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Singapore

NUS researchers turn unwanted clothing into 'supermaterial'



Associate Professor Hai Minh Duong (left) and Professor Nhan Phan-Thien from the Department of Mechanical Engineering at NUS Faculty of Engineering. (Photo: NUS)

SINGAPORE: A research team from the National University of Singapore (NUS) has devised a "fast, cheap and green method" to convert cotton-based fabric waste such as unwanted clothing into a type of aerogel, announced the varsity on Wednesday (Jan 24).

Aerogels can be used to keep military water bottles cold, as well as control of rapid bleeding effectively, among other uses.

They are sometimes called a "supermaterial" because they are among the lightest materials in the world, highly porous with strong absorption capacity and low thermal conductivity. However, when aerogels were first created in the 1930s, they were not widely used by industries due to the high production cost.

Scientists have since found ways to improve the manufacturing process, and the team from NUS has taken it a step further by pioneering the development of aerogels using cotton fibres harvested from textile waste.

"This new eco-friendly cotton aerogel is a major improvement from the aerogel that our team had previously developed using paper waste," said Associate Professor Hai Minh Duong, who led the team with Professor Nhan Phan-Thien.

Both are from the Department of Mechanical Engineering at NUS.

"It is highly compressible, hence storage and transportation costs could be greatly reduced. Furthermore, these cotton aerogels can be fabricated within eight hours - this is nine times faster than our earlier invention and about 20 times faster than current commercial fabrication processes. They are also stronger, making them more suitable for mass production," said Assoc Prof Duong.

The scientists have demonstrated several uses for the cotton-based aerogels including in the making of a lightweight thermal jacket for military canteens, which offers "better heat insulation performances compared to commercial insulated water bottles such as FLOE bottles". The cotton aerogel-insulated flasks are "highly comparable to that of vacuum flasks", said NUS, but are lighter and less costly.

This property of the cotton aerogels can also be applied to other products, such as cooler bags that keep food items fresh and has "tremendous potential for other high value applications such as pipeline insulation and transportation of liquefied natural gas which needs to be stored at a low temperature", said Prof Nhan.

The team also showed how the material can be used to effectively treat excessive and rapid loss of blood, which can be life-threatening. Existing haemorrhage control devices use cellulose-based sponge, which has "relatively slow" expansion and absorption rates.

NUS' cotton aerogel pellets are more effective than the sponge, with each pellet able to "expand to 16 times its size in 4.5 seconds - larger and more than three times faster than existing cellulose-based sponges - while retaining their structural integrity," said Assoc Prof Duong.

NUS said the team has filed a patent for the novel cotton aerogels and is exploring commercial opportunities.

Source: CNA/hs