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Biofilm formation and its effect on biofouling in RO membrane processes for wastewater reuse

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ABSTRACT

To reuse wastewater effluents, several advanced technologies including reverse osmosis (RO) membrane processes are being considered. However, biofouling caused by biofilm formation on the surface of RO membranes impedes their application for wastewater reclamation. Since the adhesion of bacterial cells to mambrane surfaces is the first step of biofouling, in this study, the bacterial adhesion tendency on two different surfaces, glass and RO membrane, was compared to investigate biofouling potential using two feed water sources with different organic content and ionic strength. The experimental results of biofilm formation potential showed that bacterial adhesion was substantially high when wastewater effluent was continuously supplied to the RO membrane surface due to physicochemical interactions including surface roughness and feed water properties. The membrane biofouling was determined by measuring of flux decline patterns and by analyzing foulants on the membrane surfaces. The rapid flux decline in the RO membrane exposed to the wastewater effluent was likely to be due to the biofilm formation in terms of extracellular polymeric substances (EPSs). Chlorination, the common biofouling control method, was conducted to reduce bacterial adhesion potential and remove the EPSs from the RO membrane surface. Nevertheless, the permeate flux was not improved and the EPS concentration was not decreased with increasing chlorine doses when the wastewater effluent was supplied.

Keywords: Biofouling; Reverse osmosis membrane; Wastewater effluent reuse; Extracellular polymeric substances

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