Effects of Nutrient Deprivation on the Production of Algal Biodiesel

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Previous research has demonstrated amplified algal production of oils suitable for use as biodiesel under stress conditions, sometimes linking these typically adverse conditions to media that could be supplied with the use of waste products including municipal untreated wastewater. In the interest of further assessing the relationship between nutrient availability and the yield of oils suitable for use as biodiesel, variations of Bristol's basic medium recipe containing different quantities of nitrate and phosphate were prepared and used as growth media for Chlorella vulgaris over a period of eight weeks to determine the yield for the following conditions: nitrogen and phosphorus typical, nitrogen deprived, phosphorus deprived, nitrogen excess, phosphorus excess, both nitrogen and phosphorus deprived, and both nitrogen and phosphorus excess. Following the growth period, algal populations were grouped by treatment to prepare samples of algal concentrate which were combined with hexane in a separating funnel. The lipid products of this processing were isolated using reduced-pressure evaporation to determine the quantity of lipids suitable for use as biodiesel as a percent of the initial mass of algal concentrate. Algal populations experiencing both nitrogen and phosphorus deprivation produced the highest proportion of neutral lipids, with isolated lipids constituting 49% of the mass of algal concentrate. A statistically significant negative correlation between neutral lipid production and nitrate availability was found, but the relationship between neutral lipid production and phosphate availability did not reach statistical significance, indicating that nitrogen deprivation elicits a stronger stress response related to lipid production than does phosphorus deprivation.

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