EVALUATION OF NITROGEN AND CARBON SUPPLEMENTATION STRATEGIES FOR OPTIMIZING BIOMASS PRODUCTION DURING CULTIVATION OF *CHLORELLA SOROKINIANA*, STRAIN SLA-04

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Monday, April 19, 2021
11:00 AM – 12:00 PM

Via Webex:
https://montana.webex.com/montana/j.php?MTID=mf0a327f8be1da7b44b009744e7b63aff

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ABSTRACT: Expansion of commercial algae cultivation is constrained by costs of production associated with resource supply and the operation and maintenance of large open-air systems. High productivity by microalgae requires significant nitrogen and carbon inputs, which are expensive and can offset environmental benefits associated with biofuels and other bioproducts if industrially produced fertilizers or CO_2 are used. High-alkalinity cultivation using bicarbonate instead of CO_2 has become a hot topic in algal research. High-alkalinity algal systems are able to maintain relatively high concentrations of inorganic carbon in solution due to the improved mass transfer of CO_2 into solution from the air. In addition, high HCO_3^- concentrations can cause upregulation of genes associated with carbon fixation and nitrogen assimilation. The current research investigates use of an alkaliphilic isolate of *Chlorella sorokiniana*, strain SLA-04, for cultivation in batch systems using different nitrogen and carbon supply regimes, to improve the understanding of the physiology of this novel organism and ultimately, improve biomass production and resource demand of cultivation. Nitrate, ammonium, urea, and a combination of sources were compared using CO_2 and HCO_3^- supplementation during nitrogen replete growth. In addition, growth using nitrate as the sole nitrogen source was evaluated using five inorganic carbon and four mixotrophic (inorganic and organic carbon) supplementation strategies. Biomass productivity improved with the use of HCO_3^- for conditions provided urea or a combination of nitrogen sources, but no significant difference was observed when nitrate or ammonium were used. Use of bicarbonate for cultivation increased productivity relative to other inorganic carbon conditions that did not receive continued supplementation during nitrogen deplete growth, however continued CO_2 supplementation during nitrogen deplete growth resulted in a significant increase in productivity. From an economic perspective these conditions have limited application due to their demand of CO_2. The use of additional bicarbonate supplementation during nitrogen deplete growth did not serve as an equivalent alternative for continued CO_2 supplementation during this growth stage. Glucose supplementation improved productivity for inorganic carbon conditions that were not supplemented continuously with CO_2. The combination of glucose and continuous CO_2 supplementation caused a reduction in biomass production, suggesting a negative interaction.

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