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INVESTIGATION OF LATENT HEAT STORAGESYSTEM

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Abstract

An experimental investigation was carried out to study the thermal performance due to stratification. The storage tank integrated with the available solar collectors was used to analyse the stratification performance of the thermal storage system. In the present paper, the construction of the experimental set up and the procedure adopted in the conduct of the experiments are presented.

INTRODUCTION:

A storage system should be designed to match the intermittent, variable and unpredictable nature of solar radiation along with the fluctuations in the demand for the thermal load of a given application. Storage systems are classified as buffer storage, diurnal storage and annual storage, based on the time interval for which the energy is required. Storage is required only for a short duration of hours in the case of buffer storage [1]. A system larger than buffer storage that has the capacity to store energy for a day or two is called diurnal storage. A long term storage or seasonal storage is one which stores the excess energy collected in one season for use during the other seasons. In the present research a diurnal storage system is designed and investigated, for its integration with the solar hot water collector system, suitable for various applications. The major problem associated with the first configuration, is cavity formation due to volume change during solidification [2-4]. This affects the heat transfer characteristics during repeated cycling. Further, the PCM cannot be packed separately inside a storage tank due to its poor thermal conductivity, which varies the resistance for the heat transfer during the charging and discharging processes [5-7]. The solidified layers of the PCM during its solidification on its convective heat transfer surface, acts as an insulator, and further, as the thickness of the solidified layer increases, the resistance to the heat transfer between the HTF and the liquid PCM increases. This, in turn, decreases the heat transfer rate appreciably, and causes a non-uniform rate of discharging characteristics in the storage tank, which may restrict its usage for any application [8-10].In order to avoid the above said problem, the second configuration consisting of a bed of spheres, randomly packed, and poured into a cylindrical tank, is an attractive option, particularly for solar applications. This type of storage system is very simple in construction, and also increases the heat storage capacity compared to the SHS system, and eliminates the problems that are usually encountered in a shell and tube type latent heat storage unit.

STATEMENT OF RESEARCH ARGUMENT:

The Storage systems, latent heat thermal storage is chosen, due to its high energy storage capacity and isothermal behaviour during the charging and discharging processes.Further, from the application point of view, the hot water may be required at a high rate for a short duration, and this requirement can be met by the sensible heat of the water in a storage tank. Before its use next time, the temperature of the water in the tank gradually increases again, by the slow extraction of the latent heat from the PCM. Thus, the problem of a no uniform heat flux during the withdrawal of heat from the LHS system is minimized. Further, a down flow configuration of the HTF flow was selected, considering the need to maintain a high temperature at the top, and the gravitational force aiding the HTF flow through the voids, and to maintain a high level of stratification.

OBJECT OF THE STUDY:

1. To study the Storage Tank Configuration.
2. To study the Heat Transfer Fluid and Phase Change Material.
3. To study the Solar Collector System.
4. To study the Thermal Storage System and configuration.
5. To study the Recent Trends in Solar Energy.

CONCLUSION:

The formation of thermally unstable fluid layers responsible for improved mixing and expedited thawing of PCM was also highlighted. It was found that the number of fins (or fin-pitch) and fin length have far stronger effects on the performance of the storage system than those caused by fin thickness and fin orientation. At the same time, insertion of fins will weaken buoyancy-driven convection, which is well-known to play an important role in the melting process. Therefore, the conflict between enhancement of the effective thermal conductivity and simultaneous suppression of the buoyancy effect should be considered by the designer through selecting the optimum positions and orientation of the fins. A generalized finding of these studies underlines that in employing fins with high thermal conductivity, minimum-distance conducting pathways that connect the extreme temperature of the heat storage system should be sought. Usage of PCM integrated energy storage applications leads to improved performance, efficiency, and as well as the energy storage capacity of the total system. But the major drawback of the PCMs is low thermal conductivity. Performance improvement can be obtained through proper consideration of the material with high thermal conductivity, design with higher heat transfer areas and several parameters such as input temperature, dimensions, C.F, flow rate. Hence it is important that the design of the TES is in such a way that the melting and freezing process are improved and a proper PCM with required properties are selected for an active performance of the thermal energy storage. From the literature study made, many researchers concentrated only on increasing surface area thereby increasing enhanced energy transfer. But the geometrical modification of TES system should promote the stratification effect of energy storage to utilize the excess energy.

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