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Total Lipid Content and Fatty Acid Composition of Two Morphologically Distinct *Chlorella* spp. for Biodiesel Production

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Abstract

This study investigated the potential of two morphologically distinct *Chlorella* spp. to assess the total lipid content and fatty acid composition targeting biodiesel production. Due to their rapid growth, less space requirement, and zero-conflict with current food demand, green microalgae-led biodiesel production has gained a key attention as an alternative, sustainable and eco-friendly substitute for fossil fuels diminishing the increased demand for fossil fuels, fuel prices and excessive release of greenhouse gases to the atmosphere. The *Chlorella* spp. were isolated from Beire Lake, Colombo (Wet Zone) and Kiriibban Lake, Monaragala (Dry Zone) of Sri Lanka. They were named as BCS1 and RCS2, respectively. Semi-mass culturing of *Chlorella* spp. in BG-11 medium (pH=7.5-8.5) was carried out in a greenhouse providing aeration and a 12:12 light: dark photoperiod. After 4 weeks, *Chlorella* spp. were harvested using aluminium sulphate, employing flocculation method. Harvested biomass was oven-dried and made into a fine powder for analysis. The total lipid content (TLC) of *Chlorella* spp. was determined using *n*-hexane as the extraction solvent in a soxhlet extractor maintaining three replicates for each. Extracted lipids were dried in a rotary evaporator and TLC was calculated gravimetrically. The total lipid content of BCS1 and RCS2 was recorded as 15.67% and 18.33%, respectively. After quantification, lipids were resuspended and concentrated in 1 mL of *n*-hexane to convert into fatty acid methyl esters (FAMEs)/ biodiesel via a transesterification reaction. The trans-esterified lipids (FAMEs) were analysed via Gas Chromatography. The most dominant FAMEs of BCS1 were palmitic acid (C16:0), oleic acid [C18:1 cis (n9)], stearic acid (C18:0), lignoceric acid (C24:0), lauric acid (C12:0) and myristic acid (C14:0). The most dominant FAMEs of RCS2 were cis-10-pentadecenoic acid (C15:1), elaidic acid [C18:1 trans (n9)], linolelaidic acid [C18:2 trans (n6)], cis-11-eicosenoic acid [C20:1 (n9)], lignoceric acid (C24:0) and oleic acid [C18:1 cis (n9)]. A well-balanced saturated and unsaturated FAME composition is essential for the optimal biodiesel quality, herein it was found in BCS1 with 41.62% of palmitic acid and 33.38% of oleic acid. Higher percentage of oleic acid exhibits a combination of oxidative stability and low temperature properties determining the suitability of BCS1 as a biodiesel feedstock compared to RCS2. In conclusion, even though RCS2 has a higher total lipid content, BCS1 exhibits more favourable characteristics in its FAME composition as a promising feedstock for biodiesel production.

***Keywords**:* Green microalgae, *Chlorella* spp., Total lipid content, Lipid composition, Biodiesel