Hong Kong Student Science Project Competition 2022

Template of Extended Abstract (Investigation)

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

Team Number: JABC196

Project Title: Biodegradable impermeable coating on disposable paper containers

Project Type: Investigation

To our best knowledge and after thorough literature research, as at 28/06/2022 , there ~~are~~ / are no* similar works. If there are, the reference links are as below:

N.A.

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

N.A.

***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

- Provide background information of project and/or state the problem to tackle
- Provide highlights of the **literature review** with the support of pertinent and reliable references
- Provide an overview of work and mention the **research gap that the project is trying to fill**

Nowadays, paper cups and paper drink cartons are more common. However, they cannot be recycled due to the presence of non-biodegradable plastic coating. Therefore, there are more wastes formed and increase the pressure on waste treatment in Hong Kong.

Our project has made a layer of biodegradable and water-proof fish scale gelatin coating on the paper cups and paper drink cartons so that they can be recycled. This could increase the capacity of landfills in future. In our project, by using different extraction methods and a series of additives to increase the water resistance, oil resistance and shock resistance of the fish gelatin coating. During the experiments, we found that the feasibility of this project is very high. Finally, we have found that acidic extracted fish scale gelatin with calcium carbonate is the best coating. It has highest melting point, fair performance in waterproof, very performance in oil proof. Also, it is hard to be scratched in air, in water or in oil when it is coated on a piece.

II. Objectives

- State the **aim(s)** of project

The aim of our project is to find out how we can make use of the collagen from the waste to make the food containers being recycled.

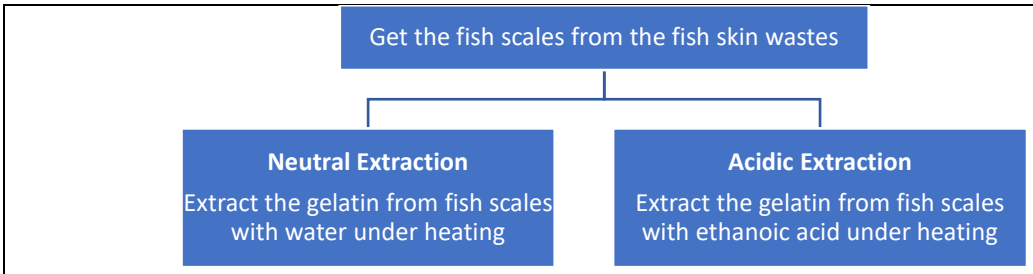
III. Hypothesis

- Propose an explanation for a phenomenon and stating how the **hypothesis** can be tested by experiments

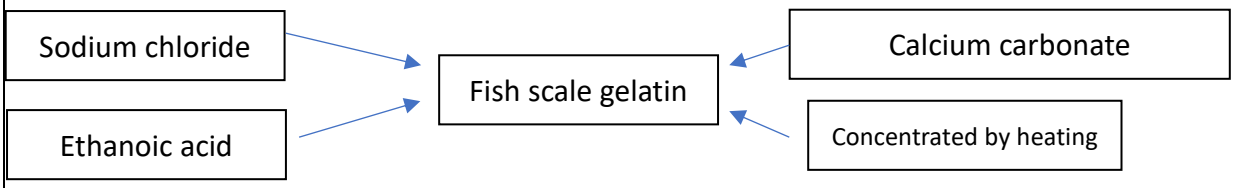
Fish scale is a kind of common waste from seafood shops. There is a kind of gelatin found from these fish scale. We have extracted its gelatin and transformed it into a biodegradable impermeable coating on the paper food containers. We assume that this gelatin is easy to extract and safe to eat. Also, it can fit the requirements of a take-away food container.

IV. Methodology

- List out the materials used
- Describe the **experimental protocol** including the set-up of **control experiment** (if any), **repeated experiment** (if any), and its scientific theory
- Indicate with the support of reasons, the **analysis** used in the investigation



A figure shows different additives used on the fish scale gelatin



Tests on the performance of these gelatin against heat, water, oil, and shock

- **Resistance to heat**
- **Resistance to oil / water**
- **Resistance to shock**

V. Results

- Present the **data** with figures, tables or photos
- **Data analysis** (if any, with emphasis on data reliability and the reproducibility based on statistics)
- Interpret the results and its implication
- Discuss **limitation** and compare with existing related works (if any)
- Discuss the importance or impact of the research and how it is applicable to real problems

We have found that **the acidic extracted fish scale gelatin with calcium carbonate is the best coating**. It has highest melting point (44.5**°C**), fair performance in waterproof, best performance in oil proof. Also, it is hard to be scratched in air, in water or in oil when it is coated on a piece of paper.

Different Fish Gelatin	Ethanoic Acid	Concentrated	Original	Sodium Chloride	Calcium Carbonate
Melting point (°C)	32.0	29.0	36.0	54.5	23.5
Waterproof Change in abs in 450nm	best (0.008)	poor (0.023)	fair (0.018)	good (0.012)	good (0.012)
Oil proof Change in abs in 630nm	best (0)	best (0)	best (0)	best (0)	best (0)
Ease being scratched in air	hardest (33.79N)	hard (27.13N)	hard (28.86N)	hard (27.82N)	hard (28.37N)
Ease being scratched in water	hard (22.76N)	fair (19.85N)	easy (10.78N)	easy (7.25N)	fair (14.51N)
Ease being scratched in oil	hardest (46.44N)	hard (35.01N)	hard (31.81N)	hard (33.25N)	harder (38.89N)

Result: Neutral Extracted fish scale gelatin

Result: Acidic Extracted fish scale gelatin

Different Fish Gelatin	Ethanoic Acid	Concentrated	Original	Sodium Chloride	Calcium Carbonate
Melting point (°C)	33.5	39.5	42.0	38.5	44.5
Waterproof Change in abs in 450nm	best (-0.024)	good (0.002)	fair (0.132)	fair (0.005)	fair* (0.022)
Oil proof Change in abs in 630nm	best (0)	best (0)	best (0)	best (0)	best (0)
Ease being scratched in air	hard (30.98N)	hard (29.19N)	hardest (43.06N)	harder (36.08N)	hard (29.79N)
Ease being scratched in water	easy (13.35N)	fair (17.22N)	fair (16.87N)	fair (18.60N)	hard (20.24N)
Ease being scratched in oil	hard (26.65N)	hard (29.07N)	harder (36.36N)	harder (38.89N)	hard (31.67N)

Limitation - Painting at least 2 layers of this gelatin coating on paper-made container for keeping slightly wet food or fried food, e.g salad, fried food, sushi, sandwiches, rice balls, etc.

VI. Conclusion

- Make a **data-driven** conclusion of the project and the way forward of the research
- Justify if the proposed project meets the objective(s)

The acidic extracted fish scale gelatin with calcium carbonate is the best coating. It has the highest melting point (44.5°C), fair performance in waterproof (The Change in absorbance: 0.022), best performance in oil proof (The Change in absorbance: 0.001), hard to be scratched in air, in water or in oil (in air: 29.79N In water: 20.24N In oil: 31.67N).

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

N.A.