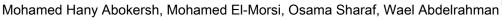
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An Experimental Evaluation of Direct Flow Evacuated Tube Solar Collector Integrated with Phase Change Material

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4 Abstract

5 The current study presents an experimental analysis for integrating a phase change 6 material (PCM) in a typical direct flow evacuated tube solar water heater with a U-tube 7 heat exchanger (HX). Each evacuated tube is filled with 0.8 kg of paraffin wax to store 8 the absorbed incident solar energy. As water flows through the U-shape copper tube 9 inside the PCM, the stored energy is transferred to the water through a combination of 10 conduction and convection. The proposed system is investigated under two 11 configurations; un-finned and finned HX to investigate the effectiveness of adding the 12 fin. Outdoor experiments are carried out to demonstrate the thermal performance of the 13 purposed systems under various scenarios including the charging phase and the overnight 14 heat loss as proposed by Chinese National Standard CNS 7277-12558 [1]. Also, the 15 thermal performance during the discharging phase is evaluated under various loads based 16 on the experimental design approach. The results show that the natural convection is the 17 main heat transfer mechanism during the charging phase, with a higher system efficiency for the un-finned collector by about 14% due to the high average temperature of the 18

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