

Abstract

Polyethersulfone (PES) hollow-fiber membranes were fabricated using poly(ethyleneglycol) (PEG) with different molecular weights (MWPEG200, PEG600, PEG2000, PEG6000, and PEG10000) and poly(vinyl pyrrolidone) PVP40000 as additives and N-methyl-2-pyrrolidone (NMP) as a solvent. Asymmetric hollow-fiber membranes were spun by a wet phase-inversion method from 25 wt % solids of 20:5:75 (weight ratio) PES/PEG/NMP or 18:7: 75 of PES/(PEG600PVP40000)/NMP solutions, whereas both the bore fluid and the external coagulant were water. Effects of PEG molecular weights and PEG600 concentrations in the dope solution on separation properties, morphology, and mechanical properties of PES hollow-fiber membranes were investigated. The membrane structures of PES hollow-fiber membranes including cross section, external surface, and internal surface were characterized by scanning electron microscopy and the mechanical properties of PES hollow-fiber membranes were discussed. Bovine serum albumin (BSA, MW 67,000), chicken egg albumin (CEA, MW 45,000), and lysozyme (MW 14,400) were used for the measurement of rejection. It was found that with an increase of PEG molecular weights from 200 to 10,000 in the dope solution, membrane structures were changed from double-layer fingerlike structure to voids in the shape of spheres or ellipsoids; moreover, there were crack phenomena on the internal surfaces and external surfaces of PES hollow-fiber membranes, pure water permeation fluxes increased from 22.0 to 64.0 L m⁻²h⁻¹ at 1 bar. Rejections of three protein for PES/PEG hollow-fiber membranes were not significant, and changes in mechanical properties were decreased. Besides, with a decrease of PEG600 concentrations in the dope solution, permeation flux and elongation at break decreased, whereas the addition of PVP40000 in the dope solution resulted in more smooth surfaces (internal or external) of PES/(PEG600PVP40000) hollow-fiber membranes than those of PES/PEG hollow-fiber membranes.