Development of a multicomponent mass transport model for predicting CO$_2$ separation behavior from its mixture with natural gas and hydrogen using zeolite membranes

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**ABSTRACT**

CO$_2$ removal from sour natural gas for the purpose of gas sweetening and from synthesis gas to obtain pure hydrogen is an important process in gas and oil refining industries. In this study, modeling of CO$_2$ separation from natural gas and synthesize gas by zeolite membrane has been investigated. This model is based on adsorption–diffusion model which uses the modified Maxwell–Stefan formulation for expression of fluxes equations. This model is capable to predict mixture fluxes and mixture separation selectivity using only pure component adsorption and permeation experimental data. The model developed in this study is also a full coupled model considering correctly the kinetic and thermodynamic contribution in component fluxes. The results of modeling indicated that the thermodynamic aspect has a major role to transport through the zeolite membranes and can not be ignored for both components, while the kinetic aspect has a major contribution in transport of strongly adsorbed species (CO$_2$). Finally the results of fluxes and separation selectivity estimated by the model showed a good agreement with experimental data.

**Keywords:** Zeolite membrane; CO$_2$; Hydrogen; Natural gas; Modeling; Maxwell-Stefan

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