

Hong Kong Student Science Project Competition 2023

Template of Extended Abstract (Investigation)
(Word Limit: 1,600 words, Pages: 3 pages only)

Team Number: JBBC228

Project Title: Investigation of the removal of microplastics using fruit peels

Project Type: Investigation

*To our best knowledge, there are no * similar works in the field; (if there are,) related research links are as below:*

The enhancement our project made / the difference with related research are:

**Please delete if not applicable. The competition values the originality of works. Students must do enough literature research to ensure that their works are unique and list relevant reference materials before starting research or invention.*

I. Background

Nearly three fourth of the weight of fresh fruit peel is water while the dry material contains a certain amount of polysaccharides. Fruit peels are competitive bio adsorbents as they show good adsorption potential with low-cost treatment or even as untreated adsorbent. They were tested for the removal of heavy metal ions (Ali & Saeed, 2015) (Mallampati, Li, Valiyaveetil, & Adin, 2015), crude oil (Ibrahim, Gulistan, Khamis, Ahmed, & Aidan, 2016), dyes (Mallampati, Li, Valiyaveetil, & Adin, 2015) and insecticide (Xu, Shen, & Guo, 2014) from water. As well, a recent study showed that Citrus Aurantiifolia (key lime) and Citrus Microcarpa (kasturi lime) can act as a natural coagulant for water turbidity removal (Dollah, Hashim, Albar, & Abdullah, 2019).

II. Objectives

Therefore, several types of fruit peels as adsorbent and/or coagulant to remove microplastics were determined in this study. As well, ferrofluid without the addition of stabilizing agents or surfactants is an innovation method for microplastic removal (Hamzah, et al., 2021). Considering the ferrofluid is made by mixing an oil with magnetite (Fe₃O₄), the effect of magnetite as an additive to fruit peels were also investigated.

III. Hypothesis

As fresh fruit peel has a certain amount of polysaccharides, we hypothesize that microplastic may be able to coagulate with fruit peels.

IV. Methodology

Preparation of fruit peel samples

Yuzu (*Citrus junos*), Orange (*Citrus x sinensis*), Dragon Fruit (*Selenicereus undatus*) and Banana (*Musa acuminata*) were collected from a fruit stall. Their peel was prepared by the method by (Yunus, Asman, & Mohd Al, 2020). They were washed with deionized water to remove dirt and dried in an oven under 65°C for 12 – 24 hours to achieve a constant weight. They were grounded by pestle and mortar into powder. The powder was kept in reagent bottles.

Preparation of water samples with microplastics

Microplastics were prepared by grinding a polystyrene plastic bottle, then they were grinded using a coarse sandpaper (grit 60-80) and fine sandpaper (grit 1500 and 8000). The powder residue was dispersed in deionized water and filtered with a grade 2 filter paper (8 µm pore size) to remove the plastic residues that were greater than 8 µm to prepare microplastics suspension.

Determine the amount of removal of microplastics by fruit peel

0.1g of the fruit peel powder was added into 50mL of the microplastics suspension. The mixture was stirred for 5 minutes. One drop of the supernatant of the mixture was taken and placed on a 1 x 1” microscope slide. This slide was gently dried in an oven under 65°C to evaporate the water. These samples were then placed under an optical microscope to count the microplastics retained.

V. Results

Banana (*Musa acuminata*) skin and dragon fruit (*Selenicereus undatus*) skin can be used to remove microplastics, but orange (*Citrus x sinensis*) and yuzu (*Citrus junos*) skin cannot. Yuzu (*Citrus junos*) repels with the microplastic when it is placed inside the solution.

VI. If your team will compete the Sustainable Development Award, please indicate the specific sustainable development goal the project is related to, and provide justification for competing for this award. (Word limit: 300 words)

VII. If your team will compete the Social Innovation Award, please list the target group or social issue the project focuses on, and provide justification for competing for this award. (Word limit: 300 words)

VIII. Conclusion

We can use banana skin and dragon fruit skin to remove microplastics. Whilst citrus plant peels may not work as both oranges and yuzu did not work. It would be suggested to investigate more fruits which are not in the citrus family for microplastic coagulation.

Our project is developed based on previous project and the enhancement is below: