Contaminants in urban water cycle – detection by hydrotoxicological experiments

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Introduction: A reliable water supply, fulfilling all quality conditions at all times, is a fundamental requirement for modern society. In urban environments especially food security, public health and energy supply are affected by negative effects of a limited water supply [1]. Therefore water supply systems are classified as critical infrastructures [2]. Within interdisciplinary project work experiments are performed to detect, understand and finally numerically simulate ongoing hydraulic and ecotoxicological processes inside water supply systems. Based on the results of the experiments new numerical models, data driven models and statistical models for event detection can be set up. The main objective of the project work is the development of a Risk Based Management Framework (RBMF) for event detection.

Methods: Basis for the experiments is the hydrotoxicological method [3], linking the gap between hydraulic engineering and ecotoxicology. Here the processes between specific parameters, like processes between sediment and contaminants, water body and contaminants as well as effects on aquatic organisms are analyzed to understand the ecological relevance of contaminants inside the sediment-water-system. These experiments will be performed in the annular flume at the hydraulic laboratory of the Institute of Hydraulic Engineering and Water Resources Management, RWTH Aachen University (see figure 1).

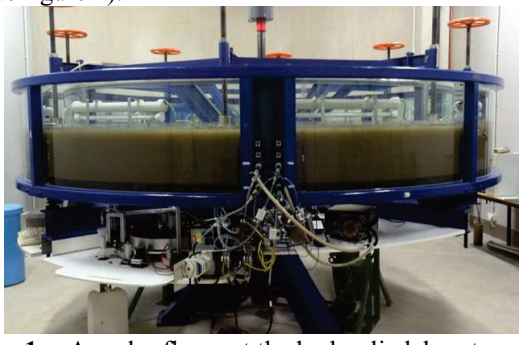

Fig. 1: Annular flume at the hydraulic laboratory

Experimentally the event of a sudden and unforeseen input of contaminants is characterized, by observing the behavior of various parameters for instant physical and chemical parameters, e.g. pH-value and redox potential, over the period of the experiment. While the experiment is running samples are taken out of the annular flume to test metal analytics and organic content. Simultaneous an on-line bio-unit, including a flow-through well-plate and a custom made pipetting robot, is under construction at the Institute of Environmental Research, RWTH Aachen University. With this innovative test set-up the embryotoxicity is investigated with zebrafish *Danio rerio* embryo and larvae. After comprehend the complex ongoing processes in the sediment-water system the description in a numerical model follows. The results of the hydrotoxicological experiments serve also as input parameter for a data-driven model, conceived from the project partners in Haifa.

Conclusion: The tools used and developed in this interdisciplinary project will enhance the understanding of underlying effects and mechanisms after contamination events and thereby improve management possibilities in monitoring water basins and urban distribution systems.

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