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## Sugar power

### Scientists unveil world's first efficient 'bacterial battery'

PARIS - Damnation ... your mobile phone, on which your work and social life depend, has become a useless lump of plastic and silicon: the battery is dead.

No problem.

Just reach for the nearest bowl of sugar, flip open the phone, top up the battery with a wee spoonful, give it a little time - and hey presto, you are connected to the world again.

This sci-fi scenario may lie in the not-too-distant future, thanks to two United States-based scientists who said that they have invented the world's first efficient 'bacterial battery'.

In a Pentagon-backed project, University of Massachusetts researchers Swades Chaudhuri and Derek Lovley said the battery's source is an underground bacterium that gobbles up sugar and converts its energy into electricity.

Their prototype device ran flawlessly without refuelling for up to 25 days and is also cheap and stable.

The bug in question is *Rhodospirillum rubrum*, which was found in airless sediment deep below ground at Oyster Bay, Virginia, and identified as a promising candidate for oxidising simple sugars.

The scientists, whose work was published yesterday in the specialist journal *Nature Biotechnology*, set up a small two-chamber vessel, with each side containing a graphite electrode and separated by a membrane.

On one side was *R. ferriducens* swimming in a glucose solution, which it broke down into carbon dioxide and electrons.

The electrons were transported to the nearby electrode, called the anode, and driven around an external circuit to the other electrode, the cathode: electrical power.

Microbial fuel cells are not new, but until now they have run into big problems of cost and energy efficiency.

Typically, they yield efficiency of '10 per cent or less', which makes them big and unwieldy relative to the power they provide, Dr Lovley said. The best effort has had an efficiency performance of about 50 per cent.

But this was only achieved thanks to chemicals called mediators which sneak across the cell's membranes, pick up the free electrons and ferry them to the anode.

The mediators are expensive and have to be replenished frequently, and this makes them unsuitable as a simple, long-term energy source.

The prototype made by Dr Lovley and Dr Chaudhuri cranks out only a tiny amount of current - enough to run a calculator or Christmas tree lights.

But as a proof of concept it is remarkable.

Its energy efficiency is an extraordinary 83 per cent, which implies that, if engineering obstacles can be overcome and manufacturing techniques devised, it could one day be as compact as household batteries.

It worked not only with glucose but also with the fruit sugar fructose, with sucrose (found in sugar cane and sugar beet) and even xylose, a sugary byproduct of wood and straw.

In addition, the bacterium is rugged and stable, able to grow at temperatures ranging from 4 deg C to 30 deg C, with 25 deg C the optimum.

All of the fuel is used up.

The process does have a pollutant, in the form of carbon dioxide, which is a greenhouse gas, but the contribution to global warming would be far less than the equivalent emission using fossil fuel, said Dr Lovley.

'In the short term, I see the usefulness would be for charging up batteries that can be used in a cell phone, something like that,' he said.

The technology could also be used in environments where it is difficult or costly to charge the batteries, Dr Lovley said, explaining that the US Department of Defence was interested in it for powering underwater microphones and sonar to spot passing ships and submarines.

And, for people living in poor, remote communities, it should be possible to adapt the electrodes so that they use carbohydrate waste from farm animals or sewage to power batteries for running fridges and stoves. \-- AFP