

Effect of ethanol concentration in water coagulation bath on pore geometry of PVDF membrane for Membrane Gas Absorption application in CO₂ removal

Abstract

In this study, polyvinylidene fluoride (PVDF) flat sheet membranes were fabricated by immersing into various concentrations of ethanol in water (M-1:0%, M-2:25%, M-3:50% and M-4:75% respectively) as the coagulation bath via a non-solvent induced phase-inversion (NIPS) method. It was observed that the presence of ethanol affected the properties of the membranes. Low concentration of ethanol improved the hydrophobicity of the membranes. It also caused the formation of smaller pore size with more uniform, narrower pore distribution. Hydrophobicity of the fabricated membranes increased when the concentration of ethanol was raised. The absorption of carbon dioxide, CO₂ in 2-amino-2-methyl-1-propanol (AMP), 1M was also studied in a Membrane Gas Absorption (MGA) system where membranes M-2 and M-4 had better mass transfer and higher CO₂ fluxes. CO₂ removal efficiency, η generally decreased with time for all membranes and had the highest value for M-2. The increasing trend of CO₂ removal efficiency for all membranes was as follows: M-1 < M-3 < M-4 < M-2 which indicates membrane with higher porosity has higher absorption rate. Stability of membranes was tested for 150min of operation. Membrane wettability was observed to be dependent on hydrophobicity of each membrane. Smaller pore size with higher hydrophobicity eliminates penetration of liquid into the pores.