AP Bio Project

I select which dye is most effective in Nanocrystalline solar cells for my AP biology project because of our energy crisis. But while regular solar seemed like a solution it wasn't economical yet. So I researched new forms of solar cells, and possibility of using a "bio solar cell", that is when I ran across the Nanocrystalline solar cell. It uses TiO2 has a ?n-type? Semiconductor and has a band gap of 3.1 eV, which would only allow for UV light solar power.

Page one TiO2

TiO2 is the white color pigment in paint, it is also in toothpaste and many other common items. It only cost $ per kg. But most of the solar spectrum is above UV wavelengths.

Resources cited

Hypothesis

I believe that the dye with a solar sensitivity closest to that of the sun's spectrum will prove to be the best dye.

If I use then it will have the highest current and voltage rating

Materials needed

* Conductive (tin dioxide (Sn02) coated) transparent glass
* Colloidal titanium dioxide powder (Ti02)
* Surfactant - dish detergent
* Acetyl acetone
* Heat source ~450C
* Iodide electrolyte solution
* Grinder, to mix and mash TiO2
* Binder Clip
* Thin tape
* Tweezers or forceps
* #2 pencil, or carbon rod
* Multimeter, capable of measuring volts, ohms, and amps
* 500 ohms variable resistor
* Wire with alligator clips
* Ethanol

Dyes and Dye Processing Equipment

* Blackberries
* Citrus leaves (from lemon plant)

Procedure

1. Making the Ti02 Suspension  
   1. Measure 6g of Ti02  
   1. Add 0.2 mL of acetyl acetone to 1 mL of water.  
   2. Mix the Ti02 powder with the acetic acid solution while grinding.  
   3. Add 12 mL of water in 1mL increments while continuing to grind.  
   4. Add more water if necessary.  
   5. Add a drop of a surfactant like clear dish detergent.?????  
   6. Store in dropper bottle.
2. Deposition of the Ti02 Film  
   1. Obtain and clean two Sn02 coated glass plates, rising in ethanol to clean, and dry  
   with soft tissue.  
   2. Use a multimeter to check for the conductive side on the glass plates.  
   3. Keep one plate, conductive side up and the other conductive side down.  
   4. Tape down with two strips of tape, masking only 1mm.  
   5. Tape down with one more strip of tape the the end, masking 4 to 6 mm strip. The masked area will be used to attach clamps for electric transfer.  
   6. (The thickness of the tape allows for a 40-50 micron thick Ti02.)  
   7. Place about 5 microliters per square centimeter of the suspension.  
   8. Quickly slide a clean glass stirring rod horizontally over the plate, back and forth over the plate.  
   9. Allow the plate to dry in a small petri dish, for one minute.  
   10. Anneal the Ti02 film by placing the conductive glass on a ring stand under a Bunsen burner for 10-15 minutes.  
   11. Allow to cool SLOWLY to room temperature as to avoid thermal stress and cracking.  
   12. Store these is a enclosed place to avoid getting dirty.
3. Preparing the Dyes  
   Warning, Do not use plastic cups!  
   1. Grind fresh leaves with about 10 ml of acetone. (I used about 25 ml)  
     
   2. Use a coffee filter to filter this into light proof bottle.  
     
   3. Place several pieces of leaves in the bottle.  
   4. Place the Ti02 coated glass plate in the bottle. Add additional acetone to the bottle till it covers the glass plate. Allow to react for 24 hours.