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Production and Characterization of Biodiesel from Algae

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Review Article

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ABSTRACT

Algae oil is an intriguing supportable feedstock for biodiesel producing. Green algae have risen as a standout amongst the most encouraging hotspots for biodiesel creation. It can be construed that green growth developed in CO_2-enhanced air can be changed over to sleek substances. This study was embraced to know the proper transesterification, measure of biodiesel production (ester) and characterization. Glycerol as a By-product which is used for many other products.

INTRODUCTION

Biodiesel

Bioenergy is a standout amongst the most imperative segments to alleviate nursery gas outflows and substitute of fossil powers. The need of energy is increasing persistently as a result of expansion in industrialization and population. The major disadvantage in using gasoline based fuels is atmosphere pollution and depletion of ozone layer. Biofuels are best example for renewable energy. Biodiesel will reduce the pollution by less CO_2 emissions and reduce the local pollution in terms of CO, CO_2, sulphur and fines particles. We can make use of various potentially energetic industrial and domestic wastes, as cooking oil and fats, as well as agricultural residues for production [1-10].

Algae

Microalgae can provide several different types of renewable biofuels. These include methane produced by anaerobic digestion of the algal biomass; biodiesel derived from micro algal oil photo biologically produced bio hydrogen [11-20].

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Algae produce 7 to 31 time greater oil than palm oil. It is very simple to extract oil from algae. The best algae for biodiesel would be microalgae (Figure 1). Eg. Spirogyra plant.

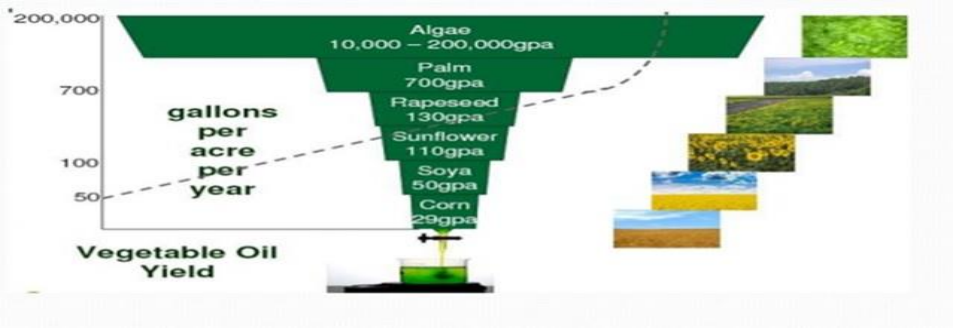

Figure 1. Comparative study of biodiesel with different feed stock [20].

DISCUSSION

Extraction of Oil from Algae

Green growth is dried it holds its oil content, which then can be "squeezed" out with an oil press. Since various strains of algae vary in their physical characteristics, different press designs (screw, expeller, cylinder, and so forth) work better for particular green growth sorts. Numerous business producers of vegetable oil utilize a blend of mechanical squeezing and chemical solvents in extricating oil [21-29].

Expeller presses can recover 75% of the oil from algae.

Production of Biodiesel

Transesterification Reaction: In Transesterification reaction oil or fat react with alcohol and produce ester with by products as glycerol. It is a reversible reaction [30-40] **(Figure 2)**.

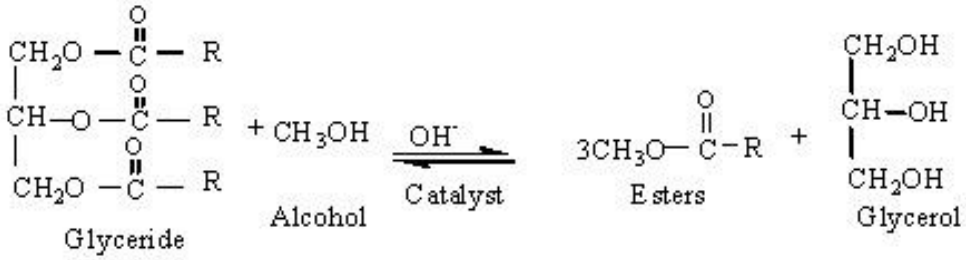

Figure 2. Transesterification reactions.

Process Flow Diagram

Figure 3 showing the process flow diagram of production. We can understand the whole process by analysing step by step.

Procedure

Sample Collection: Production of Biodiesel starts with the sample collection. The amount of biodiesel we can extract is depends on the type of algae. We have chosen spirogyra as our sample to extract algae. Spirogyra is best option for biodiesel. Spirogyra species are available in normal water ponds. Testing of spirogyra can be done for confirmation of particular species [41-50].

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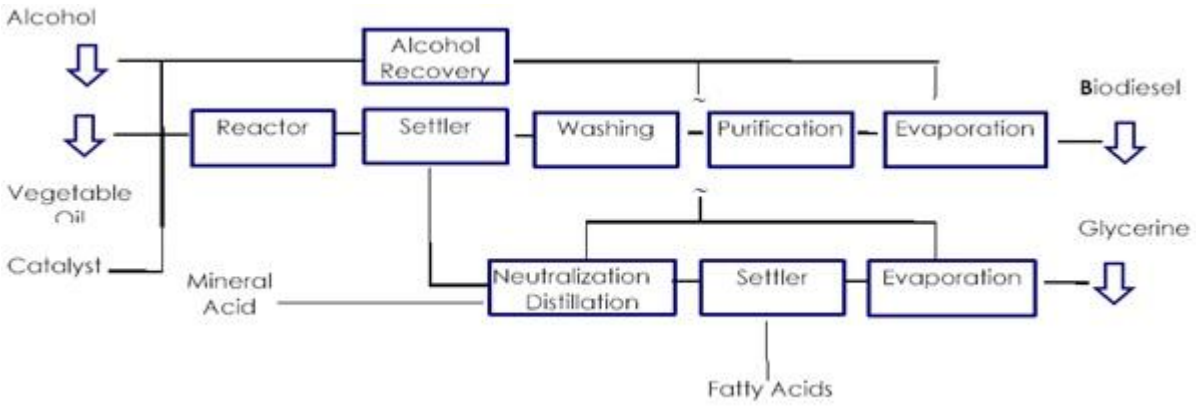

Figure 3. Flow sheet of biodiesel production [41].

Drying: Algae samples are dried in Hot Air Oven at 150°C to remove moisture content.

Algae Oil Extraction: We used ethyl alcohol as solvent for our experiment. Here using Ethyl alcohol as solvent we extracted Algal Oil. Then algal oil heated in Water Bath at 70°C (BP of Ethyl alcohol) to evaporate the remaining Ethyl alcohol in Oil. Finally we extracted 100 ml of Algae Oil [51-60] **(Figure 4)**.

Figure 4. Algae Oil extracted from samples.

Base Catalysed Method

Transesterification: Initially the Algae oil was heated to 60°C in a flask. In another flask 7.5 ml of H_2SO_4 was added in 50 ml of ethanol. Then Algae oil was added to ethanol solution. Stirring was done for 15 min and then allowed it to settle. After 24 hours the settled ethyl esters was separated and send them to Transesterification reaction for recycling [61-72] **(Figure 5)**.

Figure 5. Mixture after reaction.

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Ethanol recovery: Ethanol is usually removed after the biodiesel and glycerine have been separated into two layers, preventing reaction reversal [73-80].

Biodiesel Refining: Once separated from the glycerine, the biodiesel goes through a purification process, removing all remaining alcohol and catalyst. It is then dried and stored [81-90,45] **(Figure 6)**.

Characterization of Biodiesel

27/3 test: Initially 27 ml of methanol was added to a test tube. Then 3 ml sample of biodiesel was added to the test tube. Test tube was closed by using stopper and shaken for 30 seconds. After settling for a while we have examine the bottom of the test tube. We have observed that methanol/biodiesel solution was crystal clear with a slight yellow tint which means that complete conversion of oil to biodiesel had occurred [91-98].

Density Test: 100 ml sample of biodiesel was taken and its weight was measured by using weighing machine. It is weighted as 84.2 g [99,100].

Density of Biodiesel =0.842 g/ml

ASTM Specification for biodiesel density = 0.83-0.88 g/ml

By doing this test it has proven that there is no residual methanol present in biodiesel.

Figure 6. Separated biodiesel and glycerol from mixture.

CONCLUSION

Biodiesel production from Alage will be the best resource for Future Generation. It is the eco-friendly process. It let all waste resource to useable form. The amount of algae oil will depends on the type of algae. Spirogyra is available freely in open ponds. The purpose of the transesterification process is to lower the viscosity of the oil or fat. Cost of biodiesel can be reduced by using Algae as feed stock. Water produced during the esterification process can reduce acid catalyst, and this can be eliminated by reaction mechanism. Ethanol is best option as catalyst because of its low cost and easy separation from biofuel.

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