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Fouling and biofouling resistance of metal-doped mesostructured silica/polyethersulfone ultrafiltration membranes

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Abstract

Hybrid polyethersulfone-based ultrafiltration membranes were prepared by incorporating metal (Ag and Cu) and/or amine-functionalized mesostructured SBA-15 silica particles. The doping particles were included into the casting solution to obtain a total solids load of 3.6 wt.% in the final membranes. The physicochemical characterization of particles and membranes showed a good dispersion of metals inside the mesoporous structure of silica as well as a reduced skin layer, higher pore interconnectivity, and a larger amount of pores in membranes doped with the hydrophilic fillers. Membrane surface was also slightly less hydrophobic in hybrid membranes. Membrane performance was significantly improved as result of considerable increase of water permeation without affect negatively the membrane selectivity. The organic antifouling properties were enhanced with significant permeability improvement without compromising membrane rejection performance. In addition to it, metal-loaded silica allowed preparing membranes with high antibacterial activity. The removal of colonies of *Escherichia coli* and *Staphylococcus aureus* was complete either on membrane surface or in the liquid in contact with membranes when exposed to a 1/500 nutrient broth medium for 20 h at 36 °C. The rate of metal release depended on metal speciation and represented a 0.1-0.6 % of the total metal content of membranes.

Keywords: hybrid membranes; ultrafiltration; polyethersulfone; organic fouling; biofouling; antimicrobial materials.

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