Desalination and Water Treatment
www.deswater.com
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doi: 10/5004/dwt.2012.2831

Taylor & Francis
Taylor & Francis Group

42 (2012) 333–346
April

Transport analysis of an air gap membrane distillation (AGMD) process

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Received 2 June 2011; Accepted 20 February 2012

ABSTRACT

Membrane distillation (MD) desalination is an emerging technology for fresh water production. This process incorporates phase change and transport of vapour through a hydrophobic membrane caused by vapour pressure across the membrane. The results from experimental studies and the one-dimensional transport analyses of the heat and mass transfer processes on an air gap MD (AGMD) unit are presented in this paper. The effects of different operating variables including feed and coolant temperatures, air gap, membrane support mesh size, feed concentration and feed and coolant flow rates were investigated. Mass transport through membrane, membrane support, air gap and condensation on the coolant plate has been analysed and expression for global mass transfer coefficient has been derived. The maximum distillate flux achieved was 5.11 kg m^{-2} h^{-1} at a feed temperature of 60°C, coolant temperature of 10°C and an air gap of 2.5 mm. Feed temperature and air gap width were found to have significant influence on the performance of the membranes.

Keywords: Membrane distillation (MD); Global mass transfer coefficient; Air gap membrane distillation (AGMD); Hydrophobic membrane; Mass transport through membrane; Polyvinylidene fluoride (PVDF) membrane

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2011 Qingdao International Desalination Conference Symposium on Desalination and Water Treatment Global Platform for Water Solutions, June 20–23, 2011 Qingdao, China