

Extracellular polymeric substance characteristics and fouling formation mechanisms in submerged membrane bioreactors

Shang-Hsin Ou^a, Sheng-Jie You^{b*}, Yen-Chi Lee^a

^aDepartment of Civil Engineering, Chung Yuan Christian University, Taoyuan, Taiwan

^bDepartment of Bioenvironmental Engineering and R&D Center for Membrane Technology, Chung Yuan Christian University, Taoyuan, Taiwan

Tel. +886 (3) 2654931; Fax +886 (3) 2654933; e-mail: sjyou@cycu.edu.tw

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ABSTRACT

In this study, the characteristics of extracellular polymeric substance (EPS) and the mechanism of fouling formation investigated using a submerged membrane bioreactor system consisting of a polytetrafluoroethylene (PTFE) membrane. During 85 days of operation, the bound EPS observed as the main component, which contributed major part of resistance to fouling. The protein to carbohydrate ratio was higher in the growth phase than in the stationary phase. The fouling resistances contributed by each individual resistances, i.e. loose cake layer, dense cake layer and internal fouling evaluated by batch filtration test after rinse, wash, and backwash operations respectively. The results showed that fouling of membrane and transmembrane pressure increased very quickly within 30 min of operation mainly due to resistance offered by immediate cake layer formation. The analysis of EPS contributed by different fouling layer revealed that most of the carbohydrate adsorbed quickly on the PTFE membrane first and then protein concentration increased with increasing filtration time. The protein content of EPS gradually increased when the foulant approach the membrane, whereas carbohydrate content showed opposite trend. Furthermore, the filtration of pure bacteria (*Ralstonia*) showed that most of proteins adsorbed on the membrane surface were hydrophobic and identified its contribution as the biological functions of translation.

Keywords: MBR; EPS; Fouling; PTFE membrane; Membrane cleaning; Membrane resistance; Protein nature; Size; Cellular function

* Corresponding author.