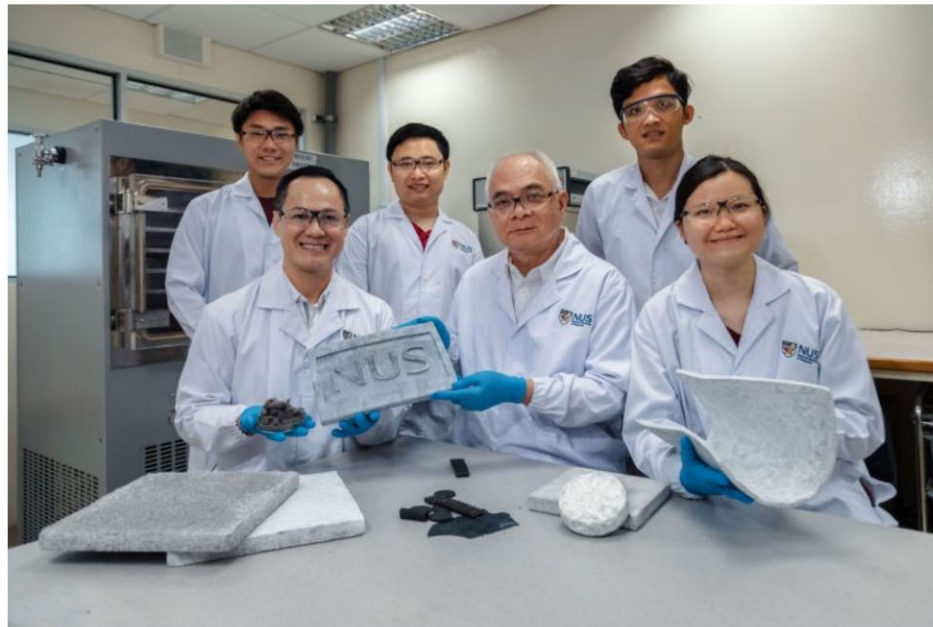


PREMIUM

NUS scientists make aerogels from old rubber tyres, possibly helping to cut back on waste in Singapore



A team of researchers from the National University of Singapore, led by Associate Professor Duong Hai-Minh (front row, first from left) and Prof Nhan Phan-Thien (front row, centre), has developed the world's first aerogels made from scrap rubber tyres. PHOTO: NATIONAL UNIVERSITY OF SINGAPORE

PUBLISHED MAR 18, 2020, 5:24 PM SGT



Vanessa Liu

SINGAPORE - National University of Singapore scientists have found a way to give old car tyres a new lease of life by turning them into aerogels.

The discovery is a potential leap in [closing a waste loop](#) in Singapore.

The team from the university's Department of Mechanical Engineering is the first in the world to succeed in making the supermaterial out of scrap rubber.

Aerogel, the least dense solid with fire-retardant and insulative properties, can be found in a range of applications, from firefighters' suits and rockets to cosmetics and paint.

In 2018, Singapore generated 32,500 tonnes of [scrap tyres](#), 90 per cent of which was recycled, figures from the National Environment Agency showed. The rest were incinerated before ending up in landfills.

Burning rubber releases toxins into the atmosphere, threatening safety and health.

Worldwide, about one billion scrap tyres are generated every year. About half of these non-biodegradable materials are burnt as fuel to generate energy, while 40 per cent are recycled. The rest are disposed of.

Associate Professor Duong Hai-Minh, leader of the research team, noted that recycling rates of rubber tyres worldwide are low because processing used rubber is costly and energy-intensive. Recyclers also lack monetary incentive, since the products made from recycled rubber are usually low-value, he added.

"Our team has decided to focus on creating rubber aerogels from used rubber tyres because they are a cheap and abundant source of raw material," said Prof Duong, who previously led a team which successfully constructed aerogels from polyethylene terephthalate (PET), the material that most plastic bottles are made of.



Front row: Scrap rubber and rubber fibres; Back row: Rubber aerogels in different shapes and sizes. PHOTO: NATIONAL UNIVERSITY OF SINGAPORE

"By converting waste rubber tyres into high-value aerogels, we can enhance the monetary incentive for recycling rubber and, in turn, cut down rubber waste," he added.

To make aerogel out of scrap rubber, the researchers shredded car tyres into fine fibres - 3mm to 8mm in length and 30 to 50 micrometres thick - and mixed them with water and solvents such as polyvinyl alcohol and glutaraldehyde. After the mixture is stirred for 20 minutes, it adopts a gel-like form.

The gel is then freeze-dried at minus 50 deg C for up to 12 hours. The process of freeze-drying removes all the liquid molecules in the nanopores of the gel, replacing them with air. This is also the reason that aerogels have ultralight properties.

The entire production process takes between 12 to 13 hours. It costs less than \$10 to produce a sheet of rubber aerogel that is 1 sq m in size and 1 cm thick.

The team is now looking to scale up production of the insulation material, which can not only be used in oil refineries and subsea systems, but also in household items such as refrigerators as well as personal items like jackets and shoe insoles.