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Antifouling enhancement of polyethersulfone membranes incorporated with silver nanoparticles for bovine serum albumin and humic acid removal

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ABSTRACT

Enhanced antifouling polyethersulfone (PES) ultrafiltration membranes were successfully modified by the incorporation of silver nanoparticles (AgNPs) for improved disinfection in water treatment applications. PES-AgNPs membranes were fabricated with AgNPs loading (0.0–2.0 wt.%) via the phase inversion method. The effect of AgNPs on PES physicochemical properties and membrane performance were investigated in terms of pure water flux, filtration of humic acid (HA) and bovine serum albumin (BSA), and antibacterial activity. The antifouling property of the membrane was analyzed by calculation of the fouling resistance parameters of BSA. The antibacterial activity of the membrane was tested using two different types of bacteria which are *Bacillus subtilis (B. subtilis)* and *Escherichia coli (E. coli)*. Hydrophilicity/hydrophobicity evaluation of the membranes was studied by water contact angle measurement which was reduced from 68° for the pristine PES membrane to 58° for the PES-0.5AgNPs membrane. The PES-0.5AgNPs membrane displayed improved water flux by 65.55% and both HA and BSA rejections were 90.04% and 82.41%, respectively. Although the surface hydrophilicity of the PES-AgNPs membrane was further decreased at higher silver loading (1.0 and 2.0 wt.%), the mechanical properties of nanocomposite membranes were reduced and significant silver leaching was observed. A high BSA flux recovery of about 97.29% was achieved for the modified membrane with 2.0 wt.% AgNPs compared to 71.12% for the neat membrane. In terms of the antibacterial performance, PES-AgNPs membranes showed an excellent property in biofouling mitigation where *E. coli* results show more sensitivity to AgNPs than *B. subtilis*. Based on the findings, the PES-AgNPs nanocomposite membrane offers a good potential membrane for filtration and disinfection.

Keywords: Polyethersulfone; Silver nanoparticles; Humic acid; Bovine serum albumin; Antibacterial; Water treatment

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