Accepted Manuscript

Modeling and simulation of CO₂ capture in aqueous ammonia with hollow fiber composite membrane contactors using a selective dense layer

Villeneuve Kévin, Albarracin Zaidiza David, Roizard Denis, Rode Sabine

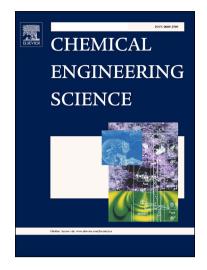
PII: S0009-2509(18)30378-6

DOI: https://doi.org/10.1016/j.ces.2018.06.016

Reference: CES 14290

To appear in: Chemical Engineering Science

Received Date: 16 January 2018 Revised Date: 23 May 2018 Accepted Date: 4 June 2018



Please cite this article as: V. Kévin, A. Zaidiza David, R. Denis, R. Sabine, Modeling and simulation of CO₂ capture in aqueous ammonia with hollow fiber composite membrane contactors using a selective dense layer, *Chemical Engineering Science* (2018), doi: https://doi.org/10.1016/j.ces.2018.06.016

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Modeling and simulation of CO_2 capture in aqueous ammonia with hollow fiber composite membrane contactors using a selective dense layer

VILLENEUVE Kévin, ALBARRACIN ZAIDIZA David, ROIZARD Denis, RODE Sabine*

Laboratoire Réactions et Génie des Procédés (LRGP) (UMR 7274), Université de Lorraine, ENSIC, 1, rue Grandville – BP 20451, 54001 Nancy Cedex, France - *sabine.rode@univ-lorraine.fr

Abstract:

Aqueous ammonia is a promising chemical absorbent for CO₂ capture but its high volatility leads to important solvent leakage necessitating expensive solvent recovery strategies. This study investigates the potential of using hollow fiber membrane contactors with composite membranes instead of packed columns to reduce solvent leakage. In this study, we used a composite membrane with a thin, dense selective layer (non-porous) coated on a microporous support to favor CO₂ transfer over NH₃. We developed one-dimensional adiabatic multi-component transfer models to simulate the capture process using both hollow fiber membrane contactors and packed columns. These models were validated with laboratory-scale and pilot-scale data. Simulations under industrial relevant operation conditions were conducted to investigate process performance as a function of membrane characteristics, i.e. membrane dense layer thickness, selectivity and the micro-porous support mass-transfer coefficient. For contactors using homemade selective membranes, the CO₂ specific absorption capacity was of 2.7 mol/m³/s, which is roughly twenty times higher than values for our simulations in packed columns. The corresponding NH₃ slip reduction was of 4.3 %. A parametric study revealed that thick dense membrane layers led to greater reductions of ammonia slip but that this corresponded to lower specific CO₂ absorption capacity, highlighting an important trade-off between two performance parameters.

Keyword:

Selective membrane contactor; composite membrane; CO, capture; aqueous ammonia; modeling

Download English Version:

https://daneshyari.com/en/article/6588305

Download Persian Version:

https://daneshyari.com/article/6588305

<u>Daneshyari.com</u>