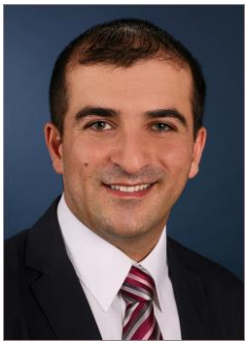
Faculty of Civil, Geo and Environmental Engineering
Institute of Water and Environment
Chair of Urban Water Systems Engineering

**Dissertation Fact Sheet**

# Removal of residual pharmaceuticals from wastewater treatment plant effluents by electrochemical oxidation using a boron doped diamond electrode.

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| Started | **11/2011** |
| Status | ☒ **ongoing** ☐ **finalized: MM/20YY** |
| Referees | -<br>- |


Wastewater treatment and water reuse is one of the main points in the strategies drown to minimize the effects of water scarcity facing the global. Due to the presence of residual micropollutants like pharmaceuticals in water sources, new treatment technologies are now under the focus of academical and industrial institutions. Different studies have shown that traces of pharmaceutical substances are present in surface and ground water bodies in the range of ng/L up to µg/L in both developed and developing countries (Fenet et al. 2012; Ternes 1998). The risk of residual pharmaceuticals in water on human health is still poorly understood, however it may affect other creatures (Oaks et al. 2004). Electrochemical oxidation as a treatment step could be an environmentally-friendly and economical technology to remove and mineralize the residual pharmaceuticals in the effluents of wastewater treatment plants.

Boron doped diamond electrodes with their unique properties show a promising future as an electrochemical oxidation process. The objective of the project is to study the applicability of a diamond electrode to remove different pre-determined pharmaceuticals in effluents from the Garching sewage treatment plant (STP) spiked with pharmaceuticals traces (one substance and mixed substances). LC-ToF/MS and other analytical instruments will be used to follow the degradation pathway and to find out the degradation products (Fig.1). Another essential point in the project is the inorganic by-products formed especially chlorate, bromate and halogenated organic compounds (AOX). The implementation of this technology to treat special wastewater from industry or agricultural industry as well the economical point of view will be studied using a pilot unit. With a total capacity up to 20 litres, scaling up of the diamond electrode system for disinfection of microorganisms will be a parallel topic in this project as a follow-up of previous laboratory scale disinfection experiments.

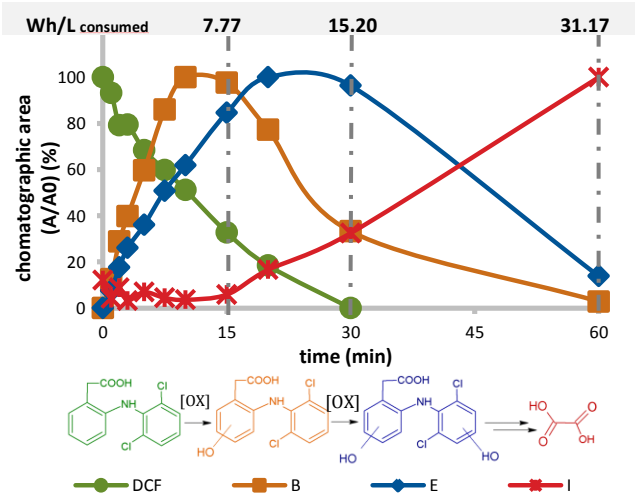


**Figure 1:** Time course of DCF degradation and some TPs in STP effluent (292 mA/cm²). Energy consumption (pump + electrode) in Wh/L during the operation.

## References

***Fenet, Hélène; et. al.*** *,(2012): Carbamazepine, carbamazepine epoxide and dihydroxycarbamazepine sorption to soil and occurrence in a wastewater reuse site in Tunisia. Chemosphere. Online verfügbar unter http://dx.doi.org/10.1016/j.chemosphere.2012.02.050.*

***Oaks, J. Lindsay et. al.****. ,(2004): Diclofenac residues as the cause of vulture population decline in Pakistan. Nature 427 (6975), 630–633.*

***Ternes, Thomas A.*** *,(1998): Occurrence of drugs in German sewage treatment plants and rivers1Dedicated to Professor Dr. Klaus Haberer on the occasion of his 70th birthday.1. Water Research 32 (11), 3245–3260.*