Binding Nanomaterials to Thin-Film Composite Membranes to Taylor Surface Properties

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Hybrid organic-inorganic membranes offer novel strategies for the prevention of performance loss due to biofouling. In this study, nanocomposite reverse osmosis and forward osmosis membranes were fabricated by irreversibly binding nanomaterials to the membrane surface. Nanomaterials were customized with surface functional groups capable of interacting with the charged moieties on the membrane selective barrier and imparting novel properties to the membrane active layer. Single-walled carbon nanotubes (SWNTs) and silver nanoparticles were chosen as antimicrobial nanomaterials, whereas super-hydrophilic silica nanoparticles were employed to increase membrane hydrophilicity. Negatively charged carboxyl group density at the membrane surface was optimized during the interfacial polymerization process to form the polyamide layer. Nanomaterials were irreversibly bound to the membrane functional groups via covalent bonds or electrostatic interaction. The transport properties of the modified membranes were not affected by the modification. Using direct contact methods with *E. coli*, enhanced bacterial cytotoxicity and decreased cell adhesion were demonstrated for the nanocomposite membranes.

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