Hong Kong Student Science Project Competition 2022

Template of Extended Abstract (Invention Design Proposal)

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

Team Number: SCBC238

Project Title: Alternative of Plastic

Project Type: Invention Design Proposal

To our best knowledge and after thorough literature research, as at 3 / 23 / 2022 , there are / are no* similar works. If there are, the reference links are as below:

1. https://youtu.be/-_eGOyAiNIQ
2. https://www.wikihow.com/Make-Bioplastic?amp=1

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

Using arrowroot starch instead of cornstarch and the addition of chitin in the making of 'bioplastic'. These enhancements help improve different aspects of the bioplastic.

***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

Our project is closely related to sustainable development. It is related to the lifestyle of people. Plastic is inevitably a vital part of our daily life, and people have started to develop a reliance on it. People have also begun to notice its environmental impacts, such as millions of organisms are killed by plastic every year and toxic chemicals are released into the soil when plastic bags perish under sunlight, which harms the growth of plants. More innovations are developed to introduce sustainable and environmentally friendly products so that greenhouse gas emissions can be effectively reduced. One of the solutions is bioplastic. Bioplastic is an alternative to conventional plastics. It can be degraded and produced without emitting toxic gases (e.g. methane) that contribute to global warming, making it a sustainable and green product.

II. Objective(s)

We aim to invent a bioplastic to replace plastic, thereby reducing non-biodegradable plastic waste.

III. Methodology

Use of equipment:

Oven is used to test the heat resistance of the bioplastic, we want to know whether it will melt under high temperature e.g. around 40°C.

Materials:

Vinegar, distilled water, glycerol, starch of plants (2 types): corn starch, arrowroot starch

Tests:

Heat resistance: For testing the heat resistance of the bioplastic, the material can be heated in the oven at different temperatures. For example, put them in the oven at 60°C for 5 hours and observe if the material melts.

Water leakage: For testing if the bioplastic is waterproof, 100cm3 water is poured into the container and observe if there is any water leakage.

Rigidness: For testing the rigidity of the bioplastic, the bioplastic container is filled with 230g water (equivalent to the weight of 300 cm^3 beverage) and observe if the container leaks or breaks. If it does not we further add water in the interval of 10g.

IV. Design of Invention

The design of our invention is make bioplastic using arrowroot starch. The arrowroot starch-made bioplastic will then be molded into different shapes to be used to contain different types of things, such as plastic food containers for food takeaways, plastic bottles for drinks, etc.

We then realized that arrowroot starch bioplastic is not strong enough, so we need to find something to be added to strengthen it. We investigated the properties of chitin and discovered that chitin is a polysaccharide even stronger than cellulose and has other properties. Therefore, after some investigations, we believe that addition of chitin can help benefit arrowroot starch- made bioplastic.

V. Application / Market Need

The bioplastic can be used in daily products such as packaging, takeaway containers to contain food or products.

Plastic, being the major contributor to the pollution and landfill problems, is highly demanded as it's inevitable to not use plastic in life. However, as we all know, plastic is quite detrimental to the environment. Therefore, we decided to design an invention which can be used to replace plastic. The bioplastic we designed could be used to replace plastic containers in takeaway meals. This is a great replacement of plastic as our product, compared to plastic, is more environmentally friendly.

The limitation of bioplastic we designed is that it takes a long time for drying to harden. If there is a high demand of the bioplastic in the market, the bioplastic might be in short supply due to the long production time. Compared to the non-degradable plastic that is commonly used, both the high money cost and time cost of the bioplastic are the disadvantages. Therefore, even though our invention is very environmentally friendly, it still has some limitations.

VI. Conclusion

In conclusion and with reference to our experimental results, arrowroot starch is a better alternative to plastic than cornstarch due to its hardness and rigidness.

It also has a higher melting point than cornstarch. This increases the heat resistance for containing food.

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

N/A