

Thermodynamic performance of a low temperature multi-effect distillation experimental unit with horizontal-tube falling film evaporation

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ABSTRACT

A five-effect distillation experimental unit was designed and fabricated and the thermodynamic performance was measured and evaluated. The mechanical design and process operation parameters of a low temperature multi-effect distillation experimental unit were optimized. This unit featured horizontal-tube falling film evaporation. Its designed performance was achieved and maintained, and its heat loss was effectively reduced. The variation of temperature and pressure in each evaporator effect and the thermodynamic performance of the unit were tested and analyzed. The results indicated that the measured and calculated vacuum and evaporating pressure in each effect coincided. Water production rate and gained output ratio (GOR) decreased slightly with an increase in flow rate of feed seawater. With an increase in flow rate of heating steam the water production rate linearly increased and GOR slightly increased. The calculated results were found to be fairly close to the experimental observation, which justified the expectation that the analytical model developed for the multi-effect distiller was reliable, and the overall design of the experimental system was correctly done.

Keywords: Horizontal-tube falling film evaporation; Low temperature multi-effect distillation; Thermodynamic performance; Gained output ratio

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