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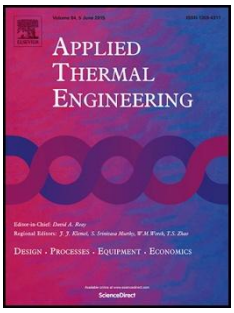

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EXPERIMENTAL INVESTIGATIONS OF A LATENT HEAT ENERGY STORAGE UNIT USING FINNED TUBES

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Highlights

- Evaluated latent heat energy storage system with finned tubes heat exchanger.
- Examined the effect of HTF inlet temperatures and flow rates.
- Studied affected parameters on charge/discharge behavior
- Displayed the significance of the characteristic length during solidification.

ABSTRACT

An experimental study was conducted on a latent heat energy storage system (LHESS) consisting of a tank filled with phase change material (PCM), dodecanoic acid, coupled with a finned tube heat exchanger. The study included charging experiments under controlled experimental conditions with parametric alterations on the HTF flow rate and inlet temperature. Discharging experiments using municipal water looked at the discharge time and heat transfer rates based on an alteration of the HTF flow rate. The characterization of the LHESS showed that increasing the HTF inlet temperature during charging resulted in significantly faster melting time. A decrease of 3.5 hours was observed when increasing the HTF temperature from 60 to 70 °C, while another decrease of 2 hours was observed with an increase from 70 to 80 °C. Increasing the HTF flow rate during charging from 0.7 to 1.5 L/min did not have any significant effects on heat transfer rates, however an increase from 1.5 to 2.5 L/min resulted in higher heat transfer rates and decreased melting time by 1 hour. The increase of flow rate did not have a significant impact during the discharge process. Further work on the system is expected to encompass a real-time solar investigation of this tank.

Keywords: *Latent heat storage, Phase change materials, Thermal conductivity enhancement – fins, experimental investigation*