Desalination and Water Treatment
www.deswater.com

46 (2012) 10–20
August

doi: 10.1080/19443994.2012.677406

Taylor & Francis
Taylor & Francis Group

Numerical study of evaporation of liquid film by mixed convection in partially wetted vertical channel

A. Nasr*, C. Debbissi, S. Ben Nasrallah

LESTE, École Nationale d'Ingénieurs de Monastir, Université de Monastir, Monastir, Tunisia
Email: abdelaziz.nasr@yahoo.fr

Received 30 December 2011; Accepted 1 March 2012

ABSTRACT

This study focuses on a numerical investigation of steady conjugated heat and mass transfer by mixed convection in a finite vertical channel. The two channel walls are symmetrically heated with uniform heat flux. One wall is partially wetted by an extremely thin water film, while the other is dry and impermeable. The partially humid plate is divided into 2.*n* equal regions which are alternately humid and dry zones. The effect of the number of wetted zones and their positions on the flow and on the heat and mass transfer is analysed. The results are reported in terms of axial distribution of wall temperature, relative heat fluxes and evaporation rate for different wetted zone positions. It is observed that the change in the wetted zone position has no significant effect on moist air flow. However, the heat and mass transfer are extremely influenced by the presence of the wetted zones and their positions. In fact, the evaporation rate is more intense when the wetted section is situated at the channel exit. Finally, it is observed that the evaporation is intensified by increasing the number of wetted zones. The importance of the studied system lies in the fact that it can describe several desalination cells associated in series.

Keywords: Evaporation; Mixed convection; Heat and mass transfer; Thin film; Vertical plates

*Corresponding author.