

Author's Accepted Manuscript

Thin-film composite hollow fiber membrane with inorganic salt additives for high mechanical strength and high power density for pressure-retarded osmosis

Chun Feng Wan, Tianshi Yang, Wenxiao Gai, Yu De Lee, Tai-Shung Chung



www.elsevier.com/locate/memsci

PII: S0376-7388(18)30159-5
DOI: <https://doi.org/10.1016/j.memsci.2018.03.050>
Reference: MEMSCI16044

To appear in: *Journal of Membrane Science*

Received date: 19 January 2018
Revised date: 18 March 2018
Accepted date: 19 March 2018

Cite this article as: Chun Feng Wan, Tianshi Yang, Wenxiao Gai, Yu De Lee and Tai-Shung Chung, Thin-film composite hollow fiber membrane with inorganic salt additives for high mechanical strength and high power density for pressure-retarded osmosis, *Journal of Membrane Science*, <https://doi.org/10.1016/j.memsci.2018.03.050>

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.

Thin-film composite hollow fiber membrane with inorganic salt additives for high mechanical strength and high power density for pressure-retarded osmosis

Chun Feng Wan, Tianshi Yang, Wenxiao Gai, Yu De Lee, Tai-Shung Chung*

Department of Chemical and Biomolecular Engineering, National University of Singapore, 4 Engineering Drive 4, Singapore 117585

* Corresponding author: Tel.: +65 6516 6645, Email: chencts@nus.edu.sg

Abstract

Using high salinity draw solutions in pressure retarded osmosis (PRO) demands novel membranes with a higher withstanding pressure and a higher power density to take full advantage of the increased osmotic gradient for greater osmotic energy production. This study highlights novel strategies to design an inner-selective thin-film composite (TFC) PRO hollow fiber membrane with a high operating pressure and a high power density by adding an inorganic salt, CaCl_2 , to the dope solution and fine-tuning the spinning conditions. An optimal CaCl_2 dosage can not only effectively increase the dope viscosity but also reduce the mean pore size and narrow the pore size distribution of the polyethersulfone (PES) hollow fiber substrates. A high flowrate ratio of dope solution to bore fluid greatly enhances the mechanical strength of the PES substrates. The combination of these two strategies results in a more permeable, better-supported and less defective polyamide selective layer after interfacial polymerization. The best newly developed TFC hollow fiber has a power density of 38 W/m^2 at 30 bar by using 1.2 M NaCl and deionized water as the feed pair. To our best knowledge, these are the highest power density and operation pressure ever achieved by PRO hollow fiber membranes in the literature. The improved performance will advance the PRO technology closer to commercialization and make osmotic energy more competitive with other renewable energies.

Download English Version:

<https://daneshyari.com/en/article/7019932>

Download Persian Version:

<https://daneshyari.com/article/7019932>

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