PREPARATION OF DYE MATERIAL WITH METAL FOR SOLAR CELL APPLICATION USING BULK METHOD

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1.0 ABSTRACT

This report shows that systems with organic and inorganic material were designed for a wide variety of applications in dye-sensitized solar cells (DSSCs). Dye-sensitized solar cell systems (DSSC) deliver cost-effective, manufacturable, large-scale, low-toxicity, high-effectiveness and scalable systems that have led to the substantial increase in the production and technology of solar cells. By sensitizing broadband semi-conductors, they can transform visible light into electricity. Solar energy is the ideal solution for future energy needs for environmental development. There have been scientific attempts to design new molecular dyes with a broad absorption spectrum in the field visible. The natural pigment is one of the production methods which reduces the high costs of metal sensitizers, often eliminating expensive chemical synthesis through a simple process of extraction. This research examines the creation and influence of natural dyes based on dye-sensitized solar cells, on the various performance parameters. Moreover, the use of TiO_2 nanotubes is a comparison of natural dyes with their photoelectric conversion effectiveness. As a photoelectrode medium, TiO_2 is used to provide wide areas with a large adsorption dye and the direction for electric transmission. In the meantime, TiO_2 increases the direction in which photons pass through the light. The electrolyte also plays a key role in DSSC, similar to the dye and metal used in the application of DSSC. The electrolyte is desired in a solid-state during the photosensitization process and is made with a polymer. This is due to the simple preparation of the solid-state and its stability, which help to cast the electrode in the DSSC. The ionic liquid would be inserted into the electrolyte to maximize the volume of ions. This is to improve the electrolyte's conductivity by replacing the sensitized dye with new electrolyte ions as majority of the ions are used to regenerate the dye. Besides, butyronitrile can be used as a solvent because the electrolyte has lower to non- volatile components as it can help increase the lifetime of DSSC by taking a long time to degrade. In the application of the DSCC as well as dye and electrolyte, metal oxide also plays a vital role. The efficiency of metal oxide can be improved individually or combined with other materials. At that time, a few metal oxides were taken to improve production due to low-efficiency yields. With rising productivity, it may be expanding rather than ecologically friendly. Some alternatives have been used to boost performance by using a double-layer structure. To improve metal oxide production, the metal oxide may be used separately or in conjunction with other substances. In the past, a few metal oxides were taken to boost performance due to low-efficiency rates. With rising productivity, it may be expanding rather than ecologically friendly. Some alternatives have been taken to maximize performance, including a double system. Better output can therefore be achieved through the improvement of the DSSC construction parameters.

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2.0 BACKGROUND OF STUDY

DSSC or known as a dye-sensitized solar cell is one of the alternatives introduced by researchers and engineers to overtake the current energy sources. This is due to the current energy sources, which are fuel energy, have been depleting day by day, thus making it crucial for us to find alternatives. Besides, it also contains more disadvantages than advantages; hence, the solar cells are introduced. As it can generate energy in a greener way by not releasing any greenhouse gases similar to fuel generation. However, green technology is known to be expensive. Resulting in research on how to improve the solar cells to be low cost and greener in its way.

The DSSC will generate energy by using the photosensitization method [1]. This method is implied by having the solar cell assemble as shown in figure 1. The first layer consists of the substrate which is made using fluorine-doped tin oxide (FTO) which will be coating the glass so that the glass able to conduct the solar energy to electrical energy. Then, the second layer is composed of a mixture between semiconductor oxide and dye. Both components are used to absorb the sunlight and convert it into solar energy which will be used as an energy source once the process is completed. Following is the last layer which consists of the electrolyte. It is used to avoid any degradation to occur, subsequently prolonging the lifespan of DSSC.

The method occurs when the sunlight is absorbed through the conductive glass which is the FTO glass and will be passed to dye. Once it reaches dye, the molecule of the sunlight will be excited to form electrons to be sent into the semiconductor oxide for a later process [2]. The molecules of sunlight are sensitized by using the anthocyanin contained in the dye which will emit its wavelength, thus destabilize it to form electrons [3]. Meanwhile, the semiconductor oxide will serve as a surface for the electrons to be harvested for the conversion to occur [2]. Then, once completed, the destabilized dye will be replaced with the ions contained in the electrolyte, hence regenerate the dye to be reused in the DSSC [1]. Besides, the electrolyte will also be used as a platform for the positive charges to be transported to the electrode. this is because the electrolyte used might be deionized from the conduction of dye. Therefore, to sustain its amounts of ions the electrode is used. The process is equivalent to a redox reaction where the electrons transfer between the electrode and electrolyte [2].

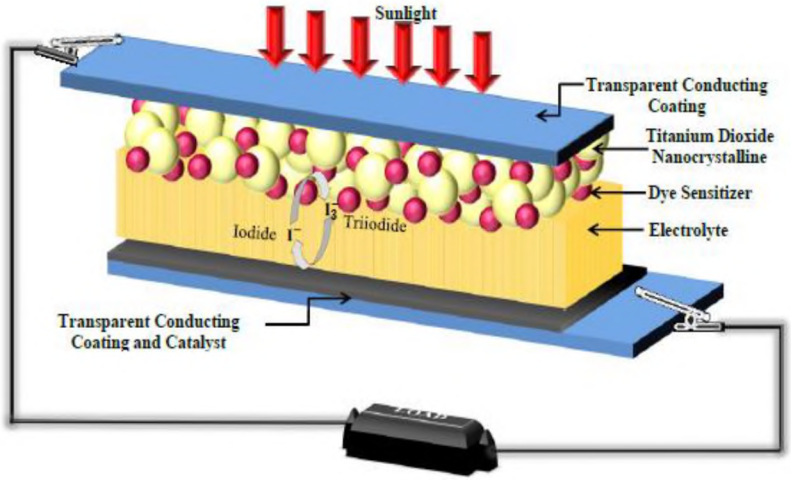

Fig. 1 Dye-sensitized solar cell: [1]