

# Experimental Analysis of Double Pass Solar Air Heater with and without Sensible Storage Media

R.Tamilselvan<sup>1</sup>, J. Harish kumar<sup>2</sup>, J. Jewin samuel<sup>3</sup>, A. Jaya prakash<sup>4</sup>,<sup>5</sup>

<sup>1</sup>Assistant Professor, Sri Ramakrishna Institute of Technology, Coimbatore,

<sup>2,3,4,5</sup> Student, Bachelor of Engineering, Mechanical Engineering, Sri Ramakrishna Institute of Technology, Coimbatore,

## Abstract

An experimental investigation was carried out to study the effect of sensible storage media on double pass solar air heater. Solar energy can be converted into different forms of energy, either to thermal energy or to electrical energy. Solar collector works by absorbing the solar radiation and converting it into thermal energy, which can be stored in the form of sensible heat or latent heat or a combination of sensible and latent heats. In this work the thermal energy is stored by using sensible heat storage material. The aim is to analyse thermal efficiency of flat plate double pass solar air heater using sensible heat storage media. The inlet and outlet temperature, ambient temperature, sensible heat storage media temperature, solar glazing temperature and the absorbing plate temperature are the measured parameters. In this investigation, thermal efficiency of the double pass solar air heater with sensible heat storage media is more efficient than the single pass solar air heater with sensible storage media and double pass solar air heater without sensible heat storage medium.

**Keywords:** Double pass, solar air heater, sensible storage media, thermal efficiency, absorbing plate.

## INTRODUCTION

Solar air heater is the simplest form of solar collector in which the working medium is air. The principle usually followed is to expose a dark surface to solar radiation so that radiation is absorbed. Apart of the absorbed radiation is the transferred to air. A flat plate collector used for heating the air usually called solar air heater. [1] Adit Gaur et al. investigation main aim of using double pass arrangement is to reduce the heat loss to ambient from the front cover of collector and thus improving the thermal efficiency of the arrangement. [2] Ajay Kumar et al. experimental investigation of solar air heater using porous media they indication the effect of mass flow rate and solar radiation on efficiency of solar collector [3] Ahmad Foudoli et al. the thermal efficiency of the double pass solar air collector with finned absorber the efficiency is increased to relational to mass flow rate and the solar radiation and the efficiency is depends on mass flow rate. [4] Bashria et al. A mathematical simulation to predict the effect of different parameter on system thermal performance and pressure drop in single and double pass mode with and without using porous media have been conducted. [5] Bashria et al. performance of the double pass of solar air heater is calculated and compare with the performances of single pass and it is found that double pass operation increases the performance of solar collector.

[6] Ben Slama et al. collector with baffles aerodynamics, heat transfer and the efficiency [7] C. choudhray et.al performance and cost analysis of double pass solar air heater.[8] ] Fouedchabane et al. The researcher has given their attention to analysis of flat plate solar air heater by experimental method. In this paper analysis is done by using smooth plate by varying different mass flow rate. [9] Fouedchabane et al. effect of tilt angle of natural convection in the solar collector with longitudinal fins ,a series of experimental test carried out on plan and in this study shows that for a single pass solar air heater using internal fin inferior and absorber plate ,there is a significant increase the thermal efficiency of the air heater [10] M. pradhraj et al. performance of solar air heater without any cover is very poor and hence at least one cove be used the better performance .[11] Silvina Gonzaler et al. thermal evaluation and modify the double pass solar collector for air heating.

## RESULTS AND DISCUSSION

The performance of the double pass solar air heater is studied and compared with the single pass. In this analysis, it's been over that the double pass solar air heater is more efficient then the single pass solar air heater. It can see that the efficiency of air heater greatly depends on air flow rate. The efficiency of air heater is increased up-to 1.435 kg/hr in single flow mode and upto 1.949 kg/hr in double flow mode. This figure clearly shows that the double flow mode is 3-4 % more efficient than single one. Thus, efficiency increases with double pass mode due to heat removal from two pass as compared to single pass.

If sensible storage materials is employed in double flow, the efficiency has been increased 6% more as compared to single flow mode. If sensible storage materials isn't utilized in double flow, the efficiency has been increased 2-3% more as compared to single flow mode without sensible storage materials.

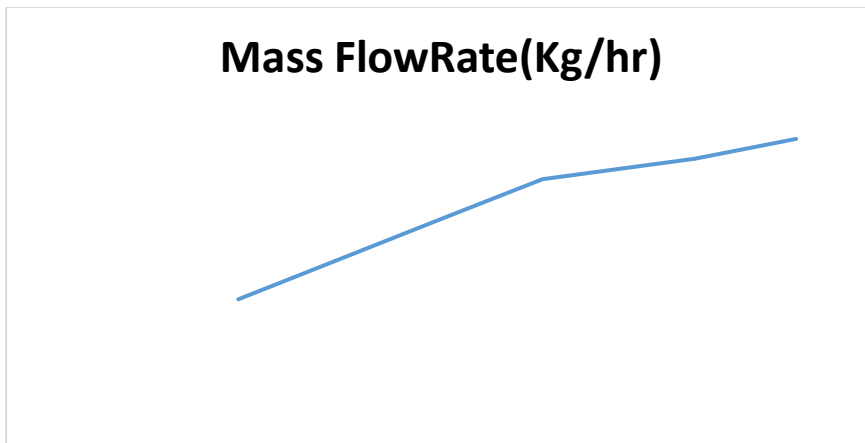


Figure 4.1: Efficiency variation with mass flow flow rate for single pass mode non porous

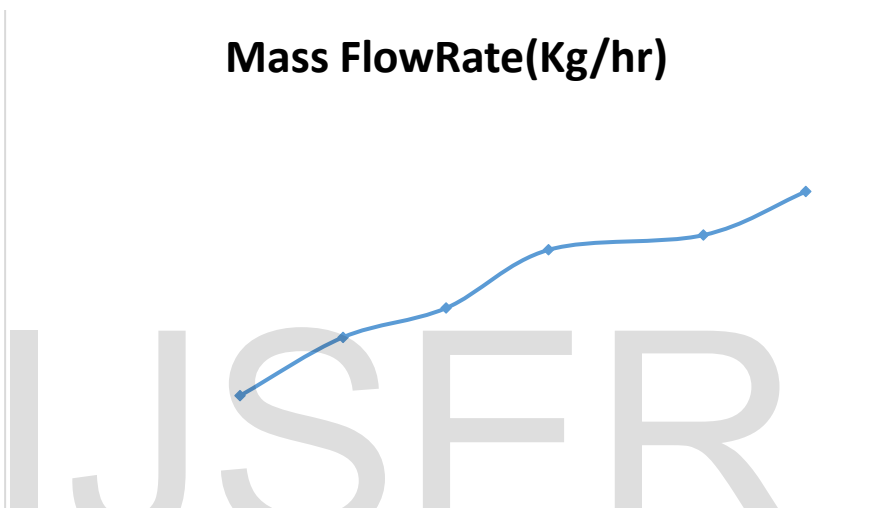


Figure 4.3: Efficiency variation with mass flow for single pass mode with porous

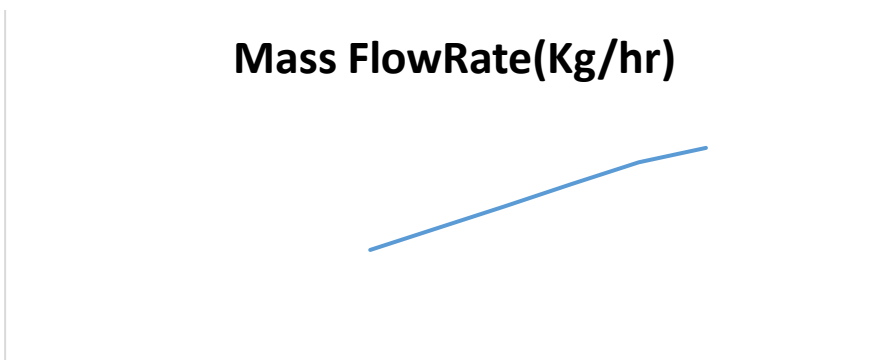


Figure 4.5: Efficiency variation with mass flow rate for pass mode with non-porous

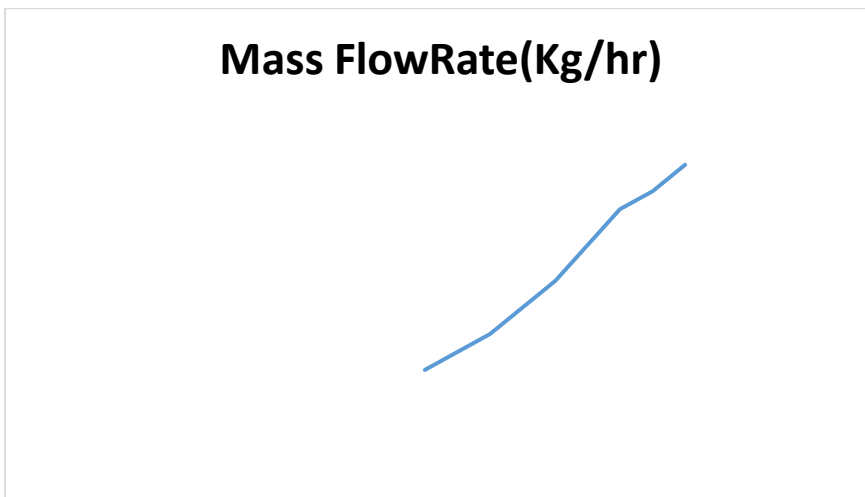


Figure 4.5: Efficiency variation with mass flow rate for Double Double pass mode with porous

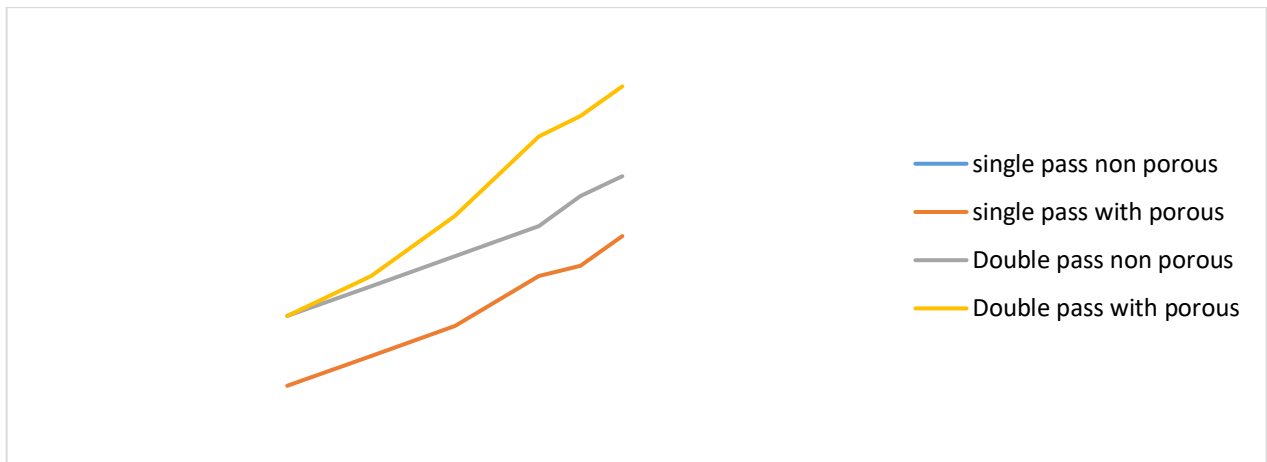


Figure 4.7: Efficiency variation with mass flow rate

Hence, the use of sensible storage materials will increase the heat transfer space that contributes to higher thermal efficiency. In this paper, figure 4.1 shows that efficiency variation with mass flow rate for single pass mode without sensible storage materials. Figure 4.3 shows efficiency variation with mass flow rate for single pass mode with sensible storage materials. Figure 4.5 shows the efficiency variation with mass flow rate for double pass mode with sensible storage materials. Finally, our result shows in figure 4.7 that mass flow rate increases with pressure drop and efficiency increases with mass flow rate.

## CONCLUSIONS

An experimental analysis is completed to predict the result of various parameter thermal performance for smooth plate single pass and double pass solar air heater with and without using a sensible storage material. It is found that thermal efficiency greatly supported mass flow rate; it increases with increasing mass flow rate. The double flow is more efficient than the single flow made, and using of sensible storage materials increases the system efficiency and therefore the outlet temperature.

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