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An experimental study of a combined solar cooking and thermal energy storage system for domestic applications

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In this paper, a combined solar cooker with a sunflower oil storage tank is presented. The solar cooker consists of a 1.8 m parabolic dish that has an oil circulating copper spiral coil receiver embedded to a metallic cooking plate. The receiver is connected to a 50 L sunflower oil storage tank for the dual purpose of heat storage and cooking. A DC pump is used to circulate the oil during charging and discharging. The receiver has a circular metallic plate for cooking, while the copper coil is embedded below the plate to circulate sunflower oil that is heated up and stored during the cooking (charging) experiments. During charging, 1.5 L of water is boiled in a cooking pot with storage tank temperatures above 100 °C being achieved. During discharging, the pump is reversed and 1.5 L of water is heated up with the stored heat, however, heat transfer is poor with the water temperature only achieving temperatures just above 50 °C. Preliminary experiments are presented, and the charging process is seen to be more efficient than the discharging process with the charging pump reversed. The system can be used to cook food as well as provide heat for indirect cooking using insulated bag slow cookers. However, cooking food directly on the cooking plate using the reverse discharging process is not efficient, and heat transfer should be enhanced to make the process more efficient and viable.

Keywords; Combined solar cooking and storage; Sunflower oil; Receiver; Thermal performance

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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