Student Green Energy Fund

Final Project Report

Date: Nov. 22, 2017

Project Name and completion date: Reducing USF CO_2 Emissions with Algae - Nov. 20, 2017

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Project summary, highlights and lessons learned: (1) Summary: The scope of the project was to assess the potential of microalgae cultivation on campus to reduce CO_2 emissions at USF. Our findings show that, if deployed on campus, algae cultivation can contribute to lowering USF's greenhouse gas emissions, while generating material (cell mass) that can serve as natural fertilizer for use on the campus grounds. **(2) Highlights**: Using the freshwater microalga *Chlorella vulgaris* we investigated whether a gas mixture of 7.5% CO_2 + 7.5% O_2 + 85% N_2, which simulates the composition of the **flue gas** emitted by USF's natural gas-burning boilers, can support algae cell growth. Three sources of CO_2 were tested (each in duplicate): (1) 100% Flue Gas; (2) 50% Flue Gas + 50% Ambient Air; and (3) 100% Ambient Air. The data showed that the 50%-50% mix resulted in the highest productivity of 0.109 g/L/day, the flue gas resulted in 0.098 g/L/day, and the ambient air resulted in 0.072 g/L/day. Hence, flue gas can support strong algae growth. **(3) Lesson learned**: Algae can indeed act as a promising sink for CO_2 emissions.

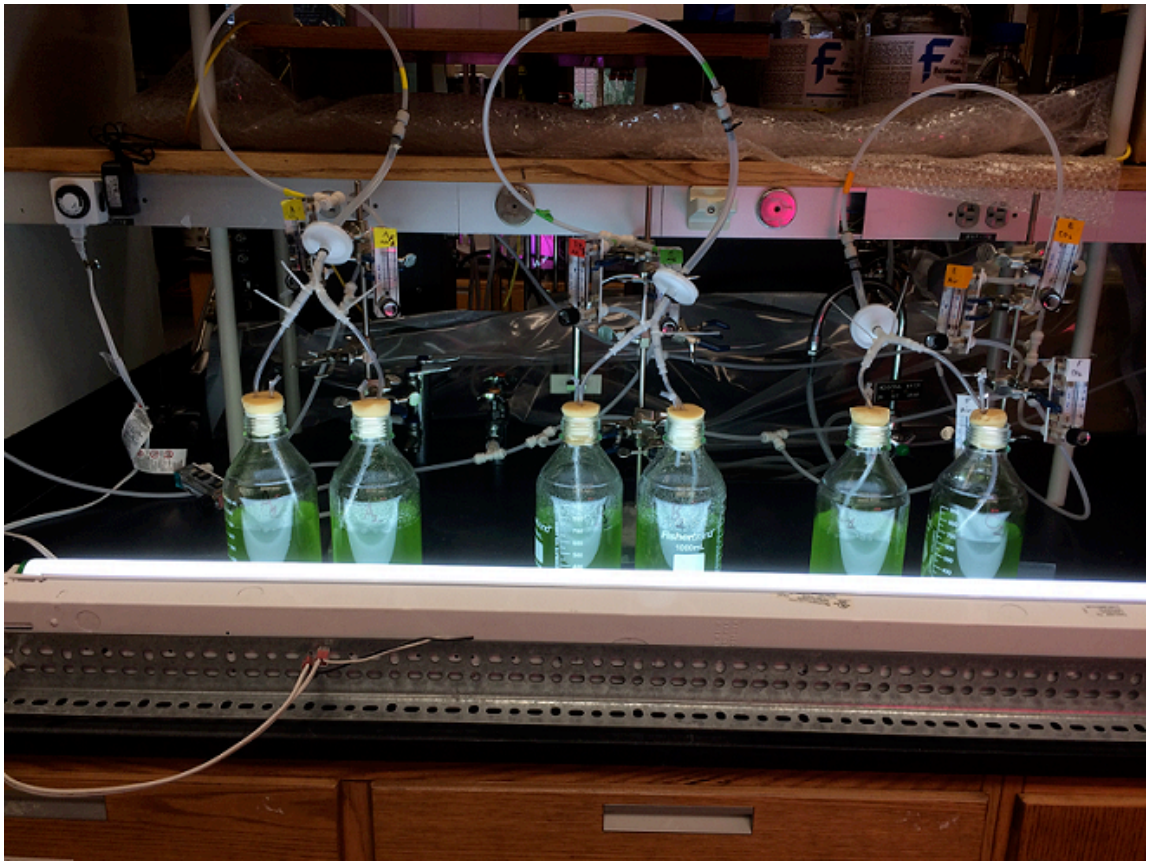
Measurable Outcomes: Using the rule-of-thumb that approximately 2 g of CO_2 are consumed per g of algae mass produced, the data indicate that *Chlorella vulgaris* cultivation can consume annually about 80 g of CO2 per liter of cultivation. If the cultivation system on campus were scaled up to 3,300 gal, it would potentially remove 1 ton of CO_2 per year from USF's emissions. Process optimization may enhance that figure.

Detail how funds were utilized including rebates (if any) and cost sharing (cash or in-kind contributions): The funds were used to purchase (1) algae cultivation chemicals and supplies; (2) compressed gas mixture tanks; (3) parts for experimental set up; and (4) algae cell mass and water compositional analysis. In-kind cost match was provided by Prof. Philippidis in the form of time dedicated to directing the project and mentoring the students (1 hour per month of project execution).

How are the project benefits being communicated to the USF community? After project completion the findings will be shared with the SGEF Council and will be communicated to the USF community via the PCGS website to stimulate further work in this area.

Expected project spin-off or up scaling: The feasibility of future scale-up of the project is under consideration and will involve close coordination with Facilities.

Include photos of the project



Experimental setup used for algae cultivation on simulated flue gas with the freshwater algae *Chlorella vulgaris*.

Questions? Contact Gidi Hendrix SGEF_Council@usf.edu 813-974-8611