

Modeling and Simulation of Membrane Contactor Employed to Strip CO₂ From Rich Solvents Via COMSOL Multiphysics®

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Abstract

A comprehensive mathematical model is developed for the stripping purpose of carbon dioxide from rich solvent. The rich solvent is used in CO₂ absorption from natural gas through gas-liquid hollow fiber membrane contactors. The polyvinylidene fluoride (PVDF) hollow fiber membrane was fabricated via thermally induced phase separation techniques. COMSOL Multiphysics software package is used in solving the set of partial, ordinary and algebraic equations. The model development is based on "non-wetted mode" in which the gas mixture filled the membrane pores for countercurrent gas-liquid contact. Axial and radial diffusion inside the hollow fiber membrane, through the membrane skin, and within the shell side of the contactor is considered in the model. Furthermore, the model is validated with the experimental results obtained for the stripping of carbon dioxide from a rich aqueous sodium hydroxide solution used in the absorption of CO₂ from CO₂/CH₄ gas mixture. In lab made polyvinylidene fluoride (PVDF) membrane contactor is used in absorption and stripping purposes. The effect of inlet gas and liquid temperature on the membrane performance is investigated. The effect of module packing factor was also investigated. The modeling predictions results obtained by COMSOL Multiphysics® software package (Figure 1) . Model prediction is compared with experimental data and is found to be in good agreement with the experimental results.

Figures used in the abstract

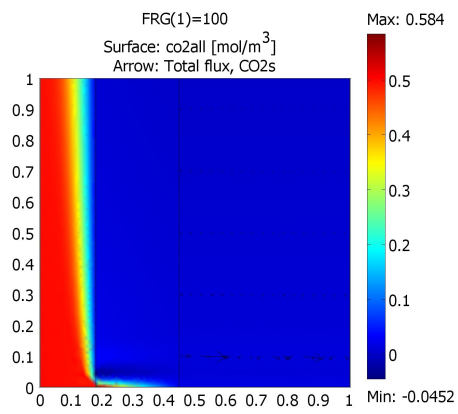


Figure 1