Effect of combined positions of feed spacer-type tricot on the performance in pressure retarded osmosis (PRO)

Jinwoo Sim\textsuperscript{a}, Jaewuk Koo\textsuperscript{b}, Sookhyun Nam\textsuperscript{b}, Eunjoo Kim\textsuperscript{b}, Tae-Mun Hwang\textsuperscript{a,b,*}

\textsuperscript{a}Korea University of Science & Technology, 217 Gajung-ro, Yuseong-gu, Daejeon 305-333, Korea
\textsuperscript{b}Korea Institute of Civil Engineering and Building Technology, 283 Goyangdae-Ro, Ilsan-Gu, Goyang-Si, Gyeonggi-Do 411-712, Korea, Tel. +82-31-910-0741; Fax: +82-31-910-0295; email: taemun@kict.re.kr (T.-M. Hwang)

Received 6 October 2016; Accepted 16 December 2016

\textbf{A B S T R A C T}

Pressure retarded osmosis (PRO) is a promising technology for renewable energy. However, its performance can be influenced by deformation of the PRO membrane caused by feed spacers at the high applied pressure and changed flow direction in the PRO membrane cell. The feed spacer-type tricot (tricot) for a flat-sheet membrane of the PRO module provides the structural support to withstand high pressure from the draw side. This keeps the feed channel open during turbulent flow at the vicinity of the membrane surface. The purpose of this study was to investigate the effect of combined positions of feed tricot on membrane performance. The surface shapes of tricot were different; one side was uneven and the other side was soft. Furthermore, when tricot was combined with the feed cell of a PRO membrane module, there were two types of positions; depending on the lines of feedwater holes of the feed cell, when placed parallel to thick lines of the tricot with the feedwater holes it was named the vertical line, and when placed across was named the horizontal line. The different surface shape and combined positions of the tricot had a big impact on this study. The study results showed that the soft surface and vertical line conditions in the PRO could operate stably, and subsequently achieved higher performance compared with other combined conditions.

\textit{Keywords}: Feed spacer-type tricot; Combined position; Pressure retarded membrane

\* Corresponding author.