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Substitution and Comparative Study of Solar Panel Efficiencies of Silver and Aluminium as a Reflector

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ABSTRACT

Solar energy and solar rays as a whole are a worldwide wealth and help in generation of large amounts energy often not put to good use by us. In an attempt to promote use of sustainable energy resources such as solar energy, it is important to venture into efficiency of solar energy and improvements herewith. Hence this pioneering research tackles ways to compare Silver (as used in mirrors) and Aluminium as possible reflectors of solar energy and see which one is more efficient, cost efficient, easily replaceable and most suited for real world non functional requirements of the common man. Hence, this paper seeks to promote the use of Aluminium as opposed to Silver reflectors.

Keywords: Silver, Aluminium, mirror, cost efficiency, Solar, foil

I. INTRODUCTION

Current theories suggest that solar Energy is still an undiscovered field of Science, full of opportunities for research and development. In this Paper we take an incremental and comparative research study, where we try to replace or substitute mirrors used in solar light reflection onto a Solar cell with Aluminium foil so as to decrease cost efficiently and make it more accessible to all without decreasing the output of the solar panel to a considerable level. We have taken up Aluminium foil as a component of study as it is easily available and other theories prove that it has considerably good reflectivity of light and it can possibly replace mirrors and provide with the similar output in a small scale event. Through this paper we can Understand the potential uses of the use of Aluminium foil other than just being a accessory in cooking.

II. EXPERIMENTAL METHOD

The apparatus used for the experiment are as follows:

1. Solar Panel -7.5V and 1.3W output, Resistance of 43.103 ohm
2. Plane mirrors- 3X4 inches dimensions
3. Aluminium foil on cardboard plane- 3X4 inches dimensions
4. Multimeter,Laser for calibration and positioning of mirrors

The theory behind this experiment is to test the reflectivity of Aluminium foil compared to mirrors when used to reflect sunlight onto the solar cell. We perform this experiment once indoors and once outdoors keeping the mirrors parallel to the plane of the sun so as to maximize reflectivity and calculate the amount of light falling on the panel when the sun and panel are not aligned. The setup used was kept 50^{o} inclined to the plane keeping the mirror in the plane. The Voltage is used as a parameter to calculate the output to get visible values. All voltage values were calculated using Multimeter connected to the ends of the solar panel. Every setup has 3 iterations performed and their average value taken as final result. The temperature, date and time of experimentation is

recorded and other temperature conditions are manipulated and obtained results are recorded and respective graphs are drawn for further comparison. The **wrinkling** of the foil during its preparation is considered **negligible**.

There are **3 setups** in the experiment

1) Solar setup using mirrors

2) Solar setup using foil

3)Control setup without any reflectors

All three setups were **performed indoors and outdoors** for comparison and revelation of glitches in the components. The **Laser** was used to **position** the mirrors in angles which would direct the sunlight falling on them towards the solar cell, this will maximize the amount of sunlight falling on the panel to get **comparable outputs** for our study. The angle at which the setups were kept was calculated by the above method. The Aluminium foil was wrapped around cardboard pieces with dimensions as the mirrors and kept in the same angle and position of the mirrors. All 3 setups were experimented on at different times of the day and compared for a final conclusion.

Observations and Graphs

1) **INDOOR**

Temperature = 24-27^{o}CSetup1 (with mirrors)

Table 1

Time	1st	2nd	3rd	Average (Volt)	Power (Watt)
8:00am	7.37	7.39	7.40	7.387	1.265
9:00am	7.56	7.55	7.55	7.554	1.323
10:00am	6.05	6.04	6.05	6.054	0.850
11:00am	5.46	5.45	5.45	5.454	0.690
12:00pm	5:04	5.04	5.03	5.044	0.590

Setup2 (with foil)

Table 2

Time	1st	2nd	3rd	Average (Volt)	Power (Watt)
8:00am	7.40	7.42	7.44	7.420	1.277
9:00am	7.56	7.55	7.56	7.564	1.327
10:00am	5.95	5.94	5.95	5.954	0.822
11:00am	5.33	5.35	5.34	5.340	0.661
12:00pm	4.95	4.94	4.95	4.950	0.568

Setup3 (control setup)

Table 3

Time	1st	2nd	3rd	Average (Volt)	Power (Watt)
8:00am	7	7.01	7	7.003	1.137
9:00am	7.34	7.34	7.44	7.343	1.250
10:00am	5.72	5.73	5.72	5.723	0.759
11:00am	5.1	5.1	5.2	5.103	0.604
12:00pm	4.74	4.74	4.75	4.743	0.521

2) **OUTDOOR**

Temperature = 25-29^{o}CSetup1 (with mirrors)

Table 4

Time	1st	2nd	3rd	Average (Volt)	Power (Watt)
8:00am	8.82	8.81	8.82	8.823	1.806
9:00am	8.46	8.46	8.46	8.46	1.660
10:00am	8.06	8.06	8.07	8.074	1.512
11:00am	7.52	7.52	7.52	7.52	1.311
12:00pm	7.30	7.29	7.29	7.293	1.233

Setup2 (with foil)

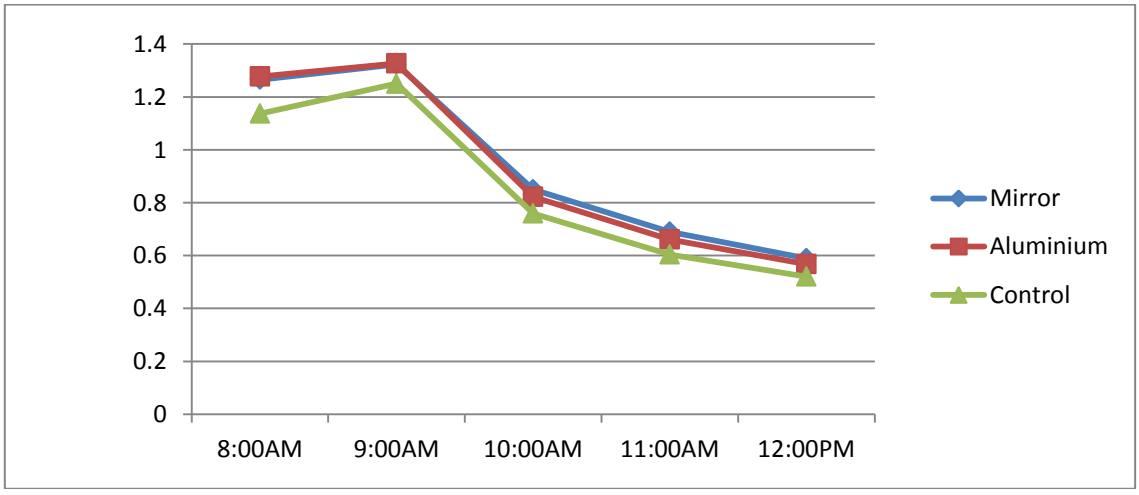
Table 5

Time	1st	2nd	3rd	Average (Volt)	Power (Watt)
8:00am	8.73	8.72	8.72	8.723	1.765
9:00am	8.48	8.48	8.49	8.484	1.669
10:00am	8.08	8.08	8.09	8.083	1.515
11:00am	7.47	7.48	7.47	7.473	1.295
12:00pm	7.26	7.26	7.25	7.263	1.223

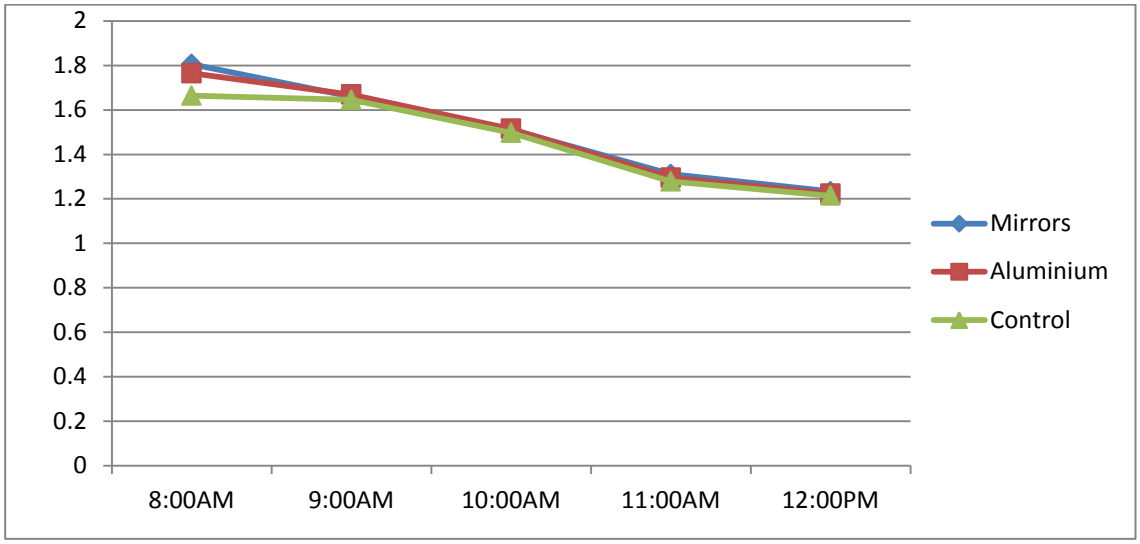
Setup3 (control setup)

Table 6

Time	1st	2nd	3rd	Average (Volt)	Power (Watt)
8:00am	8.47	8.47	8.47	8.47	1.664
9:00am	8.42	8.43	8.42	8.423	1.645
10:00am	8.03	8.04	8.03	8.034	1.497
11:00am	7.42	7.42	7.41	7.423	1.278
12:00pm	7.22	7.24	7.24	7.235	1.214



Graph1. INDOOR setup (Time (X-Axis) vs Power output(Y-Axis) in Watt)



Graph 2.OUTDOOR setup (Time(X-Axis) vs Power output(Y-Axis) in Watt)

Figure 1

III. RESULT AND DISCUSSION

According to the results obtained we can successfully say that aluminium foil can surely substitute silver mirrors for the reflection of light onto a solar cell so as to decrease cost and maintain similar efficiency. Some theories suggest that aluminium and Silver mirrors have similar reflective index with mirrors being higher. Due to this theory, we can get close values of Power output. Other than the fact that this theory was proved to be right, it is hard to maintain Aluminium foil is hard to maintain as mirrors are sturdier and easier the manufacture for this use. We can make the aluminium sturdier by placing it in between 2 plain transparent glass, this process can make it sturdier and help keep the Aluminium from wrinkling and also decrease the chance of the foil heating up too much. The only drawback of this theory is that in a large scale production of electrical energy from solar energy we can obtain very high and easily comparable values of output.

IV. CONCLUSION

From the above Observations we can see that there is clear difference between the Power output in all the setups both outdoor and indoor and by this we can conclude that, **Aluminium can act as a good and reliable substitute for Silver mirrors in the reflection of solar light onto a solar cell**.

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