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Salt and Paper Make Disposable Batteries

Eric Bland, Discovery News

Oct. 7, 2009 -- A piece of wet, salty paper doesn't look impressive, but cut it up, stack it up, and it can hold an impressive amount of energy.

With this in mind, scientists in Sweden have created a salt and paper [battery](#) that can hold up to one volt of electricity.

The scientists hope their battery will one day power remote, biodegradable sensors.

"We wanted to make a battery that was very simple and used the same material for both electrodes," said Leif Nyholm, a professor at Uppsala University in Sweden and co-author of a study that appeared in the journal *Nano Letters*. "To make it simple we just put NaCl (table salt) in."

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The [battery](#) itself is as thin as a single piece of paper, but it is made up of multiple layers of cellulose, coated in a conductive polymer 50 nanometers thick, and sandwiched between layers of filter paper. Water conducts the chlorine ions to the negative electrode, and electrons to the positive electrode.

The whole flexible assembly, several millimeters thick, is wrapped in plastic.

The initial salt and paper battery prototype can generate one volt of energy. Stacking more layers should provide more voltage, says Nyholm, but gram for gram, the salt and paper battery isn't as powerful as its thin-film cousins that use [lithium](#), cobalt or nickel. It does charge faster than these other metallic batteries, however.

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"The eco-friendly materials used for these batteries is exciting not only because it mitigates how much



The salt and paper battery won't be used to power a laptop or a cell phone. Its [environmentally-friendly](#) components will more likely be used for fabrics that heat up or remote sensors that monitor temperature or humidity.

The battery doesn't just degrade into harmless products, it actually helps solve an environmental problem.

The traditional source of paper -- wood pulp -- doesn't have enough surface area for ion exchange. Instead, the scientists turned to a noxious marine algae that clogs up harbors. The marine algae produces cellulose with 100 times the surface area, compared with terrestrial plants.

"The utilization of the nanostructure of this cellulose preparation was a bright idea," said Gyorgy Inzelt, an expert on thin films from Eotvos Lorand University in Hungary.

Another bright idea would be to use the salt and cellulose assembly as a capacitor, or device able to dump all its electrical charge at once, instead of a battery, which releases power more slowly.

As either a battery or a capacitor, Inzelt suggests the device could be useful in pacemakers, nanomotors, optical displays and other devices, but that more exhaustive testing is required before any commercial device can be produced.

"There are so many things we want to do with an actual commercial device," said Nyholm, "But we still have a lot of work to fully characterize its performance."

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[e-waste](#) we generate, but also because they lessen our reliance on other materials like lithium for which [demand is rising](#).

- Jaymi Heimbuch, [Science & Tech](#)

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