

## Abstract

A locally isolated chlorophycean microalga, *Scenedesmus obliquus* (Turpin) Kützing, was explored in laboratory-scale photobioreactors and closed raceway ponds to assess its potential for production of lipids for biodiesel purpose. In photobioreactor study, the test microalga depicted maximum biomass yield of 3.74 g L<sup>-1</sup> with lipid yield of 850 mg L<sup>-1</sup> under 15% CO<sub>2</sub> sparging at 0.6 vvm air flow. These values were increased up to 7.01 g L<sup>-1</sup> and 1690 mg L<sup>-1</sup>, respectively, with 1% glucose supplementation under the said conditions. Moreover, following one-week biphasic nitrogen starvation, the lipid content was enhanced up to 43.9% (dcw) with a yield of 2.0 g L<sup>-1</sup>. The maximum CO<sub>2</sub> bio-fixation rate was found to be high enough as 0.77 g L<sup>-1</sup> day<sup>-1</sup>.

Cultivation of the test microalga was carried out in closed raceway ponds (14×4×0.75 m) with a capacity of 40,000 L. The maximum areal biomass and lipid productivities were recorded as 13.12 and 1.39 g m<sup>-2</sup> day<sup>-1</sup> at 30 cm culture depth during winter season followed by summer and rainy seasons. Under one-week biphasic nitrogen starvation, the test microalga depicted lipid productivity of 2.43, 2.29, and 1.88 g m<sup>-2</sup> day<sup>-1</sup> during winter, summer and rainy seasons, respectively.

Drying of algal biomass can account for 30% of the total cost of microalgal biodiesel production. Therefore, three different drying protocols with solar, oven and tray dryers were developed taking into account different initial sample thickness and varying the temperature for oven and tray dryers. Solar drying was found quite effective during summer, autumn and winter seasons except rainy season. For oven and tray drying, partial drying with 10% residual moisture content reduced the energy consumption to half with more than 90% lipid recovery as compared to complete drying. On the basis of energy consumption, oven drying emerged to be highly economical as compared to tray drying.

Characterization of various fuel properties, viz. viscosity, density, acid value, saponification value, iodine value, calorific value, cetane index, ash and water contents of the biodiesel produced were found to be within the specified limits of national and international biodiesel standards.

---

**Keywords:** Biodiesel, Biphasic Nitrogen starvation, Closed raceway ponds, CO<sub>2</sub> bio-fixation, Drying, Lipids, *Scenedesmus obliquus* (Turpin) Kützing