Polyelectrolyte-Enhanced Membrane Separation for Nano-Sized Inorganic Contaminants Removal

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Removal of inorganic contaminants (Mn^{2+} and NO_3^-) from water using water-soluble chelating polymers in combination with ultrafiltration (UF) membranes was investigated. Different chelating polymers and membranes were used depending on target compounds of interest. The effects of solution pH and polymer dosages on contaminants removal were evaluated along with modeling removal efficiencies considering relevant chemical equilibria. Manganese removal was negligible with the UF membranes alone at acidic pH values, but it increased substantially when polyacrylic acid (PAA) was added to the feed solution, due to the formation of Mn^{2+}-PAA chelates followed by the rejection of the chelates by the membranes. Model development was made to explain such phenomena using chemical equilibria including complex formation and precipitation. The model parameters accounted for the competitive interaction of PAA with target and background species in multi-component systems. The equilibrium model developed in this work was able to successfully predicted contaminants removal in a chelation/UF system at various pH and polymer dosages.