

Effect of photo-autotrophic cultural conditions on the biomass productivity and composition of *Chlorella vulgaris*

ABSTRACT

The study aims to investigate the effect of photo-autotrophic cultural conditions on the productivity and biomass composition of *Chlorella vulgaris*. The following five photo-autotrophic cultural conditions were investigated: light intensity (4000, 10,500, 17,000, 23,000, 30,000 lux), temperature (25, 28, 32, 35, 40 °C), pH (6, 7, 8, 9, 10), CO₂ (0.03, 2.5, 5, 7.5, 10%) and NO₃⁻ (0, 250, 500, 750, 1000 mg/L). Results indicate that lipid and protein yields were increased by 3.19 fold and decreased by 1.47 fold, respectively, under NO₃⁻ deficiency (0 mg/L). Meanwhile, carbohydrate yield was increased by 1.39 fold in 5% CO₂. Further cultivation with parameters of the highest biomass productivity (10,500 lux, 28 °C, pH 8, 5% CO₂ and 500 mg/L NO₃⁻) achieved the maximum biomass productivity of 0.468 g/L/day. Moreover, cultivation with parameters of the highest lipid yield (23,500 lux, 40 °C, pH 8, 0.03% CO₂ and 0 mg/L NO₃⁻) achieved the maximum lipid yield of 43.70%. The major fatty acid methyl ester compositions produced were C20:0 (39.08%) and C16:0 (37.15%), producing biodiesel with high cetane number and oxidative stability. These promising results provide a comprehensive comparison regarding the effect of photo-autotrophic cultural conditions on microalgae biomass and its potential application as a biofuels feedstock.

Keyword: *Chlorella vulgaris*; Microalgae biomass; Lipid; Carbohydrate; Biofuel feedstock