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# Mycelium Building Materials - A Future Sustainable Construction Material

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***Abstract* - Mycelium composites are an emerging class of cheap and environmentally sustainable materials that can improve the energy performance of building. Manufacturing of Styrofoam and plastic construction materials greatly contribute to global warming by the discharge of chemical and hazardous waste materials to the environment. This condition or situation can be avoided by usage of bio-based, biodegradable materials in the environment. Mycelium composite materials are such type of materials that is made from mycelium (fungal threads network) and wood sawdust that is easily available. This project on mycelium building materials conveys that they can be used as a better insulation because of its low thermal conductivity properties. Materials made of mushrooms are strong and inherently fire resistant, and they are simple to mould. Using mycelium in building provides fantastic prospects for repurposing agricultural waste into a reasonably priced, environmentally friendly, and biodegradable material substitute. They protect the environment and are carbon neutral.**

***Keywords:*** Styrofoam, Biodegradable, Thermal conductivity.

## I. INTRODUCTION

The concept of eco-friendly materials is gaining popularity in society, which heightens the difficulties facing our society's transition to a sustainable economy. The manufacturing of materials and consumer goods requires less non-renewable resources in order to achieve this. Mycelium-based renewable materials have the potential to benefit the environment, primarily from the fungus that produce mushrooms since they are recognized for their propensity to colonise vast regions in the natural world. In comparison to other foams or expanded polystyrene, composite materials have been demonstrated to possess similar qualities. The primary determinants of the formation of mycelium composites are the interaction of the fungus with its lignocellulosic substrate and the manufacturing process variables that results in their mechanical behavior.

Commercially relevant mycelium composites are already generated for acoustic panels, packing, and interior design. The purpose of this project was to create mycelium building materials using scrap wood from forestry and agriculture in the area as well as mycelium from the white fungus Postreatus. The material property of thermal conductivity is determined.

### Objectives

- To determine the thermal conductivity of the mycelium brick.

## II. METHODOLOGY

- Material collection
- Mould preparation (210x100x60mm)
- Substrate preparation
- Casting of mycelium brick with 1:10 ratio mycelium and substrate
- Placing the specimen for 28 days in dark room controlling growth condition
- Baking in oven in 70-80$^{o}$C
- Thermal conductivity test on specimen

## III. EXPERIMENTAL PROCEDURE

### Mycelium Building Material

Mycelium, the root or hyphae structure of mushroom (fungi) which grows in a network like mode, which is used for the casting of mycelium brick. Mycelium building materials are made from different combinations of fungi or mushroom with different varieties of substrate like sawdust, straw and other materials that can make a bond with the fungi. Mycelium can be easily grown in fields with less raw materials, but need proper conditioning of temperature and humidity that alters the growth of the mycelium. Usage of sterilized sawdust or other substrate only can make effective growth in the network structure.

Based on the type of fungi and substrate used, the properties like compressive strength, bonding, water absorption etc of mycelium material varies widely. More compacted mycelium structure also provides properties to the building material.

 

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**Figure 1: Mycelium Building Material**

### Properties

In view of the presence of mycelium particles in every part of the structure, the brick formed has got color of white. After baking its color varies. The bonding between the brick is by virtue of the anastomosis in the structure between the fungi and the rubber wood sawdust substrate used in manufacturing. This bonding helps to reduce the conductivity of heat, which makes the material an insulator.

It also makes the material impact resistant to a certain range by maintaining its position which makes it as an alternative material for Styrofoam.

**Table 1: Composition of mycelium material**

| | |
|---|---|
| Mycelium Spawn Seeds | 30g |
| Rubber wood sawdust | 300g |
| Rice flour | 20g |

## IV. SPECIMEN TESTING

For determining the thermal conductivity property of the mycelium building material, the specimen is tested by using thermal conductivity meter after baking of material for 2 – 3 hours, to obtain thermal conductivity in W/(m/K). Three number of specimen is tested and the average value is determined. The results obtained for the same are given below:

**Table 2: Thermal conductivity test results**

| SL. No | Thermal Conductivity W/(m/K) | Average W/(m/K) |
|---|---|---|
| 1 | 0.078 | 0.086 |
| 2 | 0.071 | |
| 3 | 0.109 | |

## V. RESULTS AND DISCUSSION

The obtained average value of thermal conductivity is 0.086 W/(m/K).The obtained value is a lesser value than that of normal insulators having value 0.1 W/(m/K), which implies that the material have a low thermal conductivity, which can be used as a best insulation material.

## VI. CONCLUSION

An alternative replacement material for insulators made from different chemical polymers. Shows 15 – 20% of improved thermal properties than a normal insulator. Replacement for packaging material like Styrofoam and other plastic originated materials.

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