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Theoretical and experimental investigations on single slope solar still

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ABSTRACT

This study presents performance investigations of modified solar still placed under Jordan Mediterranean climate conditions. The effect of the condenser surface area on solar still productivity at different basin water depth has been analyzed. The effect of wind speed on solar still performance has been studied. An accurate theoretical model of the thermal behavior of solar still is developed. The highly complex behavior of the solar still is accurately described by the developed mathematical model. A numerical technique (Runge–Kutta method) is used to solve the non-linear system of differential equations. The water temperature, glass temperature, heat transfer coefficients, and productivity of the still have been analyzed. The present theoretical study is compared against experimental work and found in good agreement. The results show that solar still performance is inversely proportional to the saline water depth. Moreover, it is found that the effect of the condenser surface area depends on the water depth. Furthermore, the results show that there is a critical depth of water (2.5 cm) beyond which the productivity of solar still increases as wind speed increases until a specific value of wind speed (8 m/s) beyond which the effect of wind speed becomes insignificant. On the other hand, as basin water depth decrease than the critical depth, it is found that the productivity still decreases as wind speed increase until a specific value of wind speed (8 m/s) beyond which the effect of wind speed becomes insignificant. Also, the results show that decreasing basin water depth from 8 to 0.5 cm, the daily distillate output increases from 2,620 to 4,211 g/m^2/d respectively at 0 wind speed.

Keywords: Solar still; Water distillation; Wind speed; Condensation surface area; Theoretical modeling

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