

JAMES MADISON UNIVERSITY.

*Madison*

# Algae: Tomorrow's Bio-fuel

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# Goal of this project

- Many algae fuel systems being developed (NASA, U.S. Navy, ExxonMobil, Solazyme, Sapphire, etc.)
- Harvesting is a major issue in all systems
- Main challenge has been getting them out of the water
  - Effectively and efficiently defined as:
    - Percent Algae Harvested
    - Percent Oil Harvested
    - $E_{in}$  and  $E_{out}$
    - Cost
- Apply parameters to proposed harvesting systems:
  - Evaporation, Filtration, Centrifugation, Hydro-cyclone Separation, Electro-flocculation.

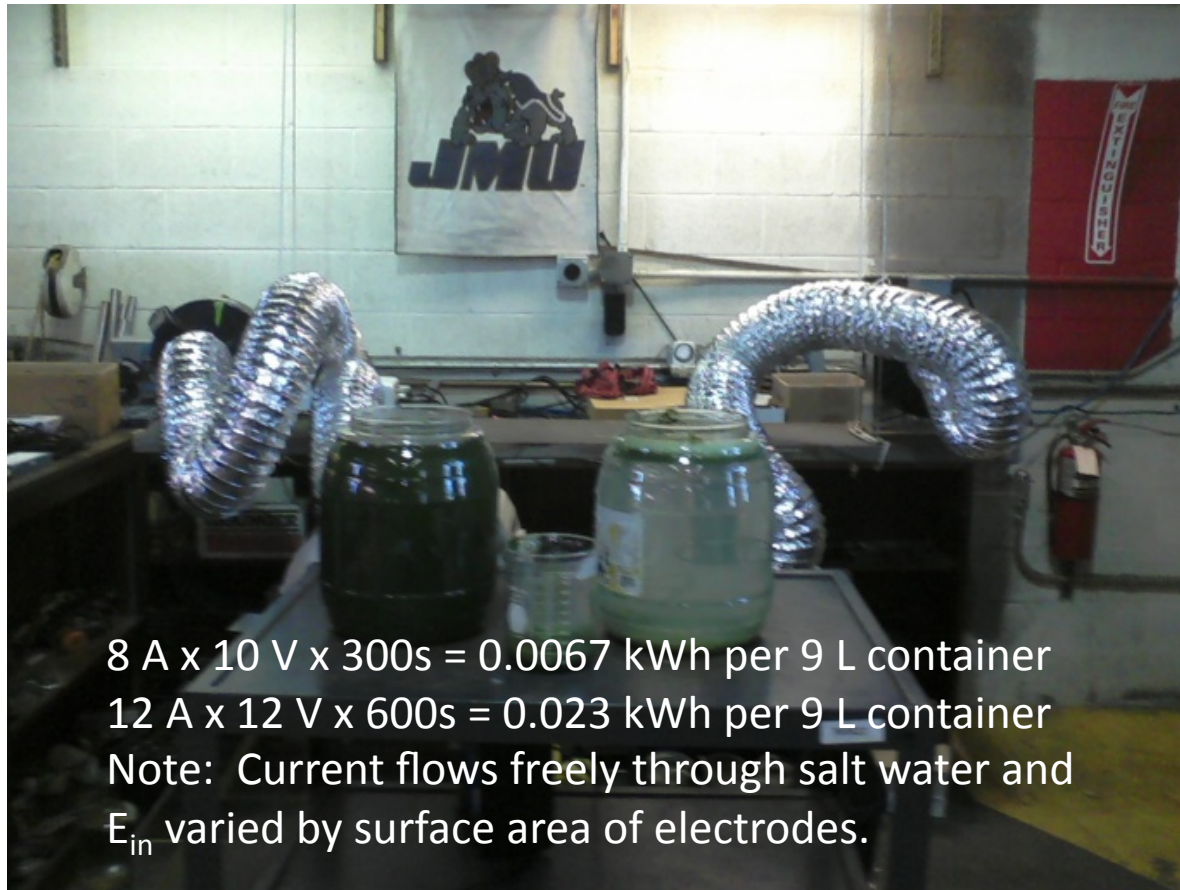


# Harvesting Methods

- “Solar” Hot Plate – Free energy; space intensive
- Filter- not continuous, plugs up quickly
- Centrifuge – works, energy intensive
- Hydro-cyclone -- flow through, needs further evaluation
- Electro-flocculation



# Electro-flocculation



# Measuring Energy Content

- Bomb Calorimetry



# Conclusions

- Electro-flocculation worked to get algae out of water, but dried product didn't burn
  - Organic molecules in the cells may have oxidized
  - Flame-retardant properties of  $\text{Al}(\text{OH})_3$  may have prevented combustion of cells
- Future Directions
  - Algae remains promising but harvesting with an energy yield remains elusive.

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