How to Feed Your Fuel: Analyzing the Effects of Nitrogen Deprivation vs. Increased Carbon on Lipid Production in an Algal Photobioreactor

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Modern society requires an energy source that is renewable, non-pollutant, efficient and compatible with most machinery. Algal biofuel, a liquid fuel synthesized from the lipid produced by microalgae grown in a photobioreactor, meets these criteria. However, current biofuel companies lack the efficiency to produce enough fuel to compete economically. Previous experimentation suggested aeration, an expensive and widely utilized growth aid, is not as crucial as companies believe. This experiment challenged the utility of nitrogen deprivation, a meticulous two-stage process that increases lipid production but requires increased processes and time. It was hypothesized that increasing organic carbon supplied to Nannochloropsis oculata would induce an increase in lipid production comparable to nitrogen deprivation, as more carbon would be available for lipid storage and colonial growth. Algae colonies were grown in a homemade photobioreactor, consisting of 4 groups to test the two methods: with or without nitrogen deprivation and with or without added carbon. Additionally, multiple carbon sources were explored. After 2 growth periods, algal growth was homologous in all groups. Final lipid content varied widely. The group with added carbon increased lipid production similarly to the group deprived of nitrogen, which both contained far more lipid than the control group. These results suggest that increased carbon can substitute for nitrogen deprivation, and it would be more feasible to increase carbon without nitrogen deprivation. If this trend is proven on an industrial scale, important advancements in efficiency could be achieved by rejecting nitrogen deprivation in favor of more efficient, equally effective methods.

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