

Organic solvent mixture separation using Organic Solvent Reverse Osmosis (OSRO) membranes

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Abstract:

We prepared a hydrophobic fluorine-incorporated thin film composite (TFC) membrane for organic solvent reverse osmosis (OSRO). 5-Trifluoro-1,3-phenylenediamine (TFMPD) and trimesoyl chloride (TMC) were used as the respective fluorine-containing hydrophobic diamine monomer in aqueous phase and acid chloride in organic phase. The hydrophobic polyamide membrane showed 98% NaCl rejection in aqueous systems, indicating defect-free preparation. Furthermore, in the pure solvent permeation test, this membrane was able to allow the permeation of nonpolar solvents, such as aliphatic and aromatic hydrocarbons, which could not permeate through the conventional hydrophilic polyamide membranes using *m*-phenylenediamine (MPD) as a diamine monomer. In addition, the OSRO test showed high performance in toluene mixed solvent systems with selective permeation of toluene and 93% rejection of triisopropylbenzene (TIPB). In conclusion, this study has successfully developed a hydrophobic fluorine-incorporated polyamide TFC membrane suitable for OSRO for separation of nonpolar solvents in mixture, providing new insights to the study of OSRO and its application for larger-scale demonstrations.

Another OSRO membrane was fabricated by spin coating a Teflon polymer, AF2400, onto a porous solvent-resistant polyketone support. Nonpolar AF2400 promotes the permeation of nonpolar liquids while inhibiting the transportation of polar liquids, resulting in the efficient separation of polar and nonpolar liquids. The separation performances in alcohol/alkane and alcohol/toluene mixtures were investigated and the results demonstrated that the molecular size and polarity of the liquids affected the selectivity.

Keywords: Organic solvent reverse osmosis, Organic solvent separation, Thin film composite membrane, Fluorine incorporation, AF2400