Optimization methodology to study/estimate permeability in reverse osmosis desalination

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ABSTRACT

In order to establish a method for the prediction of permeability, the significance of permeability in simulating a reverse osmosis (RO) module is studied. An optimization methodology incorporating the simulation model was established to estimate the water and salt permeability, and a number of correlations were studied to represent them. Optimized correlations were then validated over a wide range of operating conditions for a typical RO system for seawater desalination (50–80 bar, 20–35°C, and 25–40 kg m⁻³). Using these permeability correlations, the model satisfactorily predicted two different published experimental observations: (1) predicted the permeate flow rate within a 5% error for 88% of the readings and the permeate concentration within a 10% error for 92% of the readings, and (2) predicted the permeate flow rate within a 6.2% error for 94% of the readings and the permeate concentration within an 8% error for 91% of the readings. The relative deviation between the experimental and predicted results using this procedure is 56% less than the published predicted result. Thus, a method to reliably determine a single permeability correlation for each of the water and salt permeability was established.

Keywords: Permeability; Desalination; Reverse osmosis; Simulation; Optimization

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