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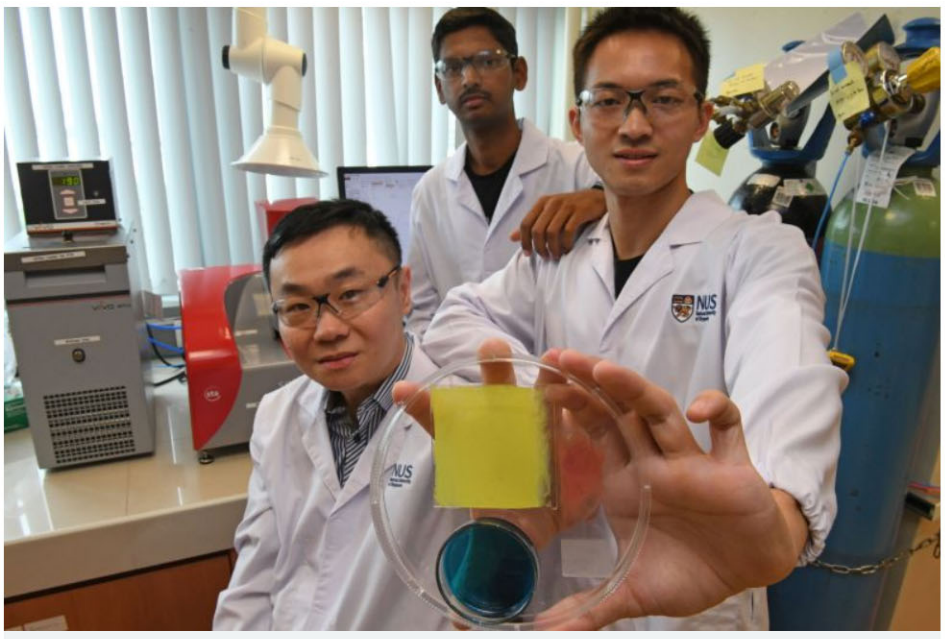
PREMIUM

NUS researchers invent 'humidity digester' to keep rooms feeling cool at zero energy cost



A team of researchers from NUS developed a hydrogel which, when combined with some chemicals and a thin carbon mesh, can absorb water vapour from the air and break it down into hydrogen and oxygen molecules, lowering the humidity in a room. ST PHOTO: DESMOND FOO

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Timothy Goh

SINGAPORE - A team of researchers from the National University of Singapore's (NUS) Faculty of Engineering has invented a novel way to lower the humidity in a room without using energy.

The team developed a hydrogel which, when combined with some chemicals and a thin carbon mesh, can absorb water vapour from the air and break it down into hydrogen and oxygen molecules, lowering the humidity in a room.

The team comprises Assistant Professor Tan Swee Ching, research fellow Dr Yang Lin and doctoral student Dilip Krishna Nandakumar. They are from the Department of Materials Science and Engineering.

The work of the three scientists was partially funded by Temasek Foundation Ecosperity.

Asst Prof Tan told The Straits Times on Thursday (Dec 5): "A lot of people feel that Singapore is hot, but this is not exactly true - the relative humidity here is very high, which affects the way we perceive temperature.

"Let's say the temperature outside is 32 deg C and the relative humidity is 80 per cent, it can make it feel like it's over 40 deg C."

The monthly mean relative humidity in Singapore in October was 78.1 per cent, according to government data portal Data.gov.sg.

Lowering the relative humidity to 60 per cent could help lower the perceived temperature by six to seven degrees, said Asst Prof Tan.

"This is because sweat on our skin can evaporate easily, and remove our body heat as it does so," he added.

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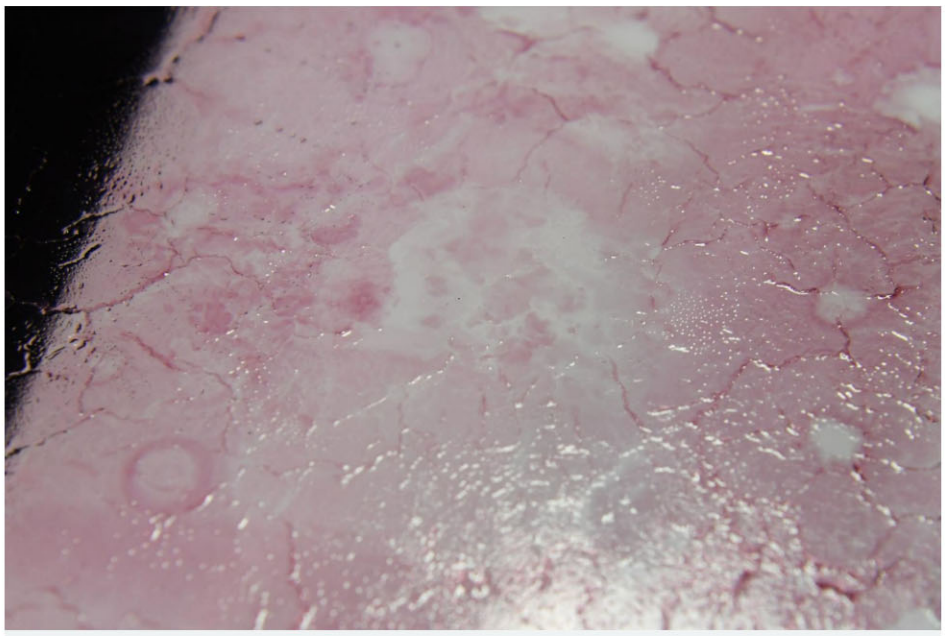

Close-up of the super moisture-absorbent gel with light-active material. ST PHOTO: DESMOND FOO

The gel is a porous material which is made by combining special chemical salts with a solvent and then baked.

Asst Prof Tan said that the team's hydrogel is able to absorb 10 times more moisture than silica gel, a common drying agent.

This is because the hydrogel is able to expand and contain more water.

"It's like if you have a plastic bottle or plastic bag, you can squeeze more things in it than if you had a metal container," he explained.

The team had previously developed a different hydrogel using zinc as a primary ingredient, which could also absorb moisture.

But Mr Dilip said that the current hydrogel, which uses cobalt instead, can absorb moisture almost twice as fast, and has a wider range of potential applications, as it is more versatile.

By itself, 1kg of the new hydrogel can absorb up to 4.5 litres of water. However, it would get saturated and stop absorbing more water after about a week.

"We realised that no material can absorb water forever," said Asst Prof Tan.

So the team came up with the idea of combining two chemicals - bismuth vanadate and barium titanate - to create what is known as a photoelectrocatalyst.

Put together with a thin carbon mesh, this new chemical compound is able to split water molecules into their hydrogen and oxygen atoms using ambient light or electrical energy, releasing them back into the environment as gas.

Mixing this with the gel ensures it does not become saturated with water, allowing it to be reused continually, said Asst Prof Tan.

The process, which does not consume energy from external sources, can also be enhanced by attaching a solar panel to the material.

The team has dubbed the combination of gel, the compound and carbon mesh the "humidity digester".

It is able to reduce the humidity of a small enclosed space from 80 per cent to 60 per cent under test conditions using 0.1g of the material inside a 0.012m cubed tank.

The team is in the midst of running larger scale tests.

Asst Prof Tan said they are looking at several applications for the product, including applying it as a coating on indoor surfaces, or using it in air-conditioning units, where about 30 to 40 per cent of energy goes into dehumidifying the air.

He added: "We're looking to improve the thermal comfort of people at minimal, or zero, energy expense in near future."