VISVESVARAYA TECHNOLOGICAL UNIVERSITY

BELAGAVI-590 018

Project Report
18MEP83

"Design and Development of Dye sensitized Solar Cells Using Synthetic Dyes."

Submitted in partial fulfillment of the requirements for the award of the degree.
(Sponsored by KSCST, IISC CAMPUS, BENGALURU)

BACHELOR OF ENGINEERING
IN
MECHANICAL ENGINEERING

KSCST REF NUMBER: 46S_BE_3667

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2022-23

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INTRODUCTION

Solar energy is a fast-growing technology in the world and solar cells have found markets in avariety of applications ranging from small-scale electronic devices to large scale power plants.According to market projections by ID TechEx, dye sensitized solar cells (DSSCs)will slowlygrow to $290 million by 2023. Although Morocco has a huge solar energy potential, in the field of dye sensitized solar cells (DSSCs). The conversion efficiency of silicon based solar cells has reached an efficiency of 28.4% - 30.2%. Second-generation solar cells are based on thin film technologies. The third-generation solar cell devices like Organic (10.7%), and dye sensitized solar cells (14.1%). Dye- sensitized solar cells (DSSCs) are one ofthe most promising alternatives to conventional silicon-based photovoltaic devices due to theireasy fabrication, flexibility, low production cost which is around 1/5 of the production cost ofSilicon-based PV solar cells. However, DSSC are substantially Cost effective and easier to manufacture and promising laboratory research revels interesting and fast progress in the efficiency of the DSSC.Consequently, dye sensitized solar cells DSSCs emerged as a new classof low-cost energy conversion devices with simple manufacturing procedures. Moreover, DSSC shows higher conversion efficiency than polycrystalline Si in diffuse light or cloudy conditions. It is believed that monocrystalline photovoltaic devices are becoming viable contender for large scale future solar energy converters. However, the efforts are continually being undertaken to improve the performance of DSSC and hence the competitiveness of this technology in the world Market. It is now possible to completely depart from the First and thesecond generation's solar cells devices by replacing the phase contacting the semiconductor byan electrolyte thereby forming a dye sensitized solar cells.

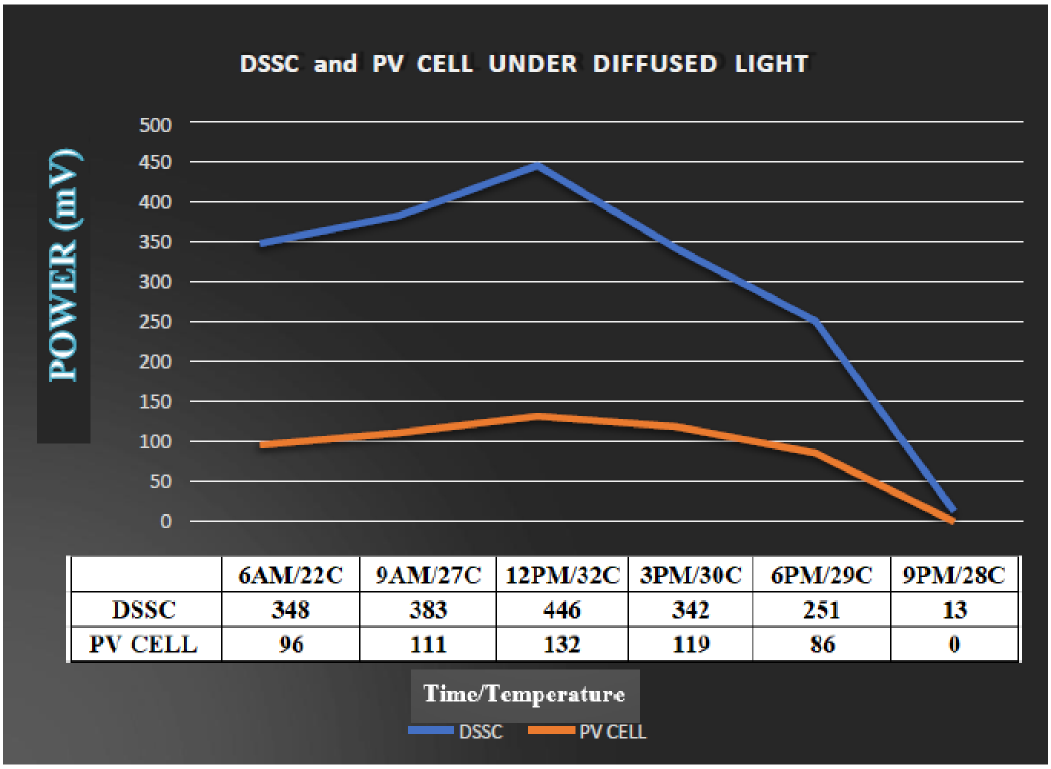
OBJECTIVES

- To fabricate DSSC by using synthetic dyes.
- To conduct experiments under different light conditions on DSSC.
- To fabricate DSSC by using different synthetic dyes.
- To increase the electron transfer from existed dye to Tio2.
- To compare the performance of DSSC with PV cell.
- To produce the constant voltage even variation in sunlight.
- To generate the solar cells which is capable of absorbing fluorescent light and diffused sunlight.
- To generate solar cells even in cloudy climate conditions.

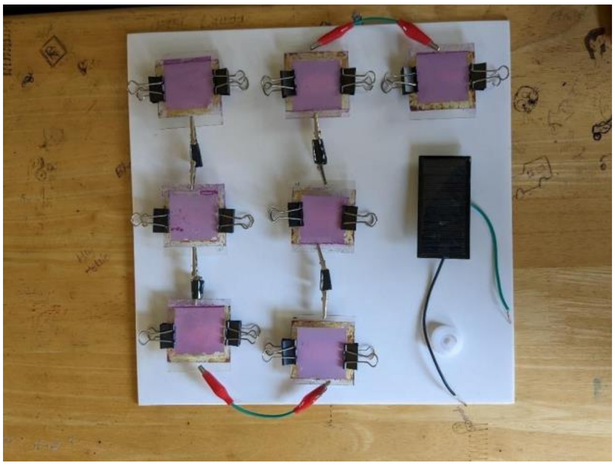
METHODOLOGY

- Testing the conductive side of the ITO glass plate using a Voltmeter.
- Mixing of Tio2 powder and Dil. Nitric acid in ratio of 1:2 ml.
- Applying the Tio2 paste on conductive side of the ITO plate.
- Heating the Tio2 applied glass plate using a hot air oven at 200°C for 10mins.
- Checking the synthetic dyes dissolvability in different liquids.
- Filtration of the synthetic dyes using Whatman filter paper.
- Dip the heated glass plate in the filtered dye solution and keep it for 10minutes.
- Apply the graphite on other conductive side of the glass plate.
- Applying the iodine solution to the graphite coated glass plate.
- Couple the graphite coated glass plate to the Tio2 coated glass plate.
- Bind the glass plates with the Clips.
- Use the Voltmeter to check the voltage in Milli-volts.

RESULTS AND ANALYSIS



DSSCs can be fabricated using low-cost materials and manufacturing processes, making thempotentially more affordable than PV cells. They can be flexible and transparent, allowing fortheir integration into a variety of applications, including wearable devices and building- integrated photovoltaics. DSSC’s perform better in low light conditions and can generate electricity even under indirect or diffused sunlight. These Cells have a smaller environmental footprint than PV cells as they use less energy and produce fewer greenhouse gas emissions during manufacturing.



CONCLUSION

- Among the different Dyes used, Reactive Hot Red shows better results under sunlightand Diffused Sunlight.
- DSSC shows better results under diffused light.
- DSSC depends not only on Temperature but also on Light Intensity.
- Synthetic Dyes can be tailored and optimized for efficient Light Absorption andelectron transfer in DSSCs.
- They Offer flexibility in terms of absorption Wavelength, Energy Levels and ElectronInjection Efficiency.
- Synthetic Dyes can be Designed to be more Environmentally friendly by MinimizingToxic Components.
- Ongoing Research and Development in synthetic dyes for DSSCs aim to enhance theirperformance further.

FUTURE SCOPE

1. Enhanced Efficiency: Researchers can focus on developing new synthetic dyes that can absorb a broader range of the solar spectrum, including near-infrared light, which is currently not efficiently captured by DSSCs. By improving the light-harvesting efficiency, the overall power conversion efficiency of DSSCs can be significantly enhanced.

2. Stability and Durability: One of the challenges with DSSCs is their long-term stability and durability. Synthetic dyes can be engineered to improve the stability of the dyes themselves and the overall device. Future research can focus on developing new dye materials with better chemical stability, resistance to degradation, and longer operational lifetimes.

3. Large-Scale Production: Synthetic dyes offer the advantage of scalability and cost-effectiveness compared to other sensitizing materials. Future efforts can concentrate on optimizing the synthesis processes and developing efficient methods for large-scale production of synthetic dyes, making DSSCs more economically viable for widespread deployment.

4. Eco-Friendly Dyes: Environmental considerations are crucial in developing sustainable energy technologies. Future research can focus on the development of eco-friendly synthetic dyes that are non-toxic, easily recyclable, and sourced from renewable materials. This would enhance the overall sustainability of DSSCs and minimize their environmental impact.

5. Integration with Emerging Technologies: DSSCs can be integrated with other emerging technologies to enhance their functionality. For example, combining DSSCs with energy storage systems, such as supercapacitors or batteries, can enable efficient energy capture and storage. Furthermore, integrating DSSCs into flexible or transparent substrates can open new application areas, such as wearable electronics and building-integrated photovoltaics.

6. New Applications: The versatility of synthetic dyes allows for their use in various applications beyond conventional solar panels. Future research can explore the potential of DSSCs using synthetic dyes in niche applications, such as powering low-power electronic devices, smart windows, portable chargers, and integrated energy-harvesting systems.