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Professor Henner Hollert is since 2007 Head of the Department of Ecosystem Analysis at the Institute for Environmental Research, RWTH Aachen University and recently Dean of the ABBt - Aachen Biology and Biotechnology. Furthermore, he is adjunct professor at the Universities of Chongqing, Nanjing and Tongji University in Shanghai (China).

He is expert in bioanalytical environmental toxicology, aquatic toxicology, development and validation of *in vitro* bioassays, sediment and soil toxicology, waste- and ground water investigations, effect-directed analysis and weight-of-evidence approaches. He has a long standing experience in investigation of flood events in respect to water quality. From 2010-2013 he was the speaker and one of the PIs of the joint project DanTox (funded by the German Federal Ministry of Education and Research). He is one of the PIs within the German Excellence Cluster Tailor made fuels from biomass at RWTH Aachen University, head of the working group on bioassays in the European Norman Network and one of the co-authors of the *report on effect based tools of the European Commission*.

In 2012 he was chair of the local organizing committee of the SETAC World Congress in Berlin and one of the organizers of the German-American Frontiers of Science Symposia (US National Academy of Science and Humboldt Foundation). He is council member of the *Society Environmental Toxicology and Chemistry*, Europe-German Language Branch (president in 2004) and is one of the Core group members of BioSC (Bioeconomy Science Centre).

He is Editor in Chief of *Environmental Sciences Europe* as the first international Open Access Journal in Environmental Sciences at Springer publishers. Since 2005 he is editor at *Environ Sci Poll Res* and subject editor of *J. Soils Sediments* and *Journal of Environmental Sciences of the CAS*. Since 2016 he is Associate Editor of *Science of Total Environment (STOTEN)*. He has published more than 280 peer-reviewed international and national articles as well as book chapters in this area (>200 listed in ISI-Web-of-Science).

Ecotoxicological impact of re-mobilized sediments and flood events for lock regulated rivers and wetlands

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In recent years, sediments have become a central topic of scientific and public discussion as an important factor for determining water quality. While the quality of surface waters in Germany has significantly improved during the past years, highly contaminated sediments still create a considerable threat to the quality of several European catchment areas. For several European river basis, including Neckar, Rhine and Elbe, highly contaminated old sediments can be described as “potential chemical time bombs”. An important process which may remobilize such sediments and which is still of increasing importance in relationship to the global climate change is more often occurrence of stronger floods in Europe as well as in other parts of the world. To understand and predict possible toxicological and ecotoxicological consequences of contaminants mobilized from sediments by flood events it is necessary to develop scientific approaches for the assessment of regularly flooded rivers. The combination of hydrodynamics and ecotoxicological investigations is devolving to an emerging field of research. Recently, it was shown that hydrodynamic aspects can be involved as additional line-of-evidence in Weight-of-evidence studies assessing the impact of sediments. In the last decade several studies were published addressing the ecotoxicological impact of flood events or using combined approaches for evaluating flood events and the risk of erosion. Here, we summarize different concepts and case studies for the assessment of sediment quality and report on some novel integrative test methods for assessing sediment toxicity including contaminant re-mobilization during simulated re-suspension events. Within the talk several case studies addressing the ecotoxicological impact of re-mobilized sediments and flood events for look regulated rivers and wetlands are prensented. Combined investigations of sediment contamination and mobility as well as acute and mechanism specific biotests in effect directed analyses/weight-of-evidence studies show great potential for the assessment of chemically polluted rivers and should be included into the 'programmes of measures' within future management concepts.

A glimpse in the black box – Ecotoxicological impacts on the Yangtze Three Gorges Reservoir, China

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The construction of the Three Gorges Dam resulted beside its benefits also in detriments, like the inundation of cities and industrial sites, increasing urbanization, rising ship traffic and progressive industrialization, which trigger new pollution scenarios that have the potential to threaten the recently established Three Gorges Reservoir (TGR) ecosystem.

Consequently, it is expected that substantial amounts of organic and inorganic pollutants are released into the reservoir from the inundated sites, runoff from adjacent agricultural areas as well as from sewage of industry, aquacultures and households. In addition, the dam reduced the flow velocity of the river for about one magnitude, changing this section from river-like to lake-like. This has a serious influence on the dilution of the pollutants that enter the water body and also an impact on the sedimention rate of supended particles. Sediment functions as a sink for a large variety of organic contaminants from which they can again be remobilized. Periodical changes in water level cause flooding events and thereby a relocation of contaminated water, particulate matter and sediment onto agriculturally used areas along the reservoirs shore. These anthropogenic impacts might have serious consequences for the TGR's biota and the people of the area that depend on this young and unique ecosystem.

Organic pollutants, particularly mutagens and genotoxicants as well as aryl hydrocarbon receptor (AhR) agonists – like polycyclic aromatic hydrocarbons (PAHs) and other dioxin-like compounds –, have been widely detected in the Yangtze River, but only little research was yet done on the TGR area after impoundment, and AhR-mediated activities in particular. Although a large number of studies have been performed along the Yangtze River, the TGR section remains a black box little iluminated only by a couple of studies mainly focusing on the chemical analysis of pollutants in the compartments water and sediment. Thus, it is reasonable to ask (a) what is the current pollution status of this newly created ecosystem, which is a source of food and water for millions of people, (b) is the local fauna, e.g, fish species, affected and (c) which would be the responsible priority pollutants.

In order to (i) record organic contamination, (ii) determine relevant ecotoxicological endpoints and (iii) find possible links between the contamination and ecotoxicological impacts determined *in vitro/in vivo* as well as to (iii) ecologically relevant *in situ* effects on fish from the field, several sites in the TGR area were screened applying the triad approach with additional lines of evidence. This method combines chemical analysis, *in vitro*, *in vivo* and *in situ* investigations to a holistic assessment.

Sediments and the benthic fish species *Pelteobagrus vachellii* were sampled in 2011 and 2012, respectively, to identify relevant endpoints. (a) Sediment was analyzed for 54 relevant organic compounds based on the European Water Framework Directive and (b) tested *in vitro* with the Ames fluctuation assay for mutagenicity, as well as (c) the ethoxyresorufin-*O*-deethylase (EROD) induction assay for AhR-mediated activity. Further, (d) the sediment was investigated *in vivo* with the Fish Embryo Toxicity Test (extractable fraction) and (e) Sediment Contact Assay (bioavailable fraction) with *Danio rerio* to both test for embryotoxicity/teratogenicity. *In situ* studies with *P. vachellii* comprised (f) the quantification of biliary pollutant metabolites and (g) micronucleus formation in erythrocytes to assess genotoxic impacts. In addition, activities of hepatic (h) phase I (EROD) and (i) phase II (glutathione *S*-transferase) biotransformation enzymes were measured *in situ* to both determine AhR-mediated activities. Further,

histopathological alterations in liver and excretory kidney of *P. vachellii* were evaluated, *inter alia* to assess immunotoxic impacts. EROD induction was tested *in vitro* and *in situ* to evaluate possible relationships between the activity of sediments and effects determined in the fish. Two sites, near Chongqing and Kaixian city, were identified as regional hot-spots and further investigated in 2013. Sediment and fish samples were taken in parallel at the hot-spots and analyzed with a set of relevant endpoints.

Only PAHs could be detected in sediments from 2011 (165-1,653 ng/g), emphasizing their role as key pollutants of the area. Their ubiquity was confirmed at Chongqing (150-433 ng/g) and Kaixian (127-590 ng/g) in 2013. Concentrations were comparable to other major Chinese and German rivers. However, the immense sediment influx suggests a deposition of 216-636 kg PAH/day (0.2-0.6 mg PAH/m^2/day), indicating an ecotoxicological risk. PAH source analysis highlighted the primary impact of combustion sources on the more industrialized upper TGR section, whereas petrogenic sources dominated the mid-low section.

Furthermore, sediment extracts from several sites exhibited significant impacts of frameshift promutagens in the Ames fluctuation assay. The sediments induced in the *in vitro/in vivo* bioassays AhR-mediated activities and embryotoxic/teratogenic effects – particularly on the cardiovascular system. These endpoints could be significantly correlated to each other and respective chemical data. However, particle-bound pollutants showed only low bioavailability.

The *in situ* investigations suggested a rather poor condition of *P. vachellii*, with histopathological alterations in liver and excretory kidney. Significant genotoxic impairments in erythrocytes of *P. vachellii* were detected (Chongqing/Kaixian), demonstrating the relevance of genotoxicity as an important mode of action in the TGR's fish. In addition, fish from Chongqing city exhibited significant hepatic EROD induction and obvious parasitic infestations. The PAH metabolite 1-hydroxypyrene was detected in bile of fish from all sites.

All endpoints in combination with the chemical data suggest a pivotal role of PAHs in the observed ecotoxicological impacts. PAHs, their derivatives and non-target compounds are considered as main causative agents.

The applied monitoring strategy can serve as an example to comprehensively observe the water body's quality, and the obtained results can serve as a reference for ensuing monitoring. This should further support decision-making processes in order to initiate and enforce necessary countermeasures in time, to prevent environmental degradation in the long-term and sustain the unique Yangtze River ecosystem for the Chinese people.