Desalination and Water Treatment
www.deswater.com

34 (2011) 190–196
October

doi: 10/5004/dwt.2011.2798

Development of a multicomponent mass transport model for predicting CO_2 separation behavior from its mixture with natural gas and hydrogen using zeolite membranes

M. Mohammadi Demochali, A.A. Ghoreyshi*, G. Najafpour

Department of Chemical Engineering, Babol University of Technology, P.O.Box 484, Babol, Iran
Email: aa_ghoreyshi@nit.ac.ir

Received 3 September 2010; Accepted 3 January 2011

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; Maxell-Stefan

*Corresponding author.

Presented at the AMS6/IMSTEC10, The 6th conference of the Aseanian Membrane Society in conjunction with the 7th International Membrane Science and Technology Conference, Sydney Australia, November 22–26, 2010