

Nano-WS₂ embedded PES membrane with improved fouling and permselectivity

Abstract

The application of nanoparticles as additives in membrane synthesis for improving the resistance of membranes against fouling has triggered recent interest in new membrane types. However, most nanoparticle-enhanced membranes suffer from the tradeoff between permeability and selectivity. In this paper, nano-WS₂ was explored as the additive in membrane synthesis by non-solvent induced phase separation (NIPS). Blended PES-WS₂ flat-sheet membranes with the incorporation of ultra-low concentrations of nanoparticles (from 0.025% to 0.25%, WS₂/PES ratio) were manufactured and investigated in terms of permeability, fouling resistance and solute rejection. Remarkably, a significant enhancement in the permeability was observed as a result of the incorporation of ultra-low fractions of nano-WS₂ to the membrane structure. The optimum permeability values were obtained for modified membranes with 0.075-0.10% nanoparticle/polymer concentration ratios. In general, fouling resistance and solute rejection were significantly enhanced by the incorporation of nanoparticles into the membrane structure. Specifically, fouling resistance increased by around 50%.

Keywords

Fouling resistance; Nano-WS₂; Nanoparticle-enhanced polymeric membranes; Permselectivity; Ultra-low concentration