Performance And Analysis of Aluminium Plate Parabolic Heat Collector

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ABSTRACT:-

The renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on the way they capture and distribute solar energy or convert it into solar power. In active solar system include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar system include orienting a building to the Sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air. The solar energy available makes it a highly appealing source of electricity. The United Nations Development Programme in its 2000 World Energy Assessment found that the annual potential of solar energy was 1,575–49,837 exajoules (EJ). The above figures several times larger than the total world energy consumption, which was 559.8 EJ in 2012.

Keywords:- Solar Energy, Collectors etc.

Types of Solar radiations:-

1] Direct Radiations:- Direct radiation is received from sun rays travelling in a straight line from sun to the earth.

2] Diffuse Radiations:- Diffuse radiation does not have any fixed direction. When sun rays are scattered by particles present in the atmosphere, these scattered sun rays account for the diffuse radiation.

3] Reflected Radiations:- Reflected radiation is the component of radiation which is reflected from surfaces other than air particles.

4] Global Radiations:- Global radiation is the sum of direct, diffuse and reflected radiation.

Types of Collector:-

1] Flat Plate collectors:- In that collector system includes (1) a dark flat-plate absorber, (2) a transparent cover that reduces heat losses, (3) a heat-transport fluid (air, antifreeze or water) to remove heat from the absorber, and (4) a heat insulating backing.

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Photo 1. Flat Plate collector

2] Evacuated tube collectors:- Most vacuum tube collectors in use in middle Europe use heat pipes for their core instead of passing liquid directly through them. Direct flow is more popular in China. Evacuated heat pipe tubes (EHPTs) are composed of multiple evacuated glass tubes each containing an absorber plate fused to a heat pipe.

Photo 2. Evacuated tube collector

3] Glass- glass evacuated tube:- Some evacuated tubes (glass-metal) are made with one layer of glass that fuses to the heat pipe at the upper end and encloses the heat pipe and absorber in the vacuum. Others (glass-glass) are made with a double layer of glass fused together at one or both ends with a vacuum between the layers (like a vacuum bottle or flask), with the absorber and heat pipe contained at normal atmospheric pressure.

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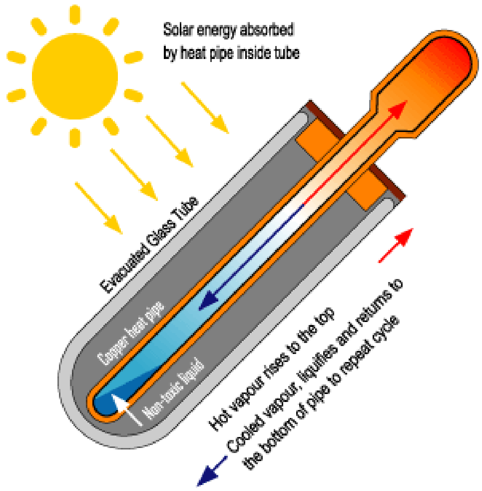

Photo 3. Glass - Glass Evacuated tube collector

4] Parabolic Troughf collector:- This type of collector is generally used in solar power plants. A trough-shaped parabolic reflector is used to concentrate sunlight on an insulated tube (Dewar tube) or heat pipe, placed at the focal point, containing coolant which transfers heat from the collectors to the boilers in the power station.

5] Parabolic Dish Collector:- With a parabolic dish collector, one or more parabolic dishes concentrate solar energy at a single focal point, similar to the way a reflecting telescope focuses starlight, or a dish antenna focuses radio waves. This geometry may be used in solar furnaces and solar power plants.

Photo 4. Parabolic Dish collector

Experimental Procedure:-

- Fill the water into the water tank.
- Give the electric supply to the motor and temperature indicator.
- Start the motor switch ,and wait until the water come out the delivery pipe.
- When water come out the pipe ,note down the reading i.e.T1,T2,T3,T4,T5,T6,T7.and solar intensity.

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- After ten minutes take another reading.
- This procedure until one hours, after one hour drain the water tank and fill the new water. and wait till the water come out the delivery pipe.
- Note down the reading .
- Do the all above procedure for whole day.
- Make the calculations and plot the graph time verses efficiency and time verses solar intensity.

Experimental setup:-

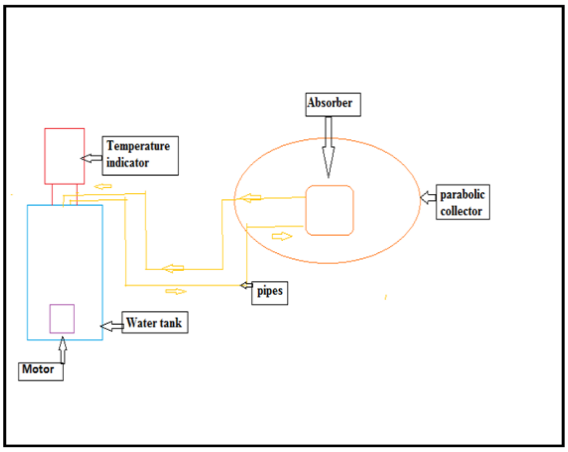

Photo No. 5 Experimental Set up

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Assembly Of Experiment Setup

Result Tables, Graphs & Discussion for Aluminum:-

SR. NO.	Time	Temperature							Solar intensity (W/m2)
		T1	T2	T3	T4	T5	T6	T7	
1	10:10	57.1	27.5	25	33.2	37	36.8	25.4	986
2	10:20	64	28.7	26.5	34	38.2	35.6	27	1048
3	10:30	64.9	28.9	27.5	29.1	34.7	33.6	27.9	1045
4	10:40	67.4	29.8	28.6	31.5	37.5	36.8	29	1060
5	10:50	67.4	30.3	29.2	34	38.4	38.9	29.7	1070
6	11:00	62.9	29.8	30.3	30.5	34.6	32.1	30.7	1077

Time	Useful Heat gain by water	Input solar Energy	Instantaneous η	Hourly Efficiency
10:10-10:20	307.75	1565.47	19.66	13.49
10:20-10:30	205.16	1610.88	12.73	
10:30-10:40	225.67	1620.11	139.2	
10:40-10:50	123.09	1639.35	7.5	
10:50-11:00	225.68	1652.44	13.05	

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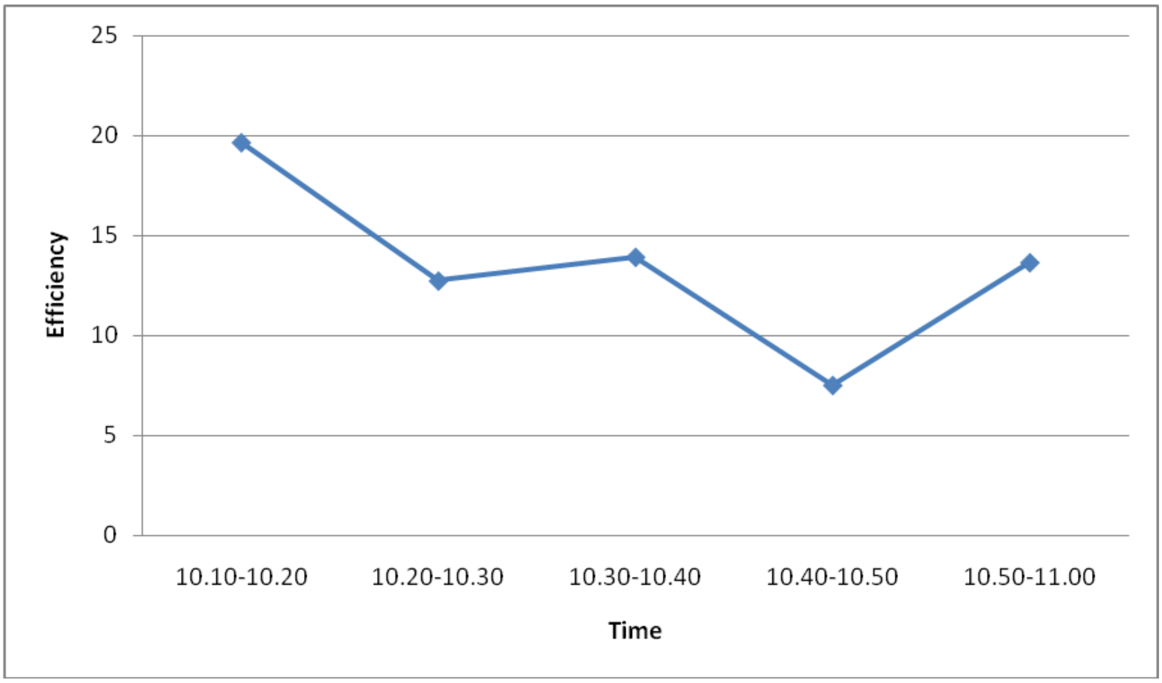
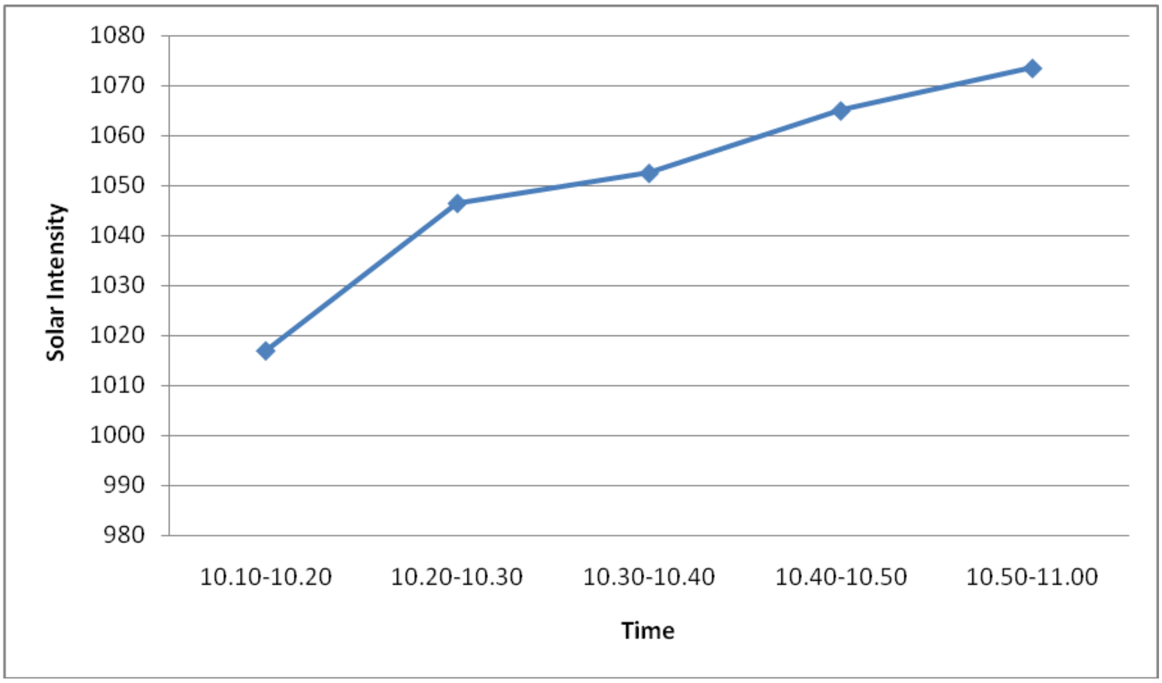
Efficiency Vs Time(10.00-11.00)



Solar Intensity VS Time (10.00-11.00)



Sample Calculation-

Output-

Heat Energy Gain by Water = MCpΔT×1000

= 0.049×4.187× (26.5-25) ×1000

= 307.74W

Input-

Average of Solar Intensity = (986+1048)/2

= 1017 W/m2

Input power= Average of Solar Intensity×Area of parabolic collector

= 1017 ×1.5395

= 1565.46 W

$$\text{Efficiency}=\frac{\text{Heat Energy Gain by Water}}{\text{Input power}}$$

$$=\frac{307.74}{1017}$$

$$\eta = \mathbf{19.65\ \%}$$

CONCLUSION :-

Efficiency of Aluminum plate is **22.6%**

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