Mycelium thermal insulation material

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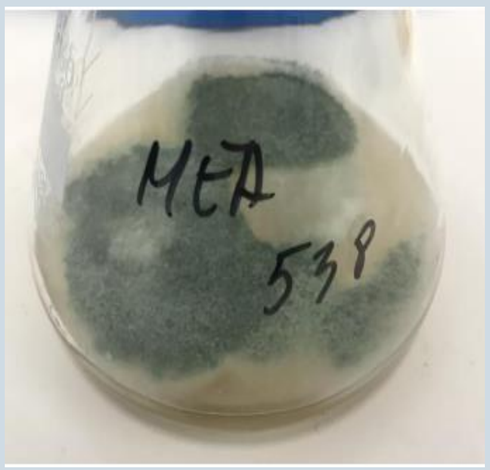
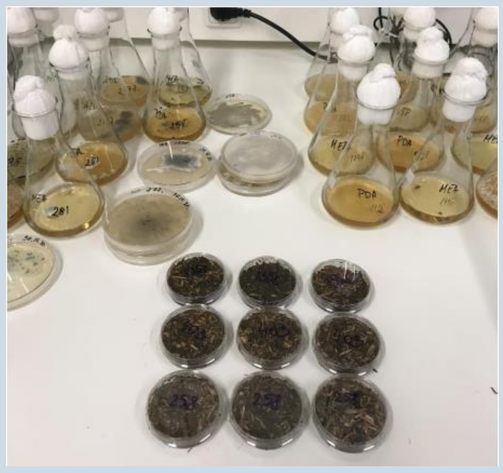
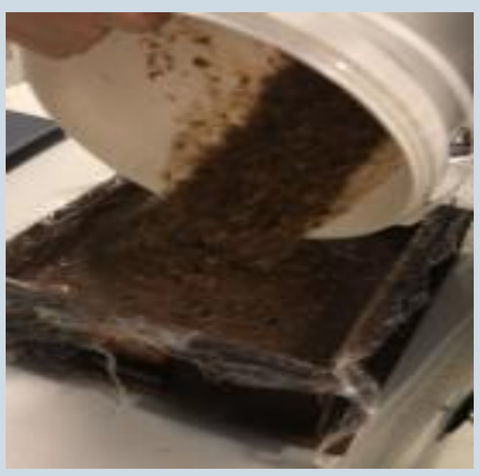


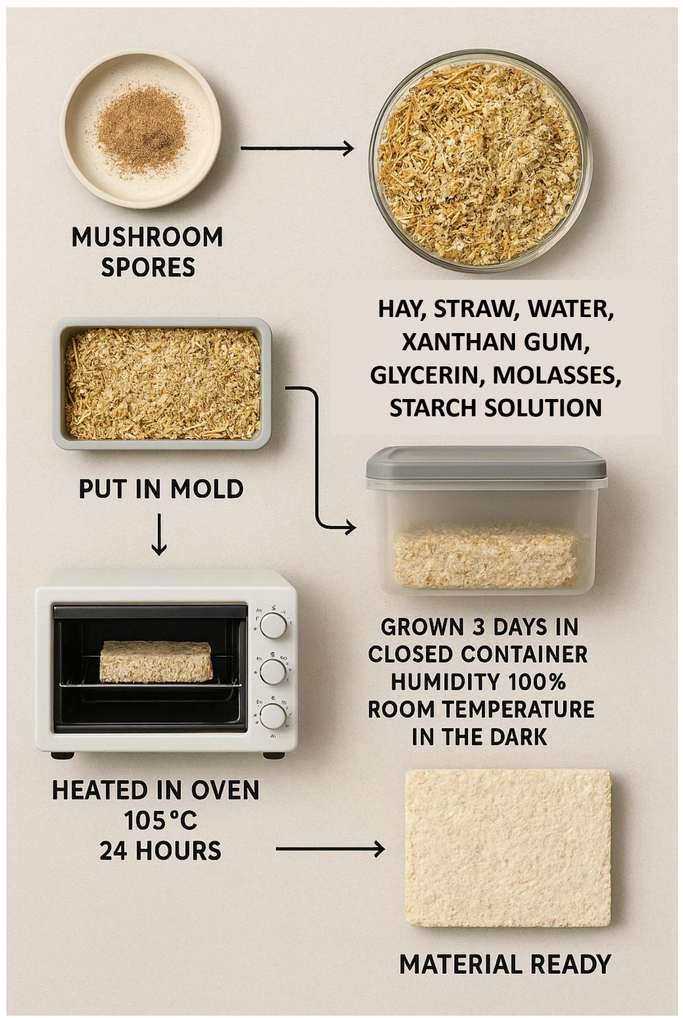




Introduction

Sustainable thermal insulation and environmental protection are key challenges of the 21st century, especially as energy consumption grows and resources dwindle. The construction sector, responsible for around 40% of global energy use and 36% of CO_2 emissions, is prioritizing energy efficiency through advanced insulation. Bio-based materials like wood fiber, hemp, and straw are gaining popularity, alongside circular economy strategies. Among these, mycelium biocomposites stand out as a biodegradable and moldable alternative to synthetic insulation. While they offer environmental and design benefits, challenges like water absorption and labor-intensive production remain. Continued research and process optimization are needed to unlock their full potential.

Methodology



Results

Aspects	Results and Observations
Thermal Conductivity	Ranged from 0.039 to 0.05 W/m·K (19 experimental samples); values comparable to mineral wool and EPS
Density	Varied from 72 to 120 kg/m³ depending on substrate: •120 kg/m³ – high woodchip content •72 kg/m³ – straw or hay-based substrates
Mechanical Properties	Higher density samples showed greater mechanical stability •Withstood compressive loads •Maintained shape after thermal treatment and dehydration
Ecological Aspects	•Made from renewable resources (straw, hay, woodchips) •No toxic chemicals used •Biodegradable •Low carbon emissions

Conclusion

- The experimental results demonstrate that mycelium-based composite materials have strong potential as sustainable thermal insulation.
- Their thermal conductivity values are comparable to conventional materials like mineral wool and EPS, confirming their effectiveness in reducing energy loss in buildings.
- Higher-density samples showed better mechanical stability, making them more suitable for structural applications, while lower-density samples provided improved insulation but require further development in terms of durability. From an environmental perspective, these materials stand out due to their biodegradability, production from renewable agricultural waste, and absence of toxic chemicals.
- Overall, mycelium composites present a promising eco-friendly alternative in the construction sector, contributing to energy efficiency and the principles of the circular economy.

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