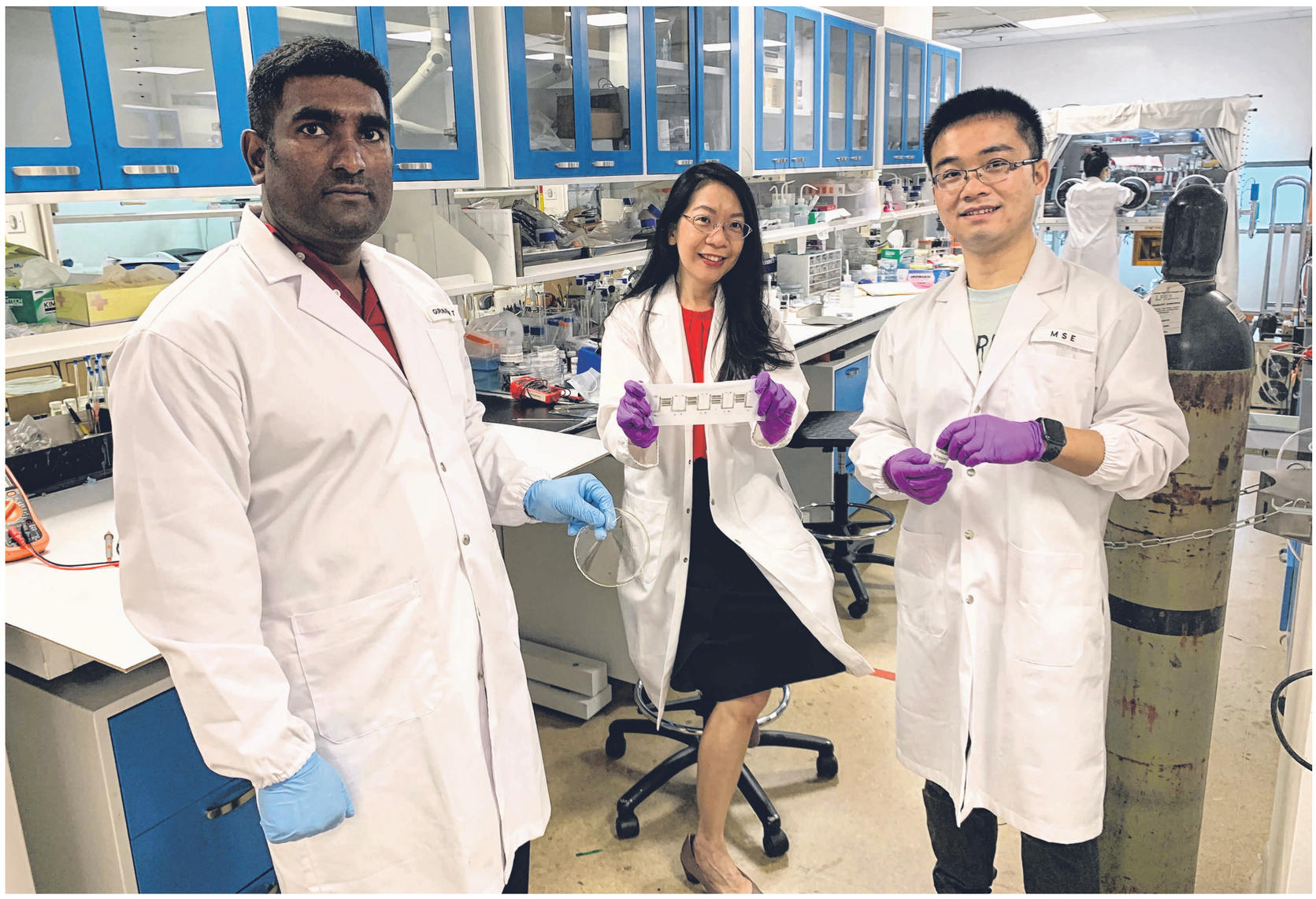

Professor Lee Pooi See (centre), who led the study, holding batteries powered by sweat, with other members of the team – NTU's School of Materials Science and Engineering senior research fellow Gurunathan Thangavel and research fellow Lyu Jian. PHOTOS: NANYANG TECHNOLOGICAL UNIVERSITY

NO SWEAT

NTU researchers develop battery powered by perspiration

Kenny Chee
Senior Tech Correspondent

Researchers at Nanyang Technological University (NTU) have developed a battery that could use sweat to power wearables such as smart watches and fitness trackers.

The team of three scientists showed that a prototype of the battery was able to power a temperature sensor and send data to a smartphone through Bluetooth.

Four of the batteries, which generated a voltage of 4.2V, were worn around the wrist of a person using a stationary bicycle for 30 minutes.

Each battery was made by printing ink containing silver flakes onto a stretchable, sweat-absorbent fabric. It measures 2cm by 2cm, about the size of a small postage stamp but thicker, and costs 40 cents to produce.

Separate tests in the laboratory showed that about 2ml of artificial sweat – or about half a teaspoon of liquid – could power a battery for about 20 hours.

When sweat comes into contact with the battery, the chloride ions and acidity of sweat cause the silver flakes to clump together.

This chemical reaction increases the flakes' ability to conduct electricity and work like electrodes to make a current flow.

The NTU battery could be more durable than those using existing technology.

It can be used when the wearer is exercising and can withstand repeated exposure to sweat.

And even when the person is not perspiring consistently, the fabric used to make the battery is able to retain a lot of sweat, which allows the battery to be powered.

Unlike other batteries, it does not contain heavy metals or toxic chemicals, so it is potentially more environmentally friendly and can help reduce harmful electronic waste, the university said yesterday.

"By capitalising on a ubiquitous product, perspiration, we could be looking at a more environmentally friendly way of powering wearable devices that does not rely on conventional batteries," said Professor Lee Pooi See, the materials scientist who led the study.

"It is a near-guaranteed source of energy produced by our bodies. We expect the battery to be capable of powering all sorts of wearable devices."

Prof Lee, who is also dean of the NTU Graduate College, added that the battery's slim size solves problems in wearable tech.

She said traditional button batteries used in some wearables can make it difficult to design a device that looks sleek and attractive.

And if such batteries are made thinner, their ability to carry a charge is reduced and may not be enough to last throughout the day.

The NTU battery turns sweat, usually a hindrance in wearables, into an asset, said Associate Professor Irene Goldthorpe from the Department of Electrical and Computer Engineering of the University of Waterloo, Canada, who is not involved in the research.

"It is well known that electronics do not like moisture and thus wearable devices are typically fully encapsulated to shield them from sweat," she said, adding that NTU's battery work could "open a new paradigm" in designing wearable electronics.

The research on the battery took about a year and a patent application has been filed.

Generally, the funding costs for projects this long are about $200,000 to $250,000.

Prof Lee does not expect the NTU battery to cost more than batteries available now. And the printing tech used to make the sweat-powered battery can be easily scaled up.

Still, the scientists are planning more research to find out if cheaper materials could replace silver. They also plan to explore the effects of other components of human sweat, as well as how factors such as body heat could affect the battery's performance.

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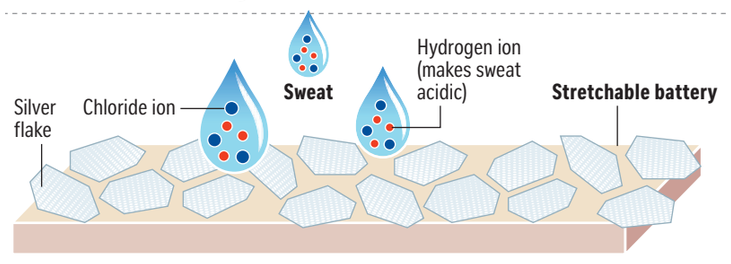
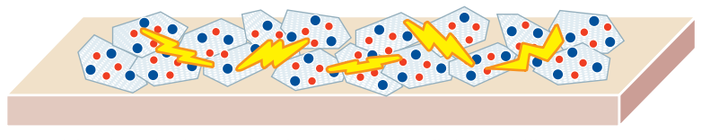
How the battery works

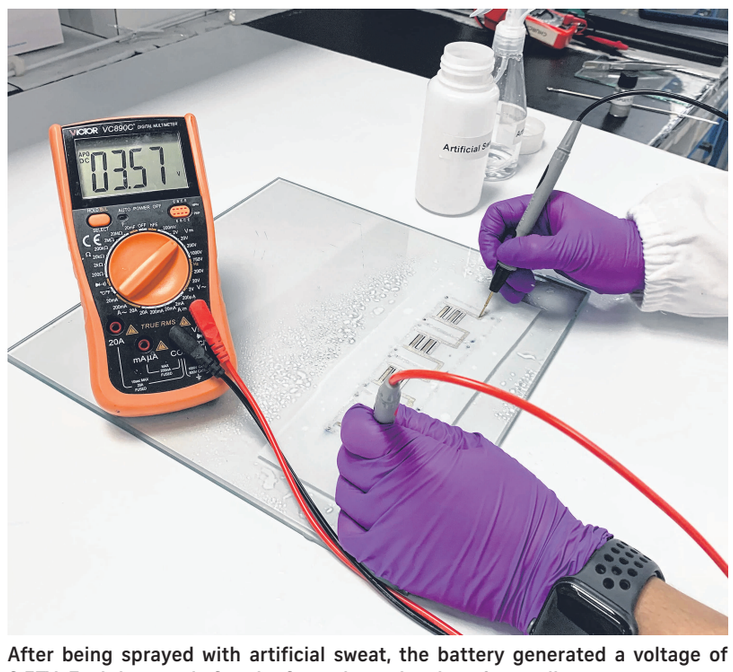


1 When sweat comes into contact with the silver flakes in the stretchable battery, the chloride ions and the acidity of sweat cause them to clump together.



2 This chemical reaction increases the flakes' ability to conduct electricity and work like electrodes to make a current flow.

Source: NTU STRAITS TIMES GRAPHICS



After being sprayed with artificial sweat, the battery generated a voltage of 3.57V. Each battery is 2cm by 2cm, about the size of a small postage stamp.

GREENER OPTION

By capitalising on a ubiquitous product, perspiration, we could be looking at a more environmentally friendly way of powering wearable devices that does not rely on conventional batteries... It is a near-guaranteed source of energy produced by our bodies. We expect the battery to be capable of powering all sorts of wearable devices.

PROFESSOR LEE POOI SEE, the materials scientist who led the study.