

Exergy, Energy Comparison and Economic Feasibility Analysis of Closed-loop Pressure Retarded Membrane Distillation for Energy and Fresh Water Production

이민석, 박기호¹, 양대륙[†]
고려대학교; ¹전남대학교
(dryang@korea.ac.kr[†])

Low-grade energy is abundant, but reuse this is harder than high-grade energy due to low temperature. Recently, the study of utilizing low-grade energy to increase the energy efficiency of the process is being proceeded. In this approach, pressure retarded membrane distillation (PRMD) was proposed. It is designed to combine membrane distillation and pressure retarded osmosis. Meanwhile, there is a difference that thermal-osmosis energy conversion (TOEC) has a structure like PRMD, but it uses waste heat to recover energy and cannot produce water. By combining the PRMD and TOEC, the structure was improved to enable water production and energy recovery by utilizing low-grade energy, which was proposed as closed-loop PRMD. This makes it possible to improve energy efficiency more than conventional methods. Modeling was carried out using Matlab to interpret the process. The three methods have analyzed the difference in the water production, the energy needed and generation based on 100 Wh of net energy production. Exergy destruction was found to be about 20% less than the existing method. The feasibility of the process was analyzed through energy efficiency and economic evaluation.