Comparative growth analysis of fresh water algae for biofuel production

ABSTRACT

Algae are simple autotrophic organisms and from simple inorganic molecules such as carbon dioxide they produce complex organic compounds using energy from light or inorganic chemical reactions. The objectives of the present research work were to study the comparative growth analysis of certain fresh water microalgae, to biochemically characterize the microalgal species, to extract lipids from microalgal species and fatty acid profiling to explore their utility for biodiesel production and to identify the gene responsible for lipid production in a selected algae species most potent for biodiesel production and its sequence characterization. Five species were isolated namely *Vaucheria* sp., *Microcystis* sp., *Oedogonium* sp., *Nostoc* sp. and *Diatom* sp. The study of Growth analysis was performed by drafting the growth pattern of microalgae; calculating doubling time, generation time and specific growth rate; measuring algal biomass; and estimating algal culture viability. To study the biochemical characteristics, protein content was estimated using Lowry’s method, chlorophyll content was estimated by observing O. D. at different wavelengths and extraction of lipids was done using soxhlet apparatus. Data ascertained from different experiments were statistically analyzed using analysis of variance two way classification with critical difference at 5% probability level. Student’s t-test was also used for testing the significance of the mean values of the data. The present study showed that algae vary remarkably in their biochemical composition. The protein content also varies from one species of algae to another. Lipids extracted from *Vaucheria* sp., *Oedogonium* sp., *Nostoc* sp. and *Diatom* sp. were used for the biodiesel production. Biodiesel produced using *Nostoc* sp. as lipid source was maximum i.e. 18.3ml and using *Vaucheria* sp. as lipid source was the least i.e. 12ml. This signifies *Nostoc* sp. was the best feed for biodiesel production. *Nostoc* sp. showed the highest content of lipid as well as biodiesel which makes it the best feed for the production of alternate fuel energy. Thus, *Nostoc* sp. was selected for HPLC analysis and sequence characterization. Algal DNA was extracted and the concentration of the isolated DNA was measured to be 325ng/μl and OD ratio (A260/280) was estimated to be 1.82. PCR was run to identify the gene delta 9 acyl-lipid desaturase. The gene sequence of Acyl lipid desaturases from *Nostoc* sp. was analyzed. Its computational characterization revealed that it belongs to Functional domain (Membrane_FADS) –like superfamily. The cost of media to produce one litre biodiesel was estimated and it was established that the cost of production of one litre biodiesel is fifteen to twenty folds that of the conventional fuel. Algal biofuels offer great promise in contributing to the growing global demand for alternative sources of renewable energy. However, to make algae-based fuels cost competitive with petroleum, lipid production capabilities of microalgae need to improve substantially and the use of alternate economic nutrient sources to cultivate algae is recommended for the reduction of production cost significantly. Algal genomics enables to identify metabolic pathways and genes that are potential targets in the development of genetically engineered microalgal strains with optimum lipid content which can be further exploited to improve upon the production of algal lipid.

**Keywords:** Growth analysis, sequence characterization, *Nostoc* sp., HPLC and superfamily