Estimation of convective heat transfer coefficient in a single-slope solar still: a numerical study

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ABSTRACT

The intention of this work is to investigate the natural convection effect in a 2-D single-slope solar still. The flow is assumed as steady, laminar, and incompressible ideal gas. A numerical model based on SIMPLEC algorithm is used for the solution of mass, momentum, energy, and concentration equations. The solutions are performed for several values of aspect ratio and Rayleigh number between 2.5 and 5.5 and between $5 \times 10^6$ and $5 \times 10^7$, respectively. Moreover, a new correlation for estimating the convective heat transfer coefficient has been obtained, which has a good agreement with published well-known models. The results show that, for a given aspect ratio, Rayleigh number has a direct effect on Nusselt number. On the other hand, for a fixed Rayleigh number, the value of Nusselt number decreases when the aspect ratio increases. Furthermore, it is found that the maximum heat transfer coefficient is in the area where flow directed downward from glass to water.

Keywords: CFD study; Single-slope solar still; Convective heat transfer coefficient; Aspect ratio; Rayleigh number

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