Research Unit
Environmental Engineering and Biotechnology

HELMHOLTZ CENTRE FOR ENVIRONMENTAL RESEARCH – UFZ

Science Talk UFZ

Challenges and Perspectives of Chemical and Bio-Technologies for the Environment

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Leipziger KUBUS, Lecture Hall 1A
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Using electrons to clean the water: are electro-chemical systems the future of water treatment?

To minimize the effects of water pollution and alleviate water scarcity, urban water infrastructure will have to be re-invented through implementation of innovative low-cost, energy efficient decentralized water and wastewater treatment systems, and use of alternative water resources. Among the available technologies, electrochemical systems have the most potential to be used for decentralized treatment of (waste)water. Electrochemical systems do not use chemical reagents, do not form a residual waste stream, operate at ambient temperature and pressure, are robust, versatile and have a small footprint. Yet, to advance from laboratory experiments to practical implementation, there are two key challenges that need to be addressed: 1) high energy consumption and cost; given that most contaminants are present at low concentrations, their electrochemical reactivity in the conventional flow-by two-dimensional (2D) electrochemical reactors is subject to pronounced mass transfer limitations, and 2) formation of toxic halogenated byproducts in the presence of halides.
Three-dimensional (3D) reactor design is characterized by the high electrode surface area to reactor volume ratio and significantly improved reactor efficiency, with a larger effective surface area available for electrolytic degradation of contaminants and reduced mass transfer limitations. Yet, low electrocatalytic efficiency and stability, and high cost of electrode materials are hampering the implementation of 3D electrochemical systems. Nanotechnology can provide solutions to enhance the current efficiency of electrochemical water treatment systems. As nanotechnology continues to generate better materials and improve their functions, its fusion with electrocatalysis will undoubtedly accelerate the development of high-performing, reliable, cost-effective, and environmentally friendly water treatment technologies.

Jelena Radjenovic graduated at the Faculty of Technology and Metallurgy, Belgrade University, Serbia. She obtained her PhD at The University of Barcelona in 2009. Shortly after, Dr. Radjenovic moved to the Advanced Water Management Centre at The University of Queensland, Australia. Since late 2014, she has been working at the Catalan Institute for Water Research. Her current research is focused on the development of electrochemical water treatment systems, nanoadsorbents and nano-engineered biotreatment systems.

All interested colleagues are kindly invited.