The forward osmosis and desalination


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ABSTRACT

Forward osmosis (FO) has emerged as a method for desalting saline water and power production. It utilizes a chemical potential difference, or a salinity gradient to permeate fresh water through membranes. This paper investigates the feasibility of using the FO process for seawater (SW) desalination in terms of consumed energy, capital costs, water recovery, operation & maintenance, water quality, and the final product water cost. The study covers FO by itself, and when combines with other desalting systems such as reverse osmosis, multi stage flash (MSF), and multi effect distillation as pretreatment method. This paper reviews first the principles of fluid and solutes flow in the FO membranes, concentration polarization, the difference between the FO, pressure retarded osmosis processes, draw solutions, and the solutes involved in these draw solutions. Then, the main characteristics of the FO membranes and their commercial availability are presented. Previous experimental work and a commercial plant using FO for desalination are also given. The use of FO as pretreatment for other desalting methods is presented in light of two proposed research projects. The first research project proposes utilizing FO as pretreatment for processing treated wastewater and SW in one system. The second project utilizes FO as pretreatment for a once-through MSF desalting method. The analysis proved energy reduction in the energy consumption of both desalting systems by more than 50 and 18%, respectively.

Keywords: Forward osmosis; Reverse osmosis; Once-through MSF; Concentration polarization; Draw solution

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