Testing Different Growing Conditions for Algae

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Abstract
With the growing demands of water in California and the increasing cost of fossil fuels to operate water-cleaning equipment, Algae was cultivated in different concentrations of Nitrogen, Phosphorus, and Potassium (NPK) during different trials to identify the best growing conditions for the removal of water contaminants. Before testing algae in waste water, the Algae: Dunaliella primolecta, Chlorella vulgaris, and Scenedesmus dimorphus were cultivated in different concentrations of N, P, and K. The different mediums used include: Orchid Grow More (20-20-20), Miracle Grow (30-10-0), Murashige & Skoog, and Orchid Bloom Boster (11-35-15).

Introduction
Algae are found in 71% of the earth’s surface. They are the primary producers of the ocean and provide oxygen for all life on earth. Algae are a very diverse group of organisms that with the right amount of nutrients, sunlight, and water have the capacity of a thriving growth. Algae acquire carbon dioxide from air, energy from the sun and nutrients from the soil. Some of those nutrients include Nitrogen, Phosphorus, and Potassium (N, P, and K). Since algae require very little components for growth and acquire carbon dioxide from air to release oxygen, it is questioned if algae can grow in conditions of high Nitrogen, Phosphorus, and/or Potassium, conditions normally present in wastewater. In order to work toward this goal, the best growing conditions for algae were tested in different concentrations of NPK. The three species of algae used were Dunaliella primolecta, Chlorella vulgaris, and Scenedesmus dimorphus. This investigation would not only remove water contaminants from water in the future, but would be more efficient and inexpensive way of cleaning waste water as opposed to using expensive cleaning equipment.

Specific Objectives
1. To monitor the growth of Dunaliella primolecta, Chlorella vulgaris, and Scenedesmus dimorphus in media containing different amounts of N, P, and K.
2. To compare the amount of cell growth between the three algae species.

Methods
Algae were grown in different concentrations of N, P, and K. As a model for the different amounts of N, P, and K, three different plant fertilizers were used: 1) Miracle Grow (30=N,10=P,10=K); 2) Orchid Bloom Boster (11=N, 35=P, 15=K); and 3) Orchid Grow More (20=N, 20=P, 20=K). Murashige & Skoog medium was used as a standard medium. Cell densities were counted every other day and recorded. Each experiment was conducted three times.

Preparation of Media:
1. Miracle Grow
2. Orchid Bloom Boster
3. Orchid Grow More
4. Murashige & Skoog

Algae inoculation included adding 200µL of Dunaliella primolecta, Chlorella vulgaris, and Scenedesmus dimorphus with 5mL of each medium.

Growth Process
Algae are kept in the shaker for two days to optimize growth. The shaker provides light and continuous rotation for the microalgae.

Cell Count Preparation
Tubes of algae were vortexed to mix the contents. 5µL of algae was gathered in 1.5mL microtubes under the hood using a micropipette. Once inoculated, 25µL were put into a hemacytometer.

Count in Microscope
Cells were counted using the hemacytometer’s 50x grid. All cells inside the grid were counted and recorded.

Results
SD: Scenedesmus dimorphus
DP: Dunaliella primolecta
CV: Chlorella vulgaris

From our research we identified that the three different algal species grew well in the media Orchid Grow More; at one point Scenedesmus dimorphus reached up to 678,000 cells per mL, Dunaliella primolecta reached up to 113,000 cells per mL, and Chlorella vulgaris reached up to 97,000 cells per mL. Orchid Grow More has NPK of 20-20-20 and it appears this is a good amount for all the three algae. Also, it appears that Scenedesmus dimorphus can also grow well in high concentration of nitrogen, and Chlorella vulgaris can also grow well in high concentration of phosphorous. Dunaliella primolecta does not grow as well as the other algae in the tested media; this may be due to the fact that Dunaliella primolecta is a halophile and require high salt concentration as well. Finally, although all the algal species grew in all the tested media, Scenedesmus dimorphus was the fastest growing algae out of the three reaching the highest cell count too.

Conclusions and Future Work
At the end of the experiment, we were able to conclude that the Orchid Grow More media with the NPK levels of (20-20-20) was where the algae had the best growing conditions. In this media, we optimized the best growing conditions for the algae Scenedesmus dimorphus compared to the other algae. For future experiments, the media with Orchid Grow More could be supplemented with seawater from different irrigation systems to see how much Chemical Oxygen Demand algae is able to remove from the water.

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References

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