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Researchers develop biodegradable fuel cell battery fueled by sugar

While soft drinks can add to your waistline, they also might add power to portable electronics. Researchers at Saint Louis University in Missouri said they have developed a fuel cell battery that runs on virtually any sugar source — from soft drinks to maple syrup, or tree sap — and has the potential to operate three to four times longer on a single charge than conventional lithium ion batteries.

" 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 Minteer, Ph.D., an electrochemist at Saint Louis University, in a written statement.

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 said.

According to the release, 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.

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 said.

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. She said 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.