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Experimental investigation of a bubble column humidifier heated through solar energy

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ABSTRACT

An experimental study was carried out to assess the performance of a novel bubble column humidifier operated through solar thermal energy. Different perforated plate geometries were studied experimentally to select the optimum design that delivers a low overall pressure drop in the system. Then, the day-round performance of the humidifier was investigated experimentally with and without Fresnel lens. The influence of the air superficial velocity, inlet water temperature, and inlet air relative humidity on the performance of the humidifier were investigated. Findings indicate that the average daily absolute humidity of the air at the exit of the humidifier increased by 12.3% when the air superficial velocity increased from 20 to 30 cm s^{-1}. This absolute humidity is further increased in the range of 9%–11% with the integration of the Fresnel lens. The new humidifier design can have a direct concentrated solar thermal heating and it acts as a heater for the water and air at the same time. Subsequently, it has high performance and it can be located in remote areas.

Keywords: Solar thermal energy; Water desalination; HDH systems; Bubble column humidifier; Fresnel lens; Air humidification

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