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Synthesis of Iron Oxide Nanoparticles to Enhance Polysulfone Ultrafiltration Membrane performance for Salt Rejection

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Abstract: The main target of membrane technologies is to provide better filtration and separation of organic and inorganic substance from water as well as for longer life of the membrane. Iron oxide (α-Fe2O3) nanoparticles (NPs) were synthesised by simple sol gel method and characterised using X-ray diffraction (XRD) and transmission electron microscopy (TEM) to show the structure and particle size of the nanoparticles. The α-Fe2O3 NPs with the size of 15 ± 2 nm was blended with Polysulfone (PSf) in lower loading of 0.5 wt% to prepare ultrafiltration (UF) membrane using the wet phase inversion method. The membrane cross section, surface, EDX and mapping were analysed using field emission scanning electron microscopy (FESEM) include EDX analyser. The effect of α-Fe2O3 NPs on membrane properties was determined in terms of permeability, hydrophilicity (contact angle), porosity and pore size. The results of α-Fe2O3 NPs incorporated PSf showed good improvement in the hydrophilicity of the membrane where the contact angle was reduced from 82° to 70°. The pure water flux of α-Fe2O3 NPs-incorporated PSf membrane increased to more than three times compared to the pure PSf membrane. This enhancement of pure flux was due to lower intrinsic membrane resistance and higher pore size. The rejection of salts (sodium chloride (NaCl) and sodium sulfate (Na2SO4)) of the modified membrane was enhanced compared to pure PSf membrane under the same condition. The addition of α-Fe2O3 NPs leads to an improvement of the PSf ultrafiltration membrane properties.