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# Development of an Integrated Methodology for Fouling Control in Membrane Bioreactors

**Authors :** Petros Gkotsis, Anastasios Zouboulis, Manasis Mitrakas, Dimitrios Zamboulis, E. Peleka

**Abstract :** The most serious drawback in wastewater treatment using membrane bioreactors (MBRs) is membrane fouling which gradually leads to membrane permeability decrease and efficiency deterioration. This work is part of a research project that aims to develop an integrated methodology for membrane fouling control, using specific chemicals which will enhance the coagulation and flocculation of compounds responsible for fouling, hence reducing biofilm formation on the membrane surface and limiting the fouling rate acting as a pre-treatment step. For this purpose, a pilot-scale plant with fully automatic operation achieved by means of programmable logic controller (PLC) has been constructed and tested. The experimental set-up consists of four units: wastewater feed unit, bioreactor, membrane (side-stream) filtration unit and permeate collection unit. Synthetic wastewater was fed as the substrate for the activated sludge. The dissolved oxygen (DO) concentration of the aerobic tank was maintained in the range of 2-3 mg/L during the entire operation by using an aerator below the membrane module. The membranes were operated at a flux of 18 LMH while membrane relaxation steps of 1 min were performed every 10 min. Both commercial and composite coagulants are added in different concentrations in the pilot-scale plant and their effect on the overall performance of the MBR system is presented. Membrane fouling was assessed in terms of TMP, membrane permeability, sludge filterability tests, total resistance and the unified modified fouling index (UMFI). Preliminary tests showed that particular attention should be paid to the addition of the coagulant solution, indicating that pipe flocculation effectively increases hydraulic retention time and leads to voluminous sludge flocs. The most serious drawback in wastewater treatment using MBRs is membrane fouling, which gradually leads to membrane permeability decrease and efficiency deterioration. This results in increased treatment cost, due to high energy consumption and the need for frequent membrane cleaning and replacement. Due to the widespread application of MBR technology over the past few years, it becomes clear that the development of a methodology to mitigate membrane fouling is of paramount importance. The present work aims to develop an integrated technique for membrane fouling control in MBR systems and, thus, contribute to sustainable wastewater treatment.

**Keywords :** coagulation, membrane bioreactor, membrane fouling, pilot plant
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