Scientists create cells that can harness sun's rays

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Canadian scientists have made a discovery that could become a catalyst for new generations of "battery-less" consumer electronic devices and the long-awaited solar-hydrogen economy. They have created paintable plastic solar cells that are the first to harness the sun's invisible, infrared rays, and could deliver up to five times the power of the most advanced photovoltaic cells today.

The plastic solar cells would be exponentially cheaper and easier to manufacture than similar material made of traditional semi-conductors like silicon, and more efficient than previous plastic solar cells that until now had managed to capture only the visible portion of the spectrum.

The material dissolves into a liquid without losing any of its performance, and may be painted onto walls or windows, sprayed on clothing, or printed onto rolls of paper.

Hydrogen-powered automobiles coated with solar cells, for example, could covert enough energy into electricity to continually recharge a car battery so it could run longer, said Ted Sargent, a University of Toronto physicist and holder of a Canada Research Chair in Emerging Technologies, who was one of the inventors.

Devices from PDAs and iPods to cellphones coated with the solar cell plastic would automatically recharge themselves, eliminating electrical chords and battery packs.

"The one thing that's not wireless about all the wireless devices we have, is the way we power them; solar energy is literally wireless power," said Josh Wolfe, a managing partner at the venture capital firm Lux Capital, in New York. "Everything you can think of will be different; from batteries to electricity bills, to the way devices themselves are manufactured."

The invention solves a basic problem of energy efficiency that is the last important barrier to mass commercialization of solar energy.

Photovoltaic cells have traditionally been made from silicon crystal wafers that need to be individually cut and smoothed into shape -- an expensive, time-consuming process relegating them to niche purposes, such as powering space vehicles.

Plastic cells were first designed in the 1990s and companies since have been refining methods of manufacturing them cheaply by printing them onto large rolls, like newsprint.

But normal plastic absorbs only visible rays within the blue-red range 400 to 700 nanometres -- billionths of a metre -- in wavelength, a region that accounts for only half of the energy in sunlight.

The Canadian version is the first to cull power from the visible spectrum plus the invisible infrared, a deep garnet region some 700 nanometres to 10 microns in wavelength.

With minor fine-tuning, the new plastic is expected to convert 30 per cent of solar energy into electricity -- a five-fold improvement over current nano-engineered solar cells.

The material is an electricity-conducting polymer mixed with nano-sized crystal particles called "quantum dots." The mix was painted onto glass, plied with electrodes and blasted with infrared light -- methods that allowed electrons to escape from the quantum dots and then be harvested almost instantaneously.

We've tapped the other half of the sun," Sargent told CanWest News Service.

Peter Peumans, a professor of electrical engineering at Stanford University in California, called it, "a very important demonstration" that will yield solar cells "on order of magnitude cheaper than silicon, with the same or better performance as [current] plastic," within a decade.

The plastic is also adaptable for medical use. A characteristic of infrared light is that it penetrates up to 10 centimetres inside human flesh, so one option would be to coat digital-camera chips with the plastic in order to create a low-cost, portable diagnostic scanner for detecting cancer, said Peumans.

By mid-century, "solar farms" consisting of photoconductive plastic rolled across unpopulated expanses of desert could conceivably generate enough low-cost, "clean" energy to supply the entire planet's power needs, said Sargent.

But to affordably replace coal-fired or nuclear-generating stations, the average cost of converting sunlight into power must drop to six cents US per kilowatt-hour, from 25 to 50 cents US per kilowatt hour, according to Michael Rogol, an expert in solar power economics from the Massachusetts Institute of Technology.

Products nearest to market will be the most consumer-oriented items, such as energy-saving plastic sheeting that could be unfurled onto a rooftop to supply heating needs, or solar cell window coatings that could let in enough infrared light to power home appliances, Rogol said.

The discovery was reported Sunday in the prestigious nanotechnology journal Nature Materials.