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## THE ELEPHANT ON THE WALL

Inspired by elephants, researchers grow fungus in elephant-skin patterns to create better insulation for buildings.

> Keeping cool or warm is a daily issue for many. With climate change, this becomes an urgent matter for millions. Looking for environmentally friendly solutions, Singapore scientists have developed new wood-decaying-fungus tiles with an elephant-skin-inspired design. This offers a better approach than energy-intensive cooling or insulation using environmentally harmful materials.

> "The materials currently used in walls to keep a pleasant temperature indoors consist essentially of glass wool for thermal insulation, and tile or paint with white colour for reflecting the sunlight. But glass wool and ceramic tiles or paint are materials produced using expensive processes and using non-biodegradable materials," explains Hortense Le Ferrand from Nanyang Technological University, who led the research funded by the National Research Foundation Singapore and ETH Zurich Switzerland.

"We combine elements of biomimicry with bioengineering by using a living material, which is a wood-decaying fungus, to produce the product," says Le Ferrand. The team first developed designs that mimic the texture of elephant skin, which has bumps and wrinkles for water to flow and evaporate, creating a cooling effect. They tested different designs with computer simulations to find an optimal pattern for insulation.

Next, they 3D-printed a tile in plastic and used that to create a silicone mould of the design. They could then grow fungus in the mould to create the final biodegradable tiles. The process is straightforward and doesn't require advanced equipment.

"Using waste biomass, in our case bamboo microfibres, and a natural common fungus, the tiles are part of a circular economy. Because they're made of natural materials, they're entirely biodegradable. But the



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The [tiles] are made of natural materials, therefore entirely biodegradable, while the special properties of the fungus also make them weather-resistant.



special properties of the fungus also make them weather-resistant," says Le Ferrand.

The design of the tiles means that the textured front of the tiles heats more slowly and cools more quickly than the flat backside. Using them on the outside of buildings would thus help insulate from heat coming in while letting the building cool down. The tiles cool even more effectively when they're wet, making them especially useful in tropical environments like Singapore.

"This approach challenges traditional construction industries. The tiles and the process bring us closer to nature while placing human needs and well-being at the centre of the technology," says Le Ferrand.

The research was published in the *Journal* of Cleaner Production and *IOP Conference* Series: Earth and Environmental Science. The scientists collaborated with Singapore companies, bioSEA Ltd for design and Mykillio, for commercialisation of the tiles.

