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Thermal modeling of a basin type solar still enhanced by a natural circulation loop

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Highlights

- A transient simulation of a basin type solar still enhanced by a NCL is proposed.
- The still was treated as a rectangular NCL with the humid air as the working fluid.
- The proposed thermal model is validated by comparing the simulation results with experimental data.
- The NC capability in driving air-convection and improving the CSS performances was demonstrated.

Abstract

A numerical simulation of a basin type solar desalination still, improved by a Natural Circulation Loop (NCL), is presented in this paper. A transient thermal model was proposed for forecasting the still thermal-hydraulic behaviour under different operating conditions. The proposed mathematical model is derived from the energy balance equations of the different components of the still, as well as, momentum equation for the humid air flowing in the system. The main heat and mass transfer phenomena having a place in the system are considered by the simulation. An extensive validation of the model has been performed by comparing the simulation results against experimental data obtained during four typical summer days. The comparison shows a reasonable agreement between the simulation results and the experimental data. The results showed that the root mean square error is ranged from 2.7% to 26% and the coefficient of determination is close to 1.0.

Keywords: *Modeling and simulation, Solar still, Natural circulation loop.*

Nomenclature

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