Hong Kong Student Science Project Competition 2022

Template of Extended Abstract (Invention)
(Word Limit: 1,000 words, Pages: 2 pages only)

Team Number: JABC255

Project Title: World of Mycelium

Project Type: Invention

To our best knowledge and after thorough literature research, as at 30/6/2022 , there are no similar works. If there are, the reference links are as below:

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

***Please delete if not applicable. HKSSPC values the originality of works. Students must conduct literature research thoroughly to ensure that their works are unique, and to list relevant reference materials to complement the research or invention.**

I. Background

In this project, we would like to raise awareness on the problem of the increasing use of non-renewable resources, like plastic. The choice of using fungi is due to its beneficial nature. Since mycelium is composed of chitin, cellulose, and many more polymers which can be defined as a natural fibrous material, it can be decomposed and is biodegradable. The kickboard is hard and not easy to break since mycelium acts as a strong binding material, it puts together agricultural waste like coffee grounds and straws, resulting in a decrease in solid manufacturing waste (Hawksworth, & Lücking, 2017). It also possesses the qualities of being able to float and replace plastic due to its lightweight, stiff, and easily shaped properties (Abhijith, Ashok, Rejeesh, 2018) By targeting children and families that may use kickboards, we would like to provide them with an alternative that can better contribute to the world.

II. Objectives

To promote environmental and economic sustainable development through replacing non-biodegradable products with biodegradable ones, as demonstrated in the production of mycelium-based kickboards.

III. Methodology

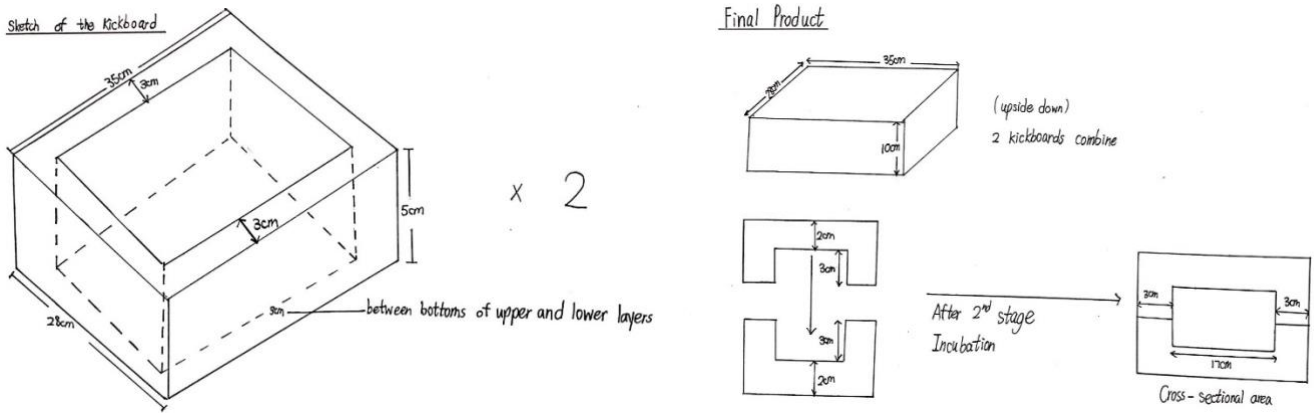
Firstly, we prepared the substrate packs. We used water, lime, oat, sugar, sawdust, and coffee grounds mix for the substrate packs. After autoclaving the packs, we inoculated the packs with mycelium, using aseptic technique. Next, we set the substrate packs aside in a dark environment for mycelium to grow. After 3 to 4 weeks, we disintegrated the substrate pack, added flour and water to the fine substrate pieces and mixed them well. The mixture was put into different moulds. We then incubated the moulds with mycelium mixture for 1 to 2 weeks in the incubator. When the incubation was complete, the kickboard prototypes were made. Finally, we applied coating on the surfaces of the kickboard prototypes. We then conducted buoyancy tests on our kickboard prototypes. We must perform all the steps with aseptic techniques to ensure there is no contamination of the biomaterial.

IV. Design of Invention

Our design consists of two main parts. Firstly, the waterproof function of the kickboard—It is important to design a kickboard which floats on water and does not absorb water. Because when the mycelium substrate absorbs water, its mass increases and the buoyant force may be lowered, therefore we used waterproof spray film as a coating. We had applied 3 layers of transparent and blue waterproof coating each to ensure that the kickboard was completely protected from water leakage. Secondly, the dimension of the kickboard–which was adjusted based on the results obtained from the buoyancy test on our prototypes. For details of the buoyancy test, please refer to part 3 methodology. During the

test, we found out that the buoyant force of the prototypes was not as high as we would have preferred. Based on the common principle that when volume increases, the mass increases as well. Therefore, we came up with a new design of making 2 'drawer-like' boxes (35cmx 28cm x 5cm), each with a hollow centre (29cm x 22cmx 3cm), then assemble the two boxes together to form the kickboard. This new kickboard will have a hollow core, and can thus increase the volume by making a thicker and larger kickboard and potentially decrease or maintain its mass. According to the Archimedes principle, a decrease in mass can decrease its density and increase the up thrust force. The kickboard can float more easily as a result. (Elaty, Ghazy, 2018)

Diagram (Sketching)



V. pplication / Market Need

Our invention - mycelium-based kickboard - will be used as a tool for young children. It is not difficult to persuade businesses to produce such invention because people nowadays are becoming environmentally conscious. In 2021, Global Consumer Insights Pulse survey by PWC, indicated 61% and 50% of respondents working from and away from home respectively, preferred to use biodegradable products. Therefore, there is potential in developing products made of biomaterial and our invention can make a significant impact on the market because it proves biomaterial is a suitable alternative to foam or even plastic. It is one of the many small steps before achieving a sustainable future with little or even no plastic. Businesses can also attract customers with DIY coating design by forming a joint venture with the company that produces the coating. However, our invention has limitations. Firstly, our kickboard with best performance (dimension: 25x20x4.1 weight: 642g) is much heavier than a conventional kickboard (weight: 350g) but the current Buoyancy Force is only 13.56 N Therefore, the current market segment that can be targeted is young children only. Secondly, there are many uncertainties in production so it can be difficult to conduct mass production of our invention. That is why there is still a large room for improvement.

VI. Conclusion

In conclusion, the aim of the project is to replace plastic and foam products by inventing a kickboard made of mycelium to promote sustainable development and its target group is young children. We choose mycelium-based biomaterial as it is biodegradable, has low density and meets the market needs with an increasing preference for biodegradable and DIY products. All in All, we made three prototypes. Buoyancy tests were conducted according to the Archimedes principle for the floating properties of the prototypes. However, the buoyant force of two prototypes was smaller than expected. For further improvement, we decided to design a kickboard with a hollow core to increase its buoyancy force.

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