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Fabrication and characterization of the chlorine-tolerant disulfonated poly(arylene ether sulfone)/hyperbranched aromatic polyamide-grafted silica composite reverse osmosis membrane

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ABSTRACT

In this study, hyperbranched aromatic polyamide-grafted silica (HBP-g-silica) and disulfonated 4,4-bis(3-aminophenoxy)phenyl sulfone (aPES) composite membrane was prepared to enhance the chlorination resistance of reverse osmosis (RO) membrane for desalination process. As the commercial polyamide (PA) RO membrane is very weak against free chlorine in desalination process, inorganic nanoparticle and new membrane material were introduced to RO membrane's active layer. The HBP-g-silica which includes lots of PA chains on the surface of silica and the new material aPES for RO membrane were characterized by ^{1}H-NMR and Fourier transform infrared spectroscopy (FT-IR). The surface morphology of synthesized RO membrane was characterized by scanning electron microscope, and the performance, salt rejection, and water flux were evaluated before and after chlorination test. After the chlorination test, salt rejection was decreased by 36.2% and water permeation was increased only by 5.6% compared to the performance before chlorination measurement. The HBP-g-silica loading significantly modified the three-dimensional polyamide network structures and contributed to high performance by the chain stiffness of the copolymer with high degree of cross-linking. Therefore, the HBP-g-silica that protects PA structure from degradation enhances chlorine resistance in RO membrane.

Keywords: HBP-g-silica; aPES; Chlorine resistance; Reverse osmosis membrane

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