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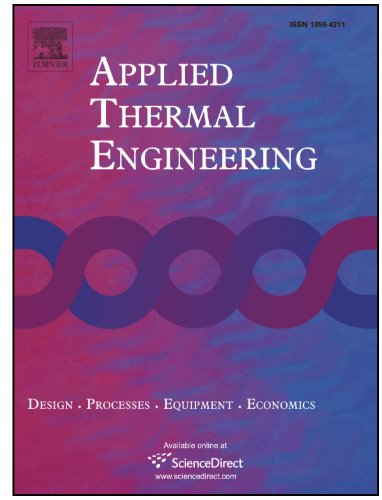

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Interaction Analysis of a Concentric Component Evaporator Absorber for an Absorption Heat Transformer

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Abstract

This work focuses on the analysis of a concentric component evaporator-absorber for an absorption heat transformer for water distillation by a H2O-LiBr refrigerant-absorbent pair. To understand the interrelationship of evaporation and absorption in this component and to identify the limiting mass and energy phenomena, a numerical model was built. This model describes the falling film heat transfer and the distillation inside of tubes per ring of coil. To make a precise specification of the conditions at which the transport properties are evaluated, the MOSAIC modeling framework was used. The model results were compared with experimental tests at steady state. Also, the effect of an increase in the composition of the absorption mixture was studied. The model was also useful to analyze the effect of the operating pressure in the dual component. The results showed that with an increase in the pressure from 17.68 to 21.33 kPa, the heat load in the evaporator decreases from 1.73 to 1.57 kW, and as result, the distilled water in the absorber decreases from $5.5x10^{-4}$ to $4.4x10^{-4}$ kg/s. This computational model identifies the effect of wetting efficiency in the evaporator as the limiting factor.
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Keywords evaporator-absorber interaction, dual component, falling film, wetting efficiency, process intensification.

1 Introduction

An absorption heat transformer has mainly four heat exchangers for energy recovery; however, because the heat losses depend on the size of the units, there are configurations to make these units suitable to reduce energy losses and to produce compact units. The absorption heat transformer of this work uses H2O-LiBr as refrigerant-absorbent pair. The design capacity is 2kW. This work focuses on a dual component, which contains two heat exchangers in the same shell: evaporator-absorber EV-AB [1]. The evaporator and absorber are heat exchangers with helical geometry on which a film of fluid descends through the coil. In the film side, the heat is transferred over the tubes by a thin layer. In the tube side, the heat is enhanced by the turbulence generated due to the collisions of the fluid with the walls.

Experimentally, some relevant variables, like the evaporated flow, are difficult to measure due to the configuration of the unit. A useful tool to estimate these variables and to predict the behavior of the heat exchangers is a computational model. As the EV-AB are in the same shell, the pressure in both heat exchangers is the same; hence, what happens in one process affects the other. A model also helps to appreciate this interaction of the EV-AB.