Effect of non-solvent additives on the structure and performance of PVDF hollow fiber membrane contactor for CO_2 stripping

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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 CO_2 stripping via membrane contactors. The membranes were characterized in terms of liquid entry pressure, contact angle, gas permeation and morphology analysis. CO_2 stripping performance was investigated by using an in-house made stainless steel module with CO_2-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 approximatly 80% stripping flux reduction which can be related to the interaction of polymer membrane and amine solution at high temperature.

KEYWORDS:

PVDF hollow fiber membrane; Non-solvent additive; CO_2 stripping; Membrane contactor

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