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Effects of Accumulation of Dust Types on the Output Voltage of the Photovoltaic Cell

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ABSTRACT

Accumulation of dust from the open-air environment on the panels of a solar photovoltaic (PV) system is natural. This study focuses on the types of dust commonly found around the area of wolaita sodo university Ethiopia; the objective of this research was to study the effects of dust accumulation on the performance of solar PV panels. Experiments were conducted using artificial dust particles, to determine the resulting output voltage. It was found from the study that the accumulated dust on the surface of a photovoltaic solar panel can decrease the output voltage and also the color of the dust determines the output.

Keyword: solar Photovoltaic Cell, Solar Energy, Voltage outcome

INTRODUCTION

Solar photovoltaic (PV) system uses solar cells to convert energy from solar radiation into electricity. The system is made up by one or more panels, a battery, a charge control, and the load. Solar PV panels are normally mounted on roofs and wired into a building by an inverter, which converts the direct current energy received from solar panels into alternating current. There are many types of solar PV cells available, which are mainly mono crystalline silicon cells, multi-crystalline silicon cells, thick film silicon, and amorphous silicon. A solar panel is comprised of smaller photovoltaic cells [1, 2].

Solar energy is one of the most popular renewable energy produced (or) generated directly by the sun. Solar energy is the most readily available renewable energy. It does not belong to anybody and is therefore free. Owing to nonpolluting nature, it became the most widely used nonconventional energy source [2].

The sun creates its energy through a thermonuclear process that converts about tons of hydrogen to helium every second. This process can generate the thermal heat and electromagnetic radiation spread out into all the space in all directions. Only a little fraction of the total radiation will reach the earth. The solar energy can be received by the collectors (solar cells); the collector simply collects the energy and converts into electricity. The converted electricity is stored in the storage unit because of the non-constant nature of solar energy [3, 4].

Dust Accumulation and dust particles deposition on PV surface in a dry region are presented with numerical and analytical models and supported by a laboratory investigation of sand particles accumulation on a glass surface. [5].

1.1. Objective

The objective of the project are as follows

- To identify which type of dust more affect the output voltage of photovoltaic cell.
- To indicate some strategies that could help to maintain the performance of PV (photovoltaic).

2. Experiment Apparatus and Setup

To determine the output voltage of photovoltaic cells, the following inputs were used.

- Sand soil
- Cement,
- Red clay,
- Beam balance
- Sifter
- volt-meter,
- Solar cell

Masses of each artificial dust were measured and covered the panel proportionally then the output voltage taken. Based on this the output voltage measured from the respective masses and type of dust is recorded under table

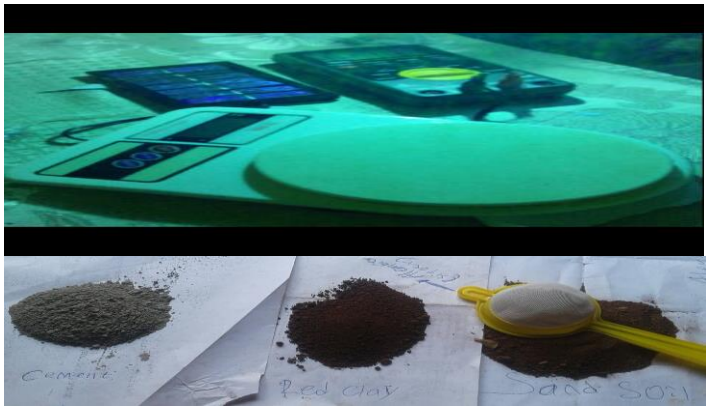

Fig 1. Apparatus used: Beam balance, cement, red clay and sand soil

3. RESULT AND CONCLUSION

Table1.1. Voltage outputs from respective masses

Types of dust	Mass (g)	Voltage (mv)	
Cement	1	23.7=23.6	Normal measurement with light=70
	2	12.3=12.2	
	3	9.4=9.3	
Red clay	1	38.7=38.6	
	2	24.3=24.3	
	3	13.1=13.1	
Sandy soil	1	26. =26	
	2	17.2=17.1	
	3	11.2=12.1	

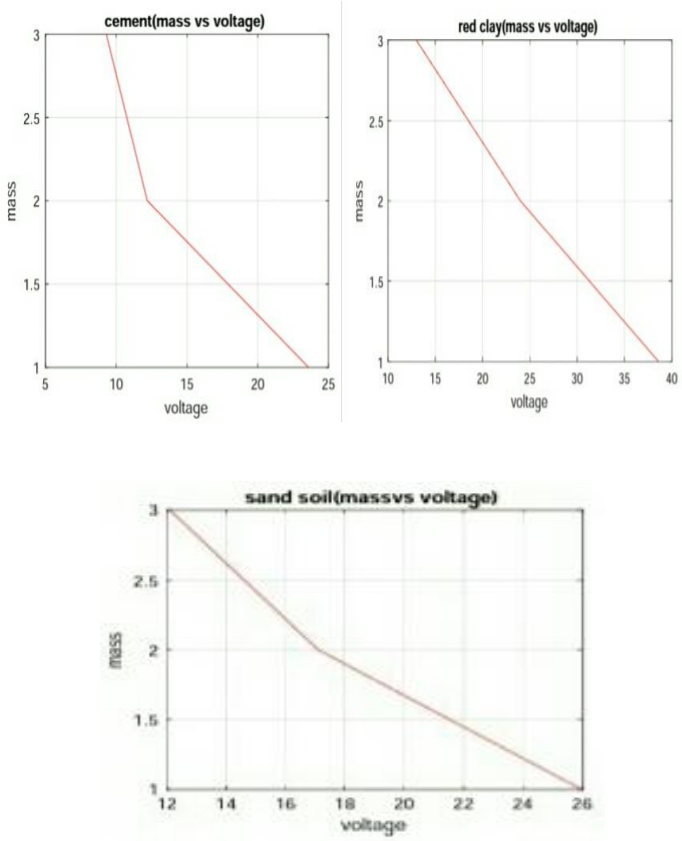

Figure 2. Cement (mass vs. voltage), Red clay(mass vs. voltage) sand soil(mass vs. voltage)

Based on the data, Table 1, three graphs were drawn, the output voltage for Cement (mass vs. voltage) falls rapidly and Red clay (mass vs. voltage) is slowly falling compared with other the two. Therefore, the type of dust determines output voltage for the photovoltaic cell.

The effects of the presence of dust were studied using artificial dust (cement, red clay and sandy soil). The dust has a major impact on performance and efficiency of the solar panel. The effects of dust can be slightly reduced but not negligible. There is significantly small reduction of voltage when compared to both red clay and sandy soil. But on cement dust more reduction of voltage because of colure cement dust that means white colure reflects the sunlight.

CONCLUTION:

The results show that the electrical parameters of the solar panel are sensitive to the dust density so it is very essential to provide an auto-cleaning mechanism to remove the dust particles from the surface of the panel in order to ensure high performance. Also the color of dust can change the performance as the result shows.

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