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**TITLE: PHOTODEGRADATION OF NATURAL
DYE**

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ABSTRACT

Decades have been spent utilising non-renewable energy especially in power generation. The transition of this energy source to renewable energy was begun by many researchers. Dye-sensitized solar cell is an excellent way to generate electricity. The research has been done to analyze the effect of metal oxide on natural dye conductivity, the effect of sunlight toward the dye colour and conductivity and to investigate the outcome of metal oxide exposure to sunlight. The photodegradation was done by adding calcium oxide into the dye solution and time exposed it to the sunlight as the parameter. The result of this study demonstrates the correlation of conductivity, dye colour and CaO frequency to the sunlight. Dye conductivity and colour intensity was decreased as the molecules of dye was reduced by the sunlight. The frequency of CaO also has been affected by the sunlight. The study found that exposure to sunlight decreased the dye's colour intensity and conductivity value. FTIR showed that the CaO had a similar peak to the dye. A dye-sensitized solar cell is an environmentally friendly alternative to current electricity generators.

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CHAPTER ONE

BACKGROUND

1.1 Introduction

Decades have been focussed to the use of non - renewable energy. Given the availability of solar power technology for electricity generation, now is the time to switch to renewable energy. "A number of factors, including a lack of investment in new power generation infrastructure, an overreliance on fossil fuels, and a lack of regulations to promote the use of renewable energy sources, have been linked to the electric grid's problems." The IBR Asia Group Sdn Bhd , 2019). There are five methods for generating electricity using renewable energy, but only three are suitable for Malaysia's environment. Malaysia generates electricity using hydro, marine, solar, and bioenergy sources. Even though Malaysia has a climate that is conducive to solar energy, only 471 GWh were generated by solar power. (IRENA, 2020) (Dato' (Dr.) Ir. Guntor Tobeng et al., 2022).

Furthermore, the price for solar panel may be the issue to fully commercialize solar electricity generation. "Solar panel price in Malaysia is almost three times the average price in other countries"(Steven Chiew, 2019). Dye-sensitized solar cells (DSSCs) are another technique to harness solar power without a solar panel and low-cost. Typically, it is a dye that absorbs light and generates electricity. Light stimulates the electrons in the dye, which then flow through the metal oxide (semiconductor) and produce electricity.(Wang et al., 2015)

Natural dye or synthetic dye is used in DSSCs but in this study, natural dye was utilized. Natural dyes are colourants derived from naturally occurring sources such as plants, fruits, vegetables, and insects. "These dyes are environmentally safe and biodegradable, and they have been used for millennia in textile dyeing. When compared

to synthetic dyes, natural.” (Pati, D., & Kumar, S. (Eds.). (2017).) (Boutrup, J., & Shelton, K. (2015))

In contrast, metal oxides are compounds composed of both metal and oxygen atoms. They are used to as pigments in ceramics, glass, and paints, catalysts in chemical reactions, and electrical conductors in batteries and other electronic devices. Iron oxide (rust), titanium dioxide, and aluminium are a few common metal oxides." In this study, metal oxides function as electron acceptors in the DSSC (semiconductor) system, enabling the conversion of light energy to electrical energy. (O'Regan, B., & Gratzel, M. (1991))

1.2 Literature Review

"As of now, PV solar systems are used to generate solar energy, which is a significant issue. In Malaysia, the recommended system size is between 4 and 13 kWp, but the cost of such a system can range between RM20,000 and RM50,000." This price range is merely an average, and the number would increase each year. Therefore, an alternative method of utilising solar energy, such as DSSC, may be the solution to this problem. (Verdant Solar, 2022). In terms of efficiency, lifetime, and cost, DSSC can compete with PV solar systems. Despite the fact that "the efficiency of DSSC is low, the stable performance of advanced DSSC can reach 20,000 hours of continuous illumination at the lowest cost." In addition, the DSSC can eventually replace the PV solar system if its efficiency can be optimised to the same level as the PV solar system. (Syed & Wei, 2022)

"The PV cell is composed of semiconducting material; the "semi" indicates that it conducts electricity better than an insulator but less efficiently than a metal."(Office of Solar Energy Technologies, 2022). In the DSSC, the semiconductor is also utilised to absorb electrons after being exposed to sunlight. (Office of Solar Energy Technologies, 2022).

The study titled "Extraction of Natural Dyes from Plants" (Judi Harriet Sumathy, 2013) investigated the method for extracting dye from plant leaves. The leaves or flower were cut into pieces and boiled in 100 ml of distilled water until the dye was released into the water.

There has been study titled "Photocatalytic Degradation of Methylene Blue