Algae Research for Filtration and Energy Capabilities

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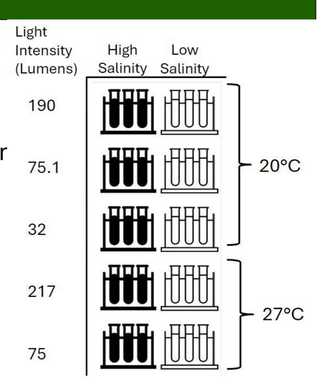
Introduction

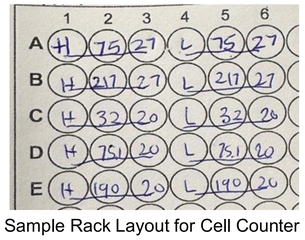
- Algae are a diverse group of photosynthetic organisms like plants, meaning they require CO2, nutrients, and light to grow, but lack complex root, stem, and leave structures
- Algae has potential as a sustainable biofuel; it is abundant and replenishes much quicker than alternative biomass such as trees, corn, or agricultural waste, and grows in locations typical crops cannot
- Algae can also be used as a water filtration device; they remove pollutants like CO2, nitrogen, phosphorus, and even heavy metals
- Wastewater treatment with the help of algae is a promising business based on its known filtration capabilities
- After harvesting and drying algae, its lipids can be extracted and refined into biofuel.
- Benefit of algae is its efficient biological design and high lipid content, producing more biofuel per acre than any other biomass

Methods

Tetraselmis Chui Lab Experiment

- 30 test tubes with Tetraselmis Chui were made, and their growth was observed for 2 weeks
- 10 conditions, each condition tested ir triplicate
- Each tube was filled with 500 mL of water (15 high salinity and 15 low salinity), as well as 1 mL each of Tetraselmis Chui
- Every 1-2 days, the cell concentrations of each test tube were counted to observe growth
- Light was set to a 12 hour on/12 hour off cycle





Sample Rack Layout for Cell Counter

Filtration Experiment Tank Conditions

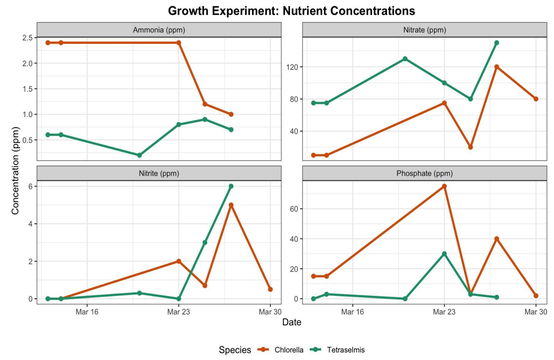
To start the algae cultures:

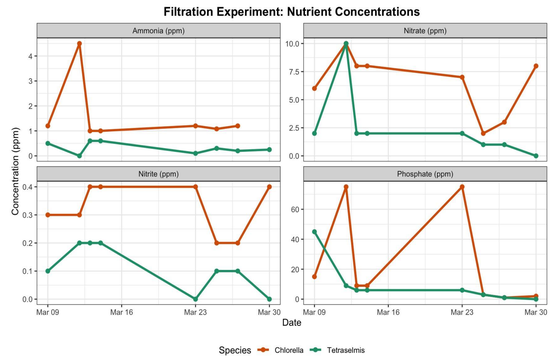
- 1400 mL of water to 14 mL of Chlorella
- 42 mL of Tetraselmis Chui (less concentrated)
- 700 mL of water added to all tanks to promote growth
- F/2 nutrients added to the growth tanks
- Took nutrient and climate data for ~3 weeks
- Algae harvested through coffee filters

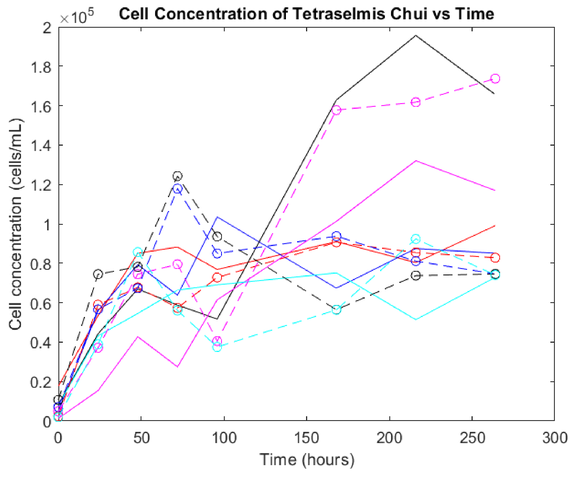
Freshwater with F/2 Nutrients	Freshwater without added nutrients
Saltwater with F/2 Nutrients	Saltwater without added nutrients

Conditions in each tank

Results







- **Found overall declines in most nutrient concentrations over time for both Chlorella and Tetraselmis algae**
- **Increased levels of light leads to higher rates of algal growth in both species**
- **1g of algae/250ml was harvested after a 3 week period**

Discussion

***Tetraselmis chui* exhibits optimal growth in high-light, high-salinity, and room-temperature conditions, suggesting high feasibility for integration into standard climate-controlled building facades.**

Comparative analysis with *Chlorella* showed visible proliferation in both species, though a two-week cultivation period was insufficient for recording significant changes in nutrient filtration levels. Future implementations will utilize extended growth cycles to fully quantify the cleaning abilities and energy production potential of these microalgae within green building systems.

Tetraselmis chui, UTEX Culture, University of Texas USA

To address the operational challenge of salt accumulation caused by evaporation in marine systems, we developed an automated salinity corrector that ensures stable environmental conditions by precisely introducing freshwater and maintaining the high-salinity profile required for optimal algal health and consistent energy production.

Next Steps

- **Next year's team can use our research as a foundation to design a physical system**
- **A longer duration and larger scale experiment would provide a better understanding of the applications of algae power and filtration**
- **The ideal team for continuing this project would have a strong foundation in biological sciences and experiments**
- **Working with the Civil Engineering team to utilize algae power and filtration within a building set-up would be a possible focus point**
- **Future partnership with the UNH AquaFort program is also a potential opportunity.**

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