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Original Research Article

Production of Biodiesel from Agarwood Oil

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Abstract

Agarwood (Aquilaria malaccensis) is a plant species native to Southeast Asia that is best known for its oil essence. In this chapter, we'll look at using its oil to make biodiesel. To further clarify the picture, a number of steps would be carried out, beginning with the extraction of the oil and ending with its categorization. The "supercritical fluid extraction" approach is used in the extraction process. Later in this process the oil would be used as a source for extraction of Fatty Acid Methyl Ester. The characterization of the methyl ester would be specifically based on density, specific gravity, Flash point, carbon residue.

Keywords: Biodiesel, Agarwood oil, alternative energy, Fatty Acid Methyl Ester.

1. INTRODUCTION

This chapter comprises the cover of the project. The reason & problems addressed along with expected outcomes. The following background information is provided to establish the content of my project. The significance and perspective of the project is highlighted. The scope of the project is to substitute the usage of the fossil fuel along with any limitations or exclusions is being narrated. The cultivation of this species and the tenure it takes to secret the source oil is also 10-15 years. In search of some new energy sources, much attention is focused on bio mass as a reliable and renewable source that is able to satisfy a significant part of the energy demands.

Thou bio diesel is technically feasible and environmentally acceptable, it should be noted that it is not economically competitive, as this is the very flaw of it.

Scope of work

An alternate fuel to be used that is environment friendly. Fuel for twin cylinder engine, water -cooled, four stroke direct injection diesel engine

Aim of work

To prepare biodiesel from agarwood oil by esterification and transesterification, later to characterized. The selection criteria of the methods used is determined on the basis of FFA % that is acidic value of the mentioned oil.

2. MATERIAL AND METHODS

Material

1. Raw material- Agarwood Oil
2. Chemical used- Methanol, NaOH(catalyst), Sulfuric Acid
3. Instrument used- Conical flask, beaker, heater, magnetic stirrer

Methods

Transesterification & Esterification

Analytical methods

1. Characterization of the biodiesel.
2. Finding out the proportionate ratio to be used satisfying the potential of being a fuel.

METHODOLOGY

The production of bio diesel is followed by two steps: -

1) Esterification
2) Transesterification

The selection criteria of the methods above are based on the moisture content of the oil. Coulometric Karl Fischer Titration method is use to identify the moisture content or FAA% of the oil. If the FAA% is below 1% w/w transesterification process will be used. And if the FAA% is less than 1% w/w esterification process will be used. In this case as the titration was not performing the moisture content of the oil is unknown.

Therefore, both the methods will be used to get the final product FAME (Fatty Acid Methyl Ester).

Acid catalyzed Esterification

In this step, 800ml agarwood oil is transferred to a reaction flask and preheated for about 60 degrees Celsius using a heater with a magnetic stirrer. The solution was then prepared by allowing 8 mL of sulfuric acid to react with 8 mL of methanol. The solution was then brought up to reaction temperature. The solution is then poured into the hot oil. After heating the solution for the requisite reaction time (a few hours), it is poured into a separatory flask and allowed to settle for at least a day. After settlement, the access methanol, as well as and impurities, were transferred to the top sheet. The top layer oil is now ready for alkali catalyzed transesterification.

Alkali catalyzed transesterification

The esterified oil is preheated at 60˚c. Then solution of 1g NaOH and 8 ml methanol is prepared and added to the pre heated oil. At constant speed of the magnetic stirrer the oil was heated for few hours with maintained temperature. The oil is poured to the separatory funnel and allowed to settle for a day. After settlement the top layer methyl ester is washed with water and heated until it appears clear.

The catalyst is made by combining methanol with a solid base, such as sodium hydroxide. During the process, the NaOH splits into Na+ and OH- ions. The OH- eliminates the hydrogen from the methanol, resulting in vapour, leaving the CH3O- available for reaction. The methanol should be as dry as possible. Water is formed when the OH- ion interacts with the H+ ion. The probability of a flood will be raised as a result of the proposed legislation.

3. RESULT AND DISCUSSION

- Any Characterization: Yes
- Results/Optimizations: Customized accordingly
- Properties: Specific Gravity, Carbon Residue, Flashpoint, Density
- Comparatively study: Comparing characterization of Agarwood oil with Waste cooking oil

Table-1: Characterizes the properties of the biodiesel prepared from waste cooking oil

Properties	Sample 1	Sample 2
Density(g/cm^3)	0.888	0.895
Specific gravity	0.890	0.896
Flash point(℃)	78	104
Carbon Residue (%)	0.14	0.14

Table-2: Characterizes the properties of the biodiesel prepared from Agarwood oil

Properties	Sample 1	Sample 2
Density(g/cm^3)	0.4	0.45
Specific gravity	0.49	0.50
Flash point(℃)	35	54
Carbon Residue (%)	0.08	0.08

Fig-1

Fig-2

Characterisation of biodisel

Biodiesel was classified using ASTM criteria and a variety of experiments. The ASTM standards for specific gravity, density (Pycnometer), carbon residue, and flash point were D189 and D93, respectively. The properties in comparison using these criteria.

ASTM standard methods for biodiesel fuel product testing were used to describe the biodiesel's physical and fuel properties.

Physical Characteristics

One approach for determining the biodiesel norm is to look at its properties. Density, viscosity, flash point, acid value, and water content can all be used to test biodiesel.

Density

It is a measure of how dense anything is. A pycnometer is used to calculate density. The density of biodiesel at 15°C was found to be 0.4 g/cm3, with density decreasing linearly with temperature for canola methyl esters.

Flash point

The apparatus for measuring biodiesel combustion using ASTM D93-Flash stage, closed cup, requirement 130°C /min. The flash point is described as the "lowest temperature corrected to a barometric pressure of 101.3kPa (760 mm Hg) at which the vapors of a specimen ignite under specified test conditions when an ignition source is applied."

Carbon Residue (%)

Apparatus for Carbon Residues This carbon residue can be calculated using one of three methods. Ramsbottom carbon residue (RCR), Conradson carbon residue (CCR), or micro carbon residue are some of the terms used to describe it (MCR). The CCR value is the same as the MCR value in terms of math. The carbon residue value is often referred to as residual carbon content, or RCC, which is usually the same as MCR/CCR. 4 grammes of the sample are placed in a weighed glass bulb for the examination. The sample in the bulb is heated for 20 minutes in a bath at 553°C. The bulb is weighed again after cooling, and the difference is noted.

CONCLUSION

Agarwood oil was used to produce fatty acid methyl ester (bio diesel). Different samples of bio diesel are produced under identical reaction conditions. All of the samples were put through their paces in compliance with ASTM guidelines. The density, specific gravity, carbon residue, and flash point of the samples were all registered.

In conclusion, due to the high FFA content of agarwood oil, a two-step reaction was used to process it in this analysis. This is accompanied by alkali canalized transesterification after an acid-free treatment.

The first acid catalyze esterification step, which was carried out at 60°C for 1.5 hours with a 40/1 molar ratio of methanol to FFA and a 5% sulfuric acid concentration, reduced the FFA level from 9 percent to .41 percent. The alkali catalyst is the second alkali catalyst.

The agarwood oil biodiesel met and even surpassed ASTM requirements in terms of fuel properties. The properties of crude glycerol were also studied, including butt, moisture, glycerol content, and flash point.

RECOMMENDATION

The need to move away from oil as a major of energy is growing year by year, due to the price instability and environmental pollution which are the consequence of over dependence on the fossil fuel. Biofuel is now the focus of current research and development on renewable energy that will replace fossil fuels. Renewable biofuels would reduce countries' reliance on oil while also reducing their trade deficits, especially in developing countries.

However, in order for biofuel to compete with fossil fuel and possibly replace it as an energy source, it must be easy, inexpensive, and quick to produce. Generation of biofuel from agarwood oil, on the other hand, is not cost-effective because biodiesel from agarwood poses a threat to bio diversity. The development of bio diesel from agarwood oil as an alternative to fossil fuel is described in this study. It can be concluded, based on the results of experimental research, that agarwood oils are suitable for the production of bio diesel.

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