



A Critical Review on Solar Water Flat Plate Collector with Fabrication

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ABSTRACT:

India has very waste source of solar energy because India has some geographical advantages India's location is made it highly reach source country of solar energy. In our research study we were trying to solve above problems with design and modification of this conventional solar water heater. We used flat plate solar water collector with PCM. For this modification we can make tube in sheet solar flat plate collector. In this tube water will be flow and PCM is surrounding this tube and modify the design as minimizing the heat losses by develops the effective Insulating box. Over main concern is improving the efficiency of collector with economic cost.

1. Introduction

It is very important for India to developed new and advance technology which helps to cultivate more and more solar energy for this purpose over study is one of the important research for development and modify the flat plate solar collector with used of PCM Design of flat plate collector and manufacturing this collector with selected optimum process parameters like polymer tubes, iron tubes, iron box, copper sheet collector, insulating material, sealing glass cover and PCM.

Table: 1 Material for Collector

S. No	Material	Length (mm)	Width (mm)	Thickness (mm)	Diameter OD/ID (mm)
1.	Iron Pipe	500	-----	-----	14.3
2.	Covering Glass	611.30	411.30	6	-----
3.	Iron box	621.60	411.30	100	-----
4.	Copper Plate	1000	307	8	-----

2. Tools Used in Fabrication

- | | |
|-----------------------|--------------------|
| 1) Sheet Cutter | 11) Knife |
| 2) Sheet Gauge | 12) Screw driver |
| 3) Measuring tap | 13) Round file |
| 4) Hand and Table saw | 14) Adhesives |
| 5) Hand Drill tool | 15) Thermometer |
| 6) Power Drill tool | 16) Venire Scale |
| 7) 1" to 3" hole saw | 17) Hammer |
| 8) Wood cutter | 18) Wood sharpener |
| 9) Glass cutter | 19) Inch tape |
| 10) Welding machine | 20) Safety gloves |

3. Required Items for Fabrication

- | | |
|----------------------|------------------------|
| 1) Iron sheet | 7) Polymer sheet |
| 2) Iron tubes | 8) Copper sheet |
| 3) PCM material | 9) Insulating material |
| 4) Adhesive material | 10) Glass sheet |
| 5) Wooden sheet | 11) Plastic Tank |
| 6) Silver foil | 12) Rubber |

4. Copper plate panel is fabricated with given specification

Copper plate size – 1000 mm x 307 mm x 8 mm.

Polymer tube diameter – 7mm

Polymer tube length – 3800mm

Polymer tube thickness – 2mm

Iron tube size (diameter) – 12mm

Iron tube length - 500mm

No. of Iron tube – 6

5. Method of Fabrication

Phase change material (PCM) is used for utilization of maximum absorbed solar energy. PCM is help to utilization the solar energy in the sun-off period that is when solar energy is not available. PCM is important material which is used in flat plate solar collector. Many researchers used PCM material In collector tank to utilized maximum solar energy. In this study we can also use PCM in collector tank, plate and tubes. This PCM material is absorbed available extra energy in day time when sun is radiate solar energy and it converted this extra energy into other form of energy and stored it. When sun is off and there is no solar radiation, that time PCM released stored extra energy for utilization. For this purpose we are modify the flat plate collector with PCM material filled tubes and water is surrounded around this PCM filled tubes.

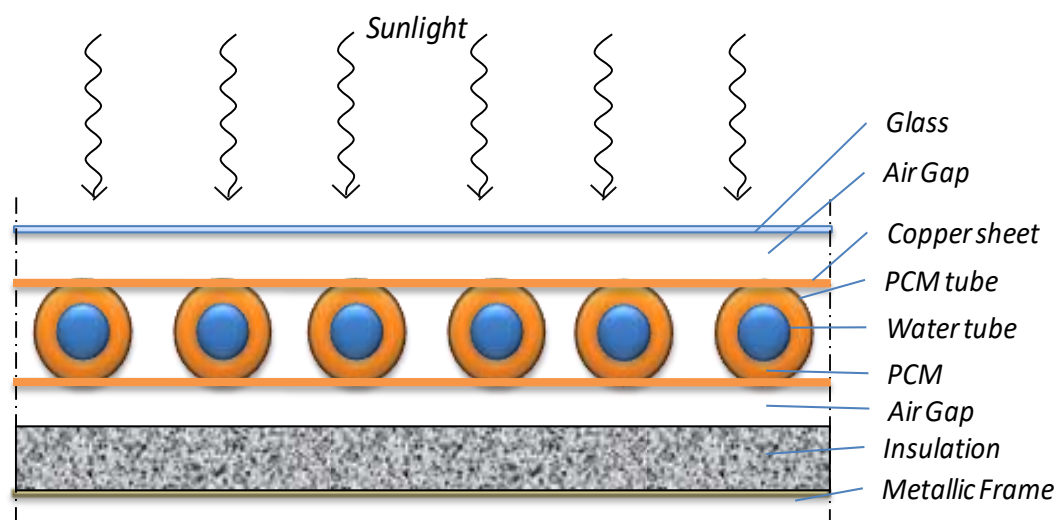


Fig: 1 Solar tube and plate arrangements

For fabricating flat plate collector, we take Six (6) galvanized iron tube and some flexible polymer tubes. Flexible polymer tubes is used for water flowing. There is some advantages of chosen this flexible polymer tube for water flowing because it is easily bend in any angle and turn. water flow is continues in this tubes. PCM material is filled in six galvanized iron tube. For filling PCM material in tubes we can cut iron tubes in required size of 12 mm diameter and 500 mm length of each tube. Arranging of this concentric tube at accurate manner is one the most important task. Arrangement of concentric tube in collector as such as the flow of water is continues and less losses of energy during flow. so that we can arrange tubes as water tubes passes inside the iron

tubes. Required manner of arrangement of tubes as water tubes passes through iron tubes make only turning "U" shape pattern and remaining tubes are left out. In this arrangement tubes are folding in adjacent to inlet-outlet tubes this arrangement is called Open folding end. Remaining tubes where folded as all ends are fold and adjacent to copper sheet folding side this arrangement is called close folding. This close folding ends are now sealed with suitable sealing material like silicon and rubber. Remaining ends of folding is filled with PCM material and then it is also sealed by silicon. There is some extra material are used and also other fixture is used for fixing tubes and filled PCM materials in tubes. Copper sheet is now cut in proper size and shape. There is two copper sheet of same size are used because make design optimum. Copper sheet are arranged in such a way that tubes are fixed between two copper plate like sandwich. Then painted all arrangement properly by the used of black paint. Black paint help to improve the heat absorption rate of collector.

Iron tray is the size of 600mm x 400mm x 10 mm is fabricated by the used of galvanized iron sheet. For preventing back radiation of energy form tray we can put layer of aluminum foil in all sides of iron tray. This aluminum foil is preventing back radiation of solar rays which is transmitted through the glass covering over the tray. All absorbing rays are insulated and prevented by the help of aluminum foil and maximum heating is provided by the tray. Tray is consist of all sets of concentric tubes with PCM material filled tubes. Iron tubes are used to flow of water, while polymer flexible tubes are filled with PCM material. All this arrangement of tubes and PCM material Tubes are passes through the iron tray and covered by Glass sheet at top of tray. This glass covering is also sealed by silicon and rubber. Then all system is well insulated and checked for preventing heat losses from all side of collector and tray.

The complete experimental setup is installed at chosen place where the system is free from sun-shadow area. Place will be selected on the basis of geographical analysis where system received maximum sun energy without any external disturbance. The intensity of solar radiation has been maximum at this place. Further we can connect our system to water supply tank for supplying adequate quantity of water to the solar collector. Generally take is placed above the level of collector to flow of water automatically due to gravity and does not required any external power supply.

Then finally we can calculate and recorded all parameters and temperature of system from inlet to outlet condition by the help of DATA LOGGER. Data logger recorded all temperature of installed system like it measure ambient air temperature, surface temperature of collector plate, collector walls temperature and temperature of water at inlet and outlet. All this data is recorded by the DATA Logger at every day basis and make sure the accuracy of recorded data.

Conclusion

This study is analyzing the process parameters of flat plate solar collector and gives optimum solution of design development and improves the performance of flat plate collector. For improving performance and increasing efficiency of collector we can fabricated the practical experimental setup and conducted all experiments over it. By the used of Taguchi analysis we can plane the experiment and their procedure.

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