



From Bloom to Doom: A Study of Algal Absorption and Cultivation

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Introduction

Real World Algae Applications:

- Renewable Energy
- Photobioreactors
- Fuel
- Supplements

Plan and Hypothesis:

- Spirulina and Spirogyra were chosen for their size and capability at filtering out nutrients.
- Aiming to absorb nutrients and gather data on cultivation techniques.
- Tested with small amounts of algae (100mL) in artificial water.
- The nitrate levels are expected to decrease, while DO is expected to increase.
- The artificial water has phosphorus and nitrate solutions in it.

Preparing Algae

Materials:

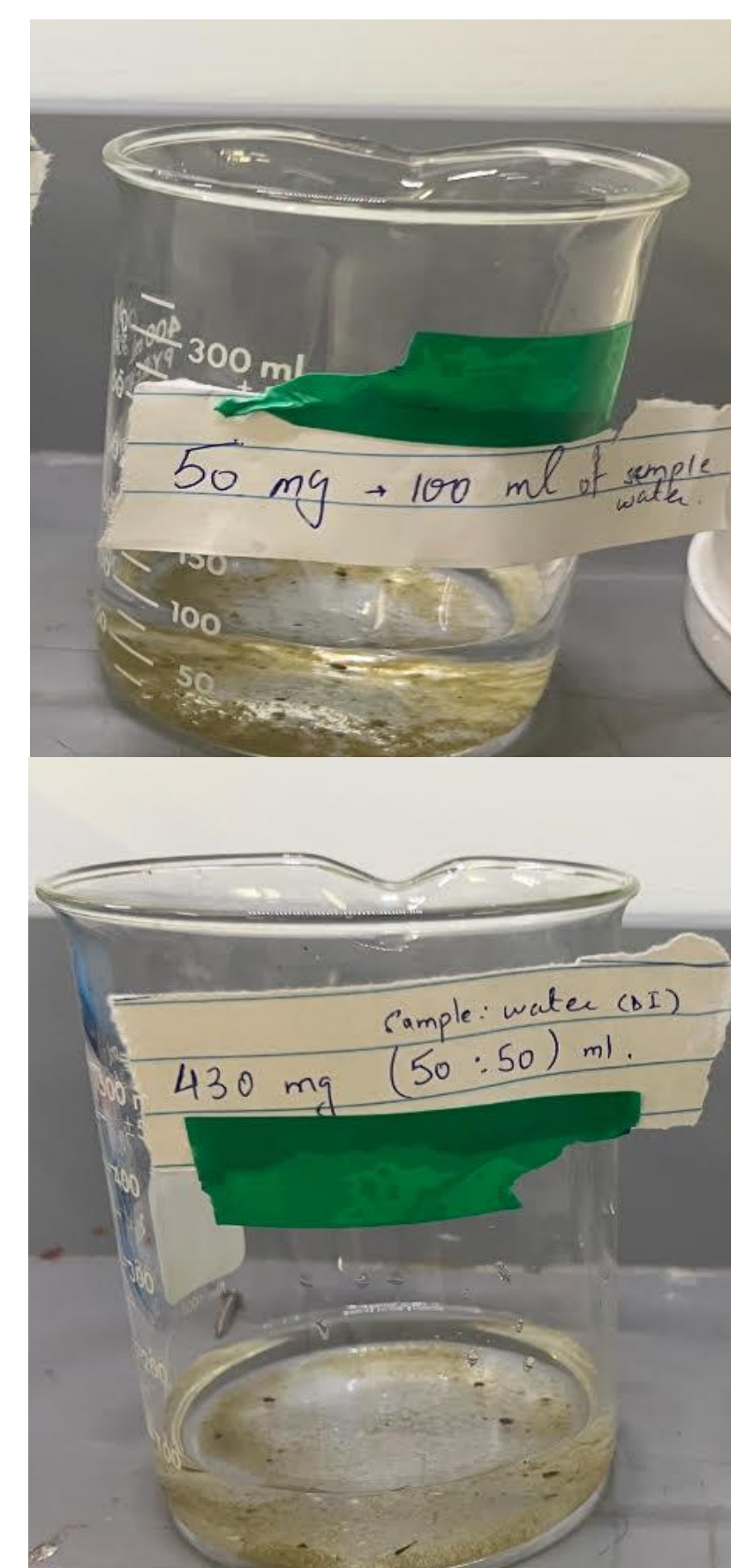
- 5 Liter tubs
- Containers for aeration
- Pumps
- Growing lamps
- F/2 Nutrient Media

Preparing the Tanks:

- Put into a mixture of melted snow (natural source of water) and set up the pumps for aeration and the growing lamps (on low setting).
- The Spirogyra algae died before testing was done.
- We added the media periodically in order to mimic a real-world algae growth environment.



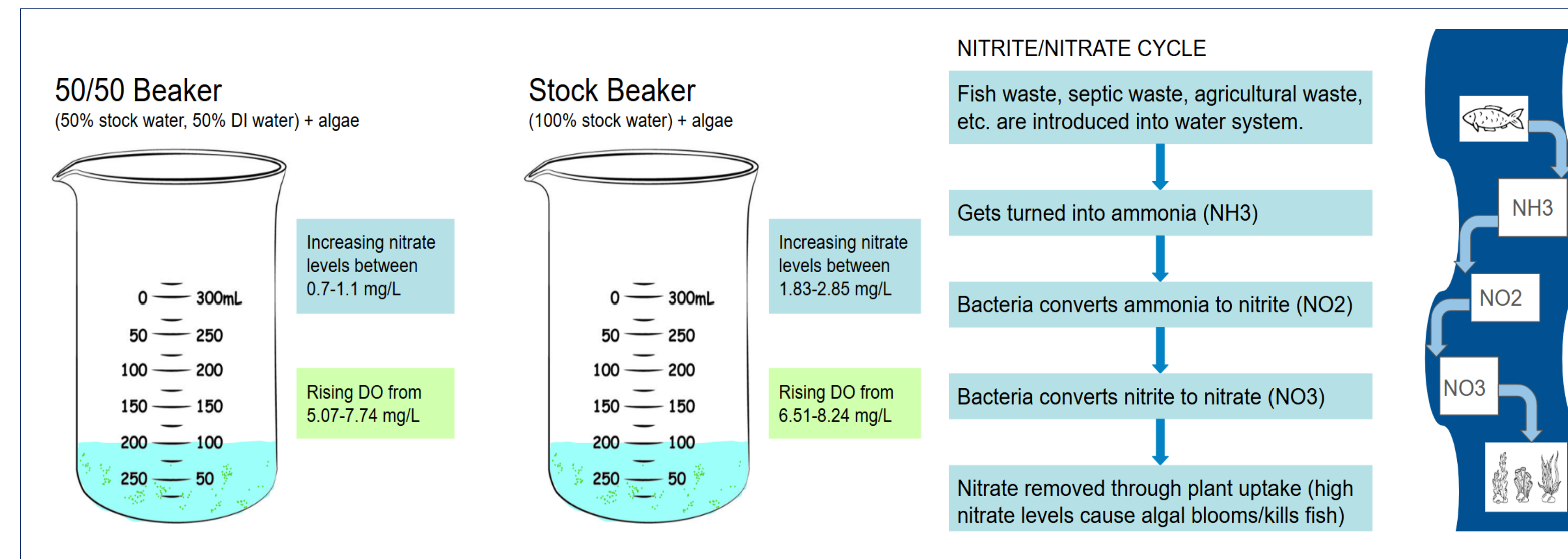
Methodology



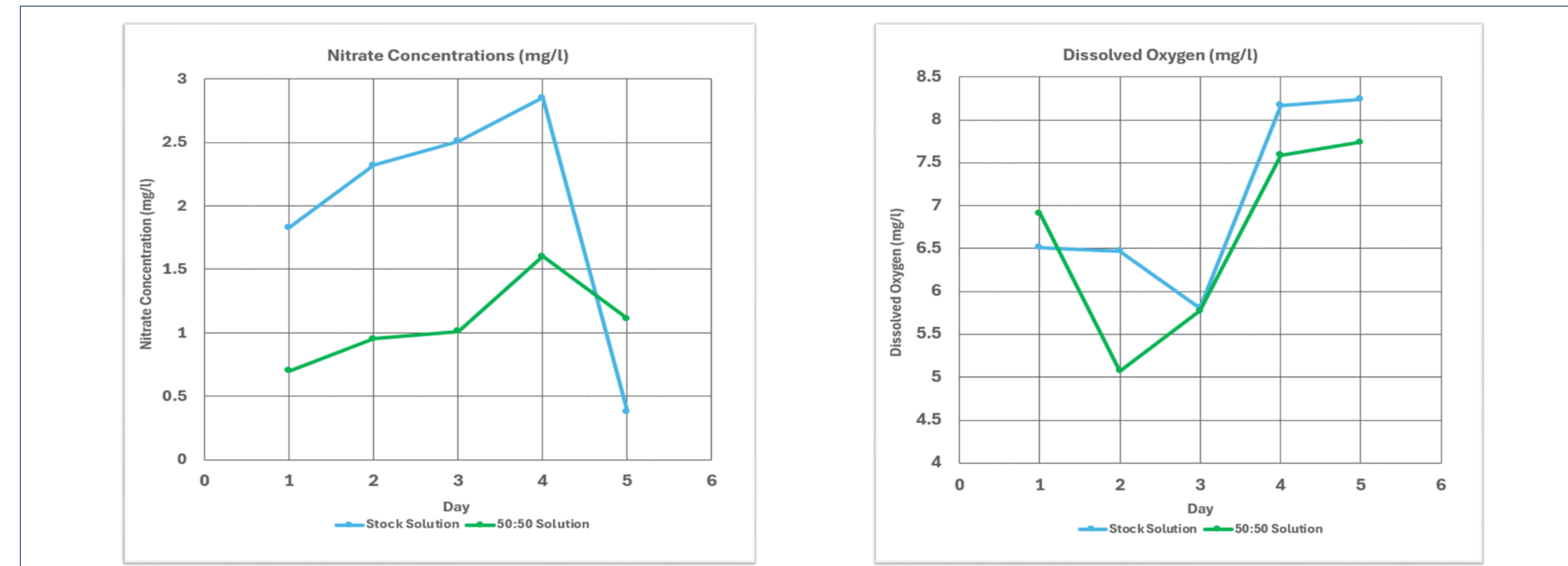
1. Filter the algae out of the water using the round cellophane filter.
2. Prepare the nitrate tests. Put 2mL of the sample into the test with a pipette. Invert the test and wait 10 minutes.
3. Prepare the nitrite tests. Put 1mL of the sample into the test with a pipette. Put 2 mL of the solution into the test with a pipette. Invert and wait 15 minutes.
4. To test for DO, pH, SPC, and temperature, use the YSI machine.
5. After their respective wait times, wipe down the vials with chemical wipes and put them into the machine.
6. Put the algae back into the water and repeat the tests for the other sample.



Methodology Visualization



Chemical Concentration in Solution



Data and Error Analysis

Reasons for Error:

- These results were affected by experimental error.
- The algae health declined over time and its decomposition may have initially raised nutrients while consuming oxygen.
- We noticed algae sticking to container walls and getting stuck in the filters. This could have led to inaccurate readings and reduced biomass in suspension, contributing to inconsistent nitrate and oxygen levels toward the end of data collection.
- The tests also took about 3mL of water away from the solutions each day, which could result in higher concentration readings than normal. This would result in our final volume being closer to 70 mL rather than 100 mL.

Day	Stock: Nitrate (mg/L)	50/50: Nitrate (mg/L)	Stock: DO (mg/L)	50/50: DO (mg/L)	50/50 Nitrite (mg/L)
1	1.83	0.71	6.51	6.93	n/a
2	2.32	0.95	6.47	5.07	n/a
3	2.51	1.01	5.81	5.75	0.017
4	2.85	1.60	8.17	7.59	0.023
5	0.38	1.10	8.24	7.74	0.032

Discussion

Natural Nutrient Levels:

- Normal Dissolved Oxygen (DO) levels are 5-14 mg/L
- Natural nitrate levels are less than 1 mg/L
- The 50/50 solution starts in a normal nitrate range.
- Stock solution starts in above normal range.
- 50/50 and stock beakers started in lower ranges of DO levels.

Overall Trends and Explanations:

- Increasing nitrate levels indicates transition of nitrite to nitrate.
- Both beakers nitrate levels increased to above normal values indicating the deteriorating algae health at end of experiment and earlier use of algae growth product.
- DO rose to median normal DO levels over course of the experiment as result of photosynthetic algae activity.

Conclusions

Summary:

- High nitrate levels resulted from increased algal death, indicating the algae's nitrate absorption capabilities.
- Algal death in the experiment towards the end was unintended and due to technical error.
- The DO levels, while increasing following Day 2, changed dramatically due to possible fluctuations of photosynthetic activity of algae or minor measurement technical issues.

Implications:

- The error was useful in assessing how algal death may affect ecosystems.
- Looking at the data collected, it is difficult to tell if Spirulina would be the best type of algae to use for these applications, as the algae began to die before data collection was over.
- If this experiment were to be repeated, it would be important to make sure the algae is not contaminated.
- A larger starting sample of algae would have also been beneficial to the experiment.

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References

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