A Study on the Efficiency of Wastewater and Oil Remediation Using *Chaetomorpha* Algae

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Introduction

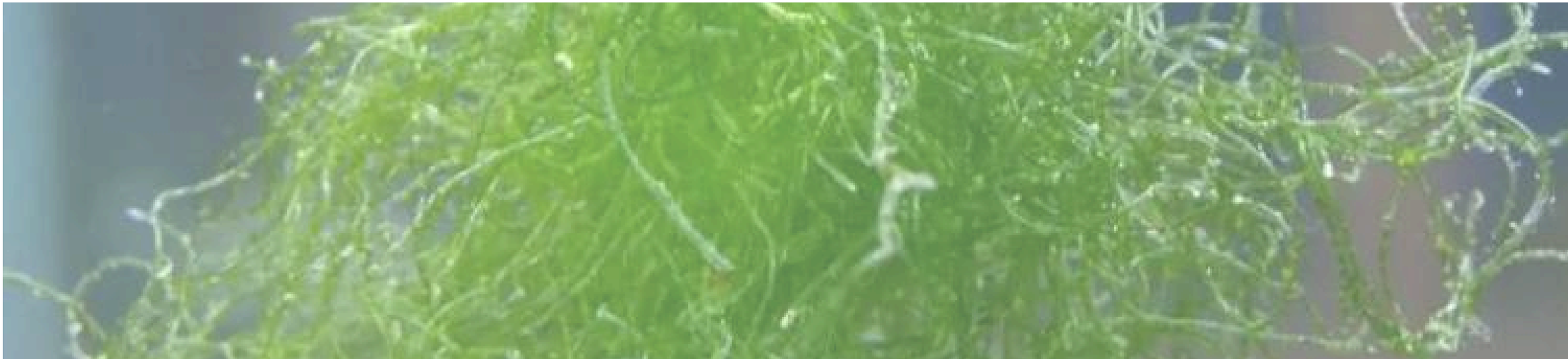
Coastal areas and the sea are increasingly facing threats from pollution caused by human activities, especially wastewater from industrial sources and oil derived from petroleum.Bioremediation using algae has gained increasing attention as a low-cost, environmentally friendly, and highly effective method for reducing water pollution, particularly through the use of Chaetomorpha algae.

Research Question

1.To what extent does synthetic wastewater affect the treatment efficiency of *Chaetomorpha* algae in seawater, and in what ways does this effect occur?

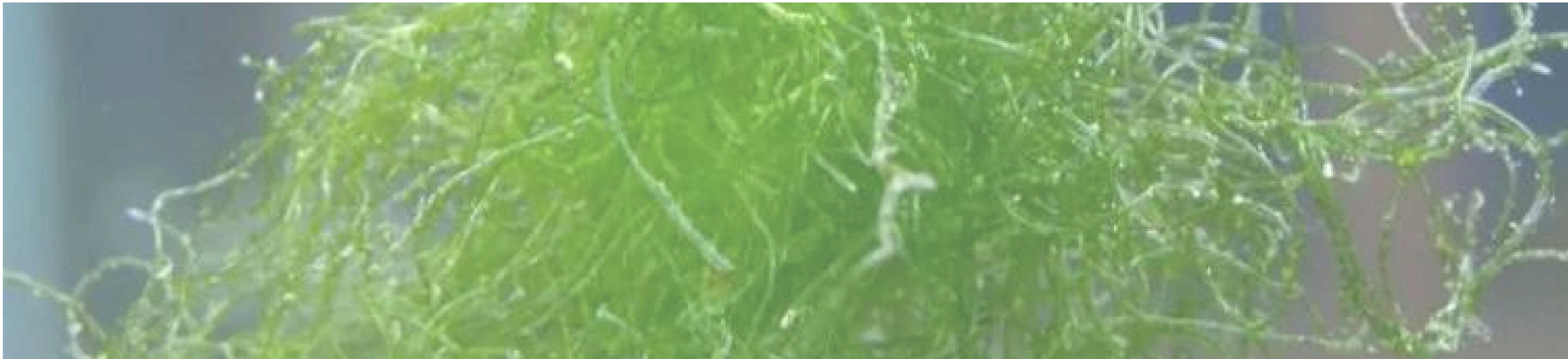
2.To what extent does engine oil contamination affect the remediation efficiency and growth of *Chaetomorpha* algae, and in what ways does this effect occur?

3.To what extent does the combined contamination of synthetic wastewater and engine oil affect the bioremediation efficiency of *Chaetomorpha* algae, and in what ways does this effect differ from single-pollutant conditions?



Hypothesis

1.*Chaetomorpha* algae significantly reduce pollutants in seawater containing synthetic wastewater.
2.*Chaetomorpha* algae significantly reduce oil contamination in seawater contaminated with engine oil.
3.The combined presence of synthetic wastewater and engine oil affects the treatment efficiency of *Chaetomorpha* algae differently from single-contaminant conditions.



Material

Chaetomorpha

sea water

vegetable oil

casava starch

granulated sugar

engine oil

plastic basin

air pump

thermometer

pH meter

DO meter

COD test kit

ammonia test kit

nitrate test kit

pipette

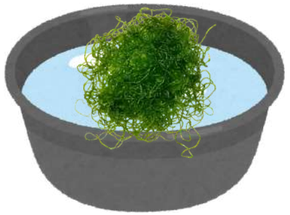
Methods

Study Sites

Experimental Design

Preparation of Algal Samples

Preparation of Seawater and Pollutants



Cultivation Conditions

Water Quality Analysis

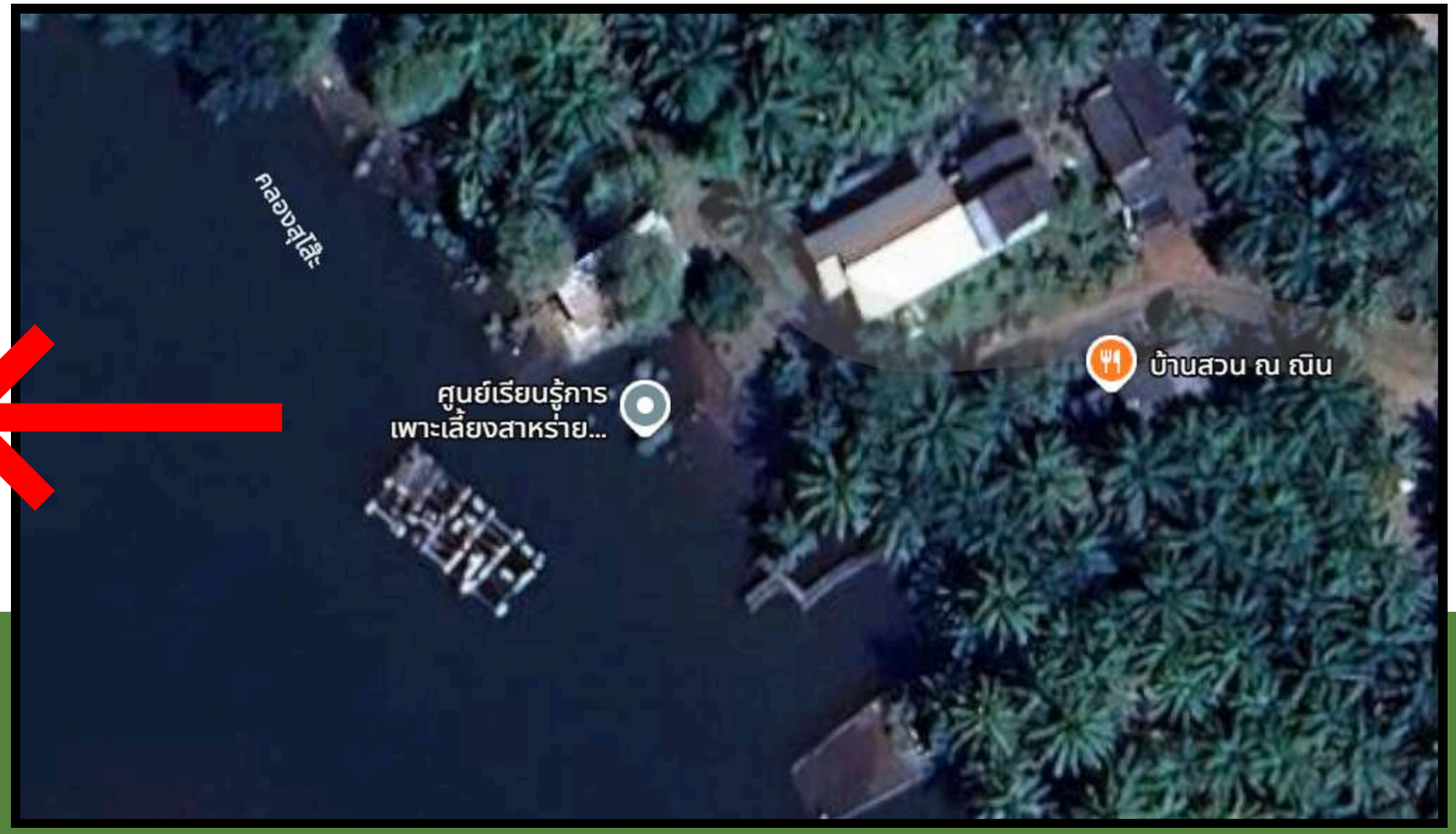
Algal Growth Measurement

Statistical Analysis

Methods

1.Study sites

Ban Na Nin,
Algae cultivation
learning area
(7.1731044,99.6766995)



Methods

2.Preparation

Chaetomorpha

Engine oil 1 L

cassava starch
2 mg

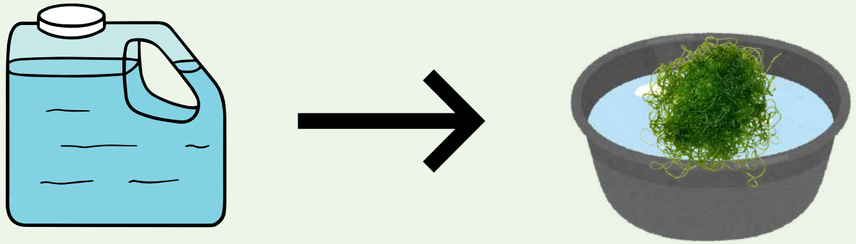
vegetable oil
50 mL

granulated sugar
2 mg

synthetic wastewater 1 L

Methods

1. **Control set**

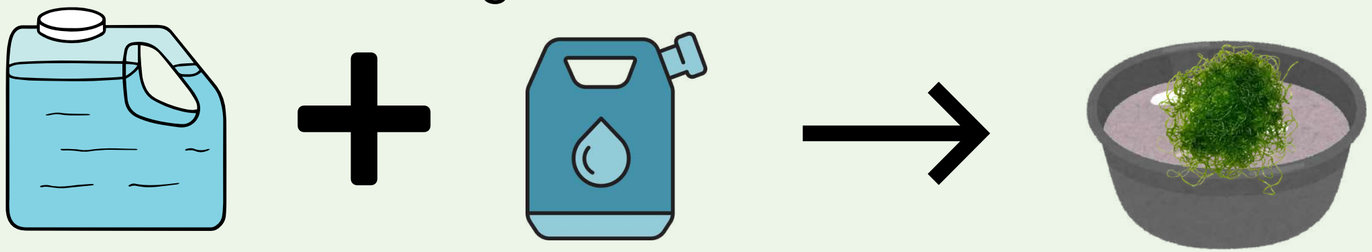


sea water 1L → *Chaetomorpha 5 g*

2. **Contaminated with oil**

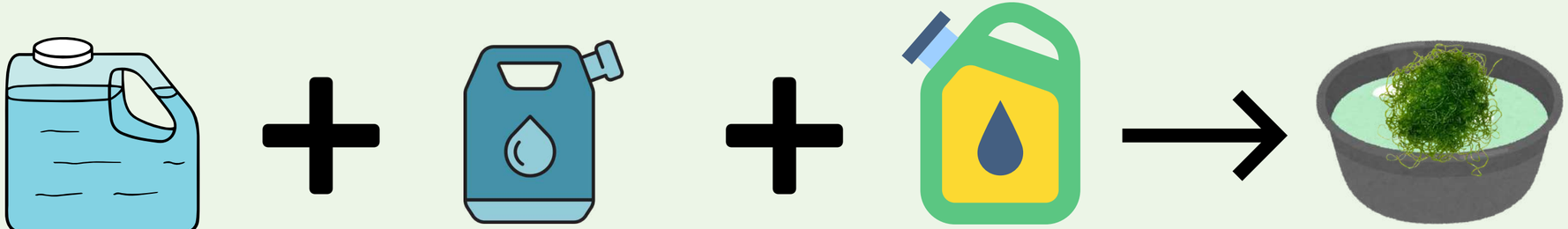
sea water 1L + engine oil 0.2 L → *Chaetomorpha 5 g*

3. **Contaminated with wastewater**



sea water 1L + synthetic wastewater → *Chaetomorpha 5 g*

4. **Contaminated with wastewater and oil**

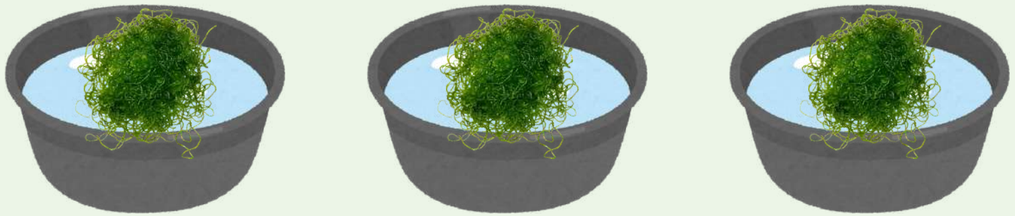


sea water 1L + synthetic wastewater + engine oil 0.2 L → *Chaetomorpha 5 g*

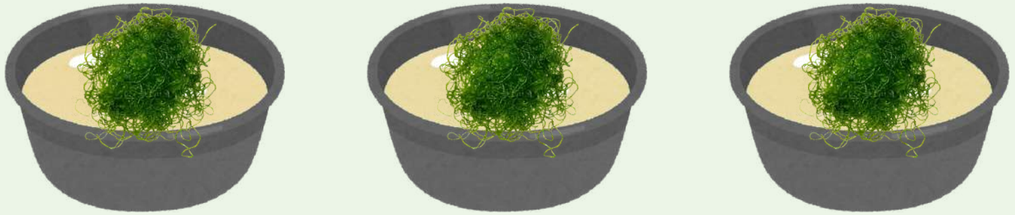
Methods

3.Cultivation

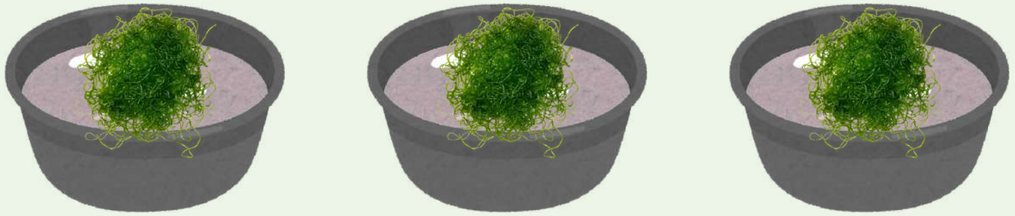
1. Control set



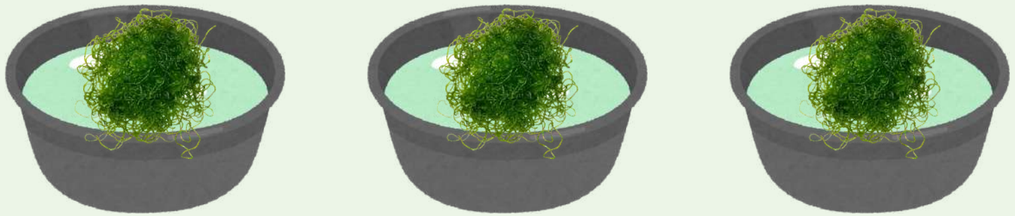
2. Contaminated with oil



3. Contaminated with wastewater



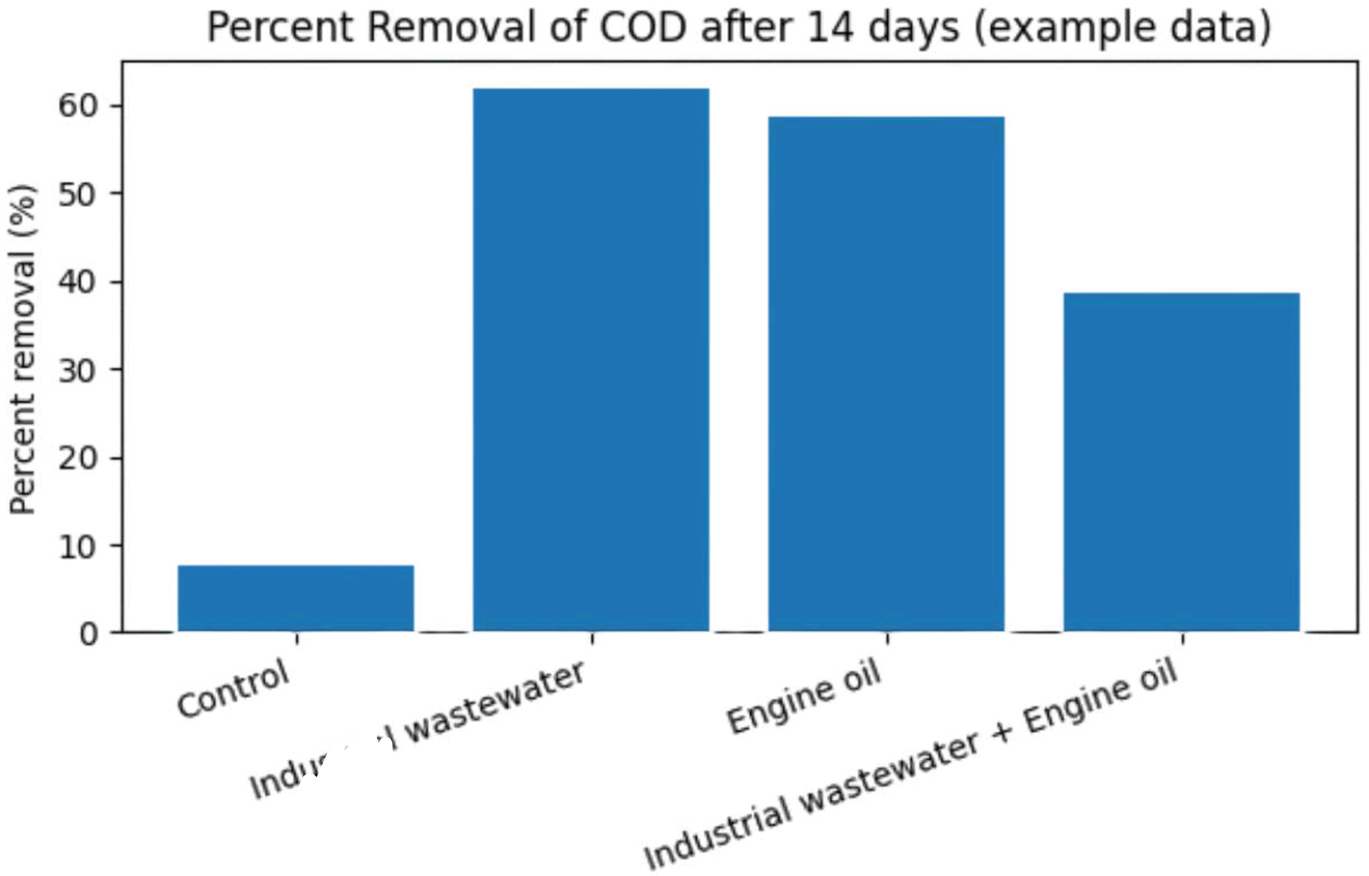
4. Contaminated with wastewater and oil



14 days

Results

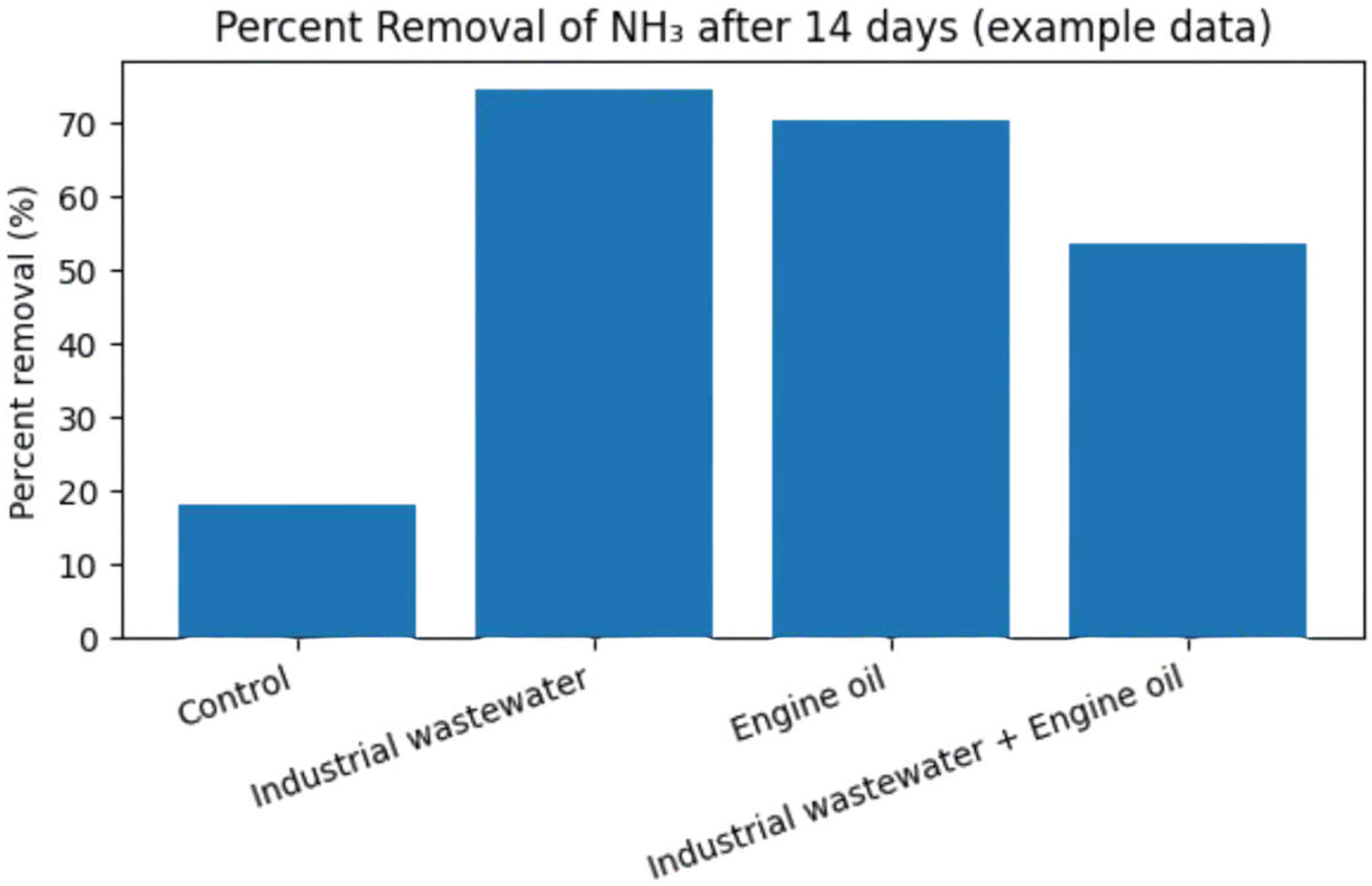
Chemical Oxygen Demand; COD



The treatments containing synthetic wastewater and engine oil showed a significantly higher COD removal efficiency compared to the control.

Results

Ammonia ; NH_3



The treatment containing synthetic wastewater exhibited the highest ammonia removal efficiency.

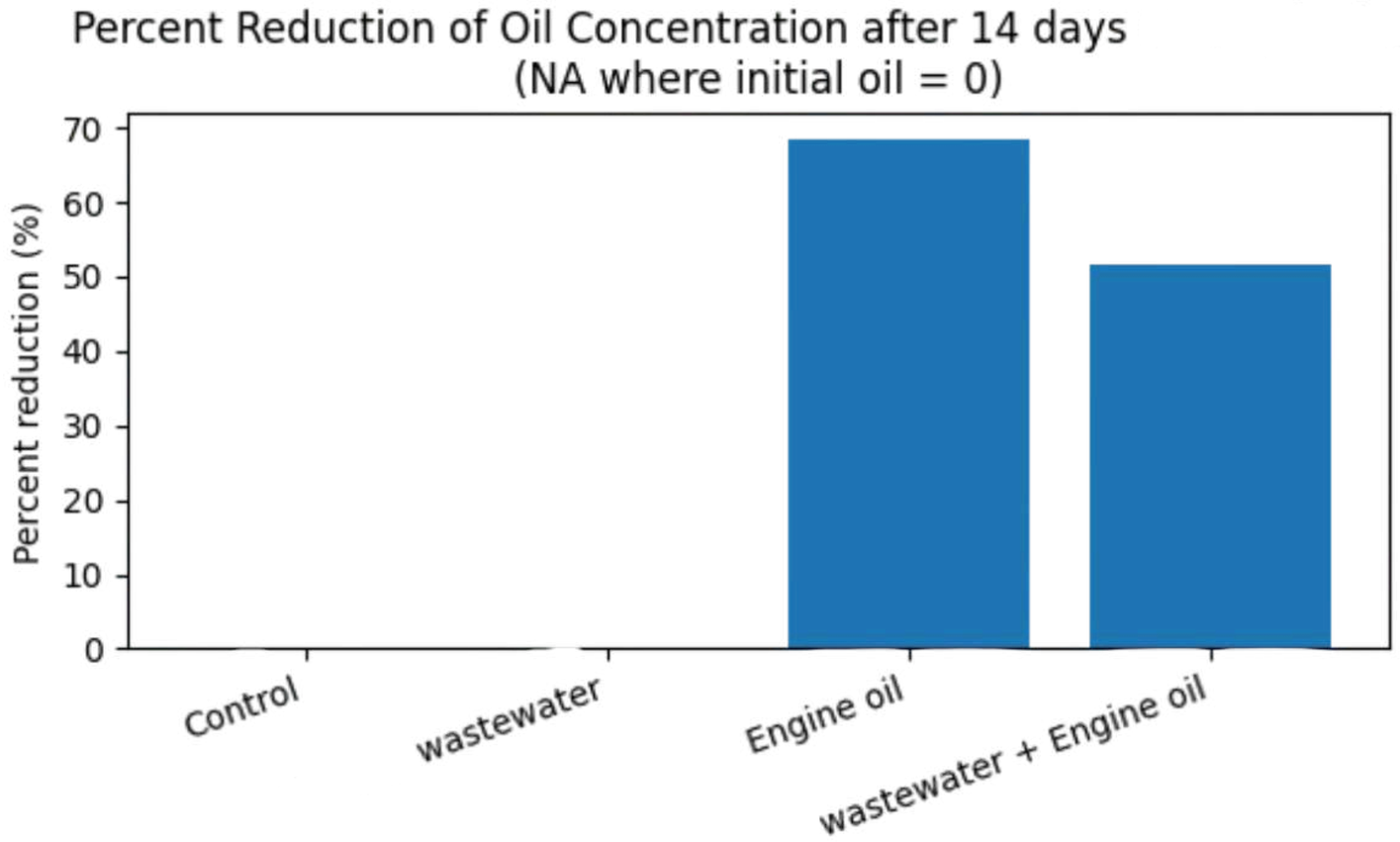
Results

Nitrate; NO_3^-

The contaminated treatments showed a significant reduction in nitrate concentration compared to the control, with the highest removal observed in the engine oil treatment.

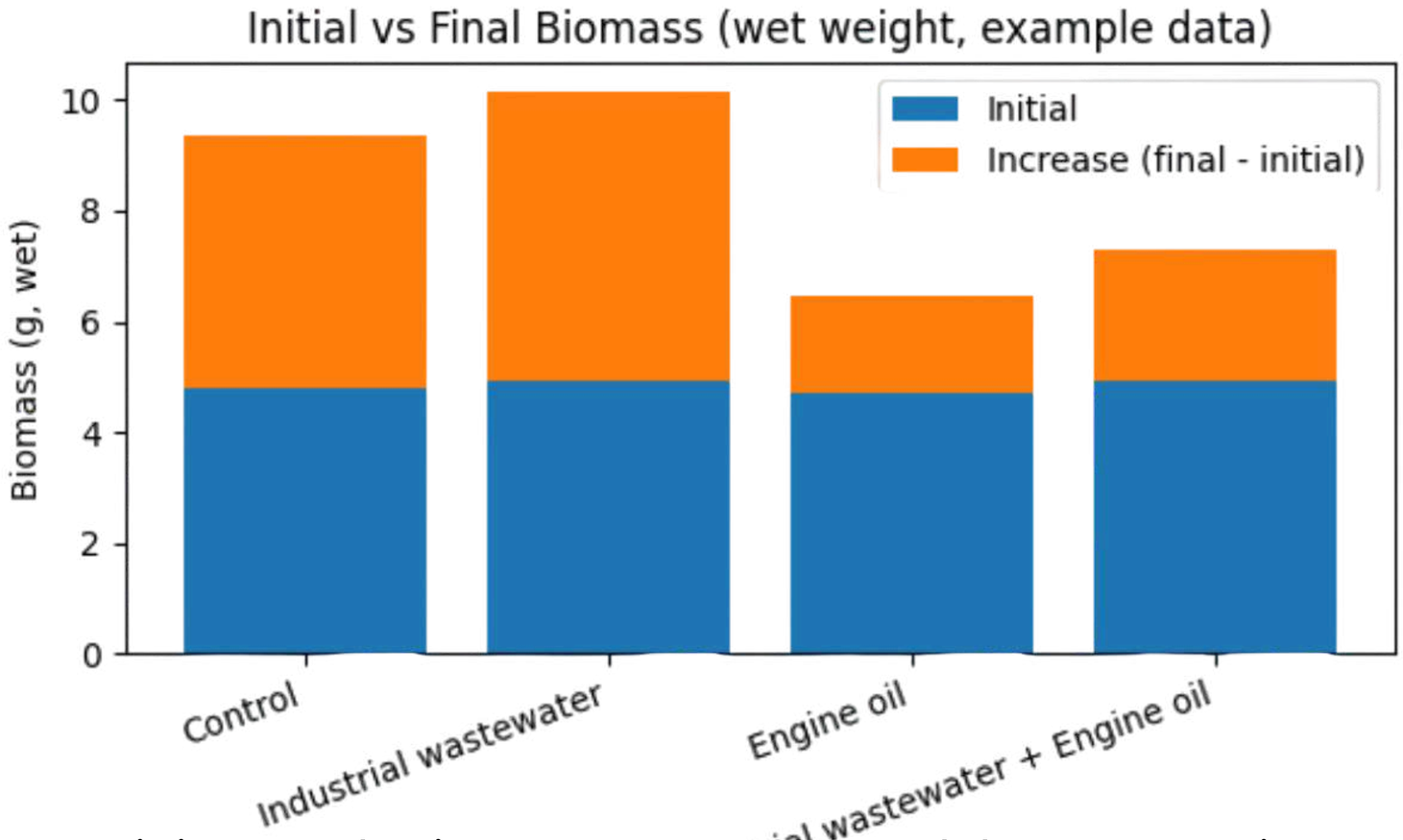
Results

Oil



The treatment containing only engine oil demonstrated a higher oil removal efficiency than the treatment containing both synthetic wastewater and engine oil.

Results



The treatment containing synthetic wastewater showed the greatest increase in biomass, indicating that Chaetomorpha algae grew well under nutrient-rich conditions. In contrast, treatments containing engine oil exhibited lower biomass increases, suggesting that oil contamination may inhibit algal growth.

Discussion and Conclusions

This study concludes that Chaetomorpha algae are effective as a biological agent for treating seawater contaminated with wastewater and oil. The algae significantly reduce organic pollutants, nitrogen compounds, and oil concentrations, while their biomass increases under nutrient-rich conditions. However, the presence of oil, especially when combined with wastewater, inhibits algal performance. Therefore, further studies are needed to optimize treatment conditions and enhance the long-term efficiency of sustainable, eco-friendly water treatment systems.

Thank You