8. Single slope solar still with low cost energy storage material

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ABSTRACT

This work concentrates on the exergy analysis of conventional solar still with and without modification (energy storage material). Experiments were carried out in different water mass maintained inside the basin under constant mass of energy storage material. Detailed exergy evaporation and efficiency investigations were carried out using different water mass. Results show that the increase in water mass decrease the exergy efficiency during sunshine hours and there is an increase during offshine and low radiation period for higher water mass. Results also show that the maximum exergy efficiency of 20 and 9% for higher water mass (m_w=50 kg) in conventional and modified solar still respectively.

In this work, a novel method is employed to improve the yield of fresh water from single slope solar still with cement coated red bricks with specified dimensions under different water mass inside the basin of the solar still. Comparative study of solar still with and without energy material is studied in order to analyze the improvement in yield of fresh water.

1. EXPERIMENTAL METHODOLOGY

Fig. 1 and 2 shows the schematic diagram and experimental photograph of a single slope solar still with low cost energy storage. It consists of a basin with 1 m^2 area and filled with water and cement coated red bricks. Saline water is stored in the storage tank and fed into the basin using flexible hose piping with insulation and flow control valve V1 and V2 are provided. To maintain the constant water mass inside the basin, fresh saline water is fed into it after evaporation from the surface. The surface area of water is increased by keeping defined dimensions of energy storage material. Murugavel used a different approach on energy storage material with indefinite shapes in basin. Each bricks are sieved with a dimension of 0.1 x 0.1 x 0.1 m and coated with cement layer of 0.05 m is coated over it. Totally 12 bricks were used during the experiments whereas, the exposure

water area is 0.84m^2. The water mass used during the experiments is 20 kg and it appeared to be the optimized mass from the literature survey. Similarly, the water mass inside the basin is increased from 20 to 50 kg to study the performance of the present system to optimize the water mass. Experiments are conducted on a domestic house hold of Chennai, India to study the feasibility of its use for commercialization.

Temperature of various elements in solar still are measured using PT-100 (RTD) sensor with an accuracy of ±1% and environmental parameters such as solar intensity and wind velocity are measured using TES-1333R solar meter and AM4836 cup type anemometer respectively. Experiments are conducted from 7 AM to 12 AM with bright and sunny condition during the sunshine hours.

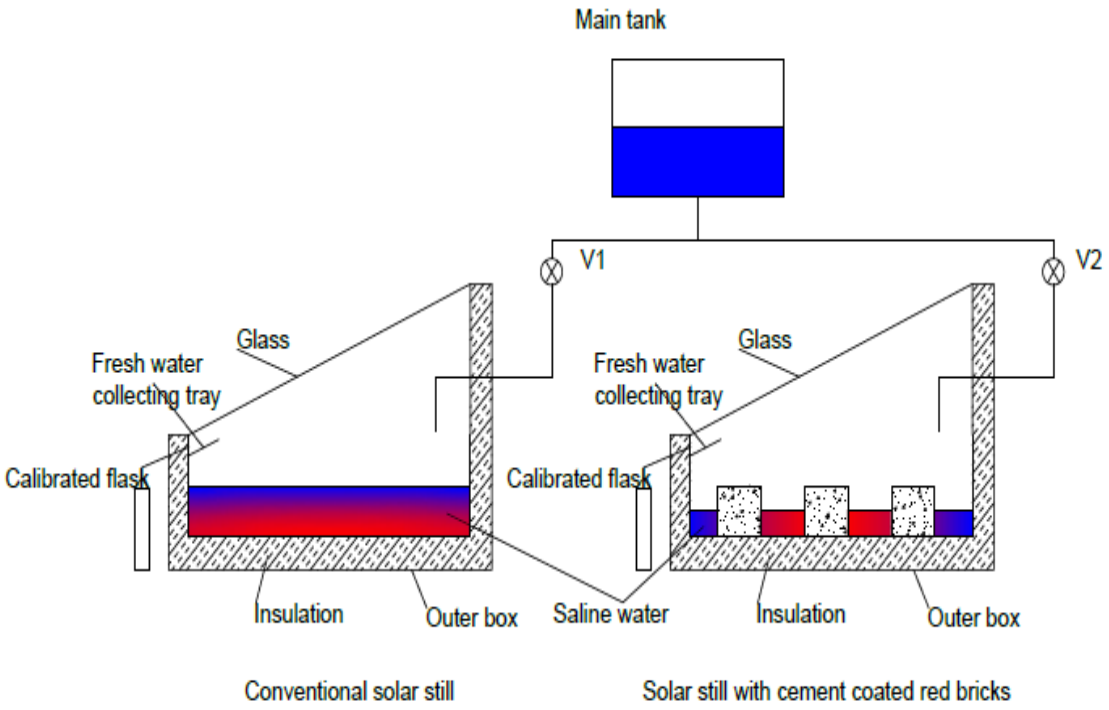

Fig. 1 Schematic diagram of conventional and modified solar still with cement coated red bricks

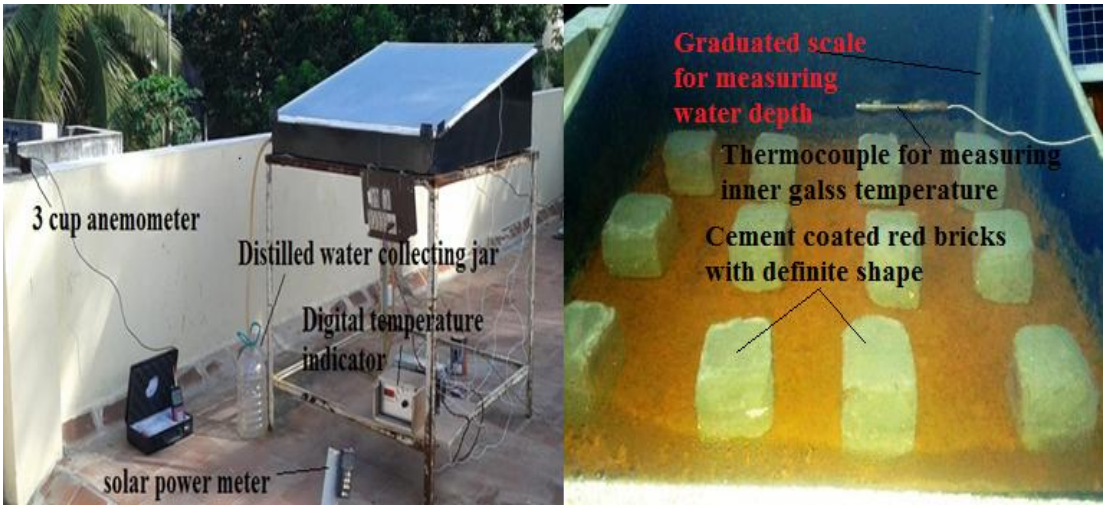

Fig. 2 Experimental photograph of the modified solar still with instrumentations used

2. CONCLUSIONS

From the experimental study the following conclusions are arrived:-

- Due to the specific heat capacity of water and increased exposure area of water the exergy efficiency and energy efficiency of modified solar still is higher.
- The maximum exergy is found to be 20 and 9% for higher water mass (m_w=50 kg) in conventional and modified solar still respectively.
- Water temperature is increased by 60% than that of solar still without any modification.