Source: *The Straits Times,* pB1
Date: 26 March 2022

NUS team develops material to battle heat

Assistant Professor Tan Swee Ching of the National University of Singapore and Dr Saravana Kumar of the Home Team Science and Technology Agency testing a sheet of the moisture-trapping film in a climatic chamber. When produced at scale, the film has the potential to make uncomfortably hot clothing items more cooling, said Prof Tan. ST PHOTO: ONG WEE JIN

Film lowers felt temperatures in protective suits by enhancing evaporation of sweat

Ang Qing

While most people resign themselves to sweating it out in the tropics, a professor returning to Singapore after seven years abroad in cooler climates was spurred to develop a material that could battle the heat.

When Assistant Professor Tan Swee Ching at the National University of Singapore (NUS) came back in 2014 from Hong Kong, he found that he was no longer used to the heat and humidity here.

"I thought to myself, if only we had something to reduce relative humidity, we would not need to turn on the air-conditioner," said the researcher from NUS' Department of Materials Science and Engineering.

High amounts of moisture in the air, or humidity, on tropical islands such as Singapore make it harder for sweat to evaporate, thus making temperatures feel hotter than they are.

Prof Tan's concern about heat stress grew as the Covid-19 pandemic hit, and he realised that healthcare workers endured a felt temperature of about 64 deg C when donning personal protective equipment at room temperature.

So he led a team of NUS researchers to develop a composite film that lowers felt temperatures to 40 deg C in protective suits by enhancing sweat evaporation.

Through trial and error over about eight months last year, the team created a non-toxic, moisture-trapping material composed of metallic salt, rubber and several chemicals.

To test the feasibility of applying the composite film in clothing, scientists from the Home Team Science and Technology Agency (HTX) helped to incorporate the film in a protective suit and tested its efficacy with a manikin that can move and simulate human sweat.

Through experiments, the researchers found that the suit could reduce humidity at peak performance for at least two hours.

When produced at scale, the lightweight material has the potential to make uncomfortably hot clothing items – from face masks to military uniforms – more cooling, said Prof Tan.

HTX scientists hope to further optimise the material for equipment and clothing worn by firefighters, emergency medical service personnel and other frontline officers who work in hot and humid conditions for long hours.

Currently, the material still needs to be improved for open environments because its ability to capture sweat is hindered when exposed to ambient moisture.

Dr Saravana Kumar, HTX deputy director of the Human Factors and Simulation Centre of Expertise, said: "We are keen to explore the possibility of enhancing the efficacy of the material for non-encapsulated suits like firefighter suits, such that it can also deliver a significant cooling effect despite absorption of ambient moisture."

Meanwhile, the NUS team is looking for partners to commercialise the film. Said Prof Tan: "The material for one suit costs $4 to produce in a lab environment, but this can be lowered when scaled up."

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