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Fabrication and characterization of polyethersulfone/carbon nanotubes (PES/CNTs) based mixed matrix membranes (MMMs) for nanofiltration application

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Abstract

Polyethersulfone/carbon nanotubes (PES/CNTs) based mixed matrix membranes (MMMs) were prepared by phase inversion method for nanofiltration (NF) application. Carboxylated CNTs with different diameter and concentration were incorporated into the polymer matrix to enhance the performances of the NF membranes. The prepared PES/CNTs membranes were characterized and evaluated in terms of membranes morphology, structure, surface properties, and separation performances. Two types of CNTs with different diameters (20 and 40 nm, marked as CNT1 and CNT2, respectively) were chosen to investigate the effect of CNT diameter on membrane performances. The effect of CNT concentrations (from 0.01 to 1 wt%) was also tested by introduction of CNT2 in the MMMs. As a result, the MMMs embedded with CNT1 achieved better NF performances. When CNT2 concentration reaches 0.1 wt%, the PES/CNT2 membranes obtained the highest water flux (38.91 L/m²h) and Na₂SO₄ rejection (87.25%) at 4 bar. The solute rejection was in a sequence of $R(\text{Na}_2\text{SO}_4) > R(\text{MgSO}_4) > R(\text{NaCl})$.

Keywords

Carbon nanotubes; Mixed matrix membranes; Nanofiltration membrane; Desalination

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