Cultivation of Filamentous Algae Spheroids

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Why Filamentous Algae?

Microalgae

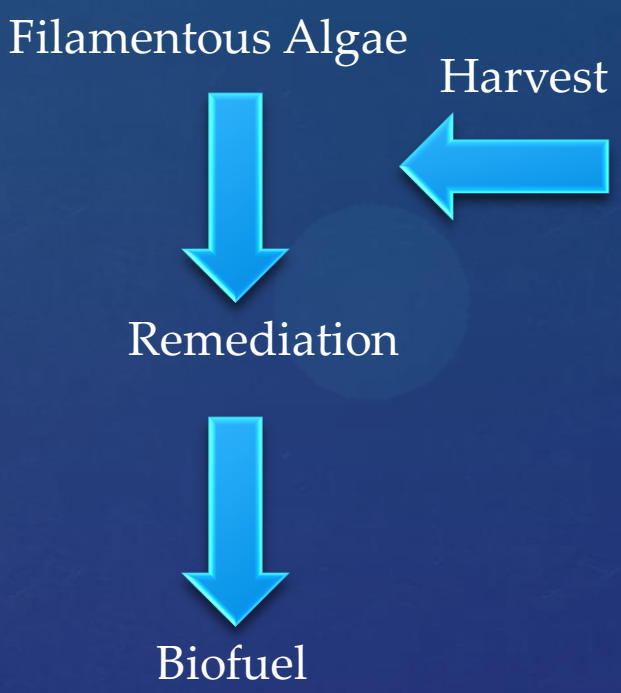
Harvest

Centrifugation

Remediation

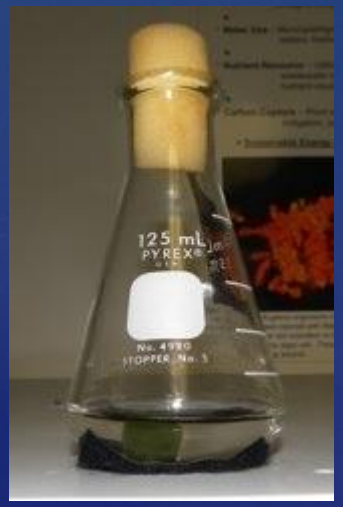
Biofuels

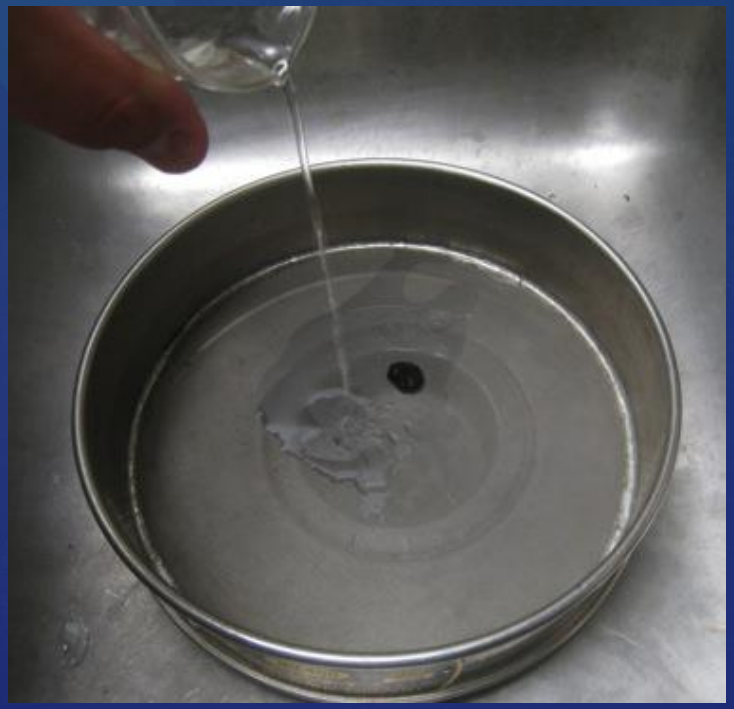
Filamentous algae offer natural advantages for harvesting



Spheroids

- *Marimo* phenomena
  - (Japanese Lake Balls – *Cladophora spp.*)
  - Naturally occurring algae spheres
- Easily harvestable
- Does not require centrifugation





Culturing Filamentous Algae

- Can the *marimo* phenomena be replicated in the lab?
  - Phycoprospecting for filamentous algae:
    - *Rhizoclonium, Cladophora, Pithophora,* Polyculture
- Aeration vs. Orbital mixing
- Media for culturing
  - Bolds Basal Medium, F/2
  - Soil Extract

Rhizoclonium

Cladophora

Algae Polyculture (*Cladophora, Rhizoclonium,* others?)

Pithophora

Objectives

- Culture a stock of filamentous algae for use in experiment
- Determine optimal mixing method for forming algae spheres
- Observe how morphological features of different genera interact to create spheres

Hypothesis

- The genus *Cladophora* and it's prominent branches will form spheres more readily on the orbital mixer than other limited or non-branching filamentous algae.

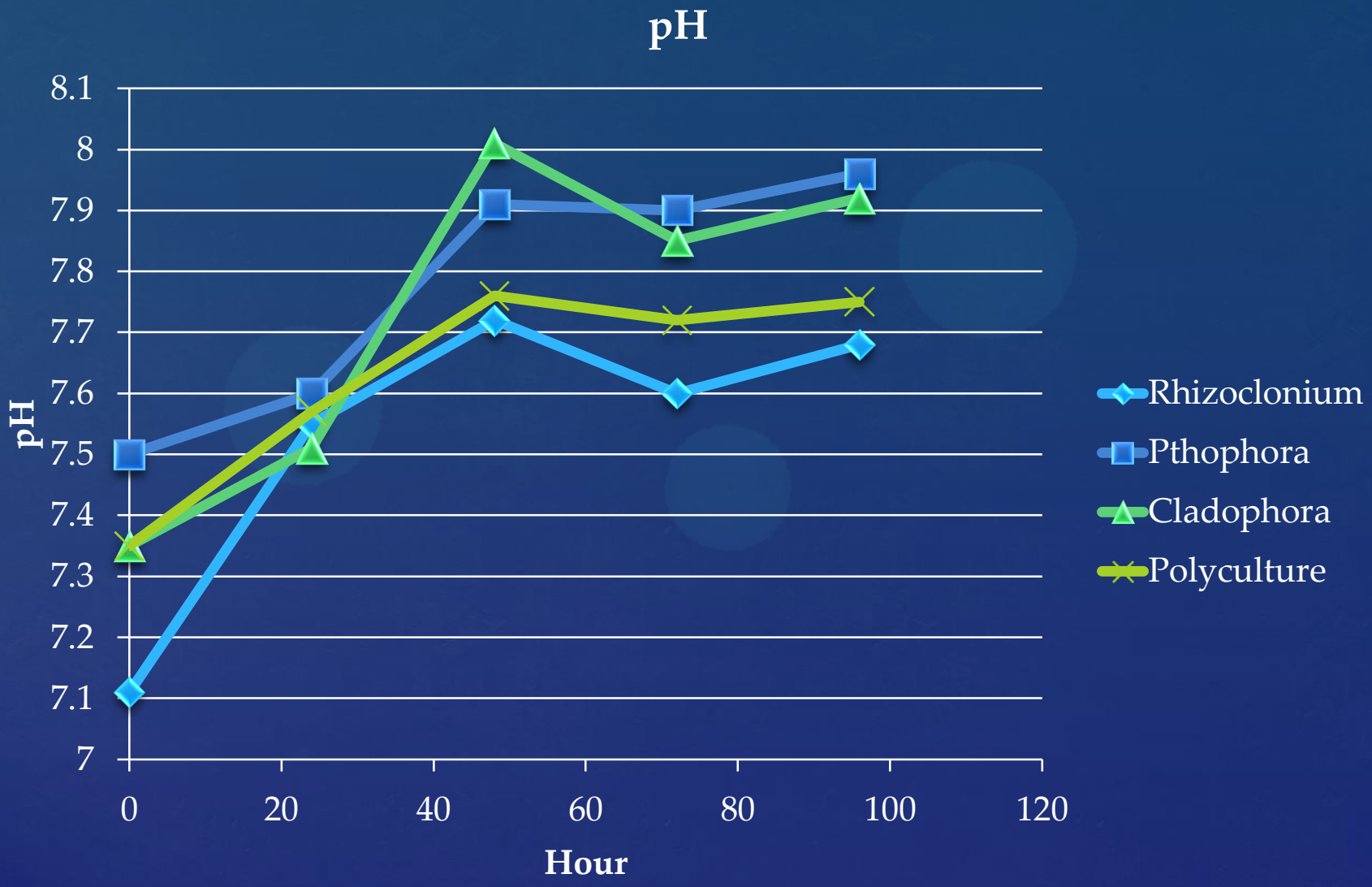
Setting Up The Experiment

Medium	Light Ratio	Light intensity ($uE/m^2/s$)	Mixing Method	RPM	Inoculum	Tested parameters
25 ml of 4% Soil Nutrient Extract	12:12 Light to Dark	150	Orbital Mixer	170	.25 ml blended algae	pH, ORP, conductivity

Methods

- Used Volumetric Displacement Method from *Standard Methods* to measure growth through biovolume.
  - Let algae drain on a 38 micrometer screen for 1 minute before displacement in a 5ml graduated cylinder

Measurements



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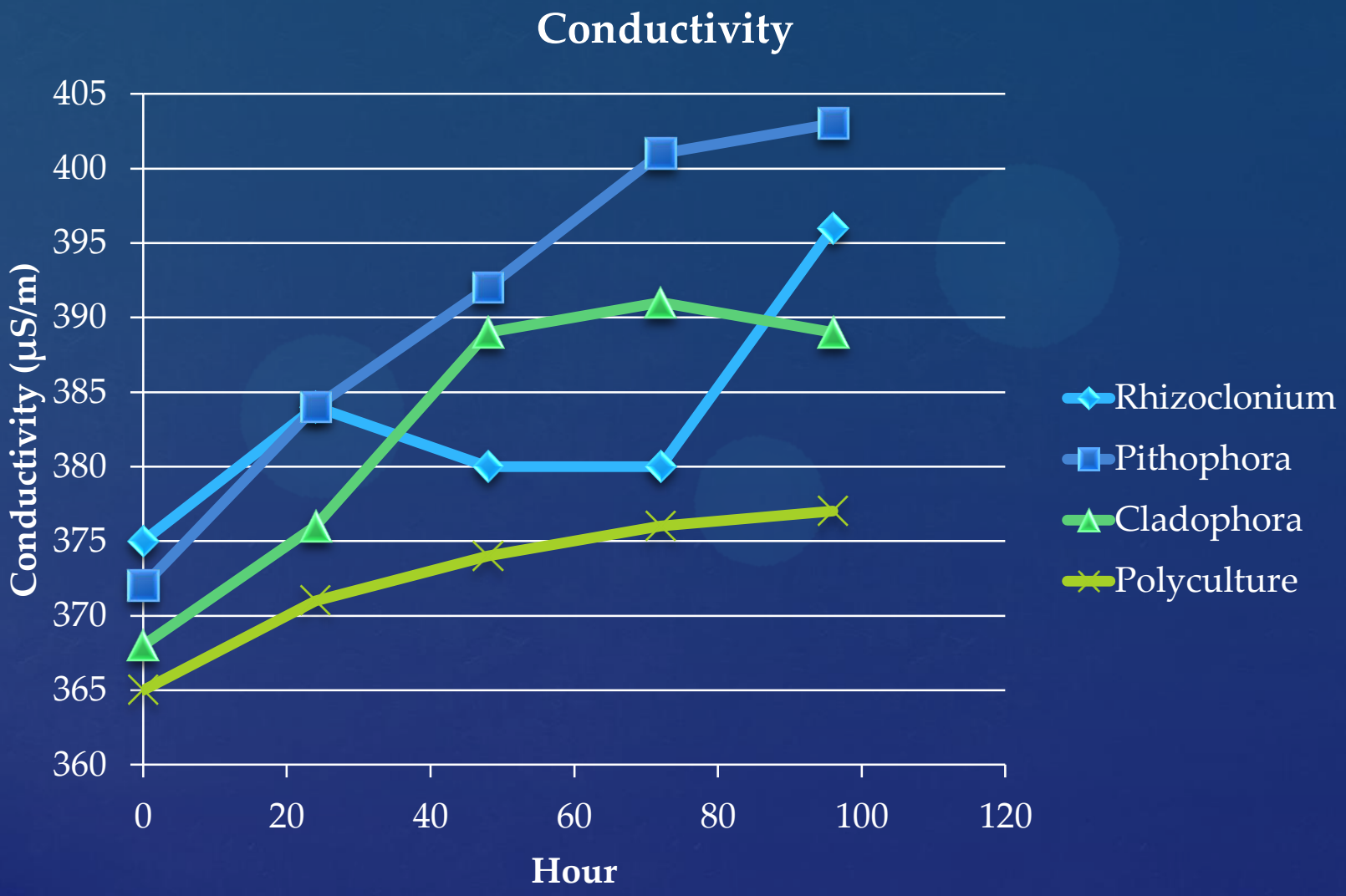

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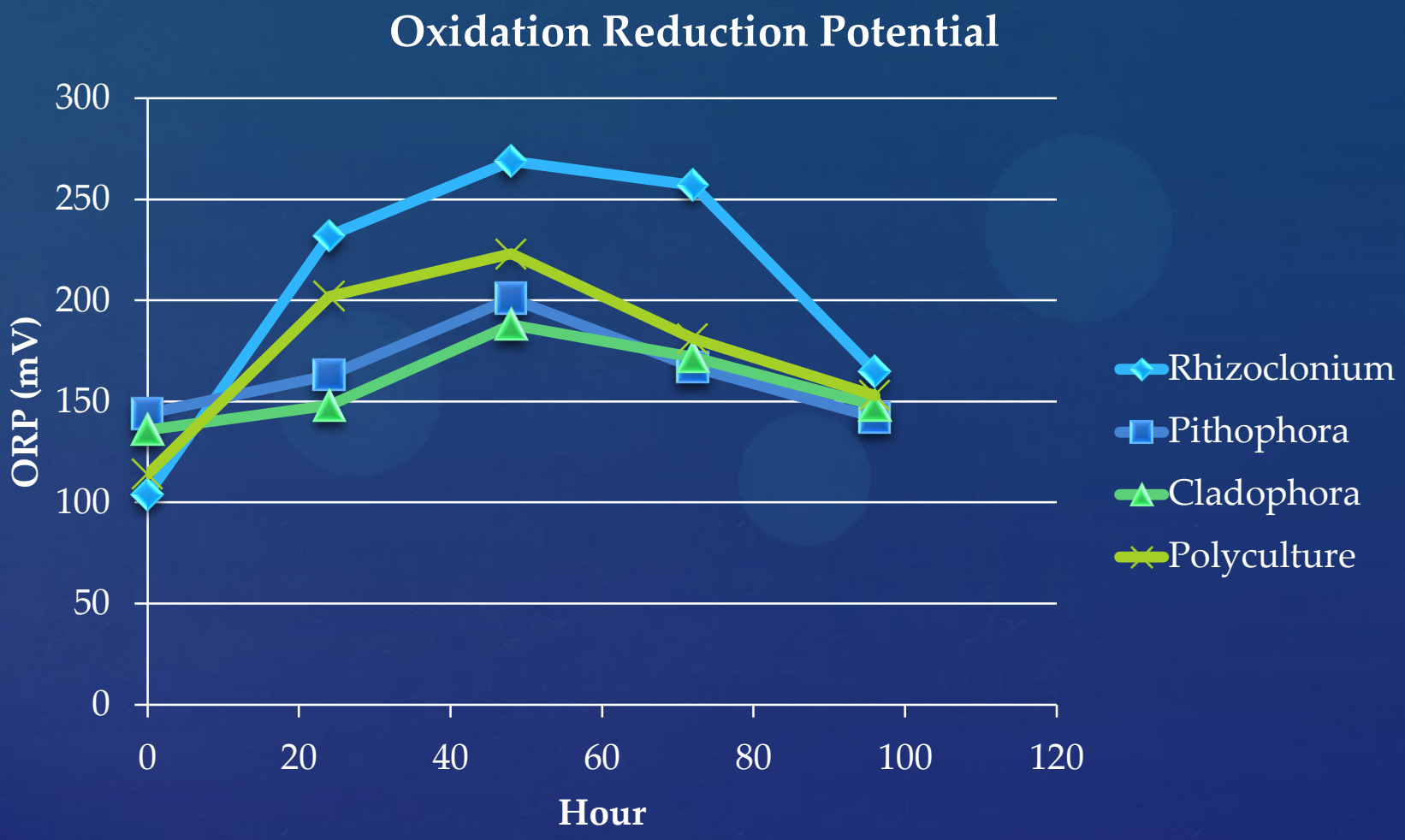

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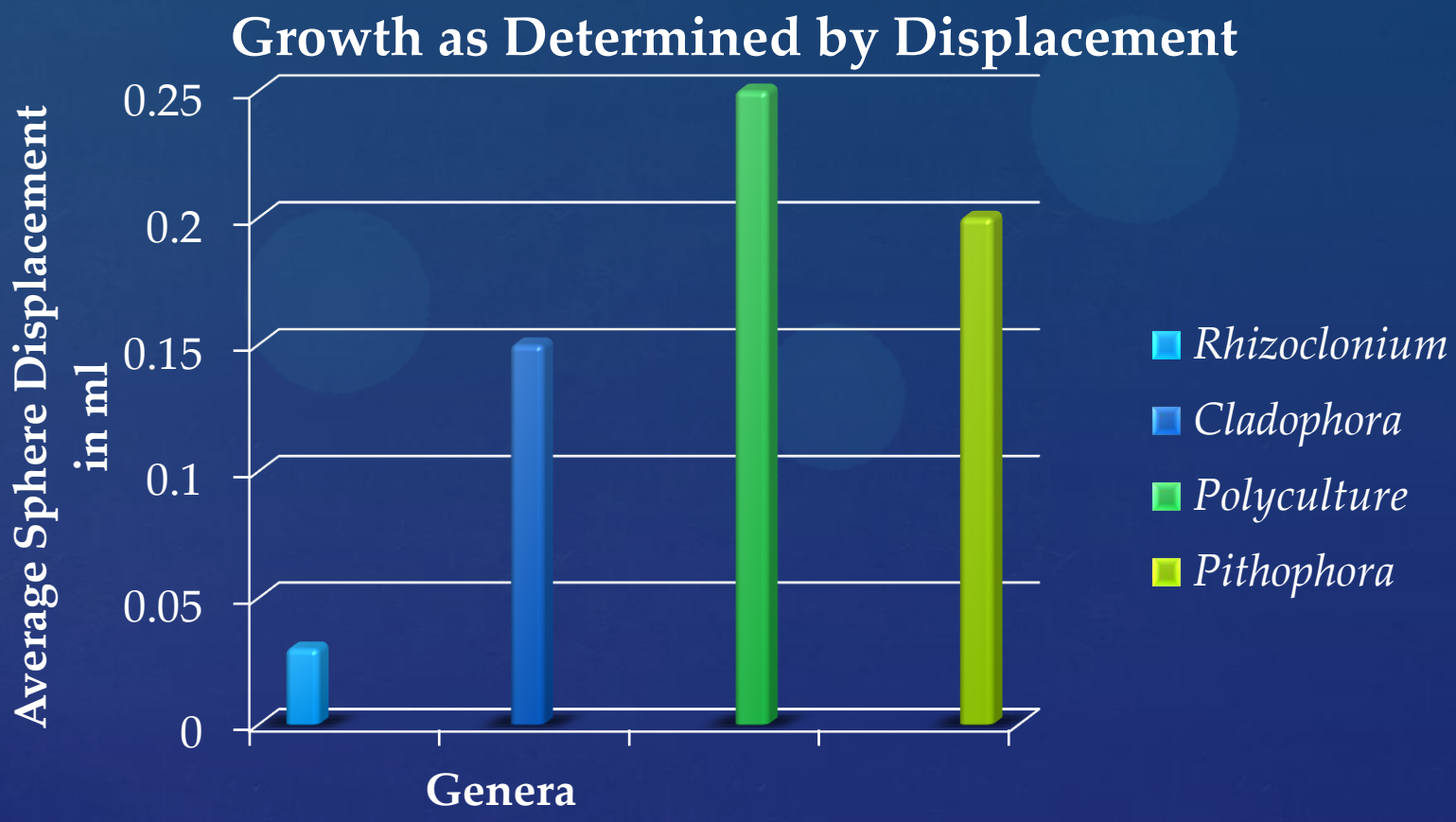
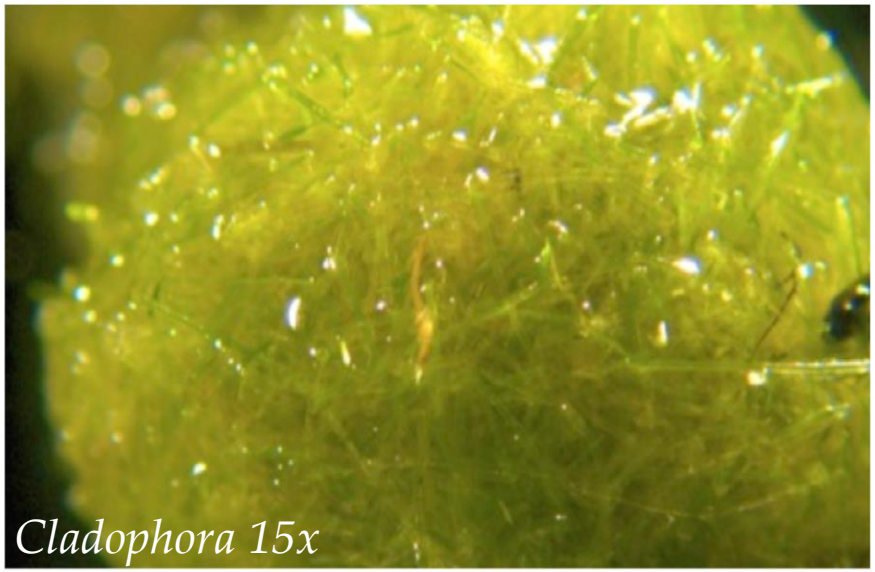
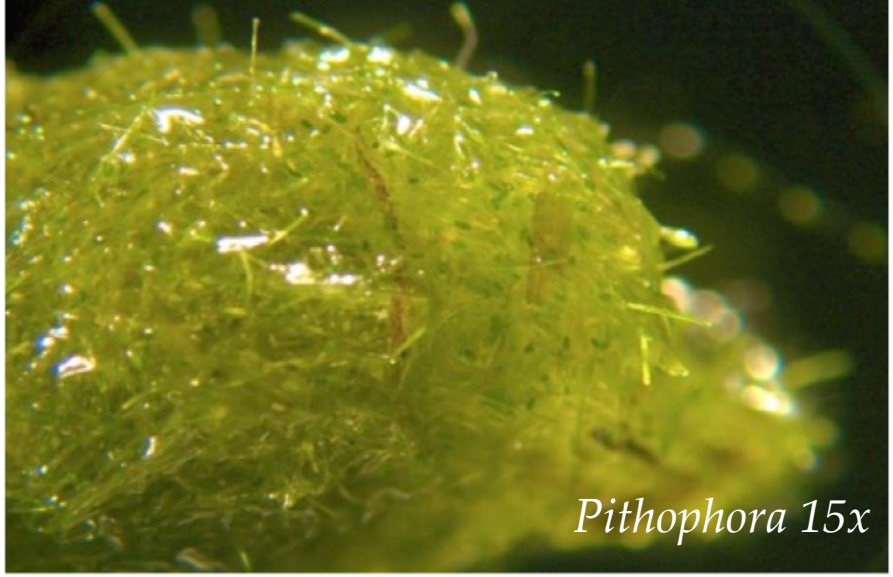
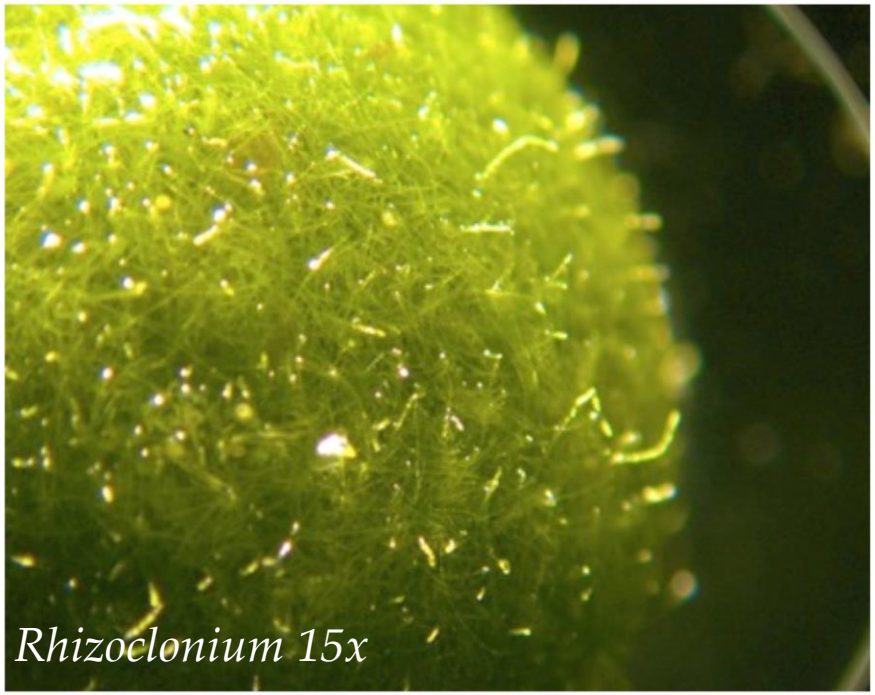



Cladophora 15x


Pithophora 15x


Rhizoclonium 15x


Polyculture 15x

Evaluation of Hypothesis

Genus	*Cladophora*	*Rhizoclonium*	*Pithophora*	*Polyculture*
Spheres Formed	2/3	2/3	2/3	3/3

Non branching and limited branching filamentous formed spheres.

The motion of the Orbital Mixer likely the key factor in sphere growth.

This motion could be replicated by a paddle wheel in a low energy system.

Conclusions

- Filamentous algae spheroids could be a viable way to remediate waste waters and produce biofuels.
- Blending may negatively effect some genera more than others
- Polyculture's biomass increase and sphere formation may be due to niche ecology

Future Research

- Find optimal inoculum to volume ratio to form spheres.
- Determine how vessel shape effects sphere formation
- Scale up experiment
- Find more consistent methods to measure biomass and biovolume
- Perform quantitative tests on remediation to gauge effectiveness
- Look into oil and lipid concentrations of sphere forming algae