



Scientists from NTU Singapore have developed paper-thin biodegradable zinc batteries that could one day become an environmentally sustainable option for powering flexible and wearable electronic systems. (Credit: NTU Singapore)

ENVIRONMENT, SCIENCE & TECHNOLOGY

## Scientists create biodegradable batteries that can be buried in soil after use!

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**SINGAPORE** — Scientists have created biodegradable batteries that can actually be safely buried in the ground after use. The paper-thin batteries could one day become an environmentally sustainable option for powering smartphones and flexible wearable electronic devices.

Researchers from The Nanyang Technological University (NTU) developed zinc batteries made up of electrodes (through which the electrical current leaves or enters the battery) screen-printed onto both sides of a piece of cellulose paper that has been reinforced with hydrogel. Once the battery has been expended, it can be buried in soil, **where it breaks down completely** within a month.

In a proof-of-concept experiment described in scientific journal *Advanced Science*, the NTU team demonstrated how a 4cm x 4cm square of printed paper battery could power a small electric fan for at least 45 minutes. Bending or twisting the battery did not interrupt the power supply.

In another experiment using a 4cm x 4cm battery to power an LED, the scientists showed that despite cutting away parts of the paper battery, the LED remained lit. This indicates that cutting does not affect the **functionality of the battery**.



The paper batteries are made up of electrodes (through which the electrical current leaves or enters the battery) screen-printed on to both sides of a piece of cellulose paper that has been reinforced with hydrogel. (Credit: NTU Singapore)

The scientists think their biodegradable battery could be integrated into flexible electronics such as foldable smartphones that are already on the market, **or biomedical sensors** for health monitoring.

“Traditional batteries come in a variety of models and sizes, and choosing the right type for your device could be a cumbersome process. Through our study, we showed a simpler, cheaper way of manufacturing batteries, by developing a single large piece of battery that can be cut to desired shapes and sizes without loss of efficiency,” explains co-lead author Fan Hongjin, a professor from the NTU School of Physical and Mathematical Sciences, in a **statement**. “These features make our paper batteries ideal for integration in the sorts of flexible electronics that are gradually being developed.”

The development of the biodegradable zinc batteries by the NTU research team is in line with the NTU 2025 vision and the University's Sustainability Manifesto, which aspire **to develop sustainable solutions** to address some of humanity's pressing grand challenges.

“We believe the paper battery we have developed could potentially help with the electronic waste problem, given that our printed paper battery is non-toxic and does not require aluminum or plastic casings to encapsulate the battery components,” says co-lead author Lee Seok Woo, an assistant professor from the NTU School of Electrical and Electronic Engineering. “Avoiding the packaging layers **also enables our battery** to store a higher amount of energy, and thus power, within a smaller system.”

*South West News Service writer Dean Murray contributed to this report.*