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The size and concentration effects of Al_2O_3 nanoparticles on PSF membranes with enhanced structural stability and filtration performance

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ABSTRACT

Nanocomposite membranes have attracted attention for their high permeability, rejection efficiency, and thermal and mechanical stability. In this study, novel flat-sheet polysulfone nanocomposite membranes were prepared by a phase inversion method with polyethylenimine and Al_2O_3 nanoparticles to increase the flux and hydrophilicity. Al_2O_3 nanoparticles were added to the membrane matrix to enhance the permeability, selectivity, and mechanical resistance. Two different sizes of Al_2O_3 nanoparticles (20 and 80 nm) were used with different weight percentages of 0.2, 1, and 5 wt%. The effects of the size and concentration of the nanoparticles on the structural properties and filtration performance of the membranes were investigated. Scanning electron microscopy, Fourier transform infrared spectroscopy, porosity, water contact angle, thermogravimetric analysis, viscosity, and tensile strength measurements were used to characterize the prepared membranes. The membrane performance was evaluated with water flux and bovine serum albumin rejection tests. According to the results, the membrane containing 15 wt% polysulfone, 1 wt% polyethylenimine, and 5 wt% 20 nm Al_2O_3 showed the highest pure water flux, porosity, viscosity, and morphological stability. This membrane may have potential uses in water treatment applications.

Keywords: Al_2O_3 nanoparticles; Nanocomposite membrane; Phase inversion; Bovine serum albumin rejection

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