

Running fuel cells on bacteria

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When biologist Netzer (left), who specialises in bioprocesses, met electrochemist Colmenares, whose field is water purification, they came up with the idea of a practical, microbial, energy-generating water purification system. Today their demonstration plant is up and running. Credit: Thor Nielsen/SINTEF

Researchers in Norway have succeeded in getting bacteria to power a fuel cell. The "fuel" used is wastewater, and the products of the process are purified water droplets and electricity.

This is an environmentally-friendly process for the purification of water

derived from industrial processes and suchlike. It also generates small amounts of electricity – in practice enough to drive a small fan, a sensor or a light-emitting diode.

In the future, the researchers hope to scale up this [energy](#) generation to enable the same energy to be used to power the water purification process, which commonly consists of many stages, often involving mechanical and energy-demanding decontamination steps at its outset.

Nature's own generator

The biological fuel cell is powered by entirely natural processes – with the help of living microorganisms.

"In simple terms, this type of [fuel cell](#) works because the bacteria consume the waste materials found in the water", explains SINTEF researcher Luis Cesar Colmenares, who is running the project together with his colleague Roman Netzer. "As they eat, the bacteria produce electrons and protons. The voltage that arises between these particles generates energy that we can exploit. Since the waste in the wastewater (organic material) is consumed and thus removed, the water itself becomes purified", he says.

Searching for the best bacteria

"Our challenge has been to find the mechanisms and bacteria that are best suited for use in this water purification method", says Netzer. "To start with, we had to find a bacterium which was not only able to consume the waste products in the water, but which could also transfer electrons to a metal electrode", he says.

The idea behind this water purification approach was born many years

ago when the two scientists first met and began discussing how bacteria could be used to generate energy. Since then, they have both been working to put the idea into practice – each from their own respective fields of expertise. While Netzer is an expert in [bacteria](#), Colmenares is an electrochemist with a knowledge of, and interest in, water purification.

Today, they have a small demonstration plant bubbling away in the lab – efficiently exploiting the bacterias' ability to purify dirty water and generate electricity. The wastewater comes from the local Tine dairy and is rich in organic acids, which are ideal for this process. But this is not essential – other types of wastewater work just as well.

"At the moment, we're not talking about producing large volumes of energy", says Netzer. "But the process is very interesting because [water purification](#) processes are very energy-demanding using current technology. We're particularly pleased at being able to produce just as much energy using low-cost materials as others are achieving using much more expensive approaches", he says.

Provided by SINTEF

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