UNIVERSITI TEKNOLOGI MARA

CONDUCTIVITY STUDY OF CHLOROPHYLL: POTENTIAL SOLAR PANEL

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ABSTRACT

The current dye sensitized solar cell (DSSC) that is widely used as the renewable energy resource to overcome the depletion of fossil fuels employs the synthetic dyes such as the ruthenium-based sensitizers. However, there are several limitations and constrains that the ruthenium-based sensitizers portrays which are much related to the environmental and health impacts. Furthermore, DSSC using ruthenium complexes as sensitizer are tedious to fabricate, plus they are expensive. These problems have led the researchers to find an alternative to improve the DSSC technology in terms of its performance as well as its sustainability. The aim of this research is therefore to investigate the ability of the chlorophyll extracted from oil palm trees, *Elaeis Guineensis*, to conduct electricity in order to substitute the conventional dye used in current dye-sensitized solar cells (DSSC). This is because the energy conversion performance of natural dye sensitized solar cells (DSSC) mostly relies on sensitizer. The chlorophyll was extracted using 96% of ethanol as the chemical method in addition of the mechanical method which is by grinding. The extracted chlorophyll was dried in an oven at 80°C. About 2 g of dry mass chlorophyll were obtained from 250 ml of extracted chlorophyll after drying. The functional anchoring groups of the *E. guineensis* chlorophyll were analysed using Fourier transform infrared spectroscopy (FTIR) and it was found that there were eight functional groups. 5 mg of dried chlorophyll was mixed with deionized water and 5 mg of carboxymethylcellulose powder which were then pressed to form 2 cm by 2 cm size of chlorophyll gel. Lastly, the chlorophyll was measured its conductivity using a multimeter. The amperage measured from the chlorophyll gel is 0.00018 A which indicates that the chlorophyll gel is capable to conduct an electricity, hence has the potential to substitute the synthetic dye sensitizer in DSSC.

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CHAPTER 1

1.0 INTRODUCTION

1.1 Research Background

The fossil fuels have become the source that provide the generation of today's electricity and fulfill approximately 60% of the current total world energy demand. This dependence of nonrenewable fossil fuels has put the world in a precarious situation. Besides, the increasing demand on fossil fuels consumption will lead to depletion of natural resources and soon the fossil fuels will become limited. The uses of today's non-renewable energy resources such as coal also contributes the carbon byproducts which promotes the buildup of air pollution, global warming and ultimately greenhouse effect. Since energy is an essential requirement for human survival, it is therefore vital to find alternative ways to produce electricity in a clean, efficient and sustainable manner.

The Earth receives energy from the sun at rate of approximately 12×10^{17} J s^{-1} which has exceeded the yearly worldwide energy consumption rate at approximately 1.5×10^{13} J s^{-1}. (Lee et al., 2017) This may offer a wide opportunity to devise an approach for the effective capture and storage of solar energy as the alternative way in replacing the non-renewable sources. In 1991, dye-sensitized solar cells (DSSC) technology was first discovered by Michael Gratzel and Brian O'Regan. (Erten-Ela et al., 2015) DSSC technology is an economical source of renewable energy that converts solar energy into electrical energy which is very dependent on the material and the quality of semiconductor electrode and the dye sensitized used to ensure the effective performance. There are four components in DSSC which are photoanode, dye-sensitizer, electrolytes, and counter electrode.

There are two categories of dye sensitizer which are synthetic dye and natural dye. At the meantime, the most effective DSSC is the one that use complex compound Ruthenium (II) polypyridyl with an overall efficiency of 10%. (Amao *et al*., 2004) Meanwhile, the natural dye used as dye sensitizer is from natural sources such as chlorophyll which is extracted from plant leaves. The simple and low operating cost procedure to extract the chlorophyll have trigger the researchers to develop natural dye-sensitized solar cells that are more environmental friendly. However, the natural dye has the disadvantage of being easily degraded at high temperature and less efficient.