Mimicking nature, water-based 'artificial leaf' produces electricity

EurekAlert

A team led by a North Carolina State University researcher has shown that water-gel-based solar devices ? "artificial leaves" ? can act like solar cells to produce electricity. The findings prove the concept for making solar cells that more closely mimic nature. They also have the potential to be less expensive and more environmentally friendly than the current standard-bearer: silicon-based solar cells.

The bendable devices are composed of water-based gel infused with light-sensitive molecules ? the researchers used plant chlorophyll in one of the experiments ? coupled with electrodes coated by carbon materials, such as carbon nanotubes or graphite. The light-sensitive molecules get "excited" by the sun's rays to produce electricity, similar to plant molecules that get excited to synthesize sugars in order to grow, says NC State's Dr. Orlin Velev, Invista Professor of Chemical and Biomolecular Engineering and the lead author of a paper published online in the *Journal of Materials Chemistry* describing this new generation of solar cells.

Velev says that the research team hopes to "learn how to mimic the materials by which nature harnesses solar energy." Although synthetic light-sensitive molecules can be used, Velev says naturally derived products ? like chlorophyll ? are also easily integrated in these devices because of their water-gel matrix.

Now that they've proven the concept, Velev says the researchers will work to fine-tune the water-based photovoltaic devices, making them even more like real leaves.

"The next step is to mimic the self-regenerating mechanisms found in plants," Velev says. "The other challenge is to change the water-based gel and light-sensitive molecules to improve the efficiency of the solar cells."

Velev even imagines a future where roofs could be covered with soft sheets of similar electricity-generating artificial-leaf solar cells.

"We do not want to overpromise at this stage, as the devices are still of relatively low efficiency and there is a long way to go before this can become a practical technology," Velev says. "However, we believe that the concept of biologically inspired 'soft' devices for generating electricity may in the future provide an alternative for the present-day solid-state technologies."

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