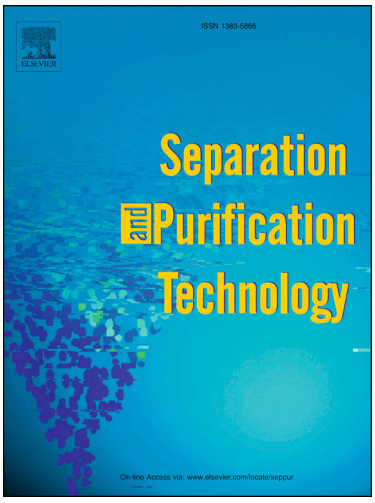

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Mechanism of SMP aggregation within the pores of hydrophilic and hydrophobic MBR membranes and aggregates detachment

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Abstract

This study aims to better clarify the mechanism of MBR membrane fouling, since it remains ambiguous due to its high complexity. The fouling mechanism was studied during long-term lab-scale MBR experiments in a hydrophilic and a hydrophobic membrane and was evaluated according to the trans-membrane pressure (TMP) profile, the size of colloid particles by dynamic light scattering (DLS) measurements and the characterization of soluble microbial products (SMP) in the form of proteins and carbohydrates. The experimental data showed that membranes withhold 62±17% of SMP carbohydrates and 23±10% of SMP proteins, which attributed both to their deposition into the membrane and to rejection back to the mixed liquor due to electrostatic repulsion by the negatively charged depositions of SMP. The size of particles detected in filtrate at the first day was equal or lower to the pore size of membranes verifying thus their nominal pore size. In contrast, the SMP that were deposited within the pores on the following days gradually aggregated resulting in either pore blockage and increased TMP or in detachment and excretion as aggregates of size equal to or greater than the membrane pores. The hydrophobic membrane presented some kind of anti-fouling properties in the first fouling phase, due to surface hydrophobicity of the membrane, but its general fouling profile was similar to the hydrophilic one, due to SMP deposition. The deposited SMP modified the characteristics of both membrane surfaces, resulting in turn in a similar fouling mechanism for both membranes.

Keywords: MBR membrane; Hydrophilic; Hydrophobic; Irreversible fouling; SMP

1. Introduction

Membrane bioreactors are an advanced wastewater treatment process that has been developed during the last decades and constantly gains ground due to their various advantages. However, membrane fouling increases operation costs and still remains a serious obstacle preventing their universal application. Extensive research has been carried out to understand the

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