

## Abstract

Polyethersulfone (PES) hollow fiber ultrafiltration (UF) membranes were fabricated using methanol, ethanol, n-propanol as well as water as additives and N-methyl-2-pyrrolidone (NMP) as a solvent. Asymmetric hollow fiber UF membranes were spun by wet and dry/wet phase inversion method from 18 wt.% solids of PES/non-solvent/NMP solutions. The non-solvents were methanol, ethanol, n-propanol and water while the external coagulant was water. Effects of non-solvent and ethanol concentrations in the dope solution and air-gap distance on morphology and separation performance of PES hollow fiber UF membranes were investigated. UF membranes were characterized in terms of their solubility parameter difference, pore size and pore density measurements, scanning electron microscope (SEM) while UF experiments were conducted using polyethylene glycol (PEG 10,000 MW) and two kinds of proteins, lysozyme (14,400 MW) and chicken egg albumin (CEA 45,000 MW) as a solute. It was found that the PES UF membrane morphology changed slowly from long and wide finger-like structure through a thin finger-like structure to the sponge-like structure with some voids as ethanol concentration in the dope solution increased from 0 to 25 wt.% using 90:10 NMP/H<sub>2</sub>O as a bore fluid; pure water permeation fluxes (PWP) increased from 47 to 167 L/(m<sup>2</sup>·h·bar) while rejections of PEG 10,000 and two proteins for wet-spun PES hollow fiber membranes were increased within less than 10 wt.% ethanol concentration and then decreased with an increase of ethanol concentration. Experimental results illustrated that PWP flux and solute rejection of the dry/wet-spun fibers were higher than that of the wet-spun fibers when 15 wt.% ethanol and 15 wt.% methanol were used as additives. PWP flux of PES hollow fibers using 25 wt.% n-propanol and 7.5 wt.% water (dry/wet) as additives in the dope solution were higher while their rejections were lower. In addition, the pore sizes of internal surfaces of PES hollow fiber membranes were controlled by adjusting the ethanol or methanol concentration in the dope solution. Using above method, PES hollow fiber UF membrane with high PWP could be prepared while the molecular weight cut-off of PES hollow fiber membranes is approximately 10,000.