PhD Candidate Profile

Name:
Samira Lambertz

Research Group:
Water technology – Cavitation – Renewable resources

Research Centre:
Institute for Technical Chemistry and Environmental Chemistry

Department/School:
Department of Chemistry and Earth Science

College:
Friedrich-Schiller-Universität Jena

Supervisor:
Dr. Patrick Bräutigam, Prof. Dr. Michael Stelter

Funding body:
N/A

Area (field) of study:
Water analysis

Thesis Title:
Determination of Chemical Oxygen Demand using an electrochemical AOP process

Abstract:
Chemical Oxygen Demand (COD) is an important parameter for water monitoring. It is a sum parameter that determines the amount of organic matter in the water sample. It is defined as the oxygen needed in the total mineralization of the organic matter. It is used to control the quality of fresh water as well as in wastewater treatment plants.

The standard method for the determination of COD is part of the law for water analysis in most countries. However, it uses toxic chemicals like $K_2Cr_2O_6$ and $HgSO_4$ which are supposed to be faded out from usage. Additionally, it has high costs, a high energy demand and takes a long time. Because of these disadvantages it is necessary to find an alternative method for the determination of COD. On top of that a method that has a short analysis time and can be automated could be used for controlling the biological treatment in wastewater treatment plants which would lead to huge reductions in greenhouse gas emissions.

The COD measures the amount of oxidant that is needed to oxidize all organic matter in the sample in terms of oxygen concentration. In the standard method the sample is digested by chemical oxidation. An alternative approach can be to use an electrochemical AOP for the oxidation of the organic matter.

July 2021

PhD Candidate Profile

In this approach the organic matter is oxidized by hydroxyl radicals that are produced at Boron Doped Diamond electrodes. By measuring the oxidation current in this reaction, the COD of a sample can be measured.

Challenges in the development of a COD sensor based on an electrochemical advanced oxidation process is to reach at least the same linear working range and limit of detection of the standard method.

Consequently, the goal of this project is to optimize the method by using different electrochemical methods, optimization with Design of Experiments and using ultrasound to enhance the measurement sensitivity and to avoid fouling on the electrode. Moreover, different approaches will be used to activate the electrode and augment the electrode surface.

Collaborations:

N/A

Publications:

N/A

Presentations:

N/A