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Higher boron rejection with a new TFC forward osmosis membrane

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ABSTRACT

Due to the stringent limits for boron in drinking and irrigation water, water treatment facilities have to incur additional treatment to remove boron down to a safe concentration. Forward osmosis (FO) is a membrane technology that may reduce the energy required to remove boron present in seawater. In *direct* FO desalination hybrid systems, fresh water is recovered from seawater using a recoverable draw solution, FO membranes are expected to show high boron rejection. This study focuses on determining the boron rejection capabilities of a new generation thin-film composite (TFC) FO membrane compared to a first generation cellulose triacetate (CTA) FO membrane. The effects of water permeate flux, membrane structure, draw solute charge, and reverse solute flux on boron rejection were determined. For TFC and CTA FO membranes, experiments showed that when similar operating conditions are applied (e.g. membrane type and draw solute type) boron rejection decreases with increase in permeate flux. Reverse draw solute flux and membrane fouling have no significant impact on boron rejection. Compared to the first generation CTA FO membrane operated at the same conditions, the TFC FO membrane showed a 40% higher boron rejection capability and a 20% higher water flux. This demonstrates the potential for boron removal for new generation TFC FO membranes.

Keywords: Forward osmosis, Boron removal, Seawater desalination, Thin-film composite, Cellulose triacetate, Draw solute interaction

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