

Toward a combined system of forward osmosis and reverse osmosis for seawater desalination

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Abstract

Forward osmosis (FO) is an osmotic process that uses a semi-permeable membrane to effect separation of water from dissolved solutes by an osmotic pressure gradient. Unlike reverse osmosis (RO), FO does not require high pressure for separation, allowing low energy consumption to produce water. However, the internal concentration polarization in FO is an important factor affecting the performance of FO processes.

This paper was intended to investigate the characteristics of FO and RO processes. A simple film theory model was applied to consider concentration polarization in FO and RO processes. This model allows the estimation of internal and external concentration polarization effects in FO process. A laboratory-scale FO device was used to find the model parameters for further calculations. The calculated flux was compared with experimental flux under a variety of operating conditions. It was found that the combination of FO and RO may result in a higher flux than FO-only process under some operating conditions. Further research will be required to investigate the effect of membrane materials on energy efficiency of FO and RO hybrid system.

Keywords: Desalination; Forward osmosis; Reverse osmosis; Concentration polarization; Combined system

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