

Effect of non-solvent additives on the structure and performance of PVDF hollow fiber membrane contactor for CO₂ stripping

Abstract

Microporous polyvinylidene fluoride (PVDF) hollow fiber membranes with various non-solvent additives, i.e. lithium chloride, glycerol, polyethylene glycol (PEG-400), methanol and phosphoric acid, were fabricated for CO₂ stripping via membrane contactors. The membranes were characterized in terms of liquid entry pressure, contact angle, gas permeation and morphology analysis. CO₂ stripping performance was investigated by using an in-house made stainless steel module with CO₂-preloaded aqueous diethanolamine as the liquid absorbent. Hydrophobicity and gas permeability of the membranes reduced with the addition of a non-solvent additive in the polymer dope but increase in liquid entry pressure was observed as more sponge-like structures developed in the inner layer of the fibers. It was found that PVDF/PEG-400 membrane produced the highest stripping flux of 4.03×10^{-2} mol m⁻² s⁻¹ which can be correlated to its high gas permeation and high effective surface porosity. The result of long-term stripping operation indicated an approximately 80% stripping flux reduction which can be related to the interaction of polymer membrane and amine solution at high temperature.