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Improving the design, modeling and simulation in dynamic mode of a solar still

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ABSTRACT

Solar distillation greenhouse is one of the applications of solar thermal conversion at low temperatures. The present work is a theoretical study of a solar still with enhanced single-acting. In the present work, we propose to establish a mathematical model reflecting the operation of a solar still. The proposed research is to improve the production of a solar still by making changes in the design of the conventional solar still by adding a trim-level distiller which plays the role of a humidifier, a pulverizer, and a condenser to study the effect of internal and external parameters of the operation of a solar still. For this purpose, a system of equations governing the operation of the distiller and the different heat exchange coefficients is established. A global mathematical model based on heat and mass transfers is developed in dynamic state regime to investigate both the effect of different operating modes and the variation of functioning parameters and weather conditions on the freshwater production. The results obtained show the influence of external and internal parameters on the operating characteristics of the solar still, in particular production and performance. It was found that the maximum values of production rate, water temperature, and glass temperature are varying inversely with heat capacity of basin water and other materials used in the basin. The total production also decreases with the increase of basin heat capacity.

Keywords: Solar energy; Solar still; Packed bed; Modeling and simulation; Distilled water; Condenser; Water collector

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