The Effects of pH on Biomass Production of 
Spirulina platensis

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Introduction

Spirulina platensis is a single-celled, filamentous, spiral-shaped blue green algae (cyanobacteria) indigenous to the tropics. It is of great worldwide interest as a food or food supplement (for both humans and other animals) due to its high protein content and complete array of essential amino acids. The objective of this work was to evaluate growth conditions ideal for Spirulina culture. Research was done in the Bioenergy and Bioproducts Lab at Iowa State University. In order to successfully accomplish this, it was necessary to find the optimum pH, given an ambient temperature of 26 degrees C in the lab, to maximize Spirulina’s growth rate.

Methods

The seed culture for Spirulina platensis was obtained from the University of Texas Algal Culture Collection. The Spirulina was initially grown in 250 mL Erlenmeyer flasks, on a rocker shaker under continuous illumination, and then transferred to 600 mL airlift photobioreactors containing Bold's Basal Medium (BBM). When the Spirulina was ready, it was transferred to an flat panel photobioreactor. Once the culture was established, five 600 mL airlift test tubes were filled with 500 mL of BBM with Spirulina seed stock from the flat panel photobioreactor. Each airlift was titrated with 1N sodium hydroxide or hydrochloric acid until the desired pH was reached. The pHs tested were 5, 7, 9, 10, and 11. After seven days, the algae was centrifuged, freeze dried, and weighed to evaluate growth.

Results and Discussion

At the end of seven days growth, pHs 10 and 11 respectively had produced the most biomass of the five pHs tested (see Figure 3). Moreover, the least productive pHs were 7 and 9 (the typical range of most freshwater bodies). Also, samples from each pH were analyzed via a light microscope at 200X – before and after the seven day growth period. The original source of the Spirulina, the University of Texas seed stock, was contaminated with rotifers and other algal predators (Figure 4A). When samples were analyzed at the end of seven days, the airlift test tubes corresponding to the pHs of 10 and 11 were seemingly predator free (Figure 4B), while airlifts 5, 7, and 9 still contained living algal predators. – most notably rotifers and amoeboid organisms.

Conclusion

This research shows Spirulina platensis has extremophile characteristics as it thrives in alkaline waters. This can be advantageous when trying to maintain a monoculture of algae [1]. This is because manipulation of pH can be an effective means for combating rotifers and other microorganisms, such as amoebas, that graze on Spirulina. Therefore, It is probably safe to conjecture that the greater biomass production seen in the 10 and 11 pH cultures was at least partially due to the lack of algal predators and competition with other algal species. This research will be key in continued optimization of Spirulina cultures.

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References