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Original Research Article

# COMPARATIVE STUDY OF FIVE ALGAL MATERIALS FOR BIODIESEL

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**Abstract:**
Biodiesel from algae as an alternative fuel to conventional petrodiesel is getting much importance due to its renewable in nature and ecofriendly. An attempt is made to extract oil and fatty acid composition from algae. The maximum oil content (10.05 ±0.05) along with 14 fatty acids recorded in *Nostoc elipsosporum* and minimum oil content (2.2±0.52) with less number of fatty acids recorded in *Pithophora* by Gas Chromatography.

**Key words:** Fatty acid, Gas Chromatography, Algae, Biodiesel

## Introduction:

A constant rising worldwide demand of motor and power generation fuels, together with environmental concerns in terms of Green House Gases (GHG), has motivated the scientists and technologists to think about various alternate sources of energy (Jasvinder Singh *et al,* 2010). With the increasing amount of waste originating from human activities comes the negative impact on the environment and in particular the water quality.

In densely populated country like India, urbanization and industrialization are eating up cultivable lands and as a result, edible oil is falling short in supply, necessitating large scale import (Rashmi Kumar *et al,* 2012). Waste water streams are rich in carbon, nitrogen and other minerals, have potential for use as a substrate for microalgae cultivation. Biodiesel is derived from the trans-esterification of mono-, di- and tri- acylglycerides (TAGs) and the esterification of free fatty acids (FFAs) that occur naturally in biological lipids, such as animal fats and plant oils. As a result, biodiesel has the potential to be a carbon neutral fuel (Shah.*et al*2012).

Biomass is one of the better sources of energy, its introduction in large scale could contribute to sustainable development on several fronts, environmentally, socially and economic (A. B. M. Sharif Houssain et. al. (2008). Microalgae are photosynthetic

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microorganisms that convert water and carbon dioxide into biomass in presence of sunlight. Many microalgae are exceedingly rich in oil as comparison with other crop plants. In the industry, microalgae have been used as source for a wide variety of practical and potential metabolites products, such as food supplements, pharmacological substances, lipids, polymers, toxins, pigments, enzymes, biomass, waste water treatment and "green energy"(Glacio S.Araujo, *et al*,2013).

The present paper will provide feasibility of algal materials for boifuel and fatty acid composition of five algal materials.

**Materials and Methods**

**Sample collection:** The fresh water algae *Nostoc elipsosporum.*, two species of *Pithophora, Zygnema sp*., *Aulosira laxa* were collected from aquatic bodies of Nagpur city, nearby Nagpur district, Gadchiroli and nearby Gadchiroli district. All the collected algae were washed with water and dried in sunlight for a few days. Dried algae were crushed in order to obtain small solid particles (Sharif Houssain *et. al*. (2008).

**Oil Extraction:** Two hundred mL of petroleum ether for 15-20 g of dried algae were used for the oil extraction. The extraction was carried out in Soxhlet apparatus for at least 12-16 h and recorded algal oil content.

Extraction was carried out in a 0.5 L round –bottomed glass flask. The resultant solution was separated from solvent by distillation. The same solvent was reused in the next batch of extraction. Finally, the sample was dried in an oven ($100^0$C) to get constant weight of oil. (Rashmi Kumar *et al*, 2012; Sadasivam and Manickam, 2006; Govindarajan *et al.* 2009).

**Oil content:** Oil percent of algae (per gram of dry mass) = weight by difference in algae /original weight of Algae X 100 (Sadasivam and Manickam, 2006).

**Fatty acid analysis:** Fatty acid analysis was done by Gas chromatography.

**Results and Discussions:**

The first step of this study is to characterize the material suitable for transesterification process. The second step is to find suitability of biodiesel with fossil fuel (Diesel)

**Algal characterization**

Five algal species were collected from water bodies of Nagpur, nearby Nagpur region, Gadchiroli and near by Gadchiroli region and analyzed to find the oil content from extraction of algae. Oil contents recorded in the range of 2.2 % to 10.05 % per gm of dry mass. *Nostoc elipsosporum* contains maximum quantity of lipid and number of fatty acid whereas least number of fatty acids and lipid contents in two species of *Pithophora.*

While making comparison with the lipid content of the algae investigated here and some of earlier workers, it is to note that the results obtained here are quit high and encourage of as compared to those of Chapman (1950) for nitrogen fixing blue-green algae recorded only 1.2% of lipid and Ratushna *et al* (1967) estimated 3.3 to 7.6 % of lipid for *Anabaena* and *Nostoc.* The present result shows slight similarity with the results of the shaheen (1996).Shaheen obtained lipid in green algae in range from 8.30% to 12.50 %. In the study of green algae, oil percent recorded were quit higher than side the present record oil percent. The recorded lipid in the range of 24.4% to 64.5 % (Piorreck *et.al.*, 1984). The present result shows slight similarity with the results of the shaheen (1996). Shaheen obtained lipid in green algae in range from 8.30% to 12.50 %.

**Observation:**

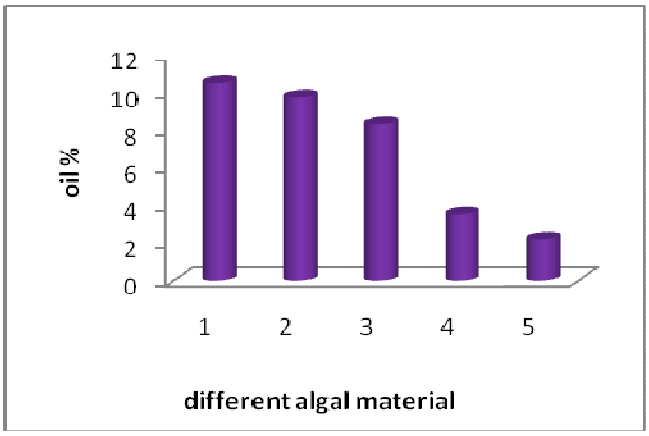
**Table1: showing oil contents of algal materials**

| Sr.no. | Sample | Oil content |
|---|---|---|
| **1.** | *Nostoc elipsosporum.* | *10.05±0.05* |
| **2.** | *Aulosira laxa* | **9.75 ±0.35** |
| *3.* | *Zygnema sp.* | **8.3 ±0.52** |
| **4.** | *Pithophora sp.** | **3.5 ± 0.30** |
| **5.** | *Pithophora sp.*** | **2.2 ± 0.52** |

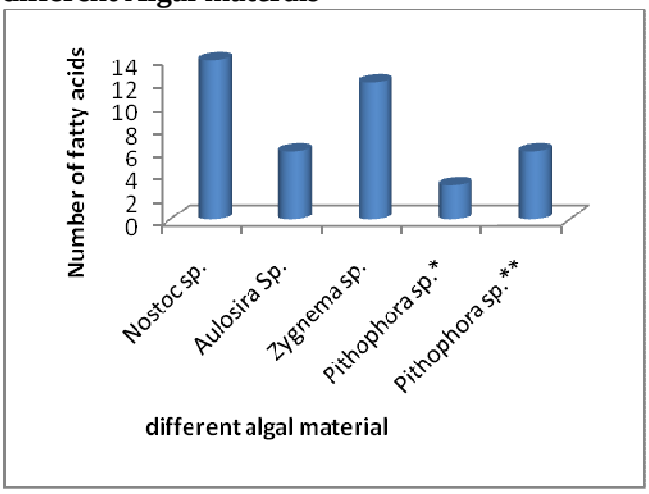
**Table 2: fatty acid composition of algal material**

| Sr. No. | Sample | No.of fatty acid | Conformed fatty acids |
|---|---|---|---|
| **1.** | *Nostoc elipsosporum.* | **14** | **Arachidic** |
| **2.** | *Aulosira laxa* | **06** | **Erucic** |
| **3.** | *Zygnema sp.* | **12** | **Palmitic,Behenic** |
| **4.** | *Pithophora sp.** | **03** | **Arachidic** |
| **5.** | *Pithophora sp.*** | **06** | **----** |

**Graph1: showing oil contents of five Algal materals**




**Graph 2: Number of fatty acid present in different Algal materals**




**Conclusion:**

Algae could be economical choice for biodiesel production, due to its common availability and low cost. The time is need to find suitable algae having high oil content. Here blue green alga *Nostoc elipsosporum* is considered to have 10 % oil contents.

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