

Preparation of Algae Biodiesel

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Abstract- As Biodiesel is emerging as an important promising alternative energy resource which can be used to or even replace the usage of petroleum diesel. Biodiesel is a domestic, renewable fuel for diesel engines derived from natural oils like Edible and Non-Edible oil, and which meets the specifications of ASTM D 6751. Technically, biodiesel is a diesel engine fuel comprised of mono- alkyl esters of long chain fatty acids derived from vegetable oils or animal fats and meeting the requirements of ASTM D 6751. Algae are a filamentous waste plant growing in any type of water such as fresh, sea water etc. Normally algae are regarded as a menace in water bodies. There are various methods for extracting the oil from algae, such as Mechanical Press Method, Hexane Solvent Extraction Method, Microwave Extraction Method, etc. The paper discusses experimental method developed for the extraction of oil from algae which is collected from canals of Salaimendha Dam, we are using hexane solvent extraction Method.

Index terms- Biodiesel, Renewable Energy, Algae, Hexane, Trans esterification, Methanol, Sodium hydroxide

INTRODUCTION

Biodiesel is a fuel derived from plant and animals which contains long chain of fatty acids esters. As biodiesel has a lot of benefits and it is made from renewable resources, it has become more attractive. Biodiesel is an alternative fuel similar to the conventional fuels. Biodiesel can fulfill the requirement of both the biomass-based diesel and overall advanced biofuel.

Vegetable oils have long been in use as a substitute for diesel fuel as far back as 1930. Biodiesel can produce from Edible and Non-Edible oil such as Algae, Soya bean, Jatropha, Karanja, Sunflower. etc. 'Bio' indicates its renewable and biological source in contrast to traditional petroleum-based diesel fuel;

'diesel' refers to its use in diesel engines. As an alternative fuel, biodiesel can be used in neat form or mixed with the petroleum-based diesel. Biodiesel, as an alternative fuel, has many merits.

The algae required for the synthesis of biodiesel was collected from the canals of Salaimendha dam which is 15km from Hingana. Biodiesel has its own merits as compared to petroleum diesel [2].:-

- Biodiesel can be used in diesel engines without any modifications.
- Biodiesel are non-toxic in nature, easily renewable and biodegradable.
- Unlike fossil fuels, biodiesels are less polluting and environmental friendly.
- Biodiesel have higher fire point and hence they are safer to handle.

METHODOLOGY AND MATERIALS

a) Collection of Algae Samples :-

The algae were collected from the canals of Salaimendha Dam near Hingana. Then the algae is washed with clean water. And is then divided into two parts, one part is kept for drying under the sunlight and another part is kept wet for the further process.

b) Materials :-

Methanol (99%), n-Hexane (85%), Sodium Hydroxide (NaOH) (98%) or Potassium Hydroxide (KOH), was purchased from Central Scientific, Nagpur.

c) Extraction of oil from Algae :-

The raw algae which is collected is grind with the help of mixture grinder. The 100gm of powered algae is then put in a flask and 80ml of n-Hexane is mixed with the powered algae in flask and stirred properly.

This solution is kept at room temperature for 24 hrs. A layer of oil is formed on the top of the solution, this oil is separated from the residue, 2.3ml of crude oil is obtained. The process flow chart for obtaining oil from algae is given in fig 1

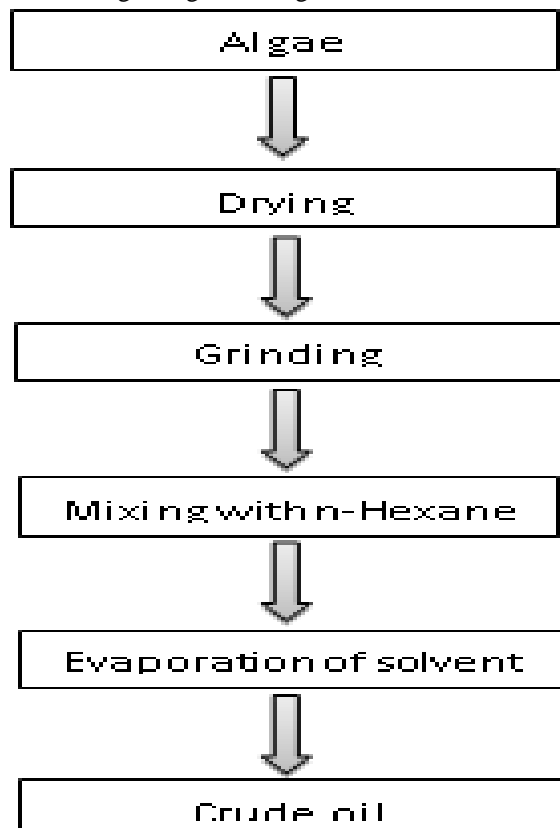


Fig 1:- Process flow chart for extraction of oil



Fig 2:- Washed Algae

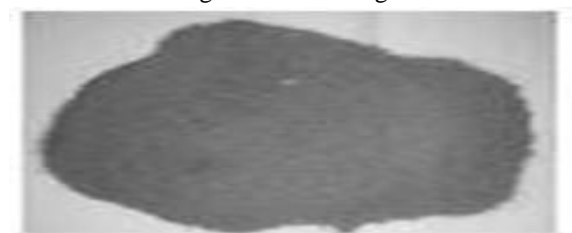


Fig 3:- Powered Dry Algae



Fig 4:- Extracted Crude Oil of Algae

d) Preparation of Biodiesel:-

For the preparation of biodiesel, the most commonly used process i.e. Trans esterification is used. The Trans esterification of an animal fats, vegetable oils, etc. is the process of making biodiesel from the oil. Around 250 ml of oil is extracted from 17.5kg of powered algae. This extracted oil is then converted into biodiesel in the presence of Methanol. In this process triglycerides react with the methanol to form the biodiesel (fatty acid ester) and the glycerol. Sodium Hydroxide is used as catalyst (enhances the rate of reaction). 2gm of NaOH is mixed with 40ml of methanol for making the biodiesel from 250 ml of oil.

This solution is stirred at 500C for 30 minutes and then poured in separating flask and allowed to settle for 6 hours. After 6hrs, layers are separated in the flask, the glycerol is settled at the bottom of the flask and biodiesel is obtained at the top. About 196 ml of biodiesel is obtained after the Trans esterification process.



Fig 5:- Extraction of Biodiesel through Trans esterification Process

e) Washing of The Biodiesel:-

The biodiesel which is obtained after Trans esterification process is then washed with hot water. The washing of the biodiesel is done for removing the impurities present in the biodiesel, the impurities get dissolved in the hot water and the pure biodiesel is obtained on the top of the flask. The process flow chart for obtaining biodiesel from oil is given in Fig 7.



Fig 6:- Biodiesel

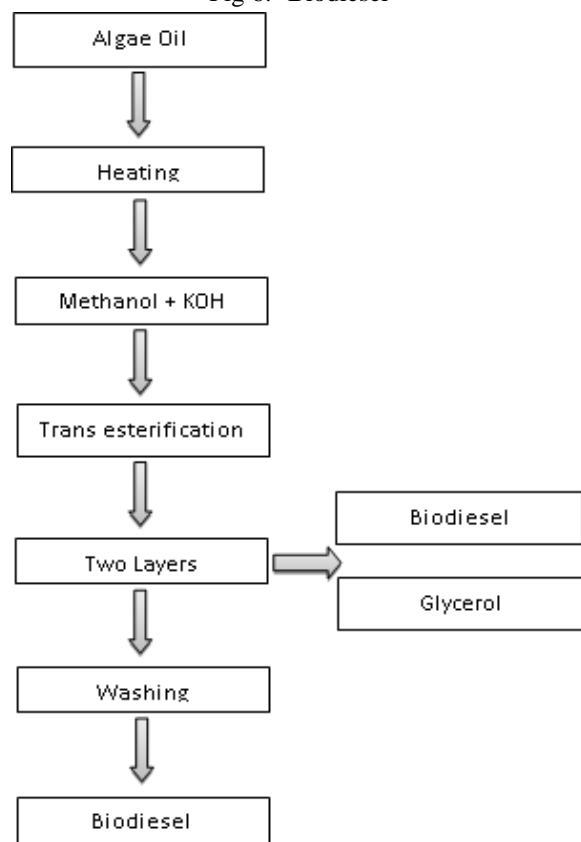


Fig 7:- Process Flow Chart of Biodiesel Production

Table1. Observation Table

Sr. No.	Observations	Reading
1.	Initial weight of algae	20kg
2.	Weight of dry algae	17.5kg
3.	Weight of oil extracted	250ml
4.	Weight of biodiesel obtained	197ml

FUTURE SCOPE

Algae biodiesel can be applied to most automotive fields and may provide alternative to Petroleum diesel. Algae require water, sunlight and CO₂ hence it can be grown anywhere. As well as it can be used with petroleum diesel in diesel engines without changing the engines. Since it requires CO₂ for its growth, it is going to reduce the pollution.

CONCLUSION

In the recent years, biodiesel has gained enormous attention among scientists and researchers to use it as a substitute for fossil diesel in diesel engine applications. To understand the current scenario about biodiesel utility, its related issues, an investigation related to biodiesel production methods, optimization of biodiesel production and effect of biodiesel and its blends on diesel engine performance and characteristics had been carried out. The algae was used successfully for the preparation of biodiesel. The total process is divided into two parts, one is oil extraction process and another one is Trans esterification process. The algae was collected from the canals, no specific species of algae was cultivated. The obtained experimental results were encouraging.

REFERENCES

- [1] Rachan Karmakar et.al., Fuel properties and emission characteristic of biodiesel produced from unused algae grown in India, Petroleum Science (2018) 15:385-395
- [2] Md Aliquer Rahman et.al., Production and Characterization of Algal Biodiesel from Spirulina Maxima, Volume 16 Issue 1 Version 1.0 Year 2016
- [3] F.R.M Batista et.al., Properties of microalgae oil from the species chlorella protocoides and its

ethylic biodiesel, Braz. J. Chem. Eng. Vol,35
no.4

- [4] Sumaira Shah et.al., Production of Biodiesel from Algae, Vol. 9(1)
- [5] Niraj S. Topare et.al., Extraction Of Oil From Algae By Solvent Extraction And Oil Expeller Method, Int. J. Chem. Sci.: 9(4), 2011, 1746-1750 ISSN 0972-768X