

# ENHANCEMENT OF OUTLET TEMPERATURE OF SOLAR AIR COLLECTOR BY MULTIFOCUS GLASS PARABOIDAL

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## Abstract

In the current scenario when the petroleum prices is increases sharply it is essential that we can switch over nonconventional energy source to avoid such type of energy crisis. Since open parabolic collector having less collector efficiency due to excessive radiation and energy losses and there is no any conservation of energy around the collector. An experimental analysis investigation has been carried out on a multifocus glass covered paraboloidal solar air collector reveal that larger enhancement of outlet temperature upto 25°C to 30 °C by using double parabola. The investigation cover a various arrangement of air flow pipe. In place of single pipe we use four pipe of the same size at the focus of two different size parabolas. These four pipe also responsible for the enhancement of outlet temperature. The effect of fraction of mass flow rate on collector efficiency on all the four pipe with artificially roughened absorber tube has also been investigated theoretically and practically and result are compared with smooth pipe flow arrangement used in solar air collector. Considerable improvement in outlet temperature performance is obtained with artificial roughness upto 15° C to 25°C . On the basis of investigation it is found that with glass cover, multi parabola and multi flow pipe arrangement the efficiency of solar air collector increases upto large extent.

## I. INTRODUCTION

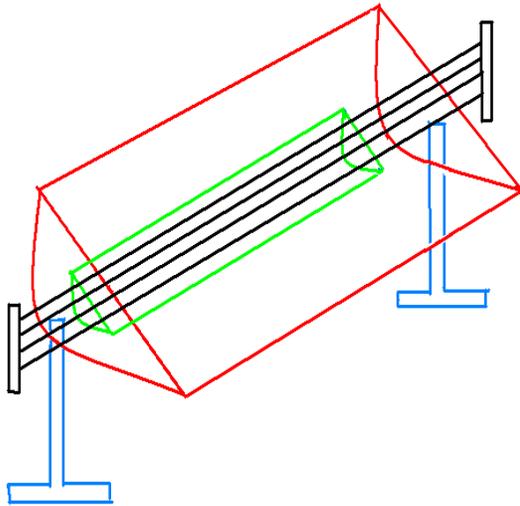
The solar air heater occupies an important place among solar heating system because of minimal use of material , and the direct use of air as the working substance reduce the number of required system component, In many industrial application where air recirculation is not practical because of contaminants, heated outside air is used ,especially for supplying fresh air to hospitals. Solar air heater, in which energy transfer comes from a distant source of radiant energy to air, may be used for space heating, drying and paint spraying operations. Without optical concentration, the flux of incident radiation is approximately up to 1100 W/m<sup>2</sup>

## II. PARABOLIC COLLECTOR DIAGRAM

and flat-plate solar collectors are designed for application requiring energy delivery at moderate temperature. Solar air collector ,because of their inherent simplicity are cheap and most widely used collection devices. The main application of solar air heater are space heating, seasoning of timber ,curing of industrial product, and these can also be effectively used for curing / drying of concrete /clay building component. The solar air heater occupies an important place among solar heating system because of minimal use of material and cost. The thermal efficiency of solar air collector in comparison of solar water collector has been found to be generally poor because of their inherent low heat transfer capability between the absorber plate and air flowing in the duct. In order to make the solar air heater economically viable, their thermal efficiency needs to be improved by enhancing the heat transfer coefficient. There are two basic methods for improving the heat transfer coefficient between the absorber plate and air. One axis solar tracking and linear focus systems can track the sun only along its angle elevation over the horizon. The most characteristic one axis tracking collector is the so called parabolic trough collector are the must mature concentrating solar technology to generate heat at temperature up to 400<sup>0</sup>c for solar thermal electricity generative or process heat application. Reflector with a parabolic shape concentrate the direct solar radiation on to the sector located in the focal line of the parabolic. The receptor consist of a absorber tube of an area usually 25 to 35 times smaller than the aperture. The fluid to be absorber piping. Water and thermal oil are typically used as working fluid. Parabolic trough collector have a very low thermal loss coefficient and are therefore will suited also for application at higher temperature. They do not use the diffuse part of the solar radiation. However they make a better usage of the direct (beam) radiation than stationery collector due to the sun tracking mechanism .

This is a multifocus glass covered paraboloidal solar air collector. Generally open parabola are less efficient due to radiative and energy losses. So for the prevention of these

losses, a glass cover is used. A parabola is a curve produced when a cone is cut by a plane. It is one of the family of curves called conic sections that also includes the circle, ellipse, and hyperbola. These curves are produced when the plane cuts the cone at different angles and positions.

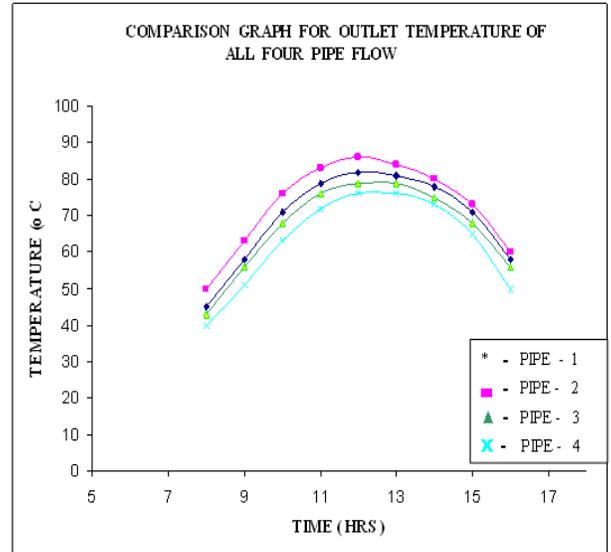


**Figure 1.** Multi-focus glass covered paraboloidal solar air collector line diagram.

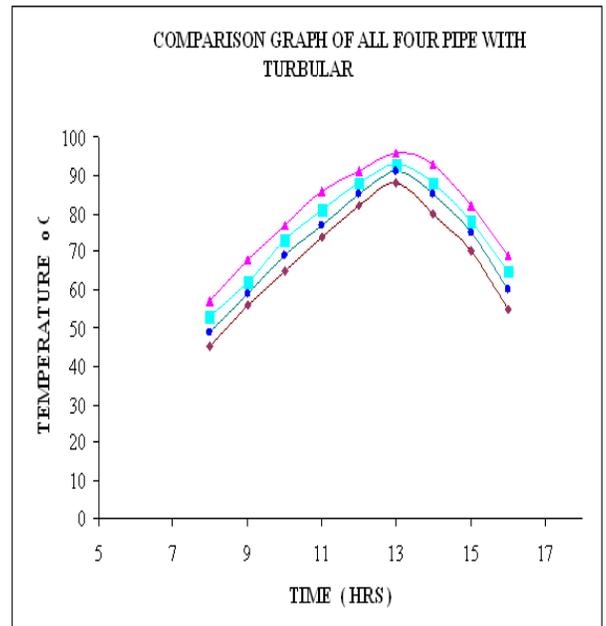


**Picture 1.** Photographs of multifocus glass covered paraboloidal solar air collector.

This setup require less space for installation, as compare to other collector of single focus and single pipe flow arrangements. This is the basic concept of double parabola as shown in figure. In such arrangement there is better utilization of solar radiation as compare to other collectors.



**Figure 2.**



**Figure 3.**

### III. Test conducted:-

1. Using top heat pipe to flow and blocking the others heat pipes.

2. Using first-middle heat pipe and blocking the others heat pipes.
3. Using second-middle heat pipe and blocking the other heat pipes
4. Using bottom heat pipe and blocking the other heat pipes.

The observations recorded are given in the tables below. The time versus rise in air outlet temperature shown in below graphs. Reflecting surface can be used to increase the energy yield of the parabolic solar collectors. Also the performance of parabola solar collector can be significant enhanced by adding of reflectors, which increase the total collection area. This initial and final weight of the content and there maximum allowable temperature shown on the table no 1.

**Table 1.**

### CONCLUSION

1. It can be concluded that a considerable enhancement of heat transfer can be obtained from multifocus glass covered paraboloidal

S.NO	Vegetables	Initial W.T	Final W.T	Tem (°C)	Time Duration
1	Potatoes	400 g.m	100 g.m	85	12 to 3
2	Onions	200 g.m	90 g.m	90	12 to 3
3	Chillies	200 g.m	80 g.m	88	12 to 3
4	Tomatoes	300 g.m	100 g.m	79	12 to 3
5	Garlic	100 g.m	40 g.m	80	12 to 3

collector solar air collector by double focus and glass covered arrangement. This enhancement is a function of parabola geometry

and operating parameters. Based on the experimental data in this work, correlations for different heat pipe with there inlet and outlet temperatures. The range of parameter covered were Input temperature Maximum output temperature On the basis of experimental analysis .the following conclusion have been drawn.

2. Presence of double parabola increases the heat transfer rate as compare to open type single parabola collector under similarly operating condition.
3. The small parabola is found to have a significant effect on the heat transfer rate. The maximum outlet temperature was found to be in between 12° clock to 3° clock.
4. The experimental value of the thermal efficiency of the artificial roughned heat pipe as compare to smooth heat pipe were tested. A maximum efficiency of 53% has been found.
5. As compare to open type parabola collector, this collector has more efficiency. Paraboloidal air collector with multi heat pipes gave best performance as compare to single heat pipe used in such type of collector.
6. There is a big enhancement of heat transfer as a result with multifocus parabola and multi heat pipes. The quantity of enhancement being a strong function of physical and operating parameter. An increase in outlet temperature from 80° to 96° C observed.

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