses.

Studying both types of stressors and its interaction with contaminants can be crucial to provide improved interpretation of ecological effects of relevant scenarios for environmental risk assessment.

TU 387

Effects of mercury contamination on acute and chronic parameters of exposed sea snail Gibbula umbilicalis

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The Minamata (Japan) incident in the 1950’s triggered the global concern regarding the mercury contamination hazard. Mercury is a very common contaminant in the environment, having natural sources, such as volcanism, and anthropogenic origins, such as mine tailings or industrial effluents. Exposure to some environmental contaminants, even for short periods of time, may cause serious damage to exposed individuals. Thus, to evaluate the possible effects of mercury in the sea snail Gibbula umbilicalis, acute and chronic assays were performed by exposing the animals to increasing doses of the contaminant for 96 and 168 hours. Mortality, feeding rates (indirect measure by post-feeding exposure egestion) and avoidance behaviour were assessed. In the end of the experiments, animals were sacrificed and cholinesterases’ activity and energy reserves were measured.

Although evaluated at individual level, the effects observed here might be translated to the population and community level, since feeding impairment and change in energy allocation may have effects on the organisms’ fitness, and reproductive performance. Moreover, modification in cholinesterases’ activity and its common link to behaviour shifts might lead to severe implications in population dynamics.

Results show that most of the parameters evaluated tend to be impaired by this common contaminant, showing the deleterious effects that this compound may have at the population level and on marine life.

TU 388

Investigation on differential sensitivity of marine mullusk to various doses of detergent

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The problem of anthropogenic impact on marine aquaculture is one of the most actual nowadays. Synthetic detergents has been detected in municipal wastewater effluent and surface waters at different concentrations ranging from mglk to low mg/l. Detergents occur in the environment as complex compounds and could cause potential risk for humans and aquatic organisms. Few chronic ecotoxicological data are available with respect to detergents’ effects in mussels. The critical issue is the choice of methods to determine concentration response threshold and the level at which detergents are essential for organism health status.

Objective of the present study was to develop improved method for assessing potential effect of detergent agent (e.g., SDS - dodecylsulfate of sodium) on marine mussels’ cardiac activity and behavior. The study was conducted on adult 3-years mussel M. galloprovincialis Lam. Continuous recordings of the heart rate and valve movements in the mussels were carried out in the laboratory under nearly natural conditions with running ambient seawater and addition of detergent. Previously, there had been reported that concentration of 1,7 mg/l detergent is the threshold for mussels to change their filtration activity. Our results have indicated that concentration of 0.5mg/l is the detection threshold limit of SDS in mussel, which could affect on heart rate and behavior (valve gape). In high concentrations detergent caused acute toxic action, which lead to rapid valve closure, isolation and subsequent bradycardia. Results have proved that implementation of behavioral and physiological biomarkers simultaneously could be effective tool to early detection stress exposure effects in marine organisms.

The study was partly supported by RBR grant N 08-04-92124/BONUS_a.

TU 389

Bio-monitoring trace metals in Mytilus galloprovincialis off the west coast of the Cape Peninsula, Cape Town

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The concentration of trace metals (Fe, Mn, Cu, Zn, Cd and Pb) in the mussel (M. galloprovincialis) were measured along the west coast of the Cape Peninsula, Cape Town, from autumn 2010 to autumn 2011. Sampling took place at Scarborough (considered an unpolluted site), Hout Bay, Green Point, Milnerton and Bloubergstrand. The efficiency of metal accumulation was to toxic substances in the environment. Currently, the method using the dinoflagellates is pilot tested in the marine laboratory. The first results on reference compounds and energy reserves were measured.

The problem of anthropogenic impact on marine aquaculture is one of the most actual nowadays. Synthetic detergents has been detected in municipal wastewater effluent and surface waters at different concentrations ranging from mglk to low mg/l. Detergents occur in the environment as complex compounds and could cause potential risk for humans and aquatic organisms. Few chronic ecotoxicological data are available with respect to detergents’ effects in mussels. The critical issue is the choice of methods to determine concentration response threshold and the level at which detergents are essential for organism health status.

Objective of the present study was to develop improved method for assessing potential effect of detergent agent (e.g., SDS - dodecylsulfate of sodium) on marine mussels’ cardiac activity and behavior. The study was conducted on adult 3-years mussel M. galloprovincialis Lam. Continuous recordings of the heart rate and valve movements in the mussels were carried out in the laboratory under nearly natural conditions with running ambient seawater and addition of detergent. Previously, there had been reported that concentration of 1,7 mg/l detergent is the threshold for mussels to change their filtration activity. Our results have indicated that concentration of 0.5mg/l is the detection threshold limit of SDS in mussel, which could affect on heart rate and behavior (valve gape). In high concentrations detergent caused acute toxic action, which lead to rapid valve closure, isolation and subsequent bradycardia. Results have proved that implementation of behavioral and physiological biomarkers simultaneously could be effective tool to early detection stress exposure effects in marine organisms.

The study was partly supported by RBR grant N 08-04-92124/BONUS_a.

TU 390

PAM chlorophyll a fluorometry, field and laboratory research for corals and seagrass along the coast of Qatar

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An two-year long field program was conducted to evaluate the effectiveness of PAM (Pulse Amplitude Modulation) chlorophyll a fluorometry in monitoring the health of coral reefs and seagrass along the coast of Qatar. The technique was calibrated and validated as a means of assessing sub-lateral stress for coral in the region. The reduced photoinhibition in coral indicated by the PAM, without clear visual signs of stress, was generally verified by loss of corals of the colonies; this was visually verified in subsequent campaigns. Two PAM derived measurements; photosynthetic efficiency and Rapid Light Curves (RLC) were well correlated with visual observations on the health status of the organisms. Furthermore, this work has suggested a critical threshold value applicable to photosynthetic efficiency for corals in this region. For seagrass, there was correlative coverage; however, PAM measurements did not appear to provide as strong an indication of sub-lateral stress before deterioration as obviously as it does for corals. This research has now been integrated with laboratory studies utilizing both the diving PAM used in field research and the imaging PAM, which can monitor photosynthetic processes and obtain detailed visual images of photosynthesis.

Gulf coral collection and cultivation and its detailed monitoring were the first steps of corals (and seagrass) laboratory experimentation. PAM measurements were performed on the Acropora sp. colonies prior to and after collection. “Mother”colonies were tagged and photographed to document their recovery. PAM measurements were well correlated with visual observations. In the field of risk assessment of chemicals entering the marine environment, tools are needed as the pressure of several pollutants impacts marine and estuarine ecosystems. Relevant sources may be the chemicals from gas/oil production platforms and sea-side refineries. The discharge of compounds to the marine environment will be receiving additional attention in the EU Marine Strategy and rapid assessment tools are available for this. Xenobiotics are increasingly present in everyday life and are easily integrated into marine ecosystems. In aquatic systems macroalgae are continuously exposed to...
contaminants. Since they represent a very large biomass, they can act as an important sink for contaminants becoming a gateway for higher trophic levels.

Moreover, it is known that macroalgae, especially estuarine, are very important in the aquatic system due to several aspects: easy to find and to identify, vast biomass percentage and great bioindicators, making them potential sentinels of to monitor xenobiotics in aquatic environments. Macroalgae presence or absence, as well as their look-like may reflect the current state of the marine ecosystem, thus it is mandatory to develop new tools and methodologies to quickly and cost-effectively assess their status. The green macroalgae Ulva lactuca was used as a model species. When exposed to xenobiotics, can show signs of decay by losing their colour and their texture. However, these changes are not always apparent, and their extent being assessed by visual inspections is difficult. To be sure the algae are in decay and correctly quantify it, a new method was developed by measuring the colour across a colour scale. For this a colorimeter (Chroma Meter CR 400/410- Konica Minolta) was used and color variations calculated when exposed to contaminants. Also its validation by measuring photosystem electron transfer in exposed macroalgae was performed. The methodology revealed to be a sensitive and effective measure of xenobiotic toxicity and a prospective tool for environmental risk assessment.

TU 393
Analysis and environmental distribution of organic micro pollutants in urban protected salt marsh areas
M.G. Pantidou-Herrera, E. González-Mazo, P.A. Lara-Martín
University of Cadiz (Spain), Puerto real (cúdiz), Spain

Conclusion: MLPPP are the most of the microorganisms and species compared to open ocean areas. However, they are often heavily affected by human activities that can jeopardize their populations. Therefore, organic compounds discharged by nearby industries and cities has attracted considerable attention from multiple fields of study.

The results showed that the growth of Dunaliella tertiolecta was more sensitive to Zn than to Cu. Photosystem II efficiency was less sensitive to the metal(mixtures) than growth. The relative toxicity of a Copper and Zinc mixture on Dunaliella tertiolecta

TU 394
Mixing toxicity of anthropogenic and natural compounds to marine micro-algae
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Primary production by micro-algae embodies the carrying capacity of marine ecosystems and is primarily linked to nutrient availability and light. However, recent studies indicate that certain industrial chemicals may have a direct impact on plant poplulations communities and hence on the carrying capacity of estuarine and marine ecosystems. At the same time the frequency and intensity of toxic compounds in the coastal zone are increasing globally, resulting in increased levels of natural toxins expecting to affect coastal ecosystems. These different chemical stressors are hypothesized to disturb regulatory mechanisms within algal communities, modifying the competitive abilities of individual species and resulting in shifts from highly nutritious to unfavourable algal species that destabilize the food chain. However, insight in the potential antagonistic or synergistic effects of these stressors is still lacking.

TU 395
Benthic foraminiferal communities in a contaminated environment
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Despite variability and patchiness normally found in benthic meiofauna, trends found in foraminiferal assemblages could be related to environmental conditions, particularly the trace metals and percentage nitrogen. The dominant genera from around Robben Island were most strongly correlated with the mean grain size. Bolivina, Elphidium and T. pseudonana richness and abundance were negatively correlated with trace metals. The percentage nitrogen was negatively correlated with diversity while the percentage carbon was positively correlated with species richness. Summary: the species diversity, size, and density of benthic foraminifera of the Robben Island, St. Helena Bay, and不同意均是研究者们对海洋环境毒性研究的普遍共识。
These results highlight that protein ubiquitination assessment represents a promising approach to evaluate and gain insight into stress response in marine ecotoxicology.

Investigated. Crabs were collected from a low impacted estuary. In the lab they were acclimated (7d) in filtered seawater (15 psu; 16ºC) and exposed individually (9 per type metabolites (FF) was also found. GST activity and TG levels were significantly increased in crabs exposed to concentrations ≥12 µg/l, compared to controls. GR activity induced alteration of cellular processes notably includes the modulation of protein metabolism and homeostasis, so that proteomics can help to understand the sub-lethal effects of chemical stress. Especially, the study of protein ubiquitination provides a particular insight into the effects of environmental stress in terms of damages to biomolecules and regulation of degradation systems as well.

We intend to further investigate the response to prolonged air exposure in a less resistant crab species, the flying velvet crab, Necora puber (L.).

Concern around contamination of the aquatic environment by polycyclic aromatic hydrocarbons (PAHs) is high due to their toxic, carcinogenic, mutagenic and/or teratogenic effects. Fluoranthene (FLU) is a priority PAH that is commonly detected in sediments, water and biota of European estuaries. It is persistent and an important lipophilic contaminant in the aquatic environment. Due to a great physiological plasticity notably, however, the compensation capacities that underlie tolerance to stress may be impacted by the life history of crabs in terms of exposure to contaminants, including PAHs. This work investigated the accumulation of FLU and its metabolites in the tissues of C. maenas following a 7-day laboratory exposure. Effects of FLU on oxidative stress biomarkers were also investigated. Crabs were collected from a low impacted estuary. In the lab they were acclimated (7d) in filtered seawater (15 psu; 16°C) and exposed individually (9 per type metabolites (FF) was also found. GST activity and TG levels were significantly increased in crabs exposed to concentrations ≥12 µg/l, compared to controls. GR activity induced alteration of cellular processes notably includes the modulation of protein metabolism and homeostasis, so that proteomics can help to understand the sub-lethal effects of chemical stress. Especially, the study of protein ubiquitination provides a particular insight into the effects of environmental stress in terms of damages to biomolecules and regulation of degradation systems as well.

We investigated the response to environmental stress in C. maenas (L.) by comparing 2-DE proteomic profiles and protein ubiquitination in gills of crabs sampled in a polluted site and a reference site at low tide. Proteomic profiles showed significant differences according to animal origin despite high individual variability. A small set of regulated spots (Student's t-test, n=7, p<0.05, 20% FDR) successfully classified the two sites by hierarchical clustering, confirming the discriminatory power of gill protein pattern. Immunoblotting of polyubiquitinated proteins with polyclonal antibody and ECL detection enabled to visualize 20 spots in average. In spite of the high individual variability of the pattern, two spots exhibited significantly different ubiquitination levels between conditions (Mann-Whitney U test, n=3, p<0.05).

We performed a multiparametric approach to evaluate and gain insight into stress response in marine ecotoxicology. Proteins whose expression and/or ubiquitination level are affected by crab location will be subjected to identification by mass spectrometry, in order to tentatively elucidate the mechanisms involved in pollutant response.

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Does contamination impact the shore crab C. maenas (L.) resistance to an additional stress? An insight through a multiparametric approach

We investigated the response to environmental stress in C. maenas (L.) by comparing 2-DE proteomic profiles and protein ubiquitination in gills of crabs sampled in a polluted site and a reference site at low tide. Proteomic profiles showed significant differences according to animal origin despite high individual variability. A small set of regulated spots (Student's t-test, n=7, p<0.05, 20% FDR) successfully classified the two sites by hierarchical clustering, confirming the discriminatory power of gill protein pattern. Immunoblotting of polyubiquitinated proteins with polyclonal antibody and ECL detection enabled to visualize 20 spots in average. In spite of the high individual variability of the pattern, two spots exhibited significantly different ubiquitination levels between conditions (Mann-Whitney U test, n=3, p<0.05).

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Mercury (Hg) is one of the most toxic metals to biota, being capable of biomagnification and bioaccumulation in food chains. High concentrations of Hg were associated with developmental and behavioral abnormalities, impairment in growth and reproduction, and reduced survival. Though this metal has been extensively studied, several knowledge gaps still exist, mainly regarding its effects in different types of organisms. Accordingly, this study aimed at assessing the effects of a short-term exposure to Hg in the shore crab, Carcinus maenas (L.), by comparing 2-DE proteomic profiles and protein ubiquitination in gills of crabs sampled in a polluted site and a reference site at low tide.

To test our hypothesis and understand how chronic exposure to pollutants affects the resistance capacity of C. maenas to stress, we imposed a 4-days air exposure to crabs sampled in a polluted area, Le Havre harbour, and in a clean area, Yport rocky shore (France) and analysed stress markers as well as proteome variations in gills. For each site, antioxidant activities (catalase, superoxide dismutase, glutathione peroxidase, glutathione reductase, glutathione S-transferase), protein expression (2D-electrophoresis, SDS 12% polyacrylamide gels, pH 3-10) and polyubquitination (immunoblotting of 2D-E gels, ECL detection) profiles of air-exposed crabs were compared to those of control crabs sampled in a clean area, Yport rocky shore (France). A strong positive linear relationship (β = 1.15, P = 0.003, R2 = 0.911) between accumulation of FLU (GC-MS) and FLU-type metabolites (FF) was also found. GST activity and TG levels were significantly increased in crabs exposed to concentrations ≥12 µg/l, compared to controls. GR activity induced alteration of cellular processes notably includes the modulation of protein metabolism and homeostasis, so that proteomics can help to understand the sub-lethal effects of chemical stress. Especially, the study of protein ubiquitination provides a particular insight into the effects of environmental stress in terms of damages to biomolecules and regulation of degradation systems as well.

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We performed a multiparametric approach to evaluate and gain insight into stress response in marine ecotoxicology. Proteins whose expression and/or ubiquitination level are affected by crab location will be subjected to identification by mass spectrometry, in order to tentatively elucidate the mechanisms involved in pollutant response.
A short-term in situ sediment assay based on the postexposure feeding of the estuarine isopod Cyathura carinata conducted off the North American coast and in the Baltic and Mediterranean seas. The methodology for feeding quantification was first developed and optimized under laboratory conditions. In situ assays provide a more realistic test environment than assays conducted under laboratory conditions, which is particularly relevant for estuarine ecosystems where environmental conditions are highly variable. In this context, the objective of the present study was to develop and evaluate a short-term cost-effective in situ assay based on the postexposure feeding of an estuarine species widely distributed and with an important ecological role in estuarine foodwebs. The selected species was the benthic isopod Cyathura carinata, a secondary prey, prey to fish and birds, occurring along the North Atlantic coast and in the Baltic and Mediterranean seas.

TU 404
Toxicity of the biotransformation products of four methylated PAHs and one PAC produced by Nereis diversicolor and Nereis virens
A.G. Hansen1, R. Fernández-Varela1, L. Malmquist1, J.H. Christensen1
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Assessments of oil spills in general focus on the content of specific PAHs in a contaminated site. When the content of these compounds are below the detection limit, elimination of the contamination has succeeded. However, when spilled oil is biotransformed, a wide range of water-soluble products are created. These compounds can reenter the sediment by desorption reactions, but also act as toxicants in the water column. If these transformation products are toxic, they do not only expose organisms in the water, they are also subjected to spreading in the environment in a much larger scale.

The objectives of this study are therefore to 1) assess the toxicity of the biotransformation products of 1-methylphenanthrene, 3,6-dimethylphenanthrene, 1-methylpyrene, 3-methylchrysenene and phenanthrene produced by the two benthic invertebrates Nereis diversicolor and Nereis virens, and 2) identify the most important water-soluble transformation products.

The biotransformation products of PAH exposed N. diversicolor and N. virens were characterized by exposing the test water of laboratory mesocosms to different times. The water-soluble biotransformation products were extracted and concentrated by SPE, and their toxicity (EC50) were determined by exposing Daphnia magna to dilutions of these extracts. The water-soluble biotransformation products were identified and quantified by UHPLC connected in series to a fluorescence detector and a Quadrupole Time of Flight Mass Spectrometer. To aid the identification enzymatic deconjugation of the phase II products was performed, and identified by use of Gas Chromatography/Mass Spectrometry (GC/MS).

This work presents a novel approach to test the toxicity of transformation products of a contaminant mixture, where organisms are exposed to the entire range of biotransformation products. Also, this work shows the changes in toxicities of the transformation products as transformation of the PAHs progresses, and gives insights to the mechanisms of biotransformation of alkylated PAHs.

TU 405
Vitellogenin and Zona Radiata gene expressions in three different species of catfish from Termenos Lagoon
O. Zapata-Perea, A. Meléndez-Zempoalteca, J. Rubio-Piña, A. García-Fuentes

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In this study, differences in the Vitellogenin and Zona Radiata gene expressions of three different species of catfish (Ariopsis felis, Bagre marinus and Catrhops melanops) collected in the Laguna de Termenos, 70 fish were collected at 5 different sites of the lagoon and were dissected to obtain liver. Total RNA was extracted using the Trizol method along with purification with the DNase enzyme. Specific primers of Vitellogenin and Zona Radiata genes were custom designed to amplify and isolate two regions from the cDNA of the organisms. The presence of contaminants in other non-commercial species, although contamination levels in these sites are low, are thought to be a problem. The presence of contaminants in other non-commercial species, although contamination levels in these non-targeted and/or discarded species are not assessed. However, a sustainable management of discards passes through the evaluation of their environmental effect, especially if it is considered that the products of discard valuation are mainly concentrates (as fish oil and meal). Pollutants contained in the raw material are usually present at lower concentrations in the valorised product, especially if the product has a high fat content. In fact, some marine valorised by-products present pollutant levels of concern [3].

In this study, the authors were able to establish the potential of using these species to recover and to produce valuable chemicals of interest in the food and pharmaceutical industry. The authors were able to establish the potential of using these species to recover and to produce valuable chemicals of interest in the food and pharmaceutical industry. The authors were able to establish the potential of using these species to recover and to produce valuable chemicals of interest in the food and pharmaceutical industry.

TU 406
Polybrominated diphenyl ethers and their methoxylated analogs in sea bass (Dicentrarchus labrax) from Bizerte Lagoon, Tunisia
M.R. Driss, W. Ben Amere

Faculty of Sciences Bizerte, Zarzouna, Tunisia

Concentrations of selected PBDEs and MeO-PBDEs were measured in muscle tissue of sea bass (Dicentrarchus labrax) collected from the Bizerte Lagoon and the Mediterranean Sea. The concentration of these contaminants was measured by using the Trizol method along with purification with the DNase enzyme. Specific primers of Vitellogenin and Zona Radiata genes were custom designed to amplify and isolate two specific domains from the cDNA of the organisms. The presence of contaminants in other non-commercial species, although contamination levels in these sites are low, are thought to be a problem. The presence of contaminants in other non-commercial species, although contamination levels in these non-targeted and/or discarded species are not assessed. However, a sustainable management of discards passes through the evaluation of their environmental effect, especially if it is considered that the products of discard valuation are mainly concentrates (as fish oil and meal). Pollutants contained in the raw material are usually present at lower concentrations in the valorised product, especially if the product has a high fat content. In fact, some marine valorised by-products present pollutant levels of concern [3].

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TU 407
Seasonal pollutant monitoring in discarded fish species: is valorisation appropriate?
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Increased by-catch utilisation interest may come from a greater demand for fish products: the development of new markets for previously discarded species, use of low-value by-catch species for aquaculture and animal feed or the creation of value-added products from by-catch or discard fish for food, pharmaceutical or cosmetic industries. However, the contribution to a sustainable management of this biomass through their optimal valorisation highly depends on the quality of the products to be obtained from these species.

While many scientific studies, like surveys of fish and fish products in markets of different countries [1] and monitoring reports of Public Administrations and the EU [2] reported significant levels of this kind of pollutants (especially of dioxins, polychlorinated byphenyl-PCBs, organochlorinated pesticides-OCPs and heavy metals) in several cases for commercial species of different species, it is not clear if this exposure is due to the presence of contaminants in other non-commercial species, although contamination levels in these sites are low. However, a sustainable management of discards passes through the evaluation of their environmental effect, especially if it is considered that the products of discard valuation are mainly concentrates (as fish oil and meal). Pollutants contained in the raw material are usually present at lower concentrations in the valorised product, especially if the product has a high fat content. In fact, some marine valorised by-products present pollutant levels of concern [3].

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TU 410
Characterization of selected Metals in United Arab Emirates coastal fish and locally produced vegetables
F. Samara, Q. Shahzad, S.L. Knuteson, K. Abbasi
American University of Sharjah, Sharjah, United Arab Emirates

Health problems in marine and coastal environments have long been recognized as a serious environmental concern. A lack of published literature on heavy metals contamination of local fish and a proper fish advisory for the United Arab Emirates (UAE) is in current need. Moreover, seafood and locally produced vegetables comprises a major portion of local daily consumption. An assessment of the contamination of selected metals including arsenic, cadmium, lead and mercury was made in several UAE food products such as fish, seaweed, sardine, shakelie, trevaly, mushrooms, cucumbers, peppers, among others using Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES). The concentration levels were dependent on the food type and metal tested. For example, arsenic was found in sardine and shakelie at concentrations of 0.0241 mg/kg and 0.0298 mg/kg, respectively. The lowest arsenic concentration was obtained in peppers at 0.089 mg/kg. This data provides preliminary information for the further formulation of health risk assessments for the community of UAE.

TU 411
Sediment-contact exposure of medaka eggs to a PAH model: combined chemical, toxicological and proteomic approaches
University of le Havre, Le havre cedex, France

Aquatic hypoxia (dissolved oxygen levels less than 2.8 mg O2/L) has become a major concern and more than 200 “Dead Zones” have been identified by the United Nations Convention for the Protection of the Marine Environment of the Mediterranean Sea. Dozens of regions have been declared as “eutrophic” or “hypoxic”, which is a direct consequence of enrichment of coastal areas by nutrients. Hypoxic conditions trigger very high mortality rates of both marine and freshwater invertebrates and fish, leading to serious impacts on food security and the economy. Fish, seafood and vegetables (sardine, shakelie, trevaly, mushrooms, cucumbers, peppers, among others) using Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES) and Inductively Coupled Mass Spectrometer (ICP-MS). Our findings suggest that the pristine size of the dispersed particles affect the bioavailability and the overall toxicity. SETAC 6th World Congress/SETAC Europe 22nd Annual Meeting
 rôle in the negative effects of these contaminants may be manifested.

The environmental presence of polychlorinated diphenyl ethers (PCDEs), among which BDE-47 is the most abundant, make toxicity data necessary to assess the hazard risk posed to marine biota. In this study, BDE-47 was the most abundant isomer. Mytilus edulis was exposed to BDE-47 for 30 days. The lipid content in the exposed phase, the mussels were allowed to depurate in clean sea water for 10 days. Samples were collected at time 2, 5, 9, 15, 20 and 30 days of exposure to toxic. In a second experiment mussels were exposed for 30 days to three BDE-47 concentrations. In both experiments samples were used to measure glutathione S-transferase (GST), glutathione peroxidase (GPx) and acetylcholinesterase (AChE) activities. GST and GPx were inhibited after 20 and 30 days exposure, while AChE was inhibited already from the second day of exposure. After the 10 days recovery period in clean water the three enzymes recovered the initial levels of activity.

TU 417

Differential gene transcription in Poccellia vivipara exposed to copper

The increasing industrial activities and the use of CuSO4 as a fungicide in agricultural practices, as well as in the control of algae and pathogens in fish culture ponds have raised the copper concentration in aquatic systems. Furthermore, occasional accidents have aggravated this situation introducing substantial amounts of copper into aquatic environments. Copper is accumulated mainly in the liver and gills and excreted via bile and kidneys. The aim of this study was to identify genes differentially expressed in liver of Poccellia vivipara (Guppy) exposed to waterborne copper (20 µg Cu/L) for 24 h, employing the subtractive suppressive hybridization (SSH) method. Results showed that 65 genes fragments were differentially expressed, 37 upregulated, earlier studies has established that some fish can debranatize certain PCDEs congeners. Whorlmouth croaker (Micropogonias furvairii) is an important species in the Brazilian fishery industry. Therefore, it is important to understand the accumulation pattern of PCDEs in its muscle.

Response times vary between metals with amphipods exposed to copper producing behavioural changes and mortality at a faster rate than exposure to cadmium, lead or nickel. Copper is accumulated mainly in the liver and excreted via bile and kidneys. The aim of this study was to identify genes differentially expressed in liver of Pocellia vivipara (Guppy) exposed to waterborne copper (20 µg Cu/L) for 24 h, employing the subtractive suppressive hybridization (SSH) method. Results showed that 65 genes fragments were differentially expressed, 37 upregulated. The up-regulated genes were bile salt export, Component Complement 3c, CYP450, enolase, Apolipoprotein B, C1 and E, microsomal glutathione-S-transferase, NAD dehydrogenase, ubiquitin a-52, plasminogen and novel protein. The down-regulated genes were Apolipoprotein A1, Coagulation factor 2, HSP70, Liver type fatty acid Binding Protein, serine–prolyase mitochondrial-like. The identified genes are associated with functional processes like biotransformation, protein, lipids and energetic metabolism, indicating the susceptibility and/or molecular responses of this organism to the toxic effects elicited following the trace metal exposure.

TU 418

Spatial distribution and accumulation patterns of cyclic methyl siloxanes (cVMS) in fish from Northern Norway

A. Warner, T. Nøst, G. Christensen

Cyclic volatile methyl siloxanes (cVMS) have come under environmental scrutiny in recent years in regards to their potential persistence and bioaccumulative nature. As polymeric ingredients in the synthesis of silicone products, cVMS are categorized as high production chemicals where they are used heavily within the personal care products and cosmetics, as well as other facets of industry (surface treatment agents, plasticizers, construction materials, mechanical fluids). Although the majority of cVMS emissions are to the atmosphere (90%), the remaining emissions are discharged via wastewater effluent into local watersheds and can accumulate in aquatic dwelling organisms. However, little data exists on the spatial distribution of cVMS in the aquatic environment. This study will investigate the spatial distribution of cVMS within Northern Norway and if physiological factors (e.g., age, body length, weight) have an effect on cVMS accumulation within fish. Atlantic cod was collected in 2010 and 2011 near the city of Tromsø (site A) and 30 km north of the city (site B) in Northern Norway. All cVMS were detected in cod livers sampled with highest median concentrations for D5, followed by D4 and D6.显著ly higher median concentrations for ozomethylocyclohexylsiloxane (D4) and decaethylcyclopentasiloxane (D5) were observed in fish collected at site A (D4: 60 ng/g lw; D5: 1380 ng/g lw) compared to site B (D4: 10 ng/g lw; D5: 139 ng/g lw). However, no significant differences were observed in the spatial distribution for dodecamethylcyclohexasiloxane (D6) between sampling sites. Concentration of D5 within cod liver was found to be negatively correlated with age. No correlation was observed between D4 and D6 and weight of the fish. Overall, the Whitemouth croaker exposure to BDE 99 ended up accumulating BDE 47 in their muscle, however, no negative effects of the contamination in the fish was observed. The concentrations of these compounds is influenced by the body condition of the bird at the time of collection and the analysis of different tissues may generate different findings regarding contamination in birds. Lipid reserves are extremely important to the achievement of high energy cost activities to seabirds, mainly those with extended reproductive periods and that spend most of their lives at sea migrating long distances, such as Procellariiformes. The process of maintenance and utilization of lipid reserves during the life cycle of the bird imply in a frequent redistribution of OCS in the organism, when the negative effects of these contaminations may be manifested.

TU 420

Development of appropriate bioassay and statistical methods for determining survival sensitivities of Antarctic marine biota to metal exposure


Albatrosses and petrels (Procellariiformes) are migratory oceanic birds of considerable conservational interest. Polychlorinated biphenyls (PCBs) and organochlorine pesticides are accumulated in the lipid and muscle tissues of the birds studied with prosthetic feathers. The influence of body condition during the migration period in the distribution of organochlorines in the lipid and muscle tissue of birds with poor body condition. The concentration of these compounds is influenced by the body condition of the bird at the time of collection and the analysis of different tissues may generate different findings regarding contamination in birds. Lipid reserves are extremely important to the achievement of high energy cost activities to seabirds, mainly those with extended reproductive periods and that spend most of their lives at sea migrating long distances, such as Procellariiformes. The process of maintenance and utilization of lipid reserves during the life cycle of the bird imply in a frequent redistribution of OCS in the organism, when the negative effects of these contaminations may be manifested.