Institute of Chemical Engineering
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Bachelor/Master thesis, Research Internship:

Photocatalytic Wastewater Treatment

Scope of the Project:

The contamination of surface waters with pharmaceuticals has increased strongly in recent years due to the increasing use of medical products.[1;2] These substances are primarily released into the aquatic environment via wastewater from municipal sewage treatment plants. As the substances often cannot be sufficiently removed in conventional wastewater treatment processes due to their chemical and physical properties, additional measures for their removal are necessary. Examples of suitable advanced sewage treatment technologies are oxidative processes, such as the treatment of wastewater with hydrogen peroxide or ozone and irradiation with UV light.

The photocatalytic degradation of pollutants is considered to be one of the *Advanced Oxidation Processes* (AOP) whose common feature is the generation of hydroxyl radicals as active species.[3] Due to its high activity, stability and toxicological harmlessness, titanium dioxide is frequently used as a photocatalyst. Irradiating the photocatalyst with light of a suitable wavelength, charge separation occurs and hydroxyl radicals can be generated (see Fig. 1). The production and fixation of the catalyst can be realized by different methods. Dip coating involves immersing the catalyst carrier in a suspension and evaporating the solvent afterwards. TiO_2 layers can also be deposited plasmachemically on metals such as titanium and aluminum using the Solectro process developed at FSU Jena.[5]

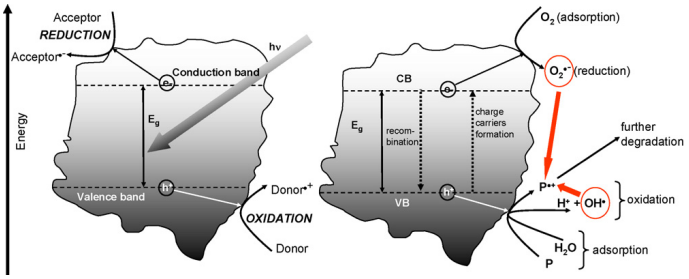

Figure 1: *Degradation mechanism of the pollutant.*[4]

Current Scientific Work:

The aim of this work is the investigation of the photochemical degradation of diclofenac by means of a heterogeneous photocatalyst. As photocatalyst titanium dioxide is used in different modifications and morphologies. It is produced by dip coating and the Solectro process. An LED whose intensity can be controlled is used as the light source. The diclofenac concentration is measured online using a UV-VIS flow cell. The production of the catalysts, investigations of the reaction kinetics of the pollutant degradation as well as the modeling of the process are part of this research project.

[1] Fent, K.; Weston, A. A.; Caminada, D.: *Aquatic Toxicology*, **2006**, *76* (2), 122–159.
[2] Zhang, Y.; Geissen, S.-U.; Gal, C.: *Chemosphere*, **2008**, *73* (8), 1151–1161.
[3] Oppenlaender, T.: *Photochemical Purification of Water and Air*, **2002**, Wiley-VCH, Weinheim.
[4] Malato, S.; et al.: *Catalysis Today*, **2009**, *147* (1), 1–59.
[5] Meyer, S.: *Plasmachemische Beschichtung: Eine Methode zur Herstellung substratunabhängiger photokatalytisch aktiver TiO2-Schichten*, **2003**, Der Andere Verlag, Osnabrück.

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