PP 28 - Thermal analysis of honeycomb rectangular structure flat plate collector as energy storage unit to enhance the performance of coupled acrylic pyramid solar still

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Study had been carried out to enhance the energy storage capacity of flat plate collector coupled with single pyramid solar still. Honeycomb rectangular segments are made of 3 mm transparent glass plates. Honeycomb structures act as a thermal storage unit, which traps heat so that it can be utilized for desalination. Rectangular strips had been made of 2 mm glass plate. This rectangular segments act as a thermal storage unit for trapping heat, sothat it can be utilized effectively for water heating. Acrylic pyramid solar still of area 0.5 m^2 is designed. The top cover of the still is made up of transparent acrylic sheet of 3mm thickness.

The objective of the present paper is to study the behavior of the still performance coupled with flat plate collector by analysing the internal heat transfer coefficients and thermophysical properties of the pyramid solar still. The radiative heat transfer (Q_{ri}), convective heat transfer (Q_{ci}) and evaporative heat transfer (Q_{ei}) under internal heat transfer modes are predicted. Similarly external heat transfer modes by conduction heat transfer (Q_{be}), external heat transfer through radiation from the glass cover (Q_{re}) and heat transfer from acrylic cover to atmosphere by convection (Q_{ce}) are also estimated and it is tabulated. The instantaneous efficiency, performance ratio, saturation vapour pressure, latent heat and dimensionless parameters are also calculated for the pyramid solar still and still combined with flat plate collector. The readings are recorded for number of clear sky days and almost equal average radiation received during the three studies are considered for the analysis and reported.

The study incorporates the influence of different environmental and operational parameters on the still productivity. Environmental parameters include solar intensity, ambient temperature and wind speed. Operational parameters include inner and outer cover temperature, basin water temperature, basin air temperature and basin water depth. The maximum distillate output of 2 L/m^2/day was obtained for pyramid solar still and 2.89 L/m^2/day for solar flat plate collector coupled with the pyramid solar still. The efficiency of the experimental still varies from 7% to 29% and the variation for flat plate collector coupled with pyramid solar still in the range of 2 % to 1-%. These results