Influence of Polyethersulfone substrate properties on the performance of thin film composite forward osmosis membrane: Effect of additive concentration, polymer concentration and casting thickness

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ABSTRACT

This research seeks to optimize the impact of substrate parameters such as polyvinylpyrrolidone (PVP) additive concentration (3–11 wt%), polyethersulfone (PES) concentration (11–17 wt%), and casting thickness (100–250 μm) on the overall performances of (PES) thin film composite (TFC) FO membrane. Non-solvent induced phase separation (NIPS) method was used to fabricate the substrate membrane, which was then followed by the interfacial polymerization of m-phenylene diamine (MPD) in aqueous solution and trimesoyl chloride (TMC) in hexane-organic solvent to form the active polyamide (PA) layer. Analyses of contact angle, porosity, pore size, functional group, morphology, and surface roughness were performed on membrane substrates and TFC membrane. Membrane performance parameters such as water flux (J_w), reverse salt diffusion (RSD), and specific reverse flux (SRF) were evaluated for the fabricated TFC membranes using the FO filtration system (pure water as feed solution and NaCl as draw solution). In addition, the water permeability coefficient (A), the solute permeability coefficient (B), and the structural parameter (S) were computed mathematically. Optimized membranes were chosen using the specific reverse flux (SRF) as the principal performance indicator. The optimal membranes for each parameter were then evaluated for their antifouling and rejection properties using humic acid (HA) solution. Among the optimized membranes, 15%PES/5%PVP/100 μm membrane exhibited the best performance with high rejection and antifouling properties towards HA.

KEYWORDS
Forward osmosis; HA fouling; Polyethersulfone; Polyvinylpyrrolidone; Reverse salt diffusion; Specific reverse flux

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