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Investigation on porous polyvinylchloride (PVC) hollow fiber membrane contactor and its application for CO_2 absorption using distillation water

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Abstract

In this research, polyvinylchloride (PVC) hollow fiber membranes were fabricated with phase inversion method and were used for CO_2 absorption. Methanol and ethanol were added to the polymer solution as nonsolvent additive to increase the rate of phase inversion. Performance of PVC and effects of nonsolvent on the properties and structure of PVC hollow fibers membrane in terms of mean pore size, membrane porosity and contact angle was studied and compared with each other.

Additionally, the performance of fabricated hollow fiber membranes in contactor application in terms of CO_2 absorption with distilled water in two cases was examined. At V_{liquid} = 2.58 m s^{-1}, the absorption flux of PVC membrane was 8.6 x 10^{-3} mol m^{-2} s^{-1}.

1. Introduction

Carbon dioxide (CO_2) has been known as a main part of greenhouse gas. Producing large amount of CO_2 and realising to air have been caused change in climate; therefore the solution for global warming is the capture of CO_2 from flue gas [1]. Conventionally, gas separation processes have been done by some equipments such as packed towers, spry towers, venture scrubbers, bubble column etc. These equipments have some drawbacks such as difficulty of obtaining an accurate estimate of the gas-liquid mass transfer area and a limited range of gas and liquid flow rates due to operational problems. Membrane technology, on the other hand, has low weight, operational flexibility, compactness, less energy-consumption and has the ability to minimize overall environmental impacts [2,3]. In membrane contactor, the membrane does not have any role in separation and only provides the contact area between different phases which is much higher than other separation technologies. In membrane contactor, the flux depends on the membrane structure and properties. As the membrane possess a porous structure, properties such as membrane porosity, pore size and membrane tortuosity affect the performance of