Plant Archives Vol. 18 No. 1, 2018 pp. 1024-1025 *ISSN 0972-5210*

BIODIESEL PRODUCTION FROM FRESHWATER ALGAE AS A RENEWABLE SOURCE

Y. Ranjith* and T. Parameswara Naik

*Department of Botany, Sahyadri Science College (Autonomous), Shivamogga–577203

Abstract

Biodiesel is a nontoxic and biodegradable alternative fuel that is obtained by the transesterification of triglyceride oil with monohydric alcohols. The need of energy is increasing continuously, because of increases in industrialization and population. The basic sources of this energy are petroleum, natural gas, coal, and etc. In this study three naturally occurring algal samples were collected from different areas of Shivamogga. Algae were identified in the Botany lab as *Spirogyra spp, Oedogonium spp* and *Zygnema spp* oil was extracted from the all the three dried algal samples and pH were analyzed. These results indicate that biodiesel can be produced from *Spirogyra spp, Oedogonium spp.*

Key words: Biodiesel, transesterification, Algal oil, glycerine, biomass.

Introduction

The basic sources of energy are petroleum, natural gas, coal, and etc. The need of energy is increasing continuously due to the increase in population and industrialization. The continued use of petroleum sources fuels is now widely recognized as unsustainable because of the depletion supplies and the contribution of these fuels to the accumulation of carbon dioxide in the environment leading to increase of global warming. In the last ten years, many studies have been conducted on biofuels for substituting fossil fuels and reduce the greenhouse gas (GHG) emission (Bastianoni *et al.*, 2008).

Biodiesel from oil crops, waste cooking oil and animal fat cannot realistically satisfy even a small fraction of the existing demand for transport fuels. Recent researchers involved not only the existing renewable sources available from land plants, but also those coming from aquatic systems. Algae (macro and micro) have been taken in consideration as a residual biomass ready to be used for energy purposes. Algae, especially micro algae, were found to be the only source of renewable biodiesel that is capable of meeting the global demand for transport fuels (Chisti 2007 and 2008).

The idea of using algae as a source of fuel is not new, but it is now being taken seriously because of the increasing price of petroleum and more significantly, the emerging concern about global warming that is associated with burning fossil fuels (Chisti 2005).

Micro algae can provide several different types of renewable biofuels which include methane, biodiesel and bio-hydrogen. Oil productivity of many microalgae greatly exceeds the oil productivity of the best producing oil crops (Shay 1993).

***Author for correspondence :** E-mail : ranjith.ykn@gmail.com

Materials and methods

Algal Samples

The Algal samples were collected from the Santhekadur pond, Shivamogga. The algal biomass was collected from freshwater bodies by mesh net, after collection the samples were brought to the laboratory, Department of Botany, Sahyadri Science College (Autonomous), Shivamogga. And they were identified as *Spirogyra spp, Oedogonium spp* and *Zygnema spp*..

Oil extraction

Algae were ground with motor and pestle as much as possible. The ground algae were dried for 20 min at 80^0C in a incubator for releasing water. Hexane and ether solution (20 and 20 mL) were mixed with the dried ground algae to extract oil. Then the mixture was kept for 24h for settling. Then the biomass was collected after filtration and weighted.

Evaporation

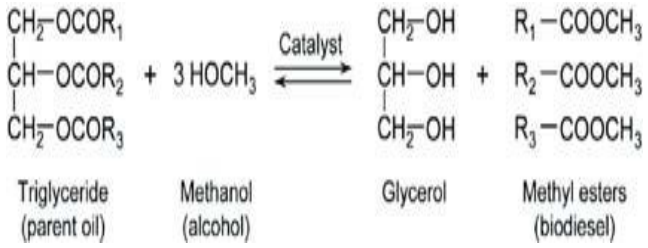
The extracted oil was evaporated in vaccum to release hexane and ether solutions using rotary evaporator, and 0.25g NaOH was mixed with 24ml methanol and stirred properly for 20 min.

Biodiesel production

The mixture of catalyst and methanol was poured into the algal oil in a conical flask. The following reaction and steps were followed.

Transesterification

The conical flask containing solution was shaken for 3h by rotatory shaker at 300rpm. After shaking the solution was kept for 16h to settle the biodiesel and sediment layers clearly. The biodiesel was separated from sedimentation by flask separator carefully. Quantity sedimeant (glycerine, pigments, etc.) was measured. Biodiesel was washed by 5% water until it was become clean. Biodiesel was dried by using dryer and finally kept under the running fan for 12h. and measured by using measuring cylinder; pH was measured and stored for analysis.



Results and Discussion

Samples	Oil percentage	pH
Oedogonium spp	16.33%	7
Spirogyra spp	14.82%	7
Zygnema spp	9.44%	6

Result shows that the production of Biodiesel was found maximum in *Oedogonium spp,* and *Spirogyra spp* but minimum in *Zygnema spp*, and the by products also obtained from these species such as glycerol and biomass. Biomass can be used as fertilizer or fodder and glycerol is used in food industries as sweetener in pharmaceutical formulations. In *Oedogonium spp*, oil content was maximum and minimum in their biomass, In *Spirogyra spp,* oil content was lower than in *Oedogonium spp*, but maximum in their biomass. In *Zygnema spp*, the oil content was lower than in *Oedogonium spp*, and *Spirogyra spp* but maximum in their biomass. These results indicate that biodiesel can be produced from *Oedogonium spp,* and *Spirogyra spp* and there was no difference in their pH.

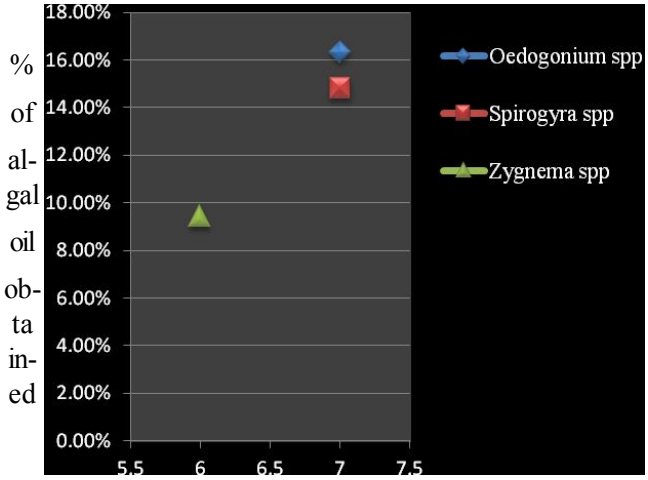


Table 1: Determination of pH from algal biodiesel

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