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A rapid performance diagnosis of seawater reverse osmosis membranes: simulation approach

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ABSTRACT

Recovery and salt rejection rate, which are directly related to the membrane properties and operating conditions (i.e., feed flow rate, pressure, temperature, and TDS concentration), are two main indicators for evaluating the performance of a reverse osmosis (RO) membrane process. A simple and rapid test with minimum data is inevitably requested to diagnose membrane performance at a certain operating conditions, because experiments at all operating conditions are inefficient and consumable work in the view of cost as well as man-hour. In this study, permeate flow rate and TDS concentration of three kinds of commercial RO membranes were carefully examined under various operating conditions [i.e., feed pressure (45–65 kgf/cm^2) and temperature (5–30°C)]. Based on the experimental data, membrane resistance models including temperature and pressure correction factors were developed for the rapid diagnosis of SWRO membrane performances. As a result, the models developed in this study have good agreements between observed and simulated data. Based on the procedure in this study, the performance of any type of RO membranes can be rapidly examined by simple model parameter inputs. Furthermore, the developed diagnosis tool for performance test of SWRO membranes can be practically applied to build database of membrane performance for designing the SWRO process with minimum data as well as to reduce the cost and effort for data acquisition.

Keywords: Reverse osmosis membrane; Membrane resistance model; Temperature correction factor; Pressure correction factor

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