Sucking energy out of the drain

Microbes in wastewater make a handy household battery.

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Flushing the toilet could help supply your home with electricity, thanks to a device developed by US researchers.

They have shown that electricity can be generated from domestic wastewater, which is full of organic matter from cooking, cleaning or sewage.

As a bonus, the dirty water is made cleaner by the process, making sewage treatment easier. By turning wastewater into a valuable economic resource, Bruce Logan and colleagues at Pennsylvania State University think that their system might help make basic sanitation more affordable in developing countries.

The process relies on bacteria that are already present in most wastewater and munch on household organic matter. These bugs burn anything from sewage to left-over cabbage, mainly turning it into carbon dioxide: as they oxidise their food, they strip electrons from the organic matter.

Researchers can harness these electrons, generating an electric current that can be tapped for power generation.

From sea to sink

Devices in which bacteria burn organic fuel and convert it to electricity have been made before. They are called microbial fuel cells, and many researchers are now exploring them as potential sources of cheap power - sometimes in unusual places.
Logan’s device is just one such fuel cell. It consists of a plastic tube 5.5 cm wide and 15 cm long, eight graphite rods running lengthwise through the tube as negative electrodes. The positive electrode is a central rod made out of plastic, carbon and platinum. When wastewater is pumped through the chamber, bacteria stick to the graphite rods and channel electrons into them as they eat organic material. The electrons travel through wires to the platinum rod, completing the circuit.

The larger the surface area of the graphite rods, the greater the power generated. The Penn State team has so far managed to extract 150 milliwatts per square metre of graphite surface from their fuel cell. “We believe we can increase power generation to levels of about 1000 mW per square metre,” Logan says. A reasonably-sized device would generate enough electricity to power small devices like light bulbs, but not enough to run a whole house. “We are continuing to improve power generation levels,” Logan says.

The device encourages bugs to eat hefty meals of organic waste by providing a convenient place for them to dump the electrons stripped from their food. The team says that bugs in their device remove up to 50% of organic waste in the water.

If the lab prototype can be scaled up to a household version, the team says it could save energy and treat waste for every home. And that could save money: the annual bill for treatment of domestic wastewater in the US is currently about $2.5 billion.

References