Development and characterization of novel charged surface modification macromolecule to polyethersulfone hollow fiber membrane with polyvinylpyrrolidone and water

Abstract

Polyethersulfone (PES) hollow fiber membranes were fabricated using water and polyvinylpyrrolidone as additives and N-methyl pyrrolidinone as solvent. Asymmetric hollow fiber membranes were spun by the dry-wet phase inversion method. A charged surface modifying macromolecule (cSMM) was synthesized and blended into the PES dope. The modification of PES hollow fiber membranes with cSMM was evaluated via contact angle measurement, field emission scanning electron microscopy (FESEM), differential scanning calorimetry (DSC), Fourier transform infrared spectroscopy (FTIR-ATR) and ionic solute separation performance. Experimental results showed that pure water permeation flux was increased by surface modification with the blended cSMM, which at the same time produced higher ionic solute rejection. From the FESEM, a small increase in the thickness of the hollow fiber outer layer was noticed when the surface was modified by cSMM blending. Nevertheless, there was no significant difference in the overall membrane morphology between the membranes with and without cSMM blending, indicating that the morphology of the base polymer remained practically unchanged. On the other hand, DSC scan and FTIR analysis confirmed the miscibility of cSMM with PES and the presence of cSMM's functional group, respectively.