

## A novel hybrid forward osmosis – nanofiltration (FO-NF) process for seawater desalination: Draw solution selection and system configuration

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### ABSTRACT

A hybrid forward osmosis–nanofiltration (FO-NF) process for seawater desalination is proposed in this study. Seven potential draw solutions for the FO-NF process were investigated using laboratory-scale forward osmosis (FO) and nanofiltration (NF) test cells. Results from both FO and NF tests suggested that the hybrid FO-NF process is a feasible process for seawater desalination. Water fluxes of about 10 L/m<sup>2</sup>h, for both FO and NF processes could be achieved. Solute rejection of the FO membrane was maintained at over 99.4% for all seven draw solutes tested. Solute rejection of the NF membrane for the four selected draw solutions could achieve a maximum of 97.9%. A hybrid FO-NF process with two-pass NF regeneration is proposed to achieve good quality product water that meets the recommended drinking water total dissolved solids (TDS) guideline, of 500 mg/L from the World Health Organisation. It is possible to desalinate seawater with this system configuration to obtain product water with TDS of 113.6 mg/L. Finally, MgSO<sub>4</sub> and Na<sub>2</sub>SO<sub>4</sub> are proposed as the most likely draw solution for the hybrid process.

*Keywords:* Forward osmosis; Nanofiltration; Seawater desalination

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