

Calophyllum Inophyllum Biodiesel for Diesel Engine

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Abstract— Energy is considered as one of the most important factors for economic and industrial growth. With the increased use and energy. This demand depleting problem of fossil fuels there is a huge demand for an alternative and better source of promoted the emergence of biofuels among which biodiesel is considered to be the most accepted and best alternative for the depleting energy resources. Biodiesel is environment friendly, nontoxic, biodegradable, renewable as well as a neat biofuel and hence plays a significant role in meeting the energy demands. Biodiesel can be extracted from vegetable oils and waste fats. The Tamanu (Calophyllum Inophyllum) oil has a new possible source of alternative fuel. Tamanu biodiesel can successfully alternate diesel fuel and help in decreasing the import of the crude oil used in diesel engine. This review has been taken up to produce Calophyllum inophyllum oil biodiesel by transesterification process.

Key words: Calophyllum Inophyllum Oil, Transesterification, Biodiesel, Properties, Diesel Engine Fuel

I. INTRODUCTION

Alternative fuel means the term refers to substances (excluding conventional fuels like gasoline or diesel) which can be used as fuels. Due to the energy crisis, the following factors have led to the increasing need for finding a feasible fuel alternative to conventional sources. Fossil sources are limited, and will eventually get used up. Only few countries have usable fossil reserves. This forces other nations to depend on them for energy. Combustion of carbon-rich fuels leads to emissions like CO and CO₂, which are harmful to the environment. Increasing number of automobiles has led to increase in demand of fossil fuels (petroleum). The increasing cost of petroleum is another concern for developing countries as it will increase their import bill. Biodiesel, an alternative fuel, is made from biological sources such as vegetable oils and animal fats. It is eco-friendly and non-toxic has low emission profiles and so it is environmentally beneficial. The properties of biodiesel are almost similar to the diesel fuel; thus, it becomes a potential alternative to diesel fuel. Fatty acids may be used to prepare biodiesel fuel. The chemical process is known as transesterification and consists of treating vegetable oils, like soybean, sunflower and rapeseed, with reactants (methanol or ethanol) to obtain a methyl or ethyl ester and glycerine. The reaction is catalysed by a reaction with either an acid or base and involves a reaction with an alcohol, typically methanol if a biodiesel fuel is the desired product.

The heat conducted through solids, walls or boundaries has to be continuously dissipated to the surroundings or environment to maintain the system in steady state conduction. In many engineering applications large quantities of heat have to be dissipated from small areas. Heat transfer by convection between a surface and the fluid

surroundings it can be increased by attaching to the surface thin strips of metals called fins. The fins increase the effective area of the surface thereby increasing the heat transfer by convection. The fins are also referred as “extended surfaces”. Fins are manufactured in different geometries, depending up on the practical applications Most of the engineering problems require high performance heat transfer components with progressively less weights, volumes, accommodating shapes and costs.

In the present work biodiesel is prepared by Transesterification and check the thermo physical properties of the raw oil, biodiesel and neat diesel.

II. MATERIAL

Calophyllum Inophyllum is a low-branching and slow-growing tree with a broad and irregular crown. It usually reaches 8 to 20 m in height. The flower is 25 mm wide and occurs in racemose or paniculate inflorescences consisting of four to 15 flowers. Flowering can occur year-round, but usually two distinct flowering periods are observed, in late spring and in late autumn. The fruit (the ballnut) is a round, green drupe reaching 2 to 4 cm (0.79 to 1.57 in) in diameter and having a single large seed. When ripe, the fruit is wrinkled and its color varies from yellow to brownish-red.



Fig. 1: Tree & Fruits of Calophyllum Inophyllum

Present Work carried out on Calophyllum Inophyllum Oil, due to second highest productivity of 4930 lit./hectare after the palm which have 5950 lit./hectares. It does not compete with food crops. It has high heating value. Its trees serve as windbreaker at the seashore where it can reduce abrasion, protect crops and provide ecotourism and conservation of coastal demarcation.

Feed Stocks	Oil Content (%)
Jatropha seed	35-40
Kernel	50-60
Linseed	40-44
Neem	20-30
Pongamia pinnata (karanja)	27-39
Soyabean	15-20
Calophyllum Inophyllum oil	65
35 Moringa oleifera	40
Rapessed	16-18
Tung	40-50
Pachira glabra	30-60
Peanut oil	45-55

Olive oil	45-55
Corn	48
Coconut	63-65
Cotton seed	18-25
Palm oil	80-85
Rice bran	15-23

Table 1: Different Feedstock for Biodiesel

III. METHODOLOGY

Present Work carried out on Calophyllum Inophyllum Oil, and the biodiesel is prepared by using Transesterification Process.

The biodiesel process (transesterification) turns the oils into esters, separating out the glycerine from the main product (biodiesel). The glycerine sinks to the bottom and the biodiesel floats on top and can be decanted off. The process is called transesterification, which substitutes alcohol for the glycerine in a chemical reaction, using a catalyst.

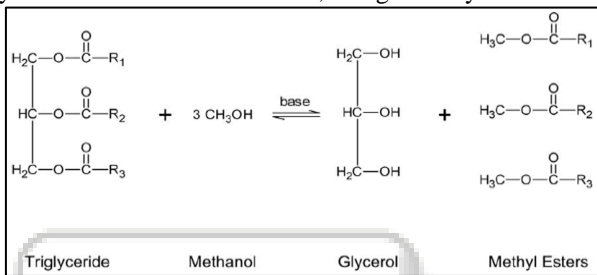


Fig. 1(a): Transesterification

IV. OBJECTIVES

There are two main objective in this work,

- Preparation of a biodiesel from Calophyllum Inophyllum Oil by Transesterification.
- Compared the thermo-physical properties of the biodiesel with diesel so that can be used as alternative fuel for diesel engine.

V. EXPERIMENTAL SETUP

For trans-esterification of Tamanu oil, First 300 ml of pure methanol is fixed with 500 ml Tamanu oil. 5gms of Potassium Hydroxide is mixed with the solution as catalyst purpose. This solution is heated and stirred up to an hour with the help of magnetic stirrer with hot plate. This solution is heated in the 60-65°C range of temperature. The heated mixture is cooled naturally for 8 hours.

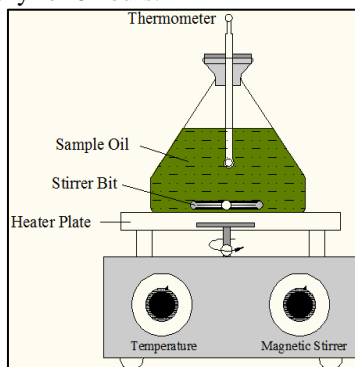


Fig. 2: Experimental Set-Up for Biodiesel

The mixture was poured from the blender into a bottle for settling and the lid was screwed on tightly. The reaction mixture was allowed to stand overnight to allow

phase separation occurred by gravity settling. The heavier layer is then removed either by gravity separation or with a syringe.

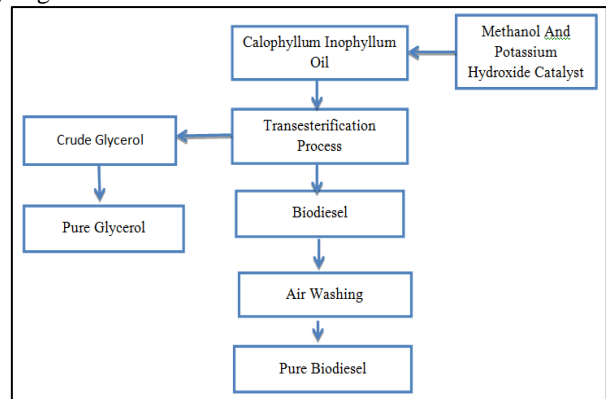


Fig. 3: Flow Chart for Biodiesel Production

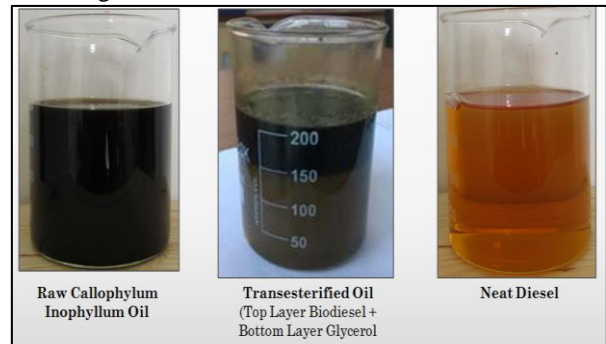


Fig. 4: Oil Samples

VI. RESULTS

Thermo-physical properties of Raw Calophyllum Inophyllum Oil and its Biodiesel are tested in Chem-Tech Laboratories, Pune, according to American Society for Testing and Materials (ASTM) as tabulated below and the Neat Diesel parameters are taken from references.

Parameters	Test Method	Neat diesel	Raw Calophyllum Inophyllum Oil	Calophyllum Inophyllum Biodiesel
Density at 15°C (Kg/m ³)	ASTM D4052 2016	835	941.9	893.9
Kinematic Viscosity at 40°C (Cst)	ASTM D7042 2016	3.5	57.60	9.231
Gross Calorific Value (MJ/Kg)	ASTM D240 2017	44	37.76	23.43

Table 2: Thermo-Physical Properties

Result shows that the raw Calophyllum Inophyllum oil can have a potential to replace a diesel but facing a problem with the very high density and kinematic viscosity this need changes in the engine setup. Whereas biodiesel from Calophyllum Inophyllum shows nearby values to neat diesel thus can be used in diesel engine without any modification only the worries of low Calorific Value result in low power development.

VII. CONCLUSIONS

Calophyllum Inophyllum oil Biodiesel is successfully prepared by Trans-esterification process.

Calophyllum Inophyllum oil biodiesel satisfies the important fuel properties as per ASTM specification, satisfying to use as alternative fuel for diesel engine without any modifications.

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