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Each day enough energy from the sun hits the earth to equal all the oil we have used and have left to use.   The problem with current solar technologies is that they are expensive and very energy consuming just to produce. Yet nature has managed to create a way of capturing solar energy and converting it into something useful. Only if there was an easy way to harness nature's ability to convert solar energy into a useful product, like electricity. That happened when Michael Gratzel at the Swiss Federal Institute of Technology, discovered that you could take Ti02 (titanium dioxide), place a photo sensitized dye, like chlorophyll on it, and produce electricity.     "Melvin Calvin, who won the Nobel Prize for his work in photosynthesis, discovered that plant chlorophyll under the influence of sunlight could give up electrons to a semiconductor such as zinc oxide. Calvin and his associates made a "green photoelement," which actually produced a 0.1 microampere per square cm current." (2)   Gratzel used TiO2 as his semiconductor, instead of ZnO. TiO2 is a n-type semiconductor and has a band gap of 3.1 eV, which only allows for UV light to cause electron flow. TiO2 is commonly used as the white color pigment in paint, in toothpaste, pills and many other common items. It only costs around $16 per pound, which will give you a large amount. Research is also being done on using it to clean water of organic materials by using UV light energy. In other applications it helps prevent deterioration of UV sensitive items, like vinyl gutters. It also serves as an active ingredient in sun screen.    (TiO2 dissolved in water and acetone)  The problem is that TiO2 has a band-gap of 3.1 eV. This means that only high energy light like UV can cause an electron to jump. In order to cause electron flow in the visible light range you must use some sort of electron injecting dye that accepts light at the visible frequency range and also attaches to the TiO2 to pass the electron on. There is a wide range of pigments and dyes that fit into this category. Some are synthetic like cis-(NCS)2 bis(carboxy-2,2'-bipyridine) ruthenium(II) (3), or natural dyes like chlorophyll and anthocyanin. While synthetic dyes likely will work the best, it takes chemicals and energy to create them, so why not just use some readily available dyes, like chlorophyll from your front lawn grass, and some anthocyanin from blackberries available at your local supermarket.  Initially I tested both lemon leaf chlorophyll and grass chlorophyll. I decided to use grass, since there seemed to be little research on using something as common as grass for chlorophyll and the data showed little difference between the dyes, according to some chromographs I ran using filter paper on the extracts.   I picked blackberries because they were darker which gave me the impression they might contain more anthocyanin.   Chlorophyll comes in two types chlorophyll A and chlorophyll B. The process I used to extract the chlorophyll from the grass was using acetone to dissolve the chlorophyll and a mortar and pestle to drive out the chlorophyll. This gave me both types of chlorophyll, covering a wider range of lightwaves.    Anthocyanin was extracted from blackberries by crushing them and adding a little deionized water and acetone. Anthocyanin dye is in a range of berries, its primary purpose is believed to be to attract birds, in hopes of having seeds deposited elsewhere.(4)   Through this research I hoped to discover a cheap, common, yet high energy producing dye. By using this information we will be able to soon cheaply produce our own solar cells. Powering us into the 21st century. | |  |  |  | | --- | --- | |  |  | |  | [[Electrifying The Sun](http://laflash.com/~chris/apbio/index.html)] [[Introduction](http://laflash.com/~chris/apbio/Introduction/introduction.html)] [[Hypothesis](http://laflash.com/~chris/apbio/Hypothesis/hypothesis.html)] [[Experiment](http://laflash.com/~chris/apbio/info/info.html)] [[Pictures](http://laflash.com/~chris/apbio/Pictures/pictures.html)] [[Data](http://laflash.com/~chris/apbio/data/data.html)] [[Conclusion](http://laflash.com/~chris/apbio/Conclusion/conclusion.html)] [[Recommendations](http://laflash.com/~chris/apbio/Recommendations/recommendations.html)] [[Bibliography](http://laflash.com/~chris/apbio/Bibliography/bibliography.html)] [[Experiment Log](http://laflash.com/~chris/apbio/Experiment_Log/experiment_log.html)] [[Acknowledgments](http://laflash.com/~chris/apbio/Acknowledgments/acknowledgments.html)] | |