CHEMISTRY PROJECT

ELECTROLYTE TURNS ON SOLAR CELL

CERTIFICATE

This is to certify that Maruvapalli Manoj of Class XII-A has successfully completed the project on the topic “Electrolyte Turns on Solar Cell”, in chemistry lab during the session 2019-20.

This has been done under the supervision of Mrs Sundari Sree Pisipati along with the lab assistant Prakash Raut.

SIGN OF TEACHER SIGN OF PRINCIPLE

SIGN OF STUDENT

ACKNOWLEDGEMENT

I warmly acknowledge the continuous encouragement and timely suggestions offered by our respected principal ma'am Mrs Ritu Sharma. I extend my hearty thanks for giving me the opportunity to make use of the facilities available in campus to carry out the project successfully. I am highly indebted to our teacher Mrs Sundari Sree Pisipati, and our lab assistant Mr Prakash Raut for their constant supervision, providing necessary information and support in completing the project.

I would like to express my gratitude towards them for their kind cooperation and encouragement. Finally I extend my gratitude to all those who are directly or indirectly involved in the successful completion of this project.

INTRODUCTION

In the late 1960s it was discovered that illuminated organic dyes can generate electricity at oxide electrodes in electrochemical cells.

A modern Dye-sensitized solar cell is composed of a porous layer of titanium dioxide nanoparticles, covered with a molecular dye that absorbs sunlight, like the chlorophyll in green leaves.

The titanium dioxide is immersed under an electrolyte solution. As in a conventional alkaline battery, an anode (the titanium dioxide) and a cathode are placed on either side of a liquid conductor (the electrolyte).

Die synthesised solar cells are extremely efficient. Due to their "depth" in the nanostructure there is a very high chance that a photon will be absorbed, and the dyes are very effective at converting them to electrons. Most of the small losses that do exist in Dye-sensitized solar cells are due to conduction losses in the TiO_2 and the clear electrode, or optical losses in the front electrode. The overall quantum efficiency for green light is about 90%, with the "lost" 10% being largely accounted for by the optical losses in the top electrode.

In theory, the maximum voltage generated a dye-sensitized solar cell is about 0.7 V. The current generated by a cell is about 20mA/cm2.

Dye-sensitized solar cells work even in low-light conditions. Dye-sensitized solar cells are therefore able to work under cloudy skies and non-direct sunlight. The cut-off is so low that they are even being proposed for indoor use, collecting energy for small devices from the lights in the house.

EXPERIMENT

AIM:

To study the effect on output of current and voltage due to the use of different berries, electrolyte and pencils on a dye-sensitized solar cell.

APPARATUS:

Beaker, pestle, mortar, glass rod, balance, multi-meter, tape, dropper, pencils, indium tin oxide glass, clips.

CHEMICALS:

Pomegranate, iodine, potassium iodide, ethylene glycol, titanium dioxide, water, vinegar, dishwashing detergent.

THEORY:

Dye sensitized solar cell is based on a semiconductor formed between a photosensitized anode and an electrolyte, a photo electrochemical system.

A dye sensitized solar cell is made up of porous layer of titanium dioxide nanoparticles, covered with a molecular dye that absorbs sunlight. Sunlight passes through the transparent electrode into the dye layer where it can excite electrons that then flow into the titanium dioxide. The electrons flow toward the transparent electrode where they are collected for powering a load. After flowing through the external circuit, they are re-introduced into the cell on a metal electrode on the back,

flowing into the electrolyte. The electrolyte then transports the electrons back to the dye molecules.

PROCEDURE:

- First get some titanium dioxide. Mix it with some drops of vinegar until it has the consistency of paint. Add a few drops of dishwashing detergent.
- Now get a piece of indium tin oxide glass. Use a multi-meter to find the conductive side by measuring the resistance of the glass. The side that's conductive will have a much lower resistance than non-conductive side.
- Tape the glass on three sides onto a flat surface, conductive side up. The tape will serve as an apace guide for titanium dioxide.
- Now using a glass rod, apply the titanium dioxide paint to the

conductive side of the indium tin oxide glass. Slide the rod across the tape so that it smears the paint evenly and smoothly across the glass. If the paint leaves steaks, you need to add more vinegar and try again. It should go on with a smooth coat.

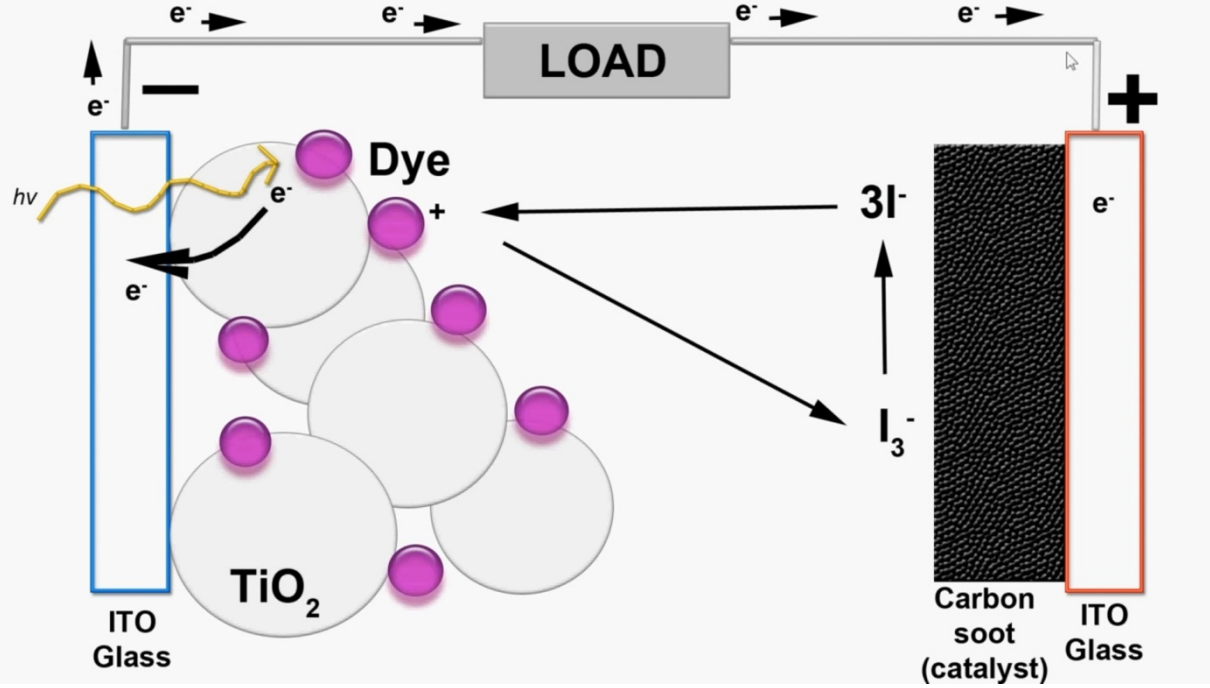
- Let the slide dry. Then carefully peel of the tape and get the slide. Use a damp cloth to clean off any excess titanium dioxide that may have oozed out around behind the slide or off the edges.
- Place the slide, conductive side up, on a hot plate and heat to 200+ Celsius. The detergent and the vinegar will burn away and bake the together the particles of titanium dioxide so they stick to the glass. As first it will turn yellow and turn white

again as this happens. The whole process takes about 20 minutes.

- As this happens, get some fresh berries and crush them.
- Now get the cooled titanium dioxide slide and pour a few drops of the juice onto it. Be careful not to damage the titanium dioxide. Let it sit for a few minutes so the anthocyanin die absorb into the titanium dioxide.
- Then carefully pour water and alcohol over the slide to wash away berry bits and other chemicals we don't need. Let the slide dry.
- Take another indium tin oxide glass slide and pass the conductive side through a candle flame several times. This will build up a layer of soot that we need as catalyst to the redox shuttle carefully wipe away the excess

soot from the edges so that they match with the titanium dioxide from the slide.

- Now we make the redox shuttle and electrolyte by mixing 127mg of iodine crystals with 830mg of potassium iodide and 10mL ethylene glycol. Mix thoroughly until completely dissolved.
- Place a few drops of the redox shuttle and electrolyte onto the titanium dioxide and place over it the soot covered slide. The coated sides must be facing each other. Be sure to offset the slides so that you can access the conductive sides of both.
- Bind the slides together using binder clips.



RESULT:

The current produced is 130 uA.

The voltage produced is 120 uV.

CONCLUSION:

The dye-sensitized solar cell produces current and voltage.

GALLARY: