Growth of *Synechococcus* in Varying Nutrient Concentrations

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Background

Fossil fuels are the largest contributors to global climate change, accounting for nearly 75% of total greenhouse gas emissions. A green energy solution can be found in autotrophs, which both sequester carbon in their growth and can be made into biodiesel. *Chlorella vulgaris* has been studied for its prolific lipid yield, leading to high biodiesel production. *Synechococcus*, a genus of cyanobacteria that grows prolifically in Conesus Lake, may be an even better source of fuel than *C. vulgaris* because it grows at a rate nearly twice as fast and is known to be a strong carbon sequester. With increased inputs of Nitrogen and Phosphorus into lakes from agricultural runoff, the growth of *Synechococcus* was tested with added nutrients in BG-11 media. *Synechococcus* yield will be compared to previous growth studies. Finally, we will compare our results from the added nutrient trials to *Synechococcus* grown in other medias to determine which produces the most yield, which correlates to more biodiesel.

Methods

1. Testing Various Nutrients Concentrations for *Synechococcus* Growth

Synechococcus was grown for at 27 ^{o}C in five different medias, with varying nutrient concentrations [BG-11, $NaNO_3$, K_2HPO_4, $MgSO_4$, and Urea Phosphate] to determine which supports the most prolific growth. A standard curve of the correspondence of cell counts to ultraviolet visible spectroscopy values was created, in order to more efficiently count cells. We collected absorbance values from each flask regularly for 40 days.

Figure 1. *Synechococcus* girowng in varying nutrient concentrations

Growth Results

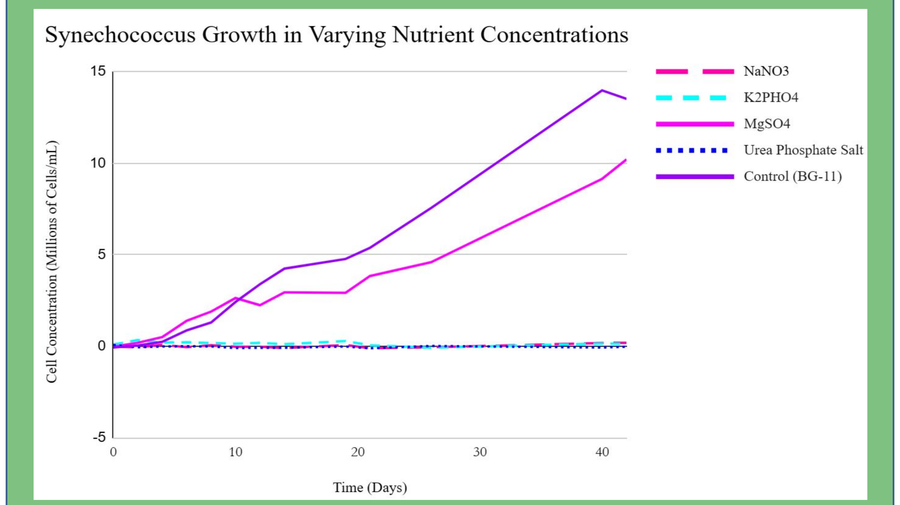

Figure 2. *Synechococcus* growth was most successful in the control BG-11 media. Maximum cell concentration was 13.9 million cells/mL

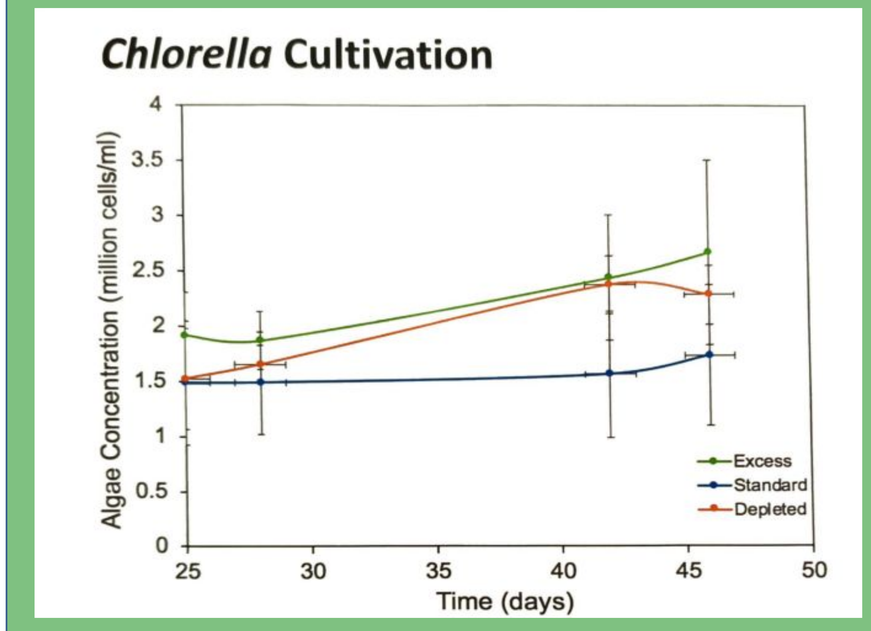

Figure 3. *Chlorella* Growth in Bold's Basal Medium in Varying Nitrogen Concentrations. 250 mL of media with varying concentrations of sodium nitrate (0 mg/mL, 0.25 mg/mL, and 1.0 mg/mL) was added to cultures on day 26. Cell concentrations were obtained using a hemocytometer.

Conclusion

Growth of *Synechococcus* in Various Nutrients:

- Excess $NaNO_3$ and K_2HPO_4 sources greatly reduced the effectiveness of BG-11 and hindered *Synechococcus* growth by almost 100%.
- Excess $MgSO_4$ also reduced the effectiveness of BG-11, reducing yield by 26.6 %.
- As Nitrogen and Phosphorus concentrations in lakes and streams continue to increase with continuous runoff from agriculture fields, *Synechococcus* will struggle to grow and population numbers will decrease.

Comparing Growth of *Synechococcus* to *C. Vulgaris*:

- In an excess of Nitrogen, *Synechococcus* did not grow. *C. Vulgaris* grew better in the high Nitrogen media than in the standard media.
- When looking at the growth of cells in the standard media for each species, *Synechococcus* had a much higher concentration of cells after 40 days of growing, 13.5 million cells/mL, while *C. Vulgaris* only reached a concentration of ~ 1.5 million cells/mL.
- The growing time varied greatly between the two species. *C. Vulgaris*, even in its best condition, took 46 days to produce 2.6 million cells/mL, while *Synechococcus* only took 10 days of growing to have 2.4 million cells/mL.

Acknowledgements and References

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