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Effects of membrane and operational features on biofouling in a pressure retarded osmosis process

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ABSTRACT

Pressure retarded osmosis (PRO) is a technology that generates power via mixing two solutions having different salinity across a semipermeable membrane. Similar to other membrane-based technologies, PRO processes are prone to membrane biofouling. In this study, the effects of membrane and operational features on the membrane biofouling of a PRO process were investigated, through a comparison with those of a reverse osmosis process. Surface roughness, charge, and hydrophobicity affected the propensity of the biofilm formation on the support layer of the PRO membrane. Nevertheless, these physical and chemical properties could not sufficiently explain the rapid flux decline of the PRO unit under an enhanced biofouling condition. Water flow from the feed solution to the draw solution, and the structural property of the PRO membrane resulted in the accumulation of microorganisms in the support matrix of the PRO membrane, which contributed significantly to the flux decline propensity. The results suggested that the pretreatment of feed solution and/or new membrane fabrication are needed to minimize the access of microorganisms in the support matrix for reducing membrane biofouling in PRO.

Keywords: Biofilm; Biofouling; Pressure retarded osmosis; Reverse osmosis; Support matrix

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