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Understanding boron rejection by reverse osmosis membranes

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ABSTRACT

Reverse osmosis (RO) membranes have high rejection for most of solutes in seawater except for boron. Therefore, boron rejection should be considered in the design and operation of the RO process for seawater desalination. In this paper, we investigated boron rejection and its relation to salt rejection using an irreversible thermodynamic model. Permeability constants for commercially-available RO membranes were obtained using theoretical model and the simulation data from membrane performance test program provided by membrane manufacturers. The effect of pH and concentration of the feed water on the boron rejection was also theoretically investigated under various operating conditions. The model calculations revealed that the rejection of boron follows a different mechanism from those of other ionic solutes and could not be readily correlated with ion rejections. To overcome the limit of mechanistic models, we explored an alternative approach for predicting boron permeability from membrane properties and ion permeability. It appears that this alternative approach can aid to achieve a better understanding of boron rejection by seawater RO membranes.

Keywords: Seawater desalination; Reverse osmosis; Boron; Rejection; Modeling

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