

## Hong Kong Student Science Project Competition 2022

Template of Extended Abstract (Investigation)

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

**Team Number:** SBBC095

**Project Title:** Removal of heavy metal ions in water with seaweed

**Project Type:** Investigation

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

Treatment of wastewater Using Seaweed: A Review (2018), N Arumugam et al.

[https://www.researchgate.net/publication/329645489\\_Treatment\\_of\\_Wastewater\\_Using\\_Seaweed\\_A\\_Review](https://www.researchgate.net/publication/329645489_Treatment_of_Wastewater_Using_Seaweed_A_Review)

Biochars derived from wasted marine macro-algae (Saccharina japonica and Sargassum fusiforme) and their potential for heavy metal removal in aqueous solution (2018) KM Poo et al.

<https://www.sciencedirect.com/science/article/pii/S0301479717310526>

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

We modified the experiment according to the local situation. The species of seaweed we chose in the project are species which could be commonly found in Hong Kong. Types and concentration of heavy metal chosen in the experiment were based on the local situation of domestic industry.

**\*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**

We have first-hand information about the removal capacity of heavy metal with eggshells and algae. According to some studies as cited in reference, some seaweed species have significant removal capacity of heavy metal ions in water. However, it appears that research has yet been done on local seaweed species and their practical application in daily lives. In light of this, this study aims to explore more into these new areas in order to make research in this field more comprehensive and increase the possibility of applying our findings in Hong Kong.

### II. Objectives

- State the **aim(s)** of project
- To investigate the relationships between the removal capacity of heavy metal and the color of seaweed, whether seaweed is dead or not, the concentration of heavy metal ions and time.

### III. Hypothesis

- Propose an explanation for a phenomenon and stating how the **hypothesis** can be tested by experiments
  1. Whether different species of seaweed execute similar heavy metal absorption ability
  2. Whether live and dead seaweed execute different heavy metal absorption ability, most probably with different absorption process during the living stage of the organism

### 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

Two 10cm seaweed samples with leaves and stems were made. One of them was cleaned as live samples while another was placed in oven at 200°C as dead samples.

Eighteen beakers were prepared. Half of them contain heavy metal ions solution with low concentration and another half with that of high concentration. Seaweed samples were placed in heavy metal solutions. One control sample with high concentration and one with low concentration were prepared. 20ml solution was transferred to a plastic sample bottle using a syringe after a specific time period. The solution samples were collected and the concentration of heavy metal ions in the samples are measured by ICP-AES.

The experiment was repeated by using two types of brown algae, *Sesbania grandiflora* (Linn.) Pers. Syn. Pl. (A1) and *Rotala rotundifolia* var. *gontin*. (B1)

### 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

From the graph presented in the report, it was found that the removal of Cr with dead seaweed is better than that with live seaweed.

The removal of Cu ion with dead seaweed is better than that with live seaweed.

Overall, the removal of Pb ions with species A1 is better than that with species B1.

The overall absorption rate is not as significant as we thought after a longer immersion time. We propose to shorten the immersion time and the time interval for recording the heavy metal concentration, so as to have a more realistic picture for overall absorption process.

If we could figure out the optimum condition for specific seaweed species to work on heavy metal absorption in water, insights of removal of heavy metal in water with seaweed could be given in residential and industrial area in Hong Kong.

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## 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 overall absorption rate is not as significant as we thought after a longer immersion time. We propose to shorten the immersion time and the time interval for recording the heavy metal concentration, so as to have a more realistic picture for overall absorption process.

The project provides us preliminary data for further research. Exploration on more species, and even a mixture of seaweed species used could be made in further study to achieve sustainable development in Hong Kong.

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

Our school's previous project focus on investigation of efficacy and feasibility of heavy metal absorption in water by eggshell. In light of this insight, our project focused on investigating the feasibility of applying a more sustainable species, seaweed, in industrial field.