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Development of high flux thin-film composite membrane for water desalination: a statistical study using response surface methodology

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ABSTRACT

High flux thin-film composite reverse osmosis membranes for brackish water desalination have been fabricated by interfacial polymerization based on aromatic polyamide chemistry. A response surface methodology was used to optimize the concentrations of the monomers, 1,3-Diaminobenzene (MPDA) and 1,3,5-Benzenetricarbonyl trichloride (TMC), and a flux-enhancing additive, Dimethyl sulfoxide (DMSO). The membranes prepared showed a salt rejection of more than 95%. The membranes produced with DMSO additive exhibited a four- to five-fold higher flux rate as compared to the membranes without additive. Quadratic mathematical models have been proposed and verified using diagnostic plots, which adequately describe the flux rate and rejection ability within the limits of the factors investigated. The membrane rejection ability was contributed by a first-order effect of the membrane preparation parameters MPDA, TMC, and DMSO concentration, a quadratic effect of TMC and DMSO concentration, and an interaction effect between TMC and DMSO concentrations. For flux rate, first-order effect of TMC, MPDA, and DMSO concentration, and quadratic effect of MPDA concentration were significant model terms.

Keywords: Desalination; Dimethyl sulfoxide; High flux; Thin film composite membrane; Response surface methodology; Interfacial polycondensation

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