

Hong Kong Student Science Project Competition 2022

Template of Extended Abstract (Investigation)

(Word Limit: 1,000 words, Pages: 2 pages only)

Team Number: SBBC040

Project Title: MycoPack

Project Type: Investigation

To our best knowledge and after thorough literature research, as at 14/2/2023, there are similar works. If there are, the reference links are as below:

Abhijith R., et al. "Sustainable packaging applications from mycelium to substitute polystyrene: a review." Science Direct, 3 Feb 2018, <https://www.sciencedirect.com/science/article/pii/S2214785317319508>. Accessed 14 Feb 2023.

The enhancement our project has made for the existing related products or research is summarized as below:

- We devised MycoPaper (blended mycelium) and MycoSheet (sheet substrate), which is original from the above work
- Other than substituting polystyrene, we investigated in more forms of application of mycelium-based substrate

I. Background

As the demand for shipped products surge, so do the amount of waste produced by the one-time packaging used in each delivery. In our literature review, we touched on the pollution caused by this industry. Plastic mailers, plastic-lined packaging, and plastic-based fillers in particular contribute to severe global issues like microplastic pollution, acid rain, and toxin emission.

Facing this issue, we devised 3 products.

- 1) MycoPaper : Recycled paper made from blending mushroom fruiting bodies
- 2) MycoSheet : Mycelium composite grown on sheet substrate
- 3) MycoPack : Mycelium composite grown on block substrate

II. Objectives

We aim to investigate in a packaging workflow that...

- 1) forms a self-sufficient cycle of sustainable operation with little maintenance
- 2) is biodegradable and compatible with the environment
- 3) releases little to no pollutants.

III. Hypothesis

A few hypotheses were made in each stage of our project.

Stage 1: MycoPaper

- Longer blending time gives paper with less spotting on the surface
- Addition of CaCO₃ gives a whiter product
- Addition of vinegar bleaches the paper white
- Coating enhances flexibility of paper
- Waterproof coating enhances water resistance.

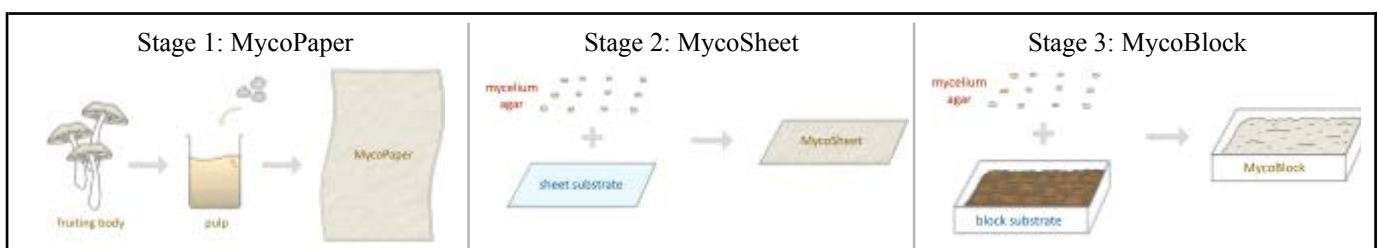
Stage 2: MycoSheet

- Allowing mycelium to grow on tissue paper can produce a sheet of mycelium that takes the shape of the substrate beneath it.

Stage 3: MycoBlock

- Cotton is preferable over rice husks as mycelium substrate, since it's less compact, allowing its hyphae to spread its colony easier.

IV. Methodology



To observe the effects of the changed parameters, a control setup is used in Stage 1.

- allows comparison between experimental setup and control
 - thickness, appearance, strength, water resistance

V. Results

Data

Stage 1: MycoPaper



To compare the effectiveness of waterproof coating, samples are immersed in water for 2.5 hours.

The average water absorption (by weight) are as followed:

Control	Waterproof Coating
+175%	+102%

Stage 2: MycoSheet

(green: mycelium) (red: contaminated)



Stage 3: MycoBlock

(green: mycelium) (red: contaminated)



Improvement

- to ensure even inoculation, rather than using cubes of agar, composite is first allowed to grow (to expand the mycelium network), then broken up to ensure even dispersal of mycelium starters

Application

We think the MycoPack products can be used as replacements of the following:



VI. Conclusion

Results

Stage 1: MycoPaper

- ✓ Blending time should be longer for coherent color
- ✓ Addition of calcium carbonate can be used to whiten the product
- ✗ Addition of vinegar doesn't turn paper white, but make it semi-transparent
- ✗ Our coatings tested did not strengthen the paper significantly
- ✓ Waterproof coating is advised to be sprayed on to enhance water resistance.

Stage 2: MycoSheet

- ✓ The product of MycoSheet showed positive results, mycelium did take on the shape of substrate beneath it.

Stage 3: MycoBlock

- ✓ Cotton showed better mycelium growth than rice husk substrate.

✗ Our project is developed based on our school's previous project and the enhancement is as below: