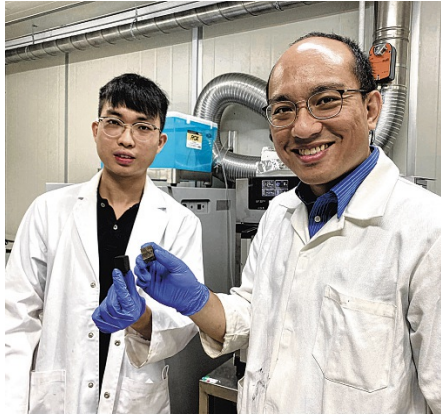


# NTU scientists turn waste paper into battery parts



Assistant professor Lai Changquan (right) and research engineer Lim Guo Yao, both from Nanyang Technological University's School of Mechanical and Aerospace Engineering, present the anodes created using their technique. PHOTO: NANYANG TECHNOLOGICAL UNIVERSITY

**By Venga Subramaniam**  
svenga@sph.com.sg

SCIENTISTS from Nanyang Technological University (NTU) have found a way to turn waste paper into a component of lithium-ion batteries, which could allow such batteries to be produced in a more environmentally-friendly way.

The research team has filed a patent with NTUitive, NTU's innovation and enterprise company, and is working towards commercialising their invention, the university said in a press statement on Wednesday (Nov 23).

Paper waste – comprising disposed kraft paper bags, cardboard, newspaper, and other paper packaging – accounted for nearly a fifth of the waste generated in Singapore in 2020.

The NTU team has turned the fibres of kraft paper into electrodes, a crucial component of the rechargeable batteries that power mobile phones, medical equip-

ment, and electric vehicles.

This is done through a process called carbonisation. The paper is exposed to high temperatures in the absence of oxygen, so that it is not incinerated.

Instead, the paper is reduced to pure carbon, water vapour, and oils that can be used for biofuel.

In this way, paper fibres are turned into carbon anodes, or negative electrodes, for use in rechargeable batteries.

Laboratory tests show that the NTU-made anodes can be charged and discharged up to 1,200 times, making them at least twice as durable as anodes in current phone batteries. They also withstood more physical stress.

In addition, NTU's method uses less energy-intensive processes and heavy metals compared to current industrial methods of manufacturing battery anodes, the university noted.

"As the anode is worth 10 to 15 per cent of the total cost of a lithi-

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**Lai Changquan, assistant professor,  
Nanyang Technological School**

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um-ion battery, this latest method – which uses a low-cost waste material – is expected to also bring down the cost of manufacturing them," said the university.

The NTU team will conduct further research to improve the energy storage capacity of their material and minimise the heat energy required to convert the paper into carbon.

Paper is used in many facets of daily life, yet little is done to manage its disposal – besides incineration, which generates high levels of carbon emissions, said assistant professor Lai Changquan of NTU's School of Mechanical and Aerospace Engineering, who led the project.

A separate NTU study in 2020 found that kraft paper bags, which make up the bulk of Singapore's paper waste, had large environmental footprints compared to their cotton and plastic counterparts, due to a greater contribution to global warming when incinerated and the eco-toxicity potential in producing them.

"Our method to give kraft paper another lease of life – funnelling it into the growing need for devices such as electric vehicles and smartphones – would not only help cut down on carbon emissions but would also ease the reliance on mining and heavy industrial methods," added Prof Lai.