

二零二三年香港學生科學比賽

延伸摘要範本 (研究項目)

(字數上限：2,500 字，頁數上限：3 頁)

隊伍號碼：

作品名稱：

參賽類別：研究項目

就我們所知，坊間 有/沒有* 類似的作品；(如有，) 相關研究連結如下：

我們的作品所作出的改良 / 其不同之處為：

*請刪去不適用。本比賽重視作品的原創性，學生須於開始研究或發明前作足夠的文獻搜索以確保自己的作品具一定獨特性並列出相關參考資料。

I. 前言

- 介紹研究項目的背景資料和/或現有需要應對的問題
 - 概述所參考的文獻並列出可靠的資料來源
 - 撰寫作品概要並指出項目嘗試填補的研究缺口

II. 目標

- 列出研究的目的

III. 假設

- 提出假設以解釋所關注的現象，並指出如何利用實驗以驗證假設

IV. 研究方法

- 列出所使用的材料
- 描述實驗設計和方案，包括對照實驗的設置（如有），重複實驗的次數（如有），及其科學理論
- 指出在研究中採用的分析方法並說明理由

V. 研究結果

- 運用圖形、表格或照片展示數據
- 數據分析（如有，並以統計為基礎以展示數據的可信度和重現性）

- 解釋研究結果及其實質意義
- 討論有關限制，並與現有相關研究作對比（如有）
- 探討研究結果的重要性和影響力，並闡述該研究如何適用於實際問題

VI. 如研究項目將角逐可持續發展大賞，請列明作品與哪一個可持續發展目標有關，並說明參與競逐此獎項的原因。(字數上限：500字)

VII. 如研究項目將角逐社會創新大賞，請列明作品所針對的目標群組或社會議題，並說明參與競逐此獎項的原因。(字數上限：500字)

VIII. 結論

- 撰寫以數據為本的結論，及有關研究的後續安排
- 證明作品是否達到研究的目標

* 我們的作品是以之前的比賽作品為題進行了持續研習，有關改良如下：



Hong Kong Student Science Project Competition 2023

Template of Extended Abstract (Investigation)

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

Team Number:

Project Title:

Project Type: Investigation

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

<https://doi.org/10.1007/s40726-021-00185-5>

<https://doi.org/10.1590/1519-6984.169372>

<https://doi.org/10.1016/j.biortech.2021.126245>

Kshirsagar, A. D. (2013). Bioremediation of wastewater by using microalgae: an experimental study. *International Journal of Life Science Biotechnology and Pharma Research*, 2(3), 339-346.

^i can't find the doi for some reason

[https://doi.org/10.1016/s0025-326x\(99\)00181-2](https://doi.org/10.1016/s0025-326x(99)00181-2)

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**

In the past few years we realised because of water pollution, which has been doing an ecstatic job at ruining our oceans, the water quality of the seas have been getting worse and worse, hence this made us want to figure out how to resolve this situation by doing experiments thoroughly to find a sustainable solution.

Afterwards, we found out that algae has the ability to improve water quality, thus we wanted to use its potential ability to decrease the amount of damage caused by water pollution to the water quality of the ocean in Hong Kong.

II. Objectives

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

Our aims of the project is to improve water quality via bioremediation of algae and raise awareness of the water pollution issues.

III. Hypothesis

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

Algae can improve water quality and thus decrease water pollution levels while also providing more oxygen and nutrients to the oceans.

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

Our experiment involved the use of 2 types of marcoalgae separated into 2 pairs of beakers of high and low concentration respectively with a control set-up that just has normal ocean water. We also made use of brine shrimp, chemical tests, oxygen and pH testers.

The brine shrimp were put into samples of the 5 water solutions and were tested on mortality rate for us to observe and obtain the basic concept of how habitable the water was. We then used the chemical tests to test samples of water to confirm the nutrition level of the water (e.g. ammonia, phosphate e.t.c.). Finally, pH and oxygen testers were used to confirm if the algae had provided the basic needs for brine shrimp to survive.

While we were researching out experiment, we learned a lot more about how algae helps the aquatic ecosystem, and we analysed that the set-ups that included brine shrimp should have a higher nutritional and oxygen levels, thus it created our hypothesis and experimental protocolb

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

Data:

	High Conc. <i>Dunaliella sp</i>	Low Conc. <i>Dunaliella sp</i>	High Conc. <i>Isochrysis galbana</i>	Low Conc. <i>Isochrysis galbana</i>	Control
Phosphate:	5	2.5	5	5	0
Nitrate:	200	20	200	20	0
Ammonia	6.1	2.4	3.7	3.7	0.3
pH	8	7.2	7.1	7.3	7.4
	High Conc. <i>Dunaliella sp</i>	Low Conc. <i>Dunaliella sp</i>	High Conc. <i>Isochrysis galbana</i>	Low Conc. <i>Isochrysis galbana</i>	Control
Temperature(° C)	21.1	20.6	19.2	19.3	20.8
Conductivity (uS/cm)	8	1000	1000	1000	1000
O₂ concentration (mg/L)	12.5	10.5	12	10.2	9.4
Turbidity(NTU)	1644.4	345.5	1563.6	2190.9	1209.8
General hardness(mg/L)	0	0	0	0	0

Data analysis:

Phosphate, nitrate , O₂ concentration: high concentration of algae means higher concentration of phosphate(i.e. algae concentration \propto phosphate, nitrate & O₂ concentration)

Ammonia: control had the least which means algae increased it

pH: algae decreased it (except high Dona)

Temp, conductivity & GH: algae doesn't really affect it

Turbidity: no specific pattern

Limitations:

-Our set-ups were made in a beaker, there are a lot of other factors that occur in nature which cannot be created in a laboratory

-Brine shrimp have a very high adaptability, so the mortality rate may not be as we expected.

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)

The sustainable development goal we are aiming for is goal 14: Life Below Water. Our main focus is on improving pollution and acidification (target 14.1 - 14.3). The objective of our experiment is to use a sustainable way to improve water quality. Through the use of algae in water, it could decrease various toxicants and increase pH, thus leading to an overall improvement in water condition.

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

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

In conclusion, we have found that algae does indeed increase nutrient and oxygen levels of water which benefits aquatic organisms. While studies have shown that algae can remove heavy metals & decrease CO₂, we cannot test this due to limited technology.

There is still a lot of researching that needs to be done in order to find out how to perfectly implant algae into improving water pollution.

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