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Performance of force circulation cross-matrix absorber solar heater integrated with latent heat energy storage material

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Abstract

The utilization of thermal energy storage in the thermal absorber applications has been increasingly important especially in the application where there is a mismatch between energy demand and energy supply. This technology implies that the heat is stored during charging or discharging process through melting and freezing of the thermal energy storage material so that it can be used in the future. This paper presents the outcome of the experimental investigation on the performance of cross-matrix absorber (CMA) utilizing paraffin as the thermal energy storage material. Experiments were carried out by exposing the CMA under different artificial solar radiation (300 W/m²), 500 W/m²), 700 W/m²) and 900 W/m²) for 30 minutes followed by 30 minutes of discharging process. Based on the observation, it was found that smaller mass flow rate value of 0.005 kg/s gave the highest temperature output regardless of the intensity of solar radiation as compared to the other after 30 minutes of charging process. In terms of heat gain by the thermal absorber, it was concluded that the highest mass flow rate of 0.01 kg/s passing through the absorber lead to the higher heat gain by the CMA, hence prolonged the cooling down /discharging period as shows by the result, where case with maximum mass flow rate (0.01 kg/s) consistently contributed to the higher heat gain by the absorber. This feature is very useful in the solar thermal collector related applications such as crop drying and domestic building heating. The heat gain by the absorber is also contributed by the intensity of the solar radiation.

Keywords

KeyWords Plus: AIR HEATER; THERMAL PERFORMANCE; PCM; BUILDINGS; SYSTEMS; DESIGN; DRYER; FLAT

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