

**Characterization of freshwater algae from JKUAT and evaluation of its
bioethanol and biodiesel potential**

Rutikanga Adrien

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ABSTRACT

Algae are good source of biofuels, nutrients and biologically active substances, which in the recent years has attracted the interest of the specialists in their search for natural, ecologically and healthy sound foods for the animals. In East Africa, freshwater algae are found easier but no systematic studies of their uses have been done. With their potential in antioxidant, antibacterial activities, there was a need to study the freshwater algae available in Jomo Kenyatta University of Agriculture and Technology. The aim of the present study is to characterise freshwater algae (*Spirogyra* genus) and determine its potential to produce bioethanol and biodiesel. The freshwater algae which were identified as a mixture of *Spirogyra weberi* and *Spirogyra nitida*, were collected in a pond within Jomo Kenyatta University of Agriculture and Technology (JKUAT) main campus. The proximate analysis of dry biomass indicated $10.66 \pm 0.41\%$ moisture content, $2.18 \pm 0.36\%$ oil content, $20.19 \pm 0.62\%$ ash, $6.30 \pm 0.50\%$ crude fibre, $20.83 \pm 0.00\%$ crude protein and 39.84% total carbohydrate. The highest mineral composition analyzed by Atomic Absorption Spectrophotometry (AAS) from dry ashing and acid digestion was 117.42 ± 1.18 and 387.22 ± 38.72 mg/100g for Ca respectively.

Phytochemical screening of methanolic and water extract showed the presence of some bioactive compounds. The content of phenolic compounds and tannins was determined spectrophotometrically using Folin-Ciocalteu reagents and was respectively 10.63 ± 0.05 g gallic acid/100g of extract and 0.399 ± 0.02 g tannic acid/100g of dried sample and the level of flavonoids was 6.86 ± 0.14 g quercetin/100g of extract.

The ability of the extract to scavenge DPPH (2, 2-diphenyl-1-picrylhydrazyl) radicals was determined spectrophotometrically at 517nm using ascorbic acid as standard. IC_{50} of methanolic extract was 0.078 mg/ml. This showed antioxidant activity in comparison with 0.008mg/ml of

Ascorbic acid. The antimicrobial activity of methanolic extract showed inhibition against *Escherichia coli*, *Candida albicans*.

The alcohol content was evaluated by specific gravity using a pycnometer and ethanol was identified using Gas Chromatography Flame Ionization Detector (GC-FID) after hydrolysis, fermentation and distillation. The alcohol content was in the range of $1.54 \pm 0.04\%$ for acid hydrolysis and $2.89 \pm 0.05\%$ for enzymatic analysis. The GC-FID shows ethanol peak at 99%. The biodiesel potential was evaluated by extraction of algal oil using both Soxhlet extraction and the Bligh and Dyer method. The yield was 2.18% and 5.79% respectively. These yields did not help to evaluate the biodiesel produced from the freshwater algae but showed the presence of saturated and unsaturated fatty acids.

The study showed that *Spirogyra nitida* and *Spirogyra weberi* could be better used as a food supplements than strains for bioethanol and biodiesel. There is a need to evaluate heavy metals in order to determine levels of contamination.