



Analysis of flux and energy efficiency for hollow fiber module in direct contact membrane distillation process

Youngkyu Park, Yonghyun Shin, Jihyuk Choi, Yongjun Choi, Sangho Lee*

School of Civil and Environmental Engineering, Kookmin University, Jeongneung-Dong, Seongbuk-Gu, Seoul 136-702, Republic of Korea, Tel. +82-2-910-4529; Fax: +82-2-910-4939; email: sanghlee@kookmin.ac.kr (S. Lee)

Received 6 October 2016; Accepted 21 November 2016

ABSTRACT

Although membrane distillation (MD) holds promise as an emerging desalination technology, relatively few studies were carried out to analyze energy efficiency of MD modules. Accordingly, this study intended to establish an energy balance for a 1 m² hollow fiber MD module. Experiments were carried out under a semi-pilot direct contact MD equipment. The feed and distillate temperatures were adjusted from 50°C to 60°C and from 25°C to 35°C, respectively. The feed and distillate flow rates ranged from 0.6 to 1.2 m³/h. A performance ratio was evaluated from a thermal energy balance in each operation condition. Results showed that the feed flow rate and temperature difference greatly affect water flux (productivity) and performance ratio (energy efficiency). The conductive heat loss through the membrane was found to be substantial, which decreased with a reduction in the temperature difference. The performance ratio was proportional to the single pass water recovery of the MD module, suggesting that the sufficient feed flow rate is required for efficient operation of MD.

Keywords: Direct contact membrane distillation; Performance ratio; Recovery; Energy balance; Membrane module

* Corresponding author.