Influence of organic surface loading rate and hydraulic retention time on removal efficiency of a submerged aerated fixed-bed biofilm reactor

Global competition and environmental legislation imposing strict emission limits lead to an increasing demand on the efficiency of wastewater treatment in the chemical industry. Identifying the adequate method for such treatment, biological technologies are increasingly preferred over physical or chemical processes due to their capability to remove pollutants in a more environmentally friendly and cost-effective way. In the field of biological wastewater treatment, fixed-biofilm technologies provide several advantages over suspended-growth systems. In particular, attached biomass becomes more specialized and adapted to not readily biodegradable components. This is attractive in view of the challenging complexity and diversity characteristic to industrial wastewater. Many industrial sectors, for example the petroleum and leather industry, are likely to generate wastewater rich in both organic matter and salt. High salinity is a microbial stress condition and thus constitutes a considerable difficulty for the development of a reliable biofilm-based wastewater treatment process.

In the course of our investigations, a submerged aerated fixed-bed biofilm process for the treatment of high saline wastewater is developed at laboratory- and pilot-plant scale. With special attention to the difficulties accompanied by high salinity, our research aims at deriving a promising reactor design and evaluating possible process improvements regarding their impact and practical implementability. In addition, the aim is to reduce uncertainties about key input parameters to ensure steady-state operation at industrial scale. The exhaustive oxidation of dissolved carbon content is chosen as the main treatment objective, representing a widely spread and industrially relevant example. To maximize the surface related reaction rate for the removal of dissolved organic carbon by means of an empirical approach, the organic surface loading rate as well as the hydraulic retention time removal efficiency are focused on.

The poster presentation will give an introduction into the overall concept to meet the challenges of our research with special attention to the requirements resulting from the high salinity conditions as well as from the maximization of the surface related reaction rate as the key design parameter of the submerged aerated fixed-bed biofilm process. Furthermore, the experimental set-up will be presented and first experimental reactor operation results will be shown.