Mush-Room

Material Research and Innovative Design of Mycelium

Mycelium has great potential as a low-cost and fully degradable biomaterial. The inherent vitality of this material makes it even more attractive. This series of mycelium homeware designs attempt to bring this new biomaterial closer to people's everyday lives.

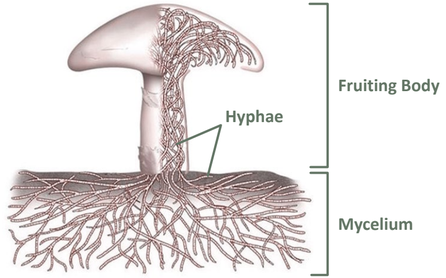
2022.1-2022.6
Individual Work

BACKGROUND

The global shortage of resources and environmental problems have aroused people's widespread concern.

Sustainable design is the inevitable trend of future design development and the right materials are fundamental to sustainable design.

DESK RESEARCH



Mycelium is the nutrient of edible fungi, which takes agricultural waste as food. The composite material formed by combining mycelium and culture medium has the characteristics of natural degradation.

EXPERT INTERVIEW

Mr. Zhou

Wuhan Edible Fungi Research Institute
Interview Time: 2022.1.26
Interview Method: Online

Key points

- The fast growing species, like oyster mushroom, is suitable to be selected for further experiments
- The cultivation cost of edible fungus is low and the yield is large
- Tissue culture or slice culture can be considered in later cultivation experiments
- Existing methods of mycelium treatment do not make good use of the characteristic of mycelium materials

EXPERIMENT

Growth Experiment — Find the influence of environmental variables on mycelia growth. Determine the most efficient way to obtain ideal mycelium material.

Performance Test — Understand the basic properties of mycelium materials and conceive application fields.

Extended Experiment — To further understand the properties of mycelium and find inspiration for specific application design.

Growth Experiment

Experiment Date	1.27	2.6	2.12	2.15	2.20
Source of Fungi	Oyster mushroom root 7g	Oyster mushroom root 7g	Oyster mushroom root 7g	Home grown strains	Cultivate strains for farmers
Culture Substrate	Corncob	Corncob	Corncob	Mixed agricultural waste	Mixed agricultural waste
Additive	Corn starch 1g / Corn starch 1g+2g	Corn starch 1g+0g / 1g+1g / 1g+2g	Corn starch 1g	Corn starch 1g	Corn starch 1g
Ventilation Mode	Use 4-hole plastic cover	Use 4-hole plastic cover	Use sterile breathable sealing film	Use sterile breathable sealing film	Use sterile breathable sealing film
Growth Process	One-time growth / Break up, fill the mold for secondary growth (loose)	Break up, fill the mold for secondary growth (loose)	Break up, fill the mold for secondary growth (Compacted)	Break up, fill the mold for secondary growth (Compacted)	Break up, fill the mold for secondary growth (Compacted)
Experimental Conclusion	After secondary growth, the mycelium is more dense, but the final sample grew mold for unknown reasons	Mold is easy to grow in an over nutritious environment	The compacted matrix is more conducive to the spread of mycelium	The strains are of poor quality	The experiment period is short and can be used for later cultivation

Experiment Date	1.4	1.11	1.15	1.16	1.21
Source of Fungi	Oyster mushroom root 4g	Oyster mushroom root 7g	Oyster mushroom root 7g	Oyster mushroom root 7g / Shii-take root 7g / Oyster mushroom root 7g	Oyster mushroom root 7g
Culture Substrate	Stack corrugated paper / Corrugated paper scrap	Corrugated paper scrap	Corncob	Corncob / Cottonseed hull	Corncob
Additive	Corn starch 2g / None	Corn starch 2g	Corn starch 1g / 2g / 3g	Corn starch 1g	Corn starch 1g
Ventilation Mode	Open the lid for 5 minutes per day / None	Open the lid for 5 minutes per day / Use porous plastic cover	Open the lid for 5 minutes per day / Use 6-hole plastic cover	Use 4-hole / 6-hole / 8-hole plastic cover	Use 4-hole plastic cover
Growth Process	One-time growth	One-time growth	One-time growth	One-time growth	One-time growth
Experimental Conclusion	Corn starch can accelerate the growth of mycelium to a certain extent Fragmented corrugated paper is more conducive to mycelium spread Mycelium growth requires a certain amount of oxygen	Too low humidity will stop mycelium growth	Corn starch content above 1g has little difference about the effect on the growth rate of mycelium	Pleurotus ostreatus mycelium has the lowest requirements for growth environment, and the cultivation success rate is high	The mycelium material after baking is fragile

Invariant experimental conditions:

26 C , completely dark, sterile environment

- The final cultivation method of mycelium materials is determined through the growth experiment.
  The whole cycle is 5-7 days.

Step 1

Mix the mushroom root fragments with the substrate

Get nutrients & Grow mycelium

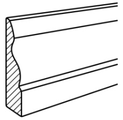
Use ready-made cultivated species to shorten the cultivation cycle

Step 2

Break up the mixture after the white mycelium is covered with the matrix

Step 3

Fill the mould

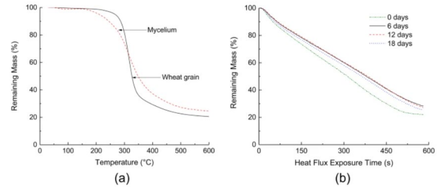


Secondary growth & Increased strength

Performance Test

- **Density** ≈0.37g/cm3
- **Flame Retardancy & Water Resistance**

The conclusion that mycelium materials have excellent flame retardancy and water resistance is mainly obtained through a large number of literature research, and carried out with experimental verification.



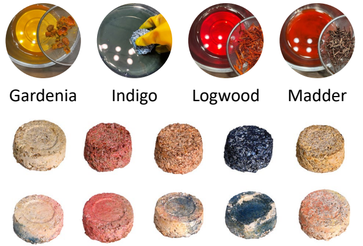
Jones M, Bhat T, Kandare E, et al. Thermal degradation and fire properties of fungal mycelium and mycelium-biomass composite materials[J]. Scientific reports, 2018, 8(1): 1-10.

Absorption (mL)						
	Without pine tar coating			With pine tar coating		
Test nr	1	2	3	4	5	6
Sample orientation	Horizontal	Horizontal	Vertical	Horizontal	Horizontal	Vertical
After 5 min	0	0	0	Total	0	0
After 10 min	0	0	0	–	0	0
After 15 min	0	0	0	–	0	0

Vallas T, Courard L. Using nature in architecture: Building a living house with mycelium and trees[J]. Frontiers of Architectural Research, 2017, 6(3): 318-328.

Extended Experiment

- **Color**



- **Shaping**

Combining with other materials

- The mycelium material can achieve color effects such as pure color, gradual dyeing and superposition dyeing.
- It can produce surface texture with high accuracy and carry out three-dimensional molding.
- It has strong adhesion, which can make the materials, that is originally loose, closely connected and shaped.

MATERIAL ANALYSIS

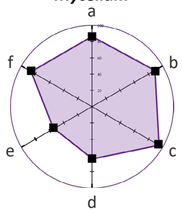
Physical

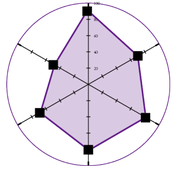
Mycelium

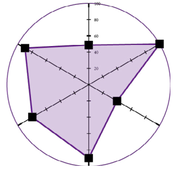
Cork

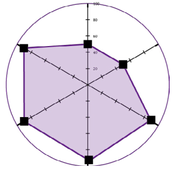
EPS Foam Board

Pulp





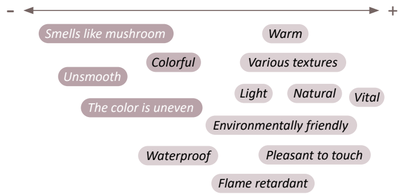




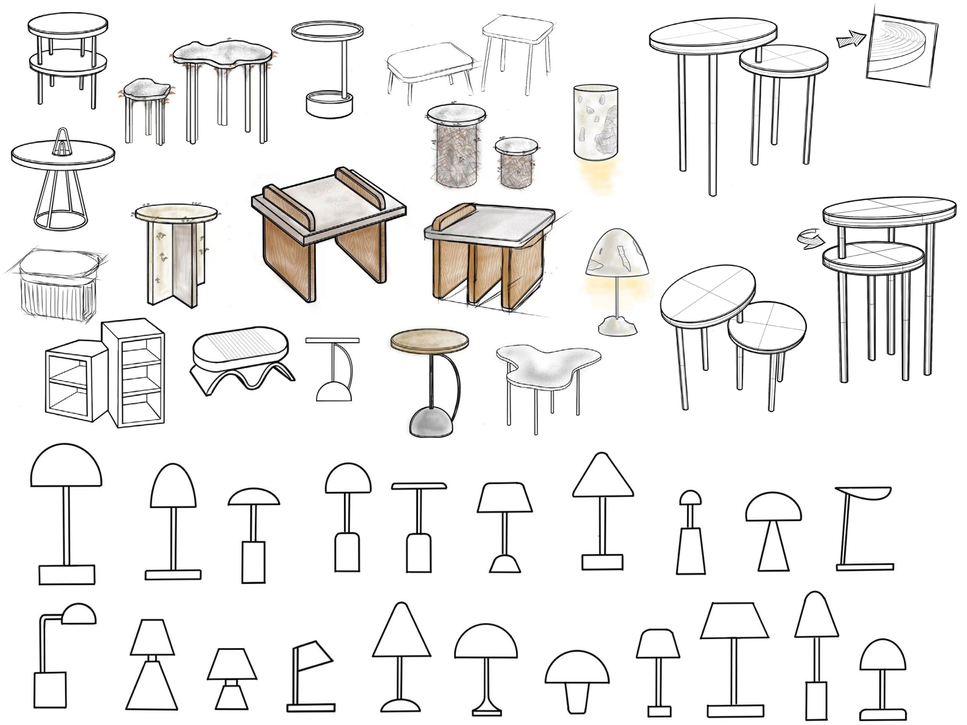
a: Flame Retardancy
b: Water Resistance
c: Environmental Protection
d: Shading Effect
e: Shaping effect
f: Cost

Emotional

Using the mycelium samples obtained from the previous material experiments to conduct user research to further understand the acceptance and preliminary impression of mycelium.



DRAFT



PRODUCT MAKING





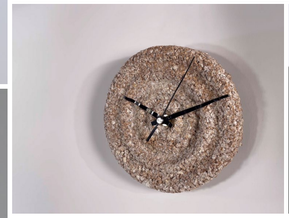


● Video: https://youtu.be/gt6ZaBLHRl8











Mush-room series presents the characteristics of mycelium material in a variety of ways, making this material more acceptable to the public in the form of household products.