230a Antifouling Thin Film Nanocomposite (Tfnc) Membranes for Desalination and Water Reclamation

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Inorganic-organic thin film nanocomposite (TFnC) membranes have been synthesized with the intent of increasing water permeability and solute rejection, while decreasing biofouling propensity over pure polyamide membranes. Polyamide (PA) thin film composite (TFC) membranes were synthesized on polysulfone ultrafiltration support membranes through an interfacial polymerization reaction. Inorganic nanoparticles were synthesized to be super-hydrophilic and negatively charged. The TFnC membranes were formed by dispersing inorganic nanoparticles in a reactant solution prior to interfacial polymerization. Nanoparticles appeared well dispersed in formed nanocomposite films and no voids were observed suggesting good contact between nanoparticles and polymer. The TFnC membranes were more hydrophilic, less rough, and more negatively charged, while exhibiting improved water permeability and solute rejection – compared to synthesized PA membranes. Microbial deposition rates were measured for both pure PA and TFnC membranes. The additional hydrophilicity imparted by inorganic nanoparticles in the polyamide films also reduced the rate, extent, and strength of bacterial adhesion on the TFnC membrane surfaces. Development of antimicrobial TFnC membranes was achieved by modifying the synthesized nanoparticles with a biocidal agent and incorporating the modified nanoparticles into polyamide films. Viability of a common aquatic bacteria adhered to pure PA, TFnC, and modified TFnC membranes was determined by a commercial staining procedure followed by observation with fluorescence microscopy. Modified nanoparticles inactivated a significant fraction of bacteria adhered to the membrane surface, whereas there was no significant inactivation of bacteria adhered to the pure PA and unmodified TFnC membranes.