

## Comparison of Fuel Properties from Species of Microalgae and Selected Second-Generation Oil Feedstocks

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**Abstract :** Comparative investigation and assessment of microalgal technology as a biodiesel production option was studied alongside other second generation feedstocks. This was carried out by comparing the fuel properties of species of *Chlorella vulgaris*, *Dunaliella* spp, *Synechococcus* spp and *Senedesmus* spp with the feedstock of *Jatropha* (ex-basirika variety), *Hura crepitans*, rubber and Natal mahogany seed oils. The micro-algae were cultivated in an open pond using a photobioreactor (New Brunswick set-up model BF-115 Bioflo/CelliGen made in the US) with operating parameters: 14L capacity, working volume of 7.5L media, including 10% inoculum, at optical density of 3.144 @540nm and light intensity of 200 lux, for 23 and 16 days respectively. Various produced/accumulated biomasses were harvested by draining, flocculation, centrifugation, drying and then subjected to lipid extraction processes. The oils extracted from the algae and feedstocks were characterised and used to produce biodiesel fuels, by the transesterification method, using modified optimization protocol. Fuel properties of the final biodiesel products were evaluated for chemo-physical and fuel properties. Results revealed *Chlorella vulgaris* as the best strain for biomass cultivation, having the highest lipid productivity (5.2mgL-1h-1), the highest rate of CO<sub>2</sub> absorption (17.85mgL-1min-1) and the average carbon sequestration in the form of CO<sub>2</sub> was 76.6%. The highest biomass productivity was 35.1mgL-1h-1 (*Chlorella*), while *Senedesmus* had the least output (3.75mgL-1h-1, 11.73mgL-1min-1). All species had good pH value adaptation, ranging from 6.5 to 8.5. The fuel properties of the micro-algal biodiesel in comparison with *Jatropha*, rubber, *Hura* and Natal mahogany were within ASTM specification and AGO used as the control. Fuel cultivation from microalgae is feasible and will revolutionise the biodiesel industry.

**Keywords :** biodiesel, fuel properties, microalgae, second generation, seed oils, feedstock, photo-bioreactor, open pond

**Conference Title :** ICGE 2015 : International Conference on Green Energy

**Conference Location :** Chicago, United States

**Conference Dates :** October 08-09, 2015