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'Juiced-Up' Battery Fueled by Sugar Could Power Small Portable Electronics

Juicing up your cell phone or iPod may take on a whole new meaning in the future. Researchers at Saint Louis University have developed a fuel cell battery that runs on virtually any sugar source – from soft drinks to tree sap – and has the potential to operate three to four times longer on a single charge than conventional lithium ion batteries, they say.

For consumers, that could mean significantly longer time to talk and play music between charges. The new battery, which is also biodegradable, could eventually replace lithium ion batteries in many portable electronic applications, including computers, the scientists say. Their findings were described today at the 233rd national meeting of the American Chemical Society in Chicago.

"This study shows that renewable fuels can be directly employed in batteries at room temperature to lead to more energy-efficient battery technology than metal-based approaches," said study leader Shelley Minter, Ph.D., an electrochemist at Saint Louis University. "It demonstrates that by bridging biology and chemistry, we can build a better battery that's also cleaner for the environment."

Using sugar for fuel is not a new concept: Sugar in the form of glucose supplies the energy needs of all living things. While nature has figured out how to harness this energy efficiently, scientists only recently have learned how to unleash the energy-dense power of sugar to produce electricity, Minter said.

A few other researchers also have developed fuel cell batteries that run on sugar, but Minter claims that her version is the longest-lasting and most powerful of its type to date. As proof of concept, she has used a small prototype of the battery (about the size of a postage stamp) to successfully run a handheld calculator. If the battery continues to show promise during further testing and refinement, it could be ready for commercialization in three to five years, she estimates.

Consumers aren't the only ones who stand to benefit from this new technology. The military is interested in using the sugar battery to charge portable electronic equipment on the battlefield and in

emergency situations where access to electricity is limited. These devices include remote sensors for detecting biological and chemical weapons. Devices could be instantly recharged by adding virtually any convenient sugar source, including plant sap, Minter said.

Like other fuel cells, the sugar battery contains enzymes that convert fuel – in this case, sugar – into electricity, leaving behind water as a main byproduct. But unlike other fuel cells, all of the materials used to build the sugar battery are biodegradable.

So far, Minter has run the batteries on glucose, flat sodas, sweetened drink mixes and tree sap, with promising results. She also tested carbonated beverages, but carbonation appears to weaken the fuel cell. The best fuel source tested so far is ordinary table sugar (sucrose) dissolved in water, she said.

One of the first applications Minter envisions for the sugar fuel cell is using it as a portable cell phone recharger, similar to the quick rechargers already on the market that allow users to instantly charge their cell phones while 'on the go.' Ideally, these rechargers would contain special cartridges that are pre-filled with a sugar solution.

These cartridges then could be replaced when they're used up. Ultimately, she hopes that the sugar battery can be used as a stand-alone battery replacement in a wide range of portable electronic devices.

Future work includes modifying the battery's performance for varying environmental conditions, including high temperatures, and extending the life of the battery, Minter said. Funding for this study was provided by the U.S. Department of Defense.

More about SLU's Minter: A chemistry professor at Saint Louis University, Minter already has invented a biobattery that can run on alcohol and natural enzymes. She formed a start-up company with a former graduate student to develop commercial applications for the invention. The company has secured millions of dollars in venture capital and other investments.

The Saint Louis University scientist says her long-term goal is to create a rechargeable battery that not only lasts longer, but also is also friendly to the environment.

For her groundbreaking research, Minter earned the 2005 Innovation Award from the Academy of Science of St. Louis. From freshmen to graduate assistants, Saint Louis University students at all levels work in her lab.

Minteer also gives back to the community, serving as a faculty mentor for "Students and Teachers as Research Scientists" or STARS, an intensive summer research program for rising junior and senior level high school students.

Saint Louis University is a Jesuit, Catholic university ranked among the top research institutions in the nation. The University fosters the intellectual and character development of more than 12,000 students on campuses in St. Louis and Madrid, Spain. Founded in 1818, it is the oldest university west of the Mississippi and the second oldest Jesuit university in the United States. Through teaching, research, health care and community service, Saint Louis University is the place where knowledge touches lives. Learn more about SLU at www.slu.edu.