Bacteria-powered battery runs on a sweet tooth

By Elizabeth Weise USA TODAY

Scientists at the University of Massachusetts-Amherst have developed a battery that uses iron-breathing bacteria to eat the sugars in carbohydrates and turn them into electricity.

Previous research has shown it is possible to use microbes to turn organic matter into electricity, but the process required the use of added materials to shuttle the electrons, making such fuel cells expensive and not long-lasting.

But in the October *Nature Biotechnology*, Swades Chaudhuri and Derek Lovley report that the bacterium *Rhodoferax ferrireducens* can turn simple sugars, found in everything from straw to fruit, directly into electricity.

"You can harvest enough electricity to power a cell phone battery for about four days from a sugar cube," Lovley says. "A cup of sugar contains enough power to light a 60-watt light bulb for about 17 hours."

This is a big innovation, says Leonard Tender, an electrochemist at the Naval Research Laboratory's Center for Bio/Molecular Science and Engineering in Washington, D.C. "What Derek has blown right open is that these (bacteria) don't need mediators."

The bacteria were found in sediments at Oyster Bay, Va. They use some of the energy from the sugars to live and usually pass the rest off to nearby iron atoms in the iron-rich, oxygen-poor bay sediments they live in.

The researchers discovered a way to dupe the bacteria into passing those electrons onto an electrode instead, producing an electrical current.

R. ferrireducens is an efficient microbe, converting up to 80% of the sugar electrons to current. Previous bio fuel cells managed only 50% energy conversion.

The downside, however, is that it's a slow process. That cup of sugar could take weeks to digest. Still, a slow but steady trickle of electricity can be used to charge up a battery, which can then discharge large amounts of power when needed.

"It's the classic tortoise-and-hare story," Tender says. "They're slow, but they run 24/7."

Scientists don't see the U.S. power grid converting to bio power anytime soon. But there are specific uses for which such batteries might be perfect.

The Department of Defense, which funded the research, is looking into ways to use the batteries to power scientific monitoring equipment at the bottom of the ocean, where it's difficult if not impossible to change traditional batteries. Another possibility would be to use glucose in the bloodstream to power medical devices, such as pacemakers.

The technology is still young, Lovley says. "Where we are now is where solar power was 20 or 30 years ago."

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