A New Design of Vacuum Membrane Distillation Module for Water Desalination

Authors : Adnan Alhathal Alanezi

Abstract : The performance of vacuum membrane distillation (VMD) process for water desalination was investigated utilizing a new design membrane module using two commercial polytetrafluoroethylene (PTFE) and polyvinylidene fluoride (PVDF) flat sheet hydrophobic membranes. The membrane module's design demonstrated its suitability for achieving a high heat transfer coefficient of the order of 103 (W/m2K) and a high Reynolds number (Re). The heat and mass transport coefficients within the membrane module were measured using VMD experiments. The permeate flux has been examined in relation to process parameters such as feed temperature, feed flow rate, vacuum degree, and feed concentration. Because the feed temperature, feed flow rate, and vacuum degree all play a role in improving the performance of the VMD process, optimizing all of these parameters is the best method to achieve a high permeate flux. In VMD desalination, the PTFE membrane outperformed the PVDF membrane. When compared to previous studies, the obtained water flux is relatively high, reaching 43.8 and 52.6 (kg/m2h) for PVDF and PTFE, respectively. For both membranes, the salt rejection of NaCl was greater than 99%.

Keywords : desalination, vacuum membrane distillation, PTFE and PVDF, hydrophobic membranes, O-ring membrane module
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