Experimental Investigation of DPSAH Using Aluminium Obstacle

Jay K Patel[1], Sukritindra Soni[2], Maulik Sukhadiya[3]
[1]M.E. Researcher, Student, Thermal Engineering, SPIT
[2]Asst. Professor, Mechanical Department, SPIT
[3]Asst. Professor, Mechanical Department, GIT

***Abstract* - Solar air heaters are used for applications at low and moderate temperatures such as crop drying, timber seasoning, and space heating. Various works have been carried out to increase the efficiency and heat transfer rate of solar air heater. This includes using different materials for absorber plate, artificial roughness geometry, surface roughness, number of pass, mass flux, effect of porous material etc. Different absorber plates had been designed and tested for experimental study.**

I. INTRODUCTION

Solar air heater produces hot air from atmospheric air which comes in contact with outer side of galvanized iron basin and leavers its latent heat and becomes cold air and it possess higher density hence it goes downside and further becomes hot air by receiving heat from sun. Solar air heating is a renewable energy and solar air heater is a simple device that heats air by utilizing solar energy from the sun. Its wide range of applications involves drying of agricultural products, such as seeds, fruits, vegetables and space heating. Also, solar air heaters are used as pre heaters in industries and as auxiliary heaters in buildings to save energy during winter times. Conventional solar air heaters mainly consist of a panel, insulated hot air ducts, a glass cover and air blowers if it is an active system. There are different factors affecting the air heater efficiency, these include collector length, collector depth, type of the absorber plate, glass cover, wind speed, inlet temperature, etc. Among all, the collector glass cover and the absorber plate shape factor are the most important parameters in the design of any type of air heater.

II. LITERATURE REVIEWS

In this comparisons between the measured outlet temperatures of flowing air, temperature of the absorber plate and output power of the double pass finned and v-corrugated plate solar air heaters were also presented. The effect of mass flow rates of air on pressure drop, thermal and thermo hydraulic efficiencies of the double pass finned and v-corrugated plate solar air heaters were also investigated. The results showed that the double pass v-corrugated plate solar air heater is 9.3–11.9% more efficient compared to the double pass-finned plate solar air heater. It was also indicated that the peak values of the thermo hydraulic efficiencies of the double pass finned and v-corrugated plate solar air heaters were obtained when the mass flow rates of the flowing air equal 0.0125 and 0.0225 kg/s, respectively [01]. The fins are arranged perpendicular to the direction of air flow to enhance the heat transfer rate and efficiency. Air enters the upper channel of the air heater and subsequently flows to the lower channel in the opposite direction. A comprehensive steady state analysis is performed, including energy balances for the upper glass cover, the super-saturate of the photovoltaic module, the absorber surface, the back plate and the air in upper and lower columns. The effects of design, climatic and operating parameters are evaluated on outlet air temperature, cell temperature, thermal (energy) efficiency, electrical efficiency and total equivalent thermal efficiency. Thermal performance characteristic curves are also developed for the PV/T collector. The effects of the presence of fins in the lower air channel, the depth of ducts of the air channels, flow rate, inlet air temperature and 9 packing factor are evaluated on the thermal and electrical efficiencies. The extended fin area reduces the cell temperature considerably, from 82 ° C to 66 ° C [02]. this study experimentally investigates a device for inserting an absorbing plate made of Aluminium cans into the double-pass channel in a flat-plate solar air heater (SAH). These types of collectors had been designed as a proposal to use aluminium materials to build absorber plates of SAHs at a suitable cost. The highest efficiency had been obtained, and a good agreement had been found. This method substantially improves the collector efficiency by increasing the fluid velocity and enhancing the heat-transfer coefficient between the absorber plate and air. Various air mass flow rates between 0.03 and 0.05 kg/s are also investigated at the experiments. The performance of double-flow type SAHs, in which air is flowing simultaneously over and under absorbing plate, is more efficient than that of the devices with only one flow channel over or under the absorbing plate because the heat-transfer area in double-flow systems is double [03]**.** The efficiency increases with increasing air mass flow rate. For the same flow rate, the efficiency of the double pass is found to be higher than the single pass. Thermal efficiency further decreases by increasing the height of the first Pass of the double pass solar air heater. ΔT reduces as after certain the air mass flow rate increase. The bed heights were 7 cm and 3 cm for the lower and upper channels respectively. The result of a single or double solar air heater using steel wire mesh arrange in layers as an absorber plate and packing material when compared with a conventional solar air heater shows a much more substantial enhancement in the thermal efficiency[04]. In investigation study a thermo-hydraulic analysis of a solar air heater with an internal multiple-fin array. A preliminary simple test was carried out to confirm the efficiency enhancement of the proposed arrangement. Proposed multiple fin-array technology enables to decrease the demanded air flux of 7-10 times in comparison to the smooth pipe arrangement of the absorber. Even with the flux decreased, the efficiency of internal multiple-fin array arrangement is higher than

the one available for smooth pipe arrangement. A thermo-hydraulic efficiency test was used to obtain the best fin arrangement of the receiver [05].

III. PROCEDURES

In solar air heater system air is heated by solar radiation on capture to glass and that absorb plate absorb with different point of plate. One blower is provided for suction of air to improve the velocity of air. An aluminium spring coil on an absorber plate is also attachment that helps to increase the heat transfer area and increase the rate of heat transfer according to their conductivity.

Methodology

For applications of solar air heater based on an absorber plate with obstacles and frame to mount the components. It absorbs the sunlight at top of collector. At bottom of solar collector, solar air heater having absorbing materials is placed, which also transfer hot air at bottom of bed.

- **Type I Arrangements -** Double pass solar air heater without obstacles on absorber plate, which is Type-I arrangement.
- **Type II Arrangements -** Double pass solar air heater with the aluminium spring in perpendicular to direction of the air inlet, which is Type-II arrangement.
- **Type III Arrangements -** Double pass solar air heater with the aluminium spring in zigzag direction to the packed bed, which is Type-III arrangement.
- **Takes other necessary data find out -** Takes the readings for air sucked from blower at the outlet of those arrangement by helping of thermocouples.

IV. RESULTS

Results of First type arrangement

In this case the double pass solar air heater is working with the different velocities 2/4/6/8/10 m/s and the necessary data has been found and calculated using the mathematical equations. Only the flow of air is flowing to inlet of the air heater defines the thermal efficiency of this Type – I as plot in table form.

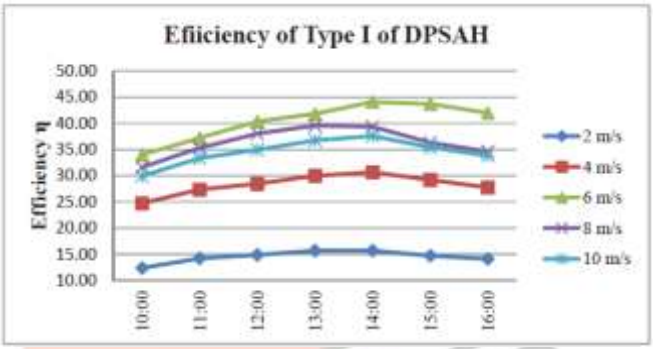

Figure 1. Efficiency of Type - I of DPSAH at velocity 2, 4, 6, 8, 10m/s

Results of Second type arrangement

In this case the double pass solar air heater is working with the different velocities 2/4/6/8/10 m/s and the necessary data has been found and calculated using the mathematical equations. Only the flow of air is flowing to inlet of the air heater defines the thermal efficiency of this Type – II as plot in table form.

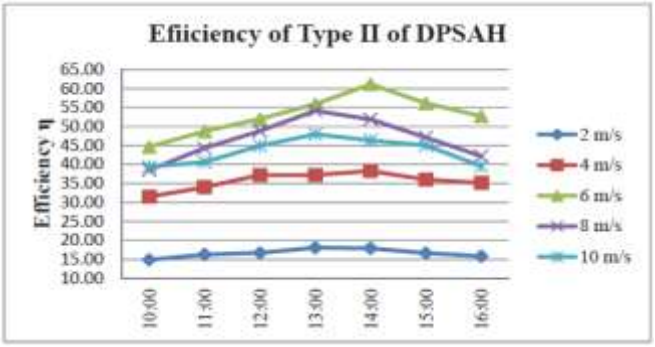

Figure 2. Efficiency of Type - II of DPSAH at velocity 2, 4, 6, 8, 10m/s

Results of Third type arrangement

In this case the double pass solar air heater is working with the different velocities 2/4/6/8/10 m/s and the necessary data has been found and calculated using the mathematical equations. Only the flow of air is flowing to inlet of the air heater defines the thermal efficiency of this Type – III as plot in table form.

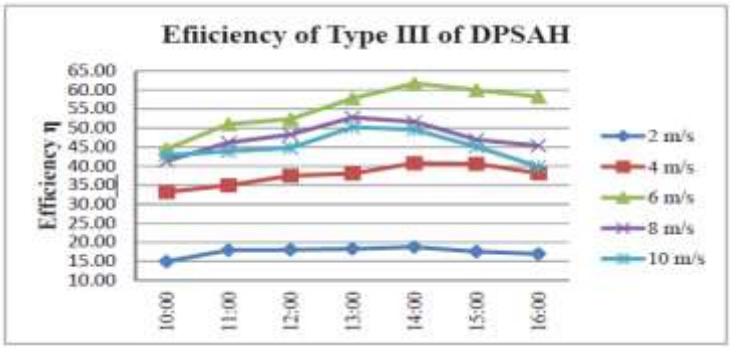

Figure 3. Efficiency of Type - III of DPSAH at velocity 2, 4, 6, 8, 10m/s

V. REFERENCES

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