

## Factorial design in optimizing parameters for thermoresponsive ionic liquids as draw solution

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### ABSTRACT

This study aims to optimize the operating conditions of the forward osmosis (FO) process by introducing thermo-responsive ionic liquids (TRILs) namely 1-butyl-3-methylimidazolium tetrafluoroborate ([Bmim][BF<sub>4</sub>]) as a draw solution for seawater desalination applications. The influence of the operation parameters, such as the feed and draw flowrate (60–300 ml/min), draw solution concentration (0.6–3.0 M), temperature (25–50 °C), and type of flow with feed concentration using artificial seawater (0.6 M NaCl). The interaction between parameters has been specified using fractional factorial design (FrFD). The draw solution concentration and the interactions between draw and feed flowrate were the most significant factors in achieving high water flux 5.1 LMH. Besides that, the draw flowrate and the interaction of both draw and feed flowrate give high significance toward adverse effects (such as concentration polarization), which is good to obtain low reverse salt at 1.3 gMH. Use the desirability function (DF) to obtain the highest water flux of 5.04 LMH and the lowest reverse salt flux of 1.71 gMH, with a desirability of 0.95. The optimal condition for FO performance is 300 ml/min feed and draw flowrate with 3.0 M draw solution at 25 °C and co-current flow.

### KEYWORDS

Forward osmosis; Desalination; Factorial design; Optimal condition; Ionic liquids; Draw solution

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