Carbon Dioxide Utilization Efficiency in Microalgae Systems: Evaluating the use of flue gas to grow microalgae

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Algae cultivation

- Carbohydrates
- Proteins
- Fats

CO₂ → Sun → O₂

Aquaculture feed
- Nutraceuticals
- Biofuels
- Livestock feed
Flue gas as an alternative CO$_2$ source

**Flue Gas**: exhaust from fossil fuel combustion
- 5-10% CO$_2$
- Primary contributor to CO$_2$ emissions

**Benefits**
- Mitigates CO$_2$ emissions
- Reduces operational cost

**Challenges**
- Toxins and heat
- Low CO$_2$ concentration
- Requires capture and delivery system
Cellana Kona Demonstration Facility
Flue gas?

Open Ponds
Cellana’s flue gas treatment and delivery system

Flue Gas

Spray tank (cools and “cleans”)

Storage tank

Open pond

3 generators

Electricity to facility

Pure CO₂
The BIG questions and objectives

Is Cellana’s flue gas system, when supplemented with CO$_2$, effective in the large scale cultivation of algae?

- Does the flue gas system offset CO$_2$ usage?
- Algae grown with flue gas vs algae grown with pure CO$_2$
- How much CO$_2$ is used for each system/what is the cost?

What is the baseline CO$_2$ usage through the open pond growth cycle?
Methods

Pure CO$_2$

Control Pond

Experimental Pond

10 days

Growth Rate
Biomass productivity
Biomass composition
Nutrient use
pH
CO$_2$ usage
Cost

flue gas + Pure CO$_2$
Balancing the outcomes

Flue Gas
- pH hard to regulate
- High toxins
- Cheap
- Less productive

Pure CO$_2$
- High quality
- Expensive
- More productive

Flue Gas = Less pure CO$_2$ needed = $$$

Flue Gas

Pure CO$_2$ (control)
Major milestones

**Completed:** System to collect flow data installed, preliminary data collected

**Future:** First cycle of flue gas experiment to be completed
Acknowledgments

Mentor: Emily Knurek

Thank you to all Cellana employees for all the support and assistance throughout my internship!

Thank you to the Akamai staff and Akamai sponsors!