Fabrication, Characterization and Modification of Polymeric Membrane with Enhanced Pore and Separation Properties via Hydrophilic Additive for Wastewater Treatment by shahed jawad Kadhem

Abstract

The present study synthesized polyethersulfone (PES) nanofiltration base membranes through the phase inversion method of combining bismuth ferrite-$BiFeO_3$ nanoparticles. To further understanding the impact of $BiFeO_3$ NPs on PES UF membrane production, a range of membranes were produced by adding varying amounts of $BiFeO_3$ NPs to the casting solution: 0, 0.1, 0.2, 0.3 and 0.4 w Fabrication, Characterization and Modification of Polymeric Membrane with Enhanced Pore and Separation Properties via Hydrophilic Additive for Wastewater Treatmenteight percent. Comparing the modified membranes to the neat PES membrane, the modified membranes exhibited significantly greater levels of pure water flow and rejection. The characteristics of the $BiFeO_3$ nanoparticles, neat PES, and modified membranes were characterized comprehensively via Field emission scanning electron microscopy (FE-SEM), Fourier transform infrared spectroscopy (FT-IR), X- Ray Diffraction (XRD), porosity and contact angle (CA) techniques. The hydrophilicity of the modified membrane's membrane surface has been enhanced as a result of the improvement of the water affinity of the membrane surface. Regrettably, the elevated concentration of $BiFeO_3$ nanoparticles in the casting solution resulted in a decline in membrane performance as a result of the nanoparticles agglomeration in the polymer matrix. When compared to the neat PES membrane, the blended membranes showed better fouling resistance and water permeability. When the BiFeO3 concentration was 0.3 wt.%, the water flux peaked at 52.5 kg/m2 h, which was about 63% higher than the bare PES membrane (20.2 kg/m2 h). The fouling resistance of the membranes examined using methylene blue dye (MB) solution filtration revealed that the 0.3 wt.% $BiFeO_3$ membrane had the best antifouling capability. The ability of the prepared membranes to conduct ultrafiltration was assessed by MB dye rejection. The dye removal performance of the PES/$BiFeO_3$ membranes was superior to that of the neat PES. The findings of this study suggest that $BiFeO_3$ is a viable nano additive with significant potential for usage in the production of UF membranes for wastewater treatment.