

Abstract

Poly(vinyl chloride) hollow fiber membranes were prepared by the dry/wet and wet/wet spinning technique at different air gap lengths keeping all other spinning parameters constants. Mean pore size, pore size distribution and mean roughness of both the internal and external surfaces of the hollow fibers were determined by atomic force microscopy. Cross-sectional structure was studied by scanning electron microscopy. Ultrafiltration experiments of pure water and aqueous solutions of different solutes having different molecular weights (bovine serum albumin, polyethylene glycol and polyvinyl pyrrolidone) were carried out. It was found that the inner and outer diameters of the PVC fiber membranes decreased with the increase of the air gap distance due to the gravitational force effect. The hollow fiber membranes prepared without and with air gap distances up to 7 cm exhibited a quite symmetric cross-structure consisting of four layers, two small finger-like structure layers at both edges of the hollow fibers and two larger finger-like voids mixed with macrovoids layers in the middle of the cross-section. The outer-middle layer thickness decreased when the air gap distance was increased to 10 cm and disappeared from the cross-section of the hollow membranes prepared with higher air gap lengths than 15 cm. For all dry/wet spun PVC hollow fibers, the outer pore size and the pure water permeation flux both increased with the increase of the air gap distance. In contrast, the solute separation factor decreased with the air gap distance. This was related to the pore size of the external surface of the PVC hollow fibers.