Numerical analysis on flow and heat transfer of a tube bundle in a horizontal-tube falling film evaporator

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ABSTRACT

In order to get a better understanding of distribution characteristics of the dynamic and heat transfer performance in a horizontal-tube evaporator, a numerical calculation was developed to simulate the internal film condensation and external falling film evaporation in a tube bundle. The temperature field, film thickness and local heat transfer coefficient were predicted along the tube length and in-between tubes. In view of a good agreement of the simulated predictions with the data of the practical desalination plant, the theoretical model was proved to be valid and accurate. The results show that the flow field and heat transfer rate are improved by means of optimizing the flow density distribution of liquid film outside a tube bundle on basis of the variation of the internal condensation process. The internal vapour condensation temperature reduces sharply at the outlet of the second pass. The local overall heat transfer coefficients tend to decrease from the inlet of the tubes to the outlet and approach the maximum at the bottom of the bundle.

Keywords: Condensation; Evaporation; Temperature field; Film thickness; Tube bundle

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