MATERIALS

"Elephant skin" mycelium tiles keep buildings chilled – and look cool, too

By Bronwyn Thompson
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The hexagonal tiles would make an eye-catching facade NTU Singapore

Oyster mushrooms and repurposed bamboo furniture scraps may be an unlikely combination for a tough building material, but engineers have used this curious mix to create a new biomimicry-inspired tile, featuring bumps and crevices like elephant skin, designed to keep walls cool and withstand the elements.

Scientists led by Nanyang Technological University, Singapore (NTU Singapore) have created what they call "fungi tiles," designed to passively cool buildings and withstand environmental forces like heavy rain in tropical climates.

“Insulation materials are increasingly integrated into building walls to enhance energy efficiency, but these are mostly synthetic and come with environmental consequences throughout their life cycle," said Hortense Le Ferrand, an associate professor at NTU’s Schools of Mechanical and Aerospace Engineering (MAE) and Materials Science and Engineering (MSE). "Mycelium-bound composite is a

biodegradable material that is highly porous, which makes it a good insulator. In fact, its thermal conductivity is comparable to or better than some of the synthetic insulating materials used in buildings today."

This new wall tile made from fungi cools buildings

Mycelium is increasingly being engineered to form the foundation of new biotech materials – from soundproofing to cement, and is even being developed as a tool to mop up oil spills and insulate homes to protect from fire. Here, researchers combined the mycelium of the common oyster mushroom (*Pleurotus ostreatus*) with bamboo shavings that had been repurposed from scrap at a furniture store. The core materials were then mixed with oats and water and pressed into molds with bubble-like indents and rough line patterns. Then, the tiles were left to "grow" in the dark for four weeks – two in the the mold and two when they'd been popped out – before being dried for three days in a hot oven.

The mold was the result of a collaboration between the NTU team and the Singaporean ecology and biomimicry design firm bioSEA, and it was engineered to not just have the undulating bumps but a textured pattern that resembled elephant skin. The large animals have a specialized cooling system: Mud, sparse fine hairs and wrinkles and crevices that help retain moisture, dissipate heat and regulate temperature.

The bamboo-mycelium mix, as it is packed into the mold, resembles pork floss

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“Elephants are large animals that live in hot and sometimes humid tropical climates," said Anuj Jain, Founding Director of bioSEA. "To withstand the heat, elephants evolved to develop a skin that is heavily wrinkled which increases water retention and cools the animal by evaporation. We were inspired by how an elephant could cool itself in hot weather without sweat glands, and tried to see how we could replicate the same cooling mechanisms of shading, trapping cool air, and increasing the surface area for water to evaporate.”

The scientists placed the tiles on a 100 °C (212 °F) hot plate for 15 minutes and tracked temperature changes with an infrared camera. The elephant skin design was slower to absorb heat, keeping the flat underside cooler, and that flat side also cooled more rapidly. In simulated rain tests, droplets of water were held in the tile's crevices, but not absorbed into the material, resulting in even more effective cooling.

“The fungal skin that develops on the tile’s surface repels water, allowing droplets to remain on the surface rather than roll off immediately," said the study's firth author Eugene Soh, a researcher at NTU. "This promotes evaporative cooling, increasing the cooling rate."

The tile team (from left): Assoc Prof Hortense Le Ferrand, Anuj Jain, Teo Jia Heng and Eugene Soh

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The scientists are now working on testing the tile's durability and also whether different mushroom species could improve the material's structure and function. While scalable, inexpensive and sustainable – the team is working with a local startup, Mykílio, to increase output and conduct outdoor tests – there are some limitations. Most notably, the time it takes for the mycelium to grow – a month to produce a tile would need some serious growing room to be commercially viable.

“We’ve developed a promising eco-friendly alternative that transforms waste into a valuable resource while rethinking conventional thermal management materials," said Le Ferrend. "This opens the pathway for more elephant skin-inspired designs and the use of different mycelium strains to overcome the challenges that come with using mycelium tiles as an alternative construction material.”

The research was published in the journal *Energy and Buildings*.

Source: Nanyang Technological University Singapore

https://newatlas.com/materials/elephant-skin-mycelium-tiles/