THE ENGINEER

NTU team develops paper-thin biodegradable batteries

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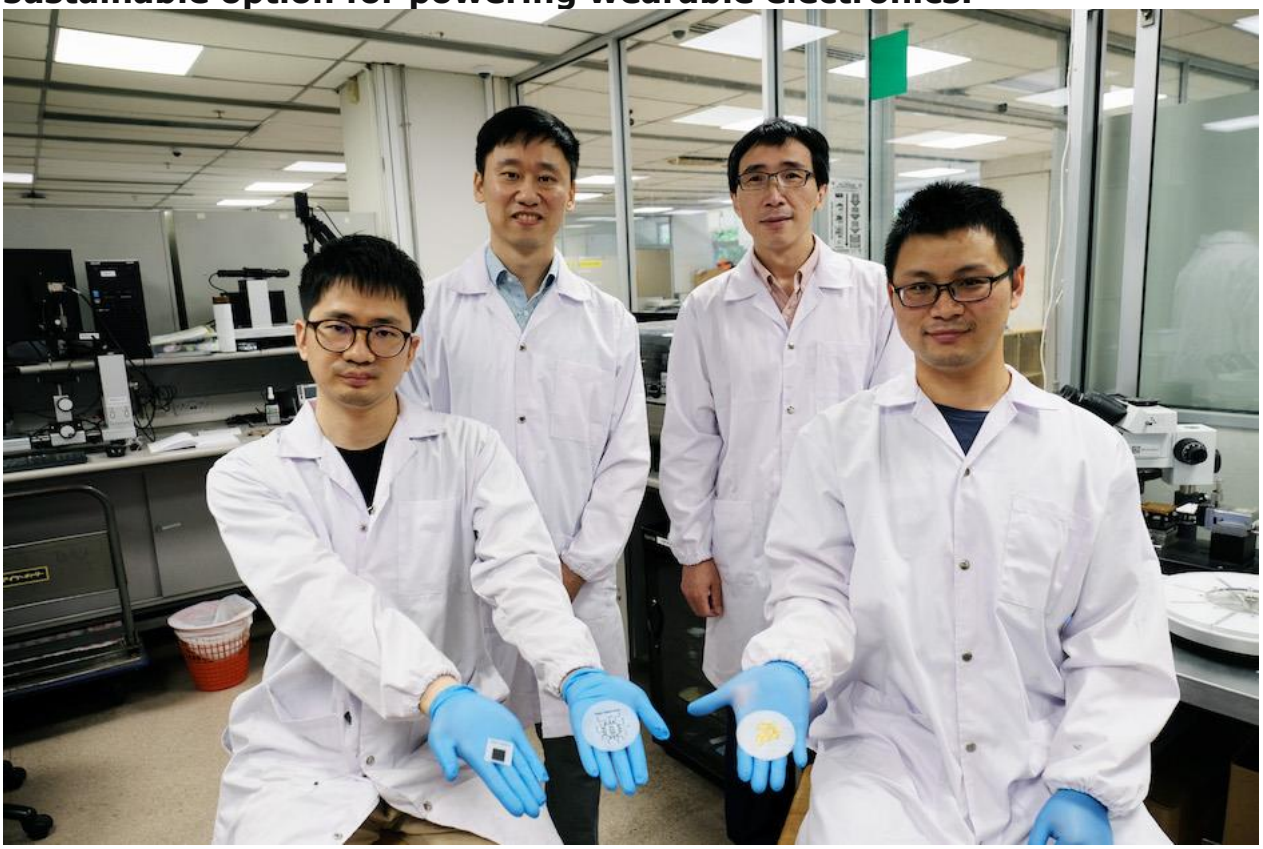
Scientists at Nanyang Technological University (NTU) Singapore have developed paper-thin biodegradable batteries, aiming to provide a sustainable option for powering wearable electronics.



Credit: NTU Singapore

The zinc batteries are made up of electrodes screen-printed onto both sides of a piece of cellulose paper that has been reinforced with hydrogel.

According to the team, 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 *Advanced Science*, researchers 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, scientists showed that despite cutting away parts of the paper battery, the LED remained lit, indicating that cutting does not affect the battery's functionality.

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Scientists think their biodegradable batteries could be integrated into flexible electronics such as foldable smart phones 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," said co-lead author professor Fan Hongjin, from the NTU School of Physical and Mathematical Sciences.

"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."

Assistant professor Lee Seok Woo, another co-lead author of the study from NTU's School of Electrical and Electronic Engineering, said that the paper battery could help with the electronic waste problem given that it is non-toxic and does not require aluminium or plastic casings to encapsulate the battery components.

"Avoiding the packaging layers also enables our battery to store a higher amount of energy, and thus power, within a smaller system," he said.

The research 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'.