UNIVERSITÄT DUISBURG ESSEN
Offen im Denken

Faculty of Engineering
Department of Mechanical Engineering
Chair of Mechanical Process Engineering /
Water Technology

DEGREE THESIS AND RESEARCH PRACTICAL WITH THE FOCUS ON: "INVESTIGATION OF PHYSICAL AND CHEMICAL INTERACTIONS BETWEEN ACTIVATED/MODIFIED CARBON AND POLAR ORGANICS"

Efforts for more environmental regulations and providing circular economy are forcing industrial consumer to use more effective and sustainable materials. The performance of activated carbon in water treatment systems is primarily influenced by both pore structure network and chemical characteristics of surface groups. Due to utilizing activated carbon in general, it is possible to remove (non-polar) dissolved organic compounds from industrial waste water by physical interactions (physisorption). Removal of polar organics and ionic substances can be improved due to chemical polarization and targeted modification of carbon surfaces. In this context the selectivity and increase of both chemical and physical interactions between surface groups and polar substances in the bulk solution are of major importance. For this reason both activation process and modification of surface structure is becoming increasingly important due to the demand for more and more specific carbon. Systematic investigations of different influencing variables (raw material, activating temperature, hold time and oxidizing agent) in a rotary kiln with regard to the formation of pore structures as well as settings of chemical surface functionalities are largely not documented in scientific publications.

Characterization of surface functionalities with different physical and chemical methods will be a main part of the thesis or research practical. The student will also investigate adsorption isotherms of aromatics in ionic solutions by using spectroscopic methods and investigate surface chemistry by using electrochemical methods. The activities can consider and contain following focusses:

- **Process optimization** and engineering of a rotary kiln for production of granular activated carbon
- **Physical and chemical characterization** of activated carbon (e.g. Iodine number and further physical properties)
- **Development and support of RSSCT-system** (rapid small scale column tests) for simulation of filtration mechanisms
- **Chemical and thermal modification/oxidation** of activated carbon during pre-treatment, activation or post-treatment
- **Investigation of surface functionalities** by using titrimetric methods (e.g. Boehm), fluorescence labeling (e.g. FLOSS) and particle charge measurements (e.g. Zeta potential)
- **Recording adsorption isotherms/capacities** on model waters with polar organics in ionic solution by utilizing fluorescence- (FEEM) and UV-Vis-Spectrometry and TOC

There is the possibility to define a suitable task according to the position of the student (e.g. bachelor/master thesis or research practical). The positions include a probationary period of 2 weeks. Under appropriate conditions there is also the possibility of employment as student assistant in our chair.

UNIVERSITÄT DUISBURG ESSEN
Offen im Denken

Faculty of Engineering
Department of Mechanical Engineering
Chair of Mechanical Process Engineering /
Water Technology

REQUIREMENTS

- Outstanding commitment and motivation according to the desired position.
- Basic knowledge of water chemistry, analytics and water treatment technologies (esp. adsorption processes).
- Current grades overview.

If you are interested, please email your application with all required documents (as PDF) to the supervisor mentioned below.

Supervisor:
Zülfü Engin, M.Sc.
Zuelfue.Engin@uni-due.de
Tel: 0203 – 379 4484

Scientific coordination:
Prof. Dr. Ing. Stefan Panglisch
Stefan.Panglisch@uni-due.de
Tel: 0203 – 379 3477