DAILY SCIENCE

The unusual inspiration for this energy-free cooling system is elephant skin

Mimicking the heat-regulating ability of an elephant's skin, the bumpy fungus-based tiles improved cooling rates by as much as 70% compared to flat tiles.

By Anthropocene Team

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Wrinkles on elephants make the gentle beasts look wise. But they also serve an important purpose: the crevices and the porous skin hold water and help keep the pachiderms cool by storing water and expelling heat via evaporation.

Researchers have now turned to elephant skin as an unusual source of inspiration for tiles that provide energy-free cooling for buildings and homes. They have used mycelium, the root network of fungi, to make wall tiles that have a bumpy, elephant skin-like texture.

The tiles, reported in the journal ***Energy & Buildings***, improve the cooling rate by 25% compared to flat tiles. That cooling effect goes up to 70% under simulated rain conditions, showing promise for energy-free passive cooling in tropical climates

As global temperatures rise, cooling has become a major use of energy. Cooling demands are especially high in dense, urban environments which suffer from the **urban heat-island effect**. Air-conditioning not only consumes a lot of energy, it can be expensive and not accessible to many people around the world.

Passive methods such as **natural cooling materials**, **cool roofs**, apertures in building facades, and strategic positioning and opening of doors and windows all offer relief. But many of these solutions use unsustainable materials such as cement or are inconvenient to implement, writes the team from Nanyang Technological University. Plus, they write, "in tropical climates where there is both high humidity and high temperature, many of these passive cooling methods are challenged."

In their quest for an accessible, **sustainable solution**, they turned to a composite material made of fungi mycelium. They make it by letting the fungus grow on bamboo microfibers. This results in an interconnected network that binds the microfibers together. By packing the susbstrate and growing the composite inside silicone molds, the researchers create tiles with a groove-and-bump pattern on their surfaces.

To test the tiles' cooling prowess, the team placed tiles on a 100 °C hot plate for 15 minutes and measured temperature changes with an infrared camera. The textured tiles absorbed heat more slowly than the flat ones, keeping their flat underside cooler, and that flat side also cooled faster.

Just as in elephant skin, the grooves between the bumps are not directly exposed to heat, which kept that area slightly cooler. In simulated rain tests, water droplets stayed in the tile's crevices and then evaporated as the water heated up, resulting in even more effective cooling of the tile surface. The 1 mm grooves between the bumps also hold 5–10 times more water compared to a flat tile.

The biodegradable tiles provide a green solution in an industry where some of the commonly used materials are not the most environmentally friendly, the team writes. The researchers now plan to test the tiles outdoors in tropical climates for performance and durability.

Source: Eugene Soh et al. Biodegradable mycelium tiles with elephant skin inspired texture for thermal regulation of buildings. *Energy & Buildings*, 2025.

Photo: Nanyang Technological University

https://www.anthropocenemagazine.org/2025/04/the-unusual-inspiration-for-this-energy-free-cooling-system-is-elephant-skin/