

Investigation on the effects of fabrication parameters on the structure and properties of surface-modified membranes using response surface methodology

Abstract:

Surface Modifying Macromolecules (SMM) were used to alter the hydrophobicity of polyetherimide (PEI) hollow fiber membranes and the effects of three fabrication parameters, which are the mass fraction of PEI and SMM in the casting dope and air gap, on the properties of fabricated membranes were investigated by application of Response Surface Methodology (RSM). The fabricated membranes were characterized in terms of mean pore size ($r_{P,m}$), permeation rate of helium gas at 1 bar transmembrane pressure difference, membrane porosity, and contact angle of water with inner and outer surfaces of membrane. The regression models obtained for mean pore size and permeation rate have good statistical parameters and are accurate. The model for $r_{P,m}$ predicts that plot of $r_{P,m}$ versus air gap has a minimum point, whereas the plots of $r_{P,m}$ versus PEI (wt %) and SMM (wt %) have maximum points. The regression model developed for membrane porosity predicts that membrane porosity decreases when air gap increases. Since water was used as bore fluid, the model developed for inner surface contact angle has low accuracy but the model developed for outer surface contact angle predicts that contact angle increases with SMM concentration in dope solution but there is a maximum point versus air gap.