'Juiced-up' Sugar-Fueled Battery Could Power Portable Electronics

March 25 2007

Juicing up your cell phone or iPod may take on a whole new meaning in the future. Researchers at Saint Louis University in Missouri 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.

“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,” says study leader Shelley Minteer, 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, Minteer says.

A few other researchers also have developed fuel cell batteries that run on sugar, but Minteer 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, Minteer says.

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, Minteer 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 says.

One of the first applications Minteer 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, Minteer says. Funding for this study was provided by the U.S. Department of Defense.

Source: ACS