Accepted Manuscript

PVDF/CaCO₃ Composite Hollow Fiber Membrane for CO₂ Absorption in Gas-Liquid Membrane Contactor

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PII: S1875-5100(16)30160-3

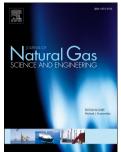
DOI: 10.1016/j.jngse.2016.03.053

Reference: JNGSE 1365

- To appear in: Journal of Natural Gas Science and Engineering
- Received Date: 19 October 2015
- Revised Date: 15 March 2016
- Accepted Date: 19 March 2016

Please cite this article as: Fosi-Kofal, M., Mustafa, A., Ismail, A.F., Rezaei-DashtArzhandi, M., Matsuura, T., PVDF/CaCO₃ Composite Hollow Fiber Membrane for CO₂ Absorption in Gas-Liquid Membrane Contactor, *Journal of Natural Gas Science & Engineering* (2016), doi: 10.1016/j.jngse.2016.03.053.

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PVDF/CaCO₃ Composite Hollow Fiber Membrane for CO₂ Absorption in Gas-Liquid 1 2 **Membrane Contactor** M. Fosi-Kofal^{a,b}, A. Mustafa^{a,b}, A. F. Ismail^{a,b,*}, M. Rezaei-DashtArzhandi^{a,b}, T. Matsuura^{a,c} 3 4 5 ^a Advanced Membrane Technology Research Centre (AMTEC), Universiti Teknologi Malaysia, 81310 6 UTM Skudai, Johor Darul Ta'zim, Malaysia 7 ^b Faculty of Petroleum & Renewable Energy Engineering, Universiti Teknologi Malaysia, 81310 UTM 8 Skudai, Johor Darul Ta'zim, Malaysia ^c Department of Chemical and Biological Engineering, University of Ottawa, 161 Louis Pasteur St., 9 10 Ottawa, ON K1N 6N5, Canada 11 *Corresponding author: afauzi@utm.my; fauzi.ismail@gmail.com, 12 Tel: +607-5535592, Fax: +607-55355925 13

14 Abstract

Porous hydrophobic polyvinylidene fluoride (PVDF) composite hollow fiber membranes were 15 fabricated via phase inversion method by embedding different amounts of hydrophobic calcium 16 carbonate (CaCO₃) nano-particles in the polymer matrix. The effects of nano-particle loadings on 17 the morphology, structure and performance of the spun membranes in gas-liquid contactors were 18 investigated. The incorporation of hydrophobic nano-particles into the polymer network enabled 19 the formation of more abundant and narrower finger-like pores in the composite membranes 20 compared to plain PVDF membrane. Moreover, the addition of nano-particles enhanced the 21 surface roughness, permeation rate, porosity and wettability resistance of the composite 22 membranes. CO₂ absorption performance of the fabricated membranes was evaluated via a gas-23 liquid membrane contactor system. The CO₂ flux was improved to some extent by increasing the 24 mixing ratio of CaCO₃. Peak absorption performance of 1.52×10^{-3} mol m⁻² s⁻¹ at 300 ml/min 25 absorbent flow rate was achieved when 20/100 weight ratio of CaCO₃/PVDF was employed. 26 However, further increase of the ratio resulted in a composite membrane with lower absorption 27 performance than the other composite membranes. Moreover, a long-term stability study of the 28

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