Screening of Native Floridian Algae For Biofuel Production

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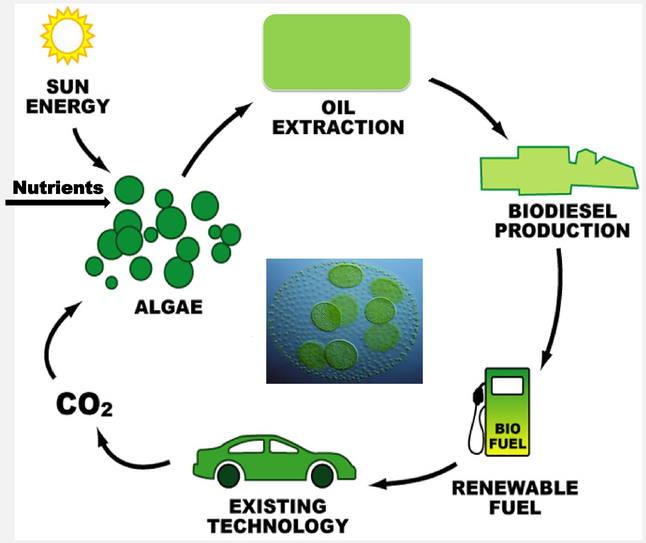
Abstract

Increasing energy demand and concerns about climate change require advances in manufacturing transportation fuels from sustainable resources. Microalgae are a promising source of biofuels, such as biodiesel, due to their potentially high fuel yield per unit area of cultivation. Biodiesel and other fuels from microalgae have the potential to displace fossil transportation fuels with minimal impact on the environment, since algae can be cultivated on marginal land using brackish (or salty) water and absorbing CO_2 from the atmosphere or from emission sources.

The goal of this project is to identify promising algae from a collection of 31 strains of native Floridian freshwater green algae in terms of growth rate and lipid accumulation. The growth conditions of the selected strains will be optimized to maximize lipid (and hence biodiesel/biofuel) production. The lipid content of the strains was via the Nile Red method by FIU student Priyanka Narender and a few strains were identified as the most promising ones. Those strains and a control strain were grown and cultivated in 3-liter flasks at exactly the same conditions to compare their growth rates and the lipid content.

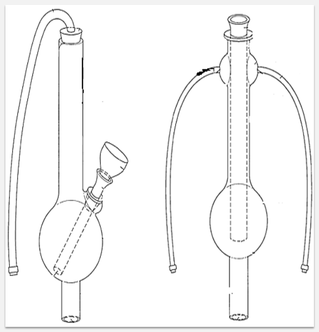
Introduction

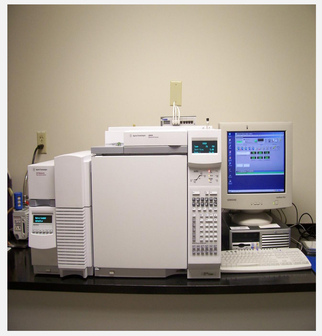
- Microalgae are the most primitive form of plants.
- Most efficient converters of solar energy because of their simple cellular structure.
- Promising source of biofuels.
- Can grow in brackish or salty water.
- Synthesize lipids from sunlight and CO_2.
- Algal lipids are used to produce biodiesel, aviation fuels, and military fuels.



Materials and Instruments

- **Lipid Extraction:** A Soxhlet device was used to extract lipids by using organic solvents.
- **Lipid Measurement**: Lipids can be quantified via GC-MS.





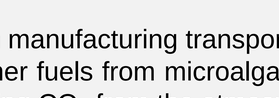
Methods

Cell Growth and Harvesting:

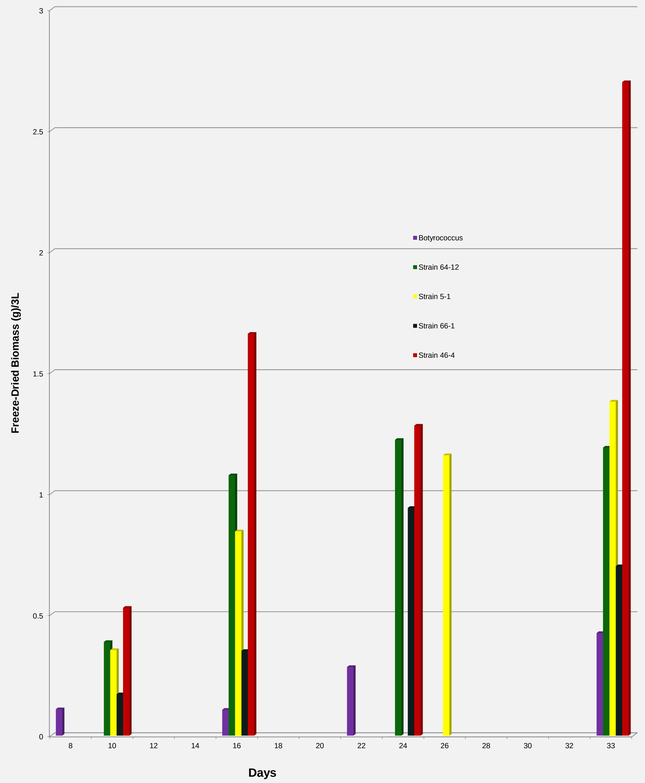
- Native Floridian algae strains were obtained from the FIU culture collection.
- The cell culture was grown in BG medium.
- The 3L algae cultures were incubated for one, two, three and four weeks under normal growth conditions.
- Cells were harvested by centrifugation.
- Cell mass was freeze-dried.

Nile Red Method:

- The proteins in the cell are precipitated through the Bligh & Dyer method.
- It is a lipophilic fluorescent characterized by a shift of emission from red to yellow.
- Polar lipids are stained red.
- Neutral lipids are stained yellow.
- The light intensity of the homogenized cells is measured at 530 nm and 575 nm wavelengths.



Results



- Four of the novel algae strains were selected for further characterization.
- One of them, EV 46-4, produced the highest amount of cell mass.
- The positive control, Bo*tryococcus braunii,* generated the least amount of cell mass.
- Freeze-dried samples were stored at -20 ^{o}C for subsequent lipid analysis.

Conclusions

- Among the investigated novel algae strains, EV 46-4 is the most promising one because of its high growth rate.
- More than 2.3 grams of dry cell mass were obtained from 3 L of cell culture after 33 days of cultivation.
- *A control strain, B. braunii* accumulates a significant amount of lipids.
- The extraction of lipids from cell mass is tedious .
- Dry mass in 3L cell culture after 33 days was only 0.42 grams.
- Because of the above disadvantages, *B. braunii is* not a promising strain for biodiesel production.

Future Work

- Lipid extraction from de-watered cell mass.
- Extracted lipids will be measured by GC-MS.
- Growth conditions of the selected algae will be optimized.
- Eventual goal is to identify growth conditions that result in cost-effective production of algal lipids.

Acknowledgement

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