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Experimental Study for a Solar Powered Desalination Unit using Humidification–Dehumidification Technique

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ABSTRACT

A solar powered desalination unit which working on a humidification –dehumidification technique (HDH) is one of the most important techniques used in seawater desalination in remote and rural areas. In this study, an experimental setup was designed and constructed for conducting a set of experiments on a solar assisted desalination unit working on a HDH principle under the prevailing conditions of Tajoura–Libya. Experiments were carried out on March, 2019 at the laboratories of Center for Solar Energy Research and Studies (CSERS) at Tajoura. The effect of different design and operating parameters that influence the performance of the unit and its productivity is closely investigated and interpreted. Results show that the productivity of HDH unit decreases by increasing the process air mass flow rate. A significant improvement in the productivity of the unit is noticed when the feed water mass flow rate to the humidifier is increased. Moreover, initial water temperature inside the tank has a remarked effect on the productivity of the unit. In order to obtain a reasonable amount of fresh water, the temperature of the water inside the tank should be increased. Increasing the cooling water mass flow rate to the dehumidifier leads to a corresponding decrease in the surface temperature of the cooling coil and hence the productivity of the unit is improved. The Productivity of HDH unit under investigation is varying from its lower value of (0.903 kg/m².day) to a higher value of (6.47 kg/m².day). These values are obtained for one meter square of solar air heater area. Gain Output Ratio (GOR) values range from a minimum of (0.082) to a maximum of (0.572). It is reasonable when compared to ones in literature for the water–heated HDH units.

Keywords: Solar, desalination, humidification, dehumidification, productivity.