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ON-LINE MEASUREMENT AND REDUCTION OF FOULING COMPOUNDS IN MEMBRANE BIOREACTOR SYSTEMS

POMIAR ON-LINE I REDUKCJA ZABURZEŃ W SYSTEMACH BIOREAKTORÓW MEMBRANOWYCH

The application of micro- and ultrafiltration membranes in biological wastewater treatment for the separation of biomass (membrane bioreactor systems) is a new development that provides several advantages in comparison to the conventional activated sludge process (e.g. bacteria free effluent, reduction of footprint). However some limitations like the long-term fouling of membranes lead to higher operation costs and restricts the widespread application of this process.

Within the framework of the European project AMEDEUS the Technical University of Berlin is focussing its research on the detection of organic fouling compounds as well as fouling control strategies in membrane bioreactor systems (MBR). Soluble and colloidal substances like soluble microbial products (SMP) (also described as extra cellular polymeric substances (EPS)) are considered to be the major foulants in MBRs [1]. Substantial reduction of such compounds in the bioreactor can be a promising technique for flux improvement, hence cutting costs in MBR operation [2]. The concentration of SMP (or EPS) present is usually determined by measuring its most important constituents: polysaccharides and proteins, which are quantified by photometrical analysis as sum-parameters. Up to now the analysis has been performed manually and results vary largely depending on laboratory conditions. The existing literature data on EPS are not consistent with respect to the variation of polysaccharides and proteins in the MBR system during a long period of operation. The goal of the present approach is to develop an on-line sensor which detects EPS parameters continuously in activated sludge. Based on the sequential injection analysis (SIA) technique, the Lowry method for proteins [3] and the Dubois [4] method for polysaccharides have been implemented and an appropriate sample extraction device has been developed [5, 6]. For further characterisation of

fouling components size exclusion chromatography (SEC) with organic detection is applied for off-line measurement of large organic biopolymers. The reduction of fouling compounds in the sludge may be accomplished by the use of additives, which adsorb or bind EPS compounds. Different substances (flocculants, activated carbon, etc.) were tested with regard to their ability to minimise the concentrations of polysaccharides and proteins and with regard to the improvement of the filterability of MBR sludge.

The final objective of the project is the combination of the on-line sensor with the dosing system for fouling-reducing additives and its control by the measured signal for the concentration of polysaccharides and proteins, hence stabilising and improving the flux of the overall MBR pilot plant.

References

- [1] Rosenberger S., Laabs C., Lesjean B., Gnirss R., Amy G., Jekel M., Schrotter J.-C. (2006) Impact of colloidal and soluble organic material on membrane performance in membrane bioreactors for municipal wastewater treatment. *Wat. Res.* 40, 710-720, 2006.
- [2] Lee W.-N., Lee C.-H., Chang I.-S. (2006) Effect of Membrane Fouling Reducer on Membrane Filtration Characteristic in MBR process. *IWA Congress and Exhibition, Beijing 10-14 September*.
- [3] Lowry O.H., Rosebrough N.J., Farr A.L., Randall R.J. (1951) Protein Measurement With The Folin Phenol Reagent. *J. Biol. Chem.* **193**, 265-275.
- [4] Dubois M., Gilles K.A., Hamilton J.K., Rebers P.A., Smith F.S. (1956) Colorimetric Method for Determination of Sugars and Related Substances. *Anal. Chem.* **28**(3), 350-356.
- [5] Mehrez R., Ernst M., Jekel M. (2007). Development of a continuous protein and polysaccharide measurement method by Sequential Injection Analysis for the application in membrane bioreactor systems. *Wat. Sci. Tech.* **56**(6), 163-171.
- [6] Mehrez R., Jekel M., Ernst, M. (2007). Sample pre-treatment device for continuous EPS analysis in membrane bioreactor systems. *In Proc. IWA Young Researchers Conference, Berlin June 4-6 2007*.