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Growth and Production of Spirulina plantesis Biomass at the Same Light Intensity and Temperature

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Growth and Oxygen Production of *Arthrospira Plantesis*

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Abstract

Arthrospira platensis (AP) is a cyanobacterium with a high economic value and is nowadays one of the most important industrially cultivated microalgae. Due to the high nutritional content of its biomass components, *Spirulina plantesis* is fascinating. In addition to the high protein content, emphasis is placed on additional ingredients such as vitamins, polyunsaturated fatty acids, and the pigments phycocyanin, beta-carotene, and chlorophyll that have been employed as food and drink, cosmetic, and medicinal colorants. Knowledge of its growth is essential for the understanding of its physiology and yield. The goal of this experiment was to compare mixed (coiled and straight) and coiled spirulina to see which one had the most cell and oxygen production over a 5-day period. Spirulina cultures were moved into six 2.5 L containers, three for the mixed and three for the coiled. They were then placed on stirring pads under a light intensity of 12 $\mu m/m^2/sec$. Each experiment lasted for five days (120 hours) and Spirulina's cell concentration and oxygen production in the cultures were measured each day around the same time.

When compared to the mixed culture, the coiled spirulina culture produced much more oxygen per cell. Also, the coiled spirulina cultures cell counts were higher and more consistent throughout the five-day experiment, as compared to the mixed spirulina culture which declined over the 120-hour course.

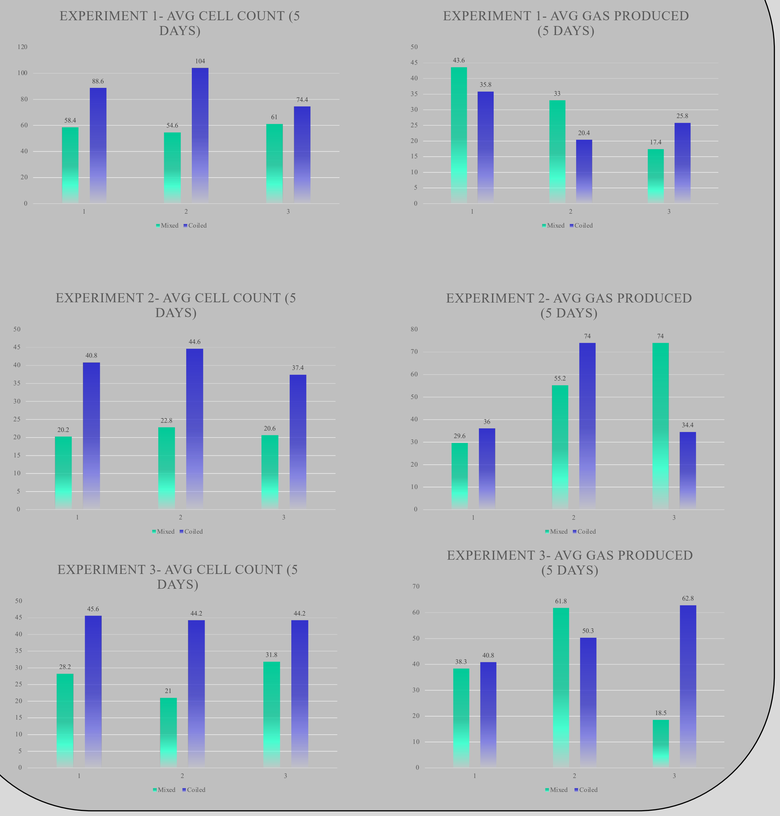
Materials

- Two tanks of Spirulina cultures:
  - -Mixed culture, 50:50 ratio containing both coiled and straight Spirulina
  - -Coiled culture, made up of mostly coiled Spirulina
- Zarrouk's nutrient medium
- Six oxygen-monitoring containers
  - -Two 50mL collection tubes and a clear plastic straw adhered to a clear, round 2L plastic container with a lid
- Light Intensity: 12 $\mu m/m^2/sec$

Methods

- The original cultures were fed 200 mL of Zarrouk's medium twice a week while being kept at 30℃ and a pH of 10.
- Cell counts from both cultures were measured at the start of an experiment to calculate the ratio required to make the cell counts equal and to determine the amount of media that would be supplied to both.
- Depending on the amount of cells from the original tank, the containers were filled halfway or a little over with cells. 200-300mL of Zarrouk's medium was then added, and the rest of the container was filled with deionized water.
- The containers were placed on stirring pads under a light intensity of
- The oxygen-monitoring containers received 5mL of nutritional media every day. Then, deionized water was used to refill the containers once more.
- The cultures were removed from the stirring pads every day for the duration of the 5-day experiment in order to track oxygen production and gauge cell concentration (cells/mL) using a sample of the media.

Results



Pictures

Figure 1: Experimental Set Up

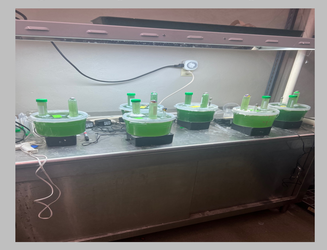


Figure 2: Original Cultures

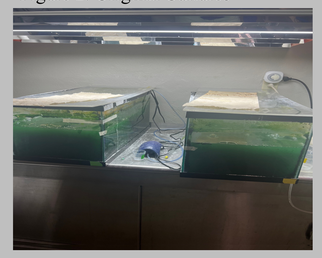


Figure 3: Mixed Culture (Green)

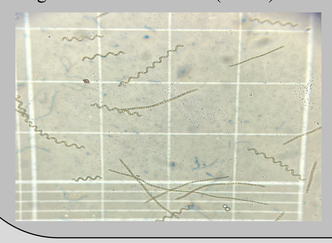
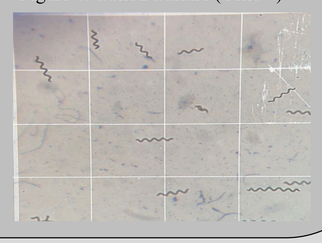


Figure 4: Coiled Culture (Yellow)



Conclusions and Future Directions

According to the findings, the mixed culture produced 0.000146mL/cell and the coiled culture produced 0.00121mL/cell different amounts of oxygen. Therefore, more oxygen was produced by the coiled culture. Additionally, the coiled spirulina had larger and higher-quality cell counts. The data also shows that spirulina can significantly boost its process energy consumption when exposed to lower light intensities.

In the future, researchers should make a concerted effort to match the cell counts in the containers to those in the original culture. This will make it possible to compare the two in a more precise manner. Additionally, using caulk rather than hot glue could result in more precise measurements of the oxygen produced. In the containers, there were so many leaks that it was challenging to measure the amount of gas produced accurately.

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