

Author's Accepted Manuscript

Sweeping Gas Membrane Distillation: Numerical simulation of mass and heat transfer in a hollow fiber membrane module

Vasiliki Karanikola, Andrea F. Corral, Hua Jiang, A. Eduardo Sáez, Wendell P. Ela, Robert G. Arnold



www.elsevier.com/locate/memsci

PII: S0376-7388(15)00107-6
DOI: <http://dx.doi.org/10.1016/j.memsci.2015.02.010>
Reference: MEMSCI13472

To appear in: *Journal of Membrane Science*

Received date: 8 September 2014

Revised date: 8 January 2015

Accepted date: 7 February 2015

Cite this article as: Vasiliki Karanikola, Andrea F. Corral, Hua Jiang, A. Eduardo Sáez, Wendell P. Ela, Robert G. Arnold, Sweeping Gas Membrane Distillation: Numerical simulation of mass and heat transfer in a hollow fiber membrane module, *Journal of Membrane Science*, <http://dx.doi.org/10.1016/j.memsci.2015.02.010>

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 galley proof before it is published in its final citable 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.

Sweeping Gas Membrane Distillation: Numerical simulation of mass and heat transfer in a hollow fiber membrane module

Vasiliki Karanikola¹, Andrea F. Corral¹, Hua Jiang¹, A. Eduardo Sáez¹, Wendell P. Ela¹ & Robert G. Arnold*¹

¹Department of Chemical and Environmental Engineering, The University of Arizona, 1133 E. James E. Rogers Way, Harshbarger 108, Tucson, AZ 85721
Email: rga@email.arizona.edu Phone: (520) 621-2410

Abstract

A hollow fiber MD module was tested at various air and brine flow rates and temperatures. A model based on heat and mass transport was developed to predict permeate production rates. The dependence of permeate production rate on brine temperature, air flow rate and brine flow rate was successfully simulated. Numerical simulations support the selection of membrane characteristics and air and brine flow conditions for optimal performance in water desalination. Condensation was predicted to occur on the air side of the membrane due to saturation of the sweeping gas and is accounted for in the model. In the absence of condensation, temperature profiles in the module could not be predicted correctly. The ratio of length to diameter of the membrane module is of particular significance as it dictates the permeation rate for a specific pore size membrane. Small pores require higher aspect ratios than large pores to obtain the same permeate production rate. The membrane module used in this study has an effective pore size of 0.1 μm , which renders membrane transport the dominant source of mass transfer resistance to through-pore water vapor transport. A module with a larger pore size and appropriate aspect ratio should produce permeate at a significantly higher rate.

Keywords

Sweeping Gas Membrane Distillation; Hollow Fiber Membrane; Modeling; Heat and Mass Transfer; Desalination

Download English Version:

<https://daneshyari.com/en/article/633058>

Download Persian Version:

<https://daneshyari.com/article/633058>

[Daneshyari.com](https://daneshyari.com)