Measurement Sheet

Lab #10: Organic Photovoltaics

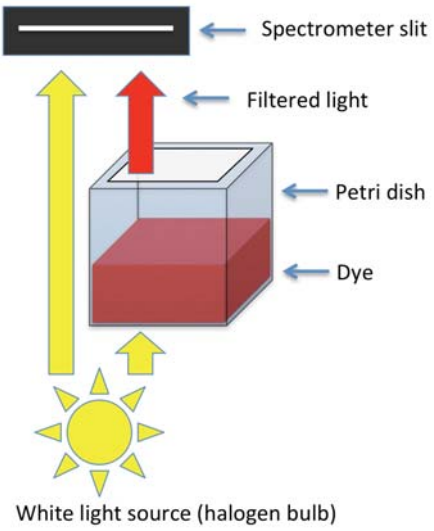
MIT Nanomaker_Spring 2013

Experiment #1: Measuring the absorption spectrum of natural dyes

You have been given three natural dyes: 1) pomegranate seeds, 2) raspberries, 3) blueberry.

Each dye has been placed at the bottom of a square, transparent petri dish. Use the petri dishes to measure the absorption spectrum of each dye by back-illuminating each dish with a white light source and measuring the spectrum of the filtered light.

Hint: *by measuring the spectrum at the edge of the dish, you can capture both the unfiltered and filtered light spectra simultaneously. The diagram below may serve as a useful guide.*



Determine the peak absorption wavelength(s) of each dye.

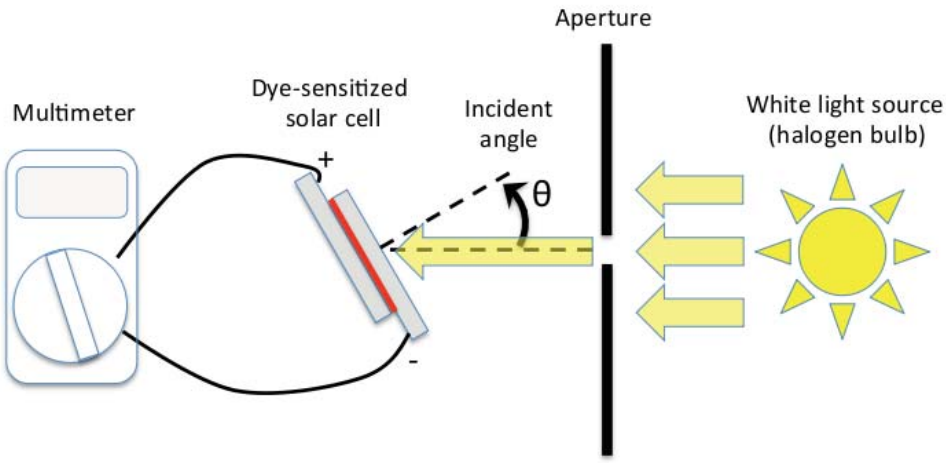
i) Pomegranate peak absorption wavelength(s): _____

ii) Raspberry peak absorption wavelength(s): _____

iii) Blueberry absorption wavelength(s): _____

Experiment #2: Characterizing the dye-sensitized PV cell

Follow the web instructions for constructing the dye-sensitized PV cell. Each member of your three-person group will have to choose one of the aforementioned dyes, such that each group will have data for all three dyes. Then, for each dye-sensitized cell, measure values for open-circuit voltage and short-circuit current as a function of illumination incident angle using the halogen lamp as a light source (see schematic).



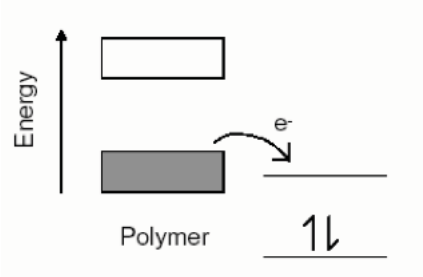
	Pomegranate		Raspberry		Blueberry	
↓Illumination incident angle	**Short Ckt (I)**	**Open Ckt (V)**	**Short Ckt (I)**	**Open Ckt (V)**	**Short Ckt (I)**	**Open Ckt (V)**
0°						
15°						
30°						
45°						

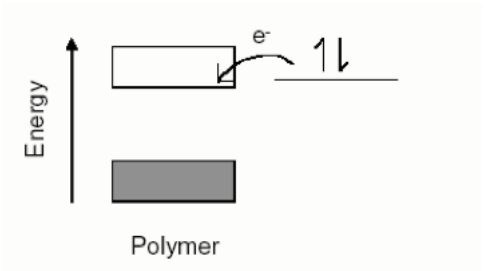
Follow-up Questions:

- **How might it be possible to improve the efficiency of the dye-sensitized cell by mixing different dyes?**

- **Instead of mixing dyes, consider what would happen if you stacked two separate cells: one made of a dye that has an absorption peak in the blue, while the other is made of a dye that has an absorption peak in the red. How would you stack the cells to maximize efficiency?**

- **Polymer solar cells are a type of flexible solar cell. They can come in many forms including: organic solar cell. We can change the conductivity of the polymer by introducing dopants. Which one is p-type doped polymer and which is n-type doped polymer. And what do people usually use as dopants for p-type doped polymer and n-type doped polymer?**





- **It takes four steps to generate energy in organic solar cells. What are the four steps? What one/ones limit(s) the efficiency of solar cells?**

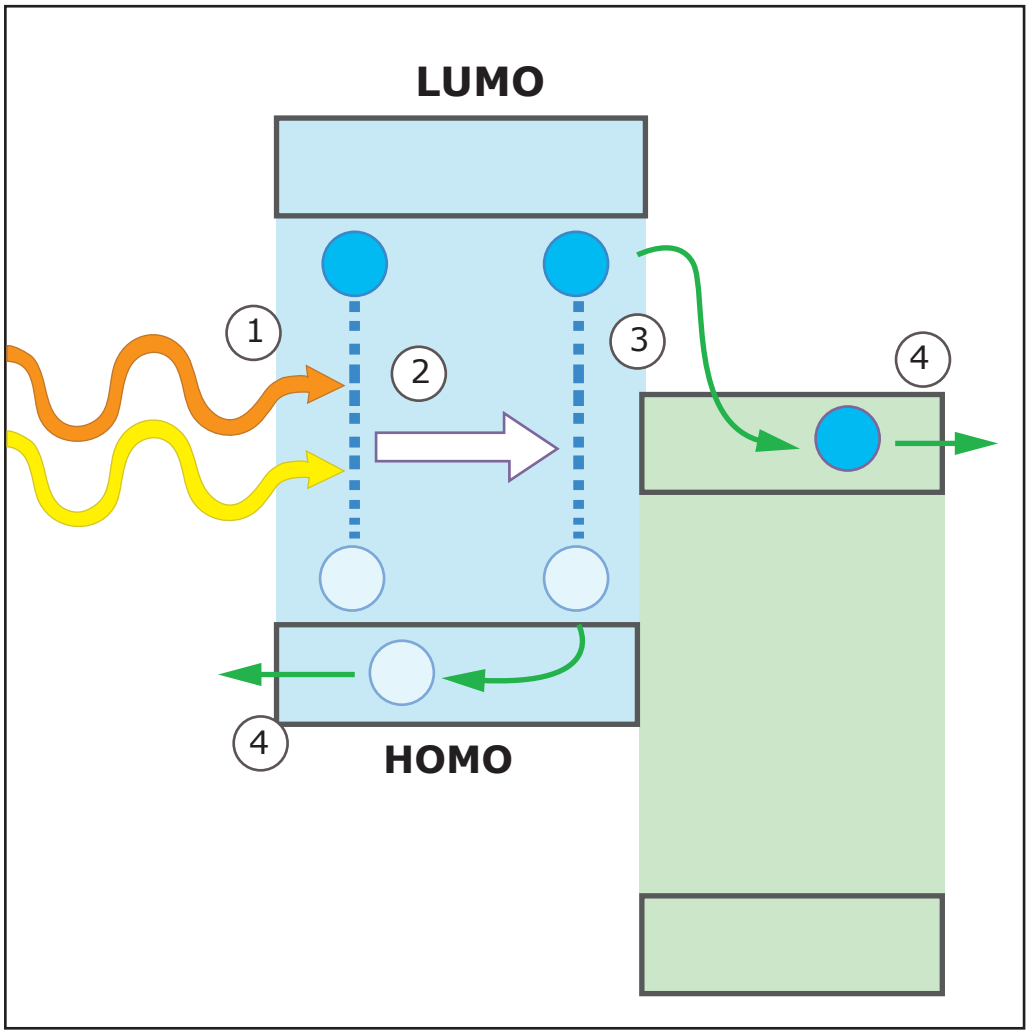


Image by MIT OpenCourseWare.

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