

Scientists grow solar cell components in tobacco plants

January 29 2010, by Lisa Zyga



Scientists are working on synthesizing solar cells from chromophore structures they produced in tobacco plants. Image credit: US Department of Agriculture.

(PhysOrg.com) -- Over billions of years, plants have evolved very efficient sunlight-collecting systems. Now, scientists are trying to harness the finely tuned systems in tobacco plants in order to use them as the building blocks of solar cells. Scientists predict that the technique could lead to the production of inexpensive, biodegradable solar cells.

In a recent study, scientists from UC Berkeley led by Matt Francis have demonstrated how to program tobacco plants to take advantage of the efficient way that they collect [sunlight](#). Rather than attempt to reprogram all the cells of a mature tobacco plant, the scientists genetically engineered a virus called the tobacco mosaic virus to do the job for

them. The researchers sprayed the modified virus on a crop of tobacco plants, and the virus caused the plant cells to produce lots of artificial chromophores, which turn photons from sunlight into electrons.

In order for the chromophores to work, however, they must be spaced at a precise distance from one another - about two or three nanometers. A little closer or further apart, and the [electric current](#) will either be halted or the [electrons](#) will be very difficult to harvest.

Thankfully, tobacco plant cells have evolved to space chromophores at this exact distance, lining them up in a long spiral hundreds of nanometers long. By exploiting this structure, the researchers could take advantage of billions of years of evolution to grow perfectly spaced strands of chromophores.

"Over billions of years, evolution has established exactly the right distances between [chromophores](#) to allow them to collect and use light from the sun with unparalleled efficiency," said Francis.

Since the modified [tobacco plants](#) themselves don't generate electricity, the researchers must harvest the plants and extract the chromophore structures. Then, the scientists can dissolve the structures in a liquid solution, and then spray the solution on a glass or plastic substrate to create a solar cell. So far, the scientists have not yet demonstrated that the resulting [solar cells](#) can turn light into electrical energy.

Compared with traditional solar cells, those made from plants could have several potential advantages. For instance, they don't require the use of toxic chemicals, they're biodegradable, and they're inexpensive to produce. On the other hand, bio-based solar cells would likely have a shorter lifetime than silicon solar cells.

In addition to using tobacco, the researchers also demonstrated how to

manipulate *E. coli* bacteria to produce chromophore structures. In this case, the researchers didn't use a virus, but modified the bacteria directly.

More information: Michel T. Dedeo, Karl E. Duderstadt, James M. Berger and Matthew B. Francis. "Nanoscale Protein Assemblies from a Circular Permutant of the Tobacco Mosaic Virus." *Nano Lett.*, 2010, 10 (1), pp 181-186. [doi:10.1021/nl9032395](https://doi.org/10.1021/nl9032395)

Via: [Discovery News](#)

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