

# Hong Kong Student Science Project Competition 2023

Template of Extended Abstract (Investigation Design Proposal)

(Word Limit: 1,600 words, Pages: 3 pages only)

**Team Number: SDBC069**

**Project Title: Shell We Drink**

**Project Type: Investigation Design Proposal**

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

**The enhancement our project proposed / 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

The water quality along coastlines has worsened over the years because of the extreme weather, global warming and the extensive use of water bays on Earth. Many substances like sediment, pesticides, bacteria, heavy metals, and other nutrients are often found in seawater, which decreases the quality of clean seawater. There are different ways to tackle this environmental issue in the society, and one of the ways is by setting up an area farming bivalve along the coastal areas, which is found to be conducive to the quality of seawater.

## II. Objective(s)

Our group would like to propose an investigation to study which kinds of bivalves can be used in filtering seawater and thus provide a way to compare their seawater purification ability. There are many ways to measure their water purifying ability, including the reduction in the amount of sediment, heavy metals and nitrogen compounds in the water.

## III. Hypothesis

## IV. Methodology

### (1) To study the ability of bivalves in removing sediments

A) Test for the remaining sediments by measuring the mass of residues

#### Procedures:

- (1) Add 800ml seawater into two beakers respectively. Add to one beaker the bivalves.
- (2) Leave them for 24 hours under room temperature
- (3) On the next day, extract 20ml of the seawater sample from each of the beaker
- (4) Filter them by using a filter paper and a filter funnel
- (5) Collect all residues from the filter paper and measure the mass

B) Test for the remaining sediments by measuring the light transmittance level of seawater

Procedures:

- (1) Add 800ml seawater into two beakers respectively. Add to one beaker the bivalves.
- (2) Leave them for 24 hours under room temperature
- (3) Place a light transmittance meter right behind the transparent tank and measure the light transmittance level of it
- (4) The higher the light transmittance level, the better the purifying ability of shellfish

**(2) To study the ability of bivalves in removing heavy metals**Procedures:

- (1) Add 800ml seawater into two beakers respectively. Add to one beaker the bivalves.
- (2) Dip the test end of the heavy metal test paper into the seawater samples to measure the initial values
- (3) Leave them for 24 hours under room temperature
- (4) On the next day, dip the test end of the heavy metal test paper into the seawater samples
- (5) The colour change indicates the presence of a certain metal substances dissolved in seawater sample (For example: by comparing the colour intensity of the golden orange colour of mercury, the test paper with the lighter colour has lesser amount of mercury containing in the sea water)
- (6) The lighter the colour of the test paper result of indicating a certain metal, the better the purifying ability of the bivalves

**(3) To study the ability of bivalves in removing nitrogen compounds**Procedures:

- (1) Add 800ml seawater into two beakers respectively. Add to one beaker the bivalves.
- (2) Dip the test end of the test paper into the seawater samples
- (3) Leave them for 24 hours under room temperature
- (4) On the next day, dip the test end of the test paper into the seawater samples
- (5) The colour changes from colourless to pink indicates the presence of nitrogen compound dissolved in the seawater sample
- (6) The lighter the pink colour of the test result, the better the purifying ability of the bivalves

**V. Expected Results and Impact of research**Expected Result:

For method (1)(A): The beaker containing bivalves will have a smaller mass of residue. A smaller mass of residue indicates a better ability to remove sediment.

For method (1)(B): The beaker containing bivalves will have a higher light transmittance level of seawater. A higher light transmittance indicates a better ability to remove sediment.

For method (2): The seawater sample extracted from the beaker containing bivalves will have a lighter colour result. A lighter colour indicates a better ability to remove heavy metals.

For method (3): The seawater sample extracted from the beaker containing bivalves will have a lighter pink colour result. A lighter colour indicates a better ability to remove nitrogen compounds.

Impact of research:

The purpose of this investigation proposal is to provide a method to compare the water purification ability of different bivalves. We hope our investigation can pave a way for further investigations on the filtering ability of bivalves. Good use of this method can be made and explore more on which bivalve can filter water more effectively. We hope to contribute more to the natural surrounding and provide a sustainable way to maintain the water quality along coastlines. There are many more habitats to be explored and as such, by comparing the ability of “filter feeders”, different bivalves can be used as a

purifying media of water.

The investigation is hoped to provide a suggestion for the government to consider of utilizing the organic filtering ability of shellfish to purify seawater along the coastal line of Hong Kong. For example, a coastal shellfish farm can be set up along the coastal line, with the factors we mentioned below in mind.

**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)**

Specific sustainable goal: 06 Clean Water and Sanitation

Hong Kong's water quality along the coastline has worsened over the years due to sewage, untreated wastewater, mud from reclamation work, and other urban development projects, etc. These wastes are typically high in chemical and metal content and can flow to other parts of the sea in Hong Kong over time. As such, a coastal shellfish farm can be set up along the coastal line to purify seawater and improve the water quality. We believe that our investigation can pave a way for further investigations on the filtering ability of bivalves, which can provide a sustainable way to maintain the water quality along coastlines. We believe that the development that utilizes our investigation and methods can meet the needs of the present without compromising the ability of future generations to meet their own needs.

**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**

Studies conducted by professional scientists and marine researchers have strongly proven that bivalves can help to filter substances like sediments, heavy metals, nitrogen compounds, etc., because they are filter-feeders with gills inside their shells to filter seawater in the ocean. As different bivalves have different filtering abilities, our group have proposed such methods to compare the seawater filtering ability of bivalves, including the amount of sediment, the number of heavy metals, and the amount of nitrogen compounds in seawater. In additional, all proposed methods have the expected result of seawater sample extracted from the beaker contains bivalves have a better purifying ability than only with the presence of seawater, which has a smaller mass of residue, higher light transmittance level of seawater, lighter colour intensity of heavy metals and nitrogen compounds tests results.

Therefore, to conclude, our team hopes to pave a way for further investigations on how to fully utilize bivalves in maintaining the water quality along coastlines. Our investigation on the different filtering abilities of bivalves in purifying seawater hopes to provide a suggestion for the government to consider utilizing the organic filtering ability of bivalves to purify seawater along the coastal line of Hong Kong. For example, bivalve farms can be practiced in outlying islands to collect more filtered seawater which had undergo the filtering system of bivalves.