www.elsevier.com/locate/memsci

Relative importance of geometrical and intrinsic water transport properties of active layers in the water permeability of polyamide thin-film composite membranes

Lin Lin, Timothy M. Weigand, Matthew W. Farthing, Panitan Jutaporn, Cass T. Miller, Orlando Coronell

PII: S0376-7388(17)31751-9
DOI: https://doi.org/10.1016/j.memsci.2018.08.002
Reference: MEMSCI16375

To appear in: *Journal of Membrane Science*

Received date: 19 June 2017
Revised date: 1 August 2018
Accepted date: 1 August 2018

Cite this article as: Lin Lin, Timothy M. Weigand, Matthew W. Farthing, Panitan Jutaporn, Cass T. Miller and Orlando Coronell, Relative importance of geometrical and intrinsic water transport properties of active layers in the water permeability of polyamide thin-film composite membranes, *Journal of Membrane Science,* https://doi.org/10.1016/j.memsci.2018.08.002

Relative importance of geometrical and intrinsic water transport properties of active layers in the water permeability of polyamide thin-film composite membranes

Lin Lin[1], Timothy M. Weigand[1], Matthew W. Farthing[2], Panitan Jutaporn[1], Cass T. Miller[1], Orlando Coronell[1,*]

[1]Department of Environmental Sciences and Engineering, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-7431
[2]US Army Engineer Research and Development Center, 3909 Halls Ferry Rd., Vicksburg, MS 39180-6133, USA

*Corresponding author tel:+1-919-966-9010; fax:+1- 919-966-7911. coronell@unc.edu

Abstract

Analytical and numerical modeling studies in the literature have shown that the water permeability of reverse osmosis (RO) membranes is a function of geometrical (thickness, pore structure, surface roughness) and intrinsic water transport (water partition and diffusion coefficients) properties of their active layers. Nevertheless, no study has evaluated the relative importance of these properties with respect to the substantial differences (i.e., >10-fold) observed in water permeability among commercial RO membranes with active layers made of the same base material (e.g., crosslinked aromatic polyamide). Thus, we evaluated which active layer properties account for the differences observed in water permeability among five commercial RO membranes having crosslinked aromatic active layers and a wide water permeability range. We determined experimentally membrane water permeability and surface roughness, as well as active layer thickness, pore volume fraction, pore size, and water partition coefficient. We determined water diffusion coefficients in the active layers via macroscale modeling (i.e.,