Electrochemical Advanced Oxidation Process (EAOP) using DiaChem® Electrodes for Industrial Water Treatment

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With a rapidly growing world population and increasing levels of pollution, the protection of the environment and the preservation of resources have become major issues for future technological progress. Since several years Advanced Oxidation Processes (AOP) are used for the total mineralization or the decomposition to harmless or biological degradable products of organic pollutants[1]. A common feature of all AOPs is the utilization of hydroxyl radicals with a high oxidation potential for an effective oxidation process.

Because of the high overpotential for water decomposition doped diamond electrodes (Figure 1) are appropriate to produce hydroxyl radicals directly by electrolyzing water with high current efficiencies[2]. Additionally diamond electrodes exhibit an outstanding chemical stability. Therefore an electrochemical oxidation process with diamond electrodes provides several advantages compared to other AOPs like safety, easy handling and cost efficiency.

In cooperation with academic and industrial partners we studied the oxidation of organic pollutants in different industrial waste waters from a laboratory up to a pilot scale. Different electrochemical cell designs with monopolar as well as bipolar electrode arrangements (Figure 2) were used. We present investigations which contain pollutants like oil-water suspensions (Figure 3), EDTA and TBT in harbor sludge. The EAOP yields current efficiencies for decomposition of these waste waters of > **90%** for the case of no limitations due to mass transport. However, mass transport limitations reduce efficiencies to values of **55% - 75%,** indicating the necessity for the development of optimized electrochemical systems to use the full potential of EAOP.

1. R. Andreozzi, V. Caprio, A. Insola, R. Marotta, Catalysis Today 53 (1999) 51-59

2. M. Fryda, A. Dietz, D. Herrmann, A. Hampel, L. Schäfer, C.-P. Klages, A. Perret, W. Haenni, C. Comninellis, D. Gandini,Electrochemical Proceedings Volume 99-32, 2000, 473

Figure 1: DiaChem® electrodes based on expanded metal with areas up to 0.5m^2.

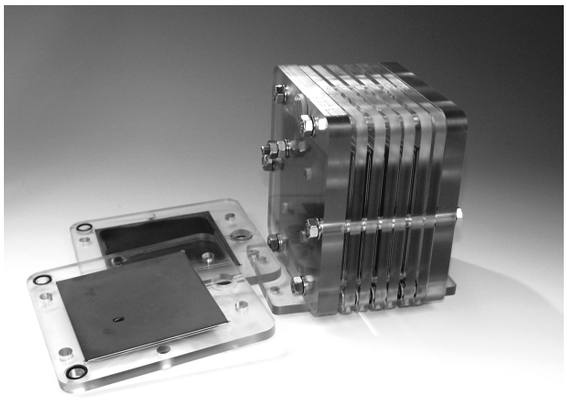

Figure 2: Example of an electrochemical bipolare cell for waste water treatment.

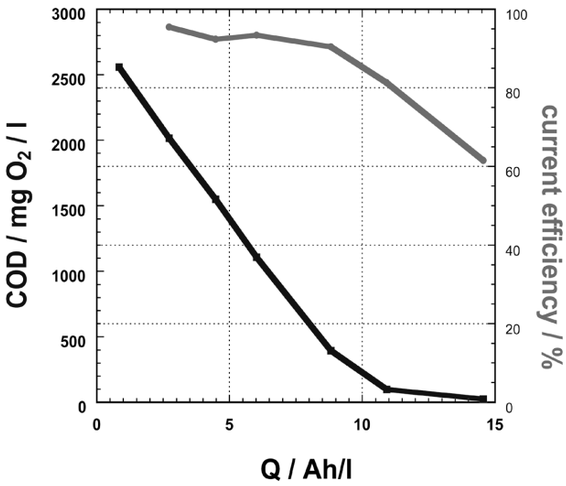

Figure 3: Effective decomposition of organics in an oil polluted waste water from automotive industry applying EAOP.