

Characterization of Biodiesel from Gossypium-Barbadense linn. and Helianthus Annuus Seeds Oil

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Abstract

In this research work, the yield percent of the prepared biodiesel from two selected seeds oil: cotton, Gossypium barbadense Linn. and sunflower, Helianthus annuus were observed (82

Index terms— cotton, sunflower, biodiesel, transesterification.

1 INTRODUCTION

nowadays throughout the world, we are facing with the lack of petroleum, which is the main source of energy in mobile transportation that enhanced the increment of total carbon dioxide in the atmosphere and it can cause the global warming [1]. One of the ways to solve this problem is substitution of petroleum with biodiesel. Biodiesel can be used in diesel engines with little or no modification and can be used as a complete substitute for petroleum-based diesel fuel. It is as biodegradable as sugar, less toxic than salt, and essentially free of sulphur and aromatics [2]. Although the fuels produced from biomass release the carbon dioxide into the atmosphere, because the plants use carbon dioxide from the atmosphere to grow (photosynthesis), the carbon dioxide formed during combustion is balanced by that absorbed [3]. It can also reduce the emission of CO, SO₂, hydrocarbons and particulate matter in the exhaust gas compared to petrodiesel, resulting in causing less environmental pollution than petrodiesel.

Biodiesel is therefore, a fuel alternative of the conventional, petroleum based diesel engine fuel, and is manufactured from vegetable oil or animal fats by catalytically reacting these with a short-chain aliphatic alcohol (methanol or ethanol), typically using a process called transesterification, or alcoholysis. A catalyst such as sodium or potassium hydroxides or an enzyme, lipase is required. Glycerol is produced as a co-product [2].

In our laboratory, biodiesel as fatty acid methyl ester form has been prepared from different plant oils such as jatropha oil, palm oil, coconut oil, peanut oil, corn oil, sesame oil and the waste oils. Here in, preparation of biodiesel from cotton, Gossypium barbadense Linn. and sunflower, Helianthus annuus seeds oil by reacting with methanol using NaOH catalyst and their characterization are presented.

2 II. MATERIALS AND METHODS

About 6 kg of cotton and sunflower seeds oil were purchased from Aung-Lan Township, Magway Division, and Demosoe Township Loikaw District Myanmar. The collected cotton seeds oil were firstly subjected to degumming and made for the preparation of biodiesel [7].

3 a) Degumming of the Gossypium barbadense Linn. and Helianthus annuus seeds oil

The collected seeds oil were degummed by two step process. The first step is water degumming and the second is acid degumming step [5].

100 ml of oil were pre-heated at 70 °C. Simultaneously, 1/3 v/v amount of water were heated at 70 °C and the hot soft water was mixed with the preheated oil by means of an overhead stirred for 1 hr. The temperature was maintained at 70 °C. The hydrated gums were removed from oil by centrifugal method. And then oils were

dried by oven drying method to give 95 % and 88 % of water degummed oil from cotton and sunflower seeds oil [3].

The water degummed oil was heated at 85 °C for about 15 min. The hot oil was mixed with 10% (v/v) phosphoric acid with constant stirring for about 1 hr and neutralized with 30% v/v of 0.1 M NaOH solution. Non hydratable phosphatides were separated by centrifugal method. 87% and 80 % of degummed oil from cotton and sunflower seeds oil were obtained [8].

4 b) Preparation of biodiesel

0.34% w/v of sodium methoxide solution was prepared in 99% methanol. 100 ml of oil sample were heated in a 250 cm³ three necked round bottom flask at 100°C, to remove the moisture. After the temperature was allowed to decrease to 55 °C, 25 ml of sodium methoxide (4:1 ratio of oil and sodium methoxide) were added and mixed vigorously with a magnetic stirrer.

The temperature was maintained at 55 °C throughout the reaction time for 120 min. This reaction mixture was allowed to stand overnight to provide the better separation of oil and glycerol layers. After removal of the glycerol (lower layer), the upper biodiesel layer was then washed with water to remove alkali and glycerol. The biodiesel was weighed and the yield % was calculated [8].

The procedure was carried out using oil: NaOMe ratios of 5:1, 6:1 and 7:1 v/v under same conditions.

5 c) Determination of some physicochemical properties of the prepared biodiesel from of *Gossypium barbadense* Linn. And *Helianthus annuus* seeds oil

The fuel related properties such as flash point, cloud point, pour point, solid point, specific gravity, and dynamic viscosity, and acid value, moisture content of the biodiesel prepared from the crude cotton seed oil and the degummed oil were determined according to conventional AOCS methods [10].

6 d) Characterization of prepared biodiesel from *Gossypium barbadense* Linn. and *Helianthus annuus* seeds oil

The characterization of the prepared biodiesel from the *Gossypium barbadense* Linn. and *Helianthus annuus* were also studied by FT-IR spectroscopy and Gas chromatography. The FT-IR spectra were recorded on a Shimadzu FT-IR 8900 Fourier Transform Infrared Spectrophotometer at Department of Chemistry, University of Mandalay. The fatty acid components of the oil samples were analyzed by using Shimadzu Model Autosystem XL Gas Chromatography at the Post-Harvest Technology Application Department, Hlegue Township, Yangon Division.

7 III.

8 RESULTS AND DISCUSSION

The two crude seeds oil were found in reddish brown colour and if the gum is present in the oil, it can disturb the engine nozzle and can destroy the piston of diesel engine. Therefore it is necessary to remove the gum before transesterification.

The degumming process involved two steps: water degumming step to remove hydratable phosphatides and acid degumming step to remove non hydrated phosphatides. After removal of the gum, (87, 80) % of the degummed oil were obtained by acid degumming method.

The biodiesel as a fatty acid methyl ester were prepared using 0.34 % (w/v) sodium methoxide solution in 4:1 volume ratio of oil and methanol at 55 °C for 2 hrs reaction time to yield (82, 75)% of biodiesel from crude cotton seed oil and sunflower seed oil. While the amounts of NaOMe solution were reduced to 5:1, 6:1 and 7:1 ratios (oil: methoxide volume ratio), the yields of biodiesel were decreased to 70%, 65% and 60%, respectively, and formation of more soaps occurred. In addition, the yield of biodiesel (78,72) % using degummed oil in oil: methoxide volume ratio 4:1 were observed not different from the yield of biodiesel using crude cotton and sunflower seeds oil under same conditions. Consequently, it can be inferred that the biodiesel could be prepared from the crude cotton seed oil without refining via degumming process, on the basis of the yield of biodiesel.

The characterization of prepared biodiesel such as acid value, cloud point, flash point, moisture content, pour point, solid point, specific gravity and viscosity were mentioned. The resulting data are summarized in Table 1 and 2 and their fuel properties were also compared with the ASTM data of biodiesel.

It was found that the physicochemical properties of the prepared biodiesels from crude cotton and sunflower seeds oil and their degummed oil were similar. The prepared biodiesel were found to contain lower acid value (0.1 and 0.35) mg KOH / g than standard data (0.5 mg KOH / g). Since the flash point of prepared biodiesel (80 and 75) °C were significantly lower than ASTM standard (<110 °C), the quality of the prepared biodiesel is good due to high tendency of vaporization. In addition, cloud point (0 °C), pour point (-4 and -3)°C and solid point (-10 and -12) °C of the prepared biodiesel were also observed to be lower than the ASTM standard data indicating the lesser amount of wax present in biodiesel and they could be used even in the cold season. The

prepared biodiesel also showed very low viscosity (55.1 and 65.3) cP at room temperature compared to ASTM standard data (67 and 73 cP) at 40 °C indicating the good ability of complete burning of biodiesel.

It also has the lower specific gravity (0.879, 0.778) than ASTM standard data (0.9186 and 0.8891) [7].

The FT-IR spectroscopic study on the prepared biodiesel from two collected seeds sample oil indicated the presence of ester group and aliphatic groups due to the sharp absorption bands appearing at (1747 and 1768) cm^{-1} for C=O stretching vibration at (1654, 1660) cm^{-1} and (2908, 2918) cm^{-1} for C-H asymmetric stretching vibrations of CH₃ and CH₂ groups and C=O stretching for ester group occurred at (1739, 1747) cm^{-1} . In addition, since there occurred no O-H broad absorption band, the biodiesel may not contain the free fatty acid [6].

The types of fatty acid components of prepared biodiesel from cotton seed oil was also studied by GC chromatography. It showed that the prepared biodiesel may be the methyl esters of linoleic acid (C₁₈H₃₂O₂), Global Journal of Researches in Engineering palmitic acid (C₁₆H₃₂O₂) and oleic acid (C₁₈H₃₄O₂). Consequently, it can be deduced that the biodiesel prepared from cotton seed oil and sunflower oil could be used as alternative diesel fuel, the number of carbons in fatty acids are in the range of that in diesel, between 11 to 25 [9].

9 CONCLUSION

From the overall assessment of the research, it can be inferred that the biodiesel prepared from the cotton and sunflower seeds oil without degumming could be used as an alternative fuel diesel since the prepared biodiesel has the good fuel related properties such as acid value, cloud point, flash point, moisture content, pour point, solid point, specific gravity and viscosity. The following benefits can be availed by you only for next three years from the date of certification:

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21 Ask

? To-the-point depiction of the research.

? Consequences, including definite statistics-if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

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XV Approach:

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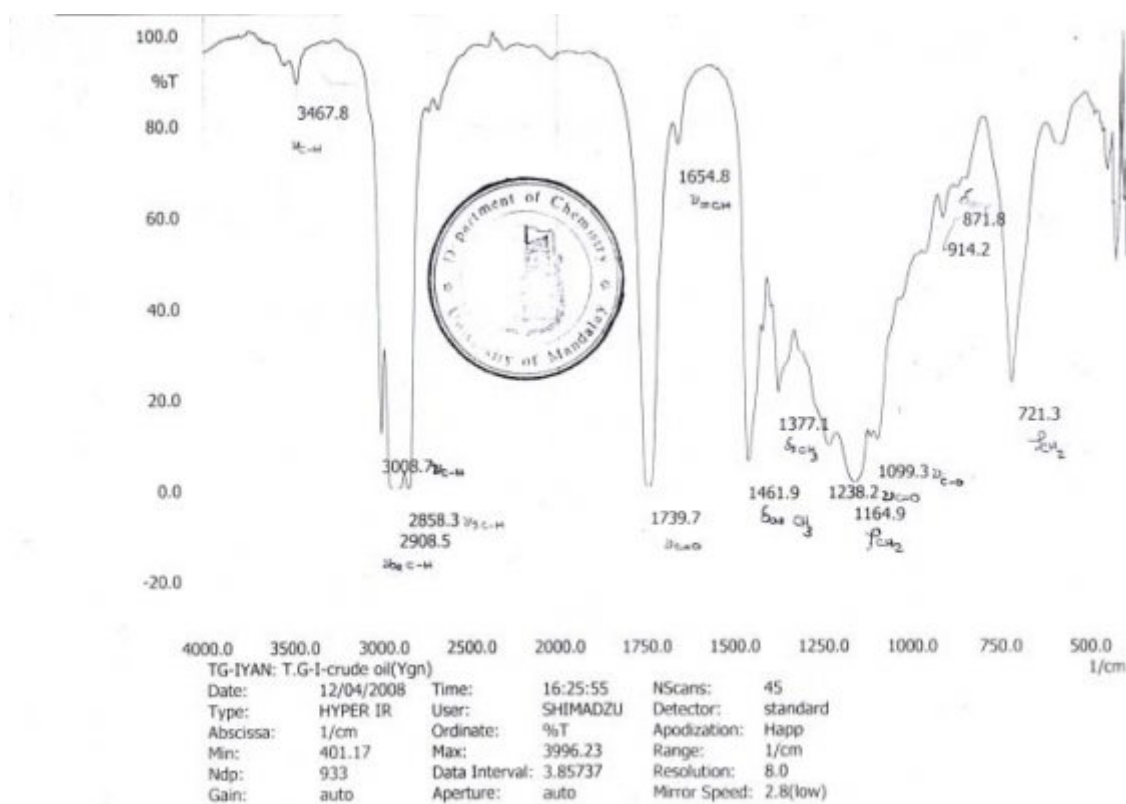
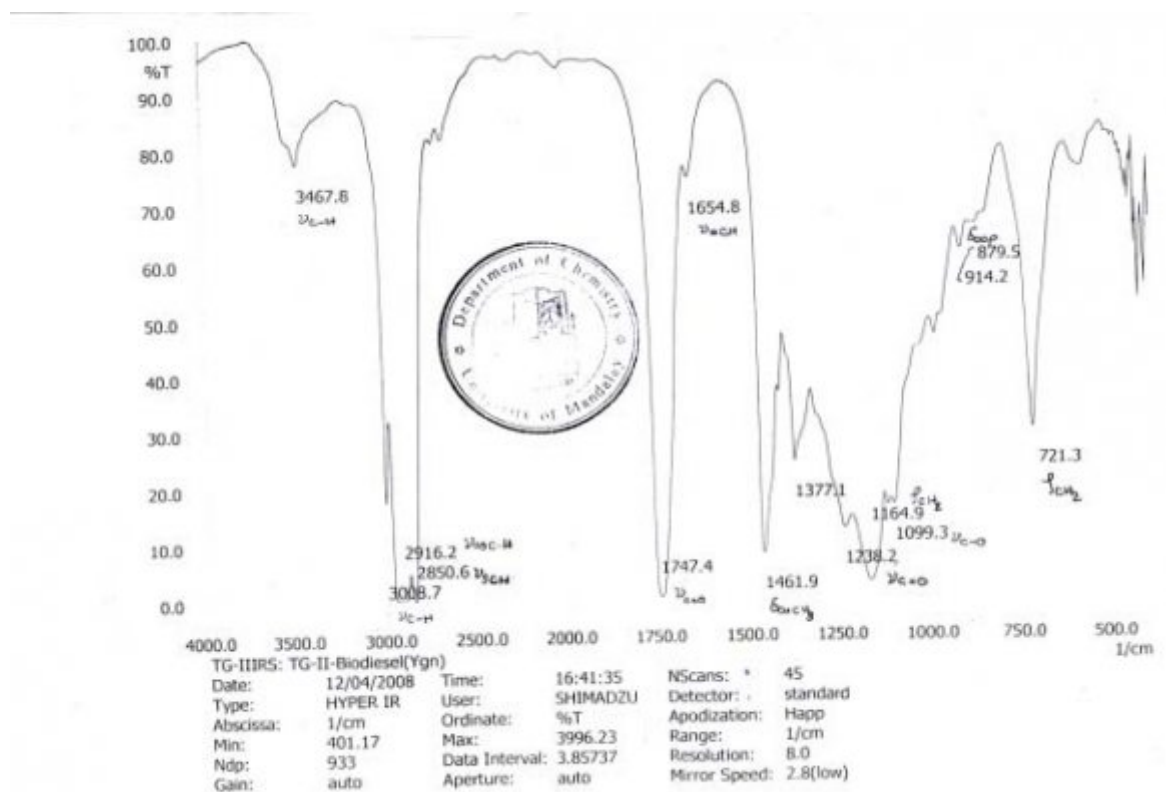


Figure 2: Figure 2 :



3

Figure 3: Figure 3 :

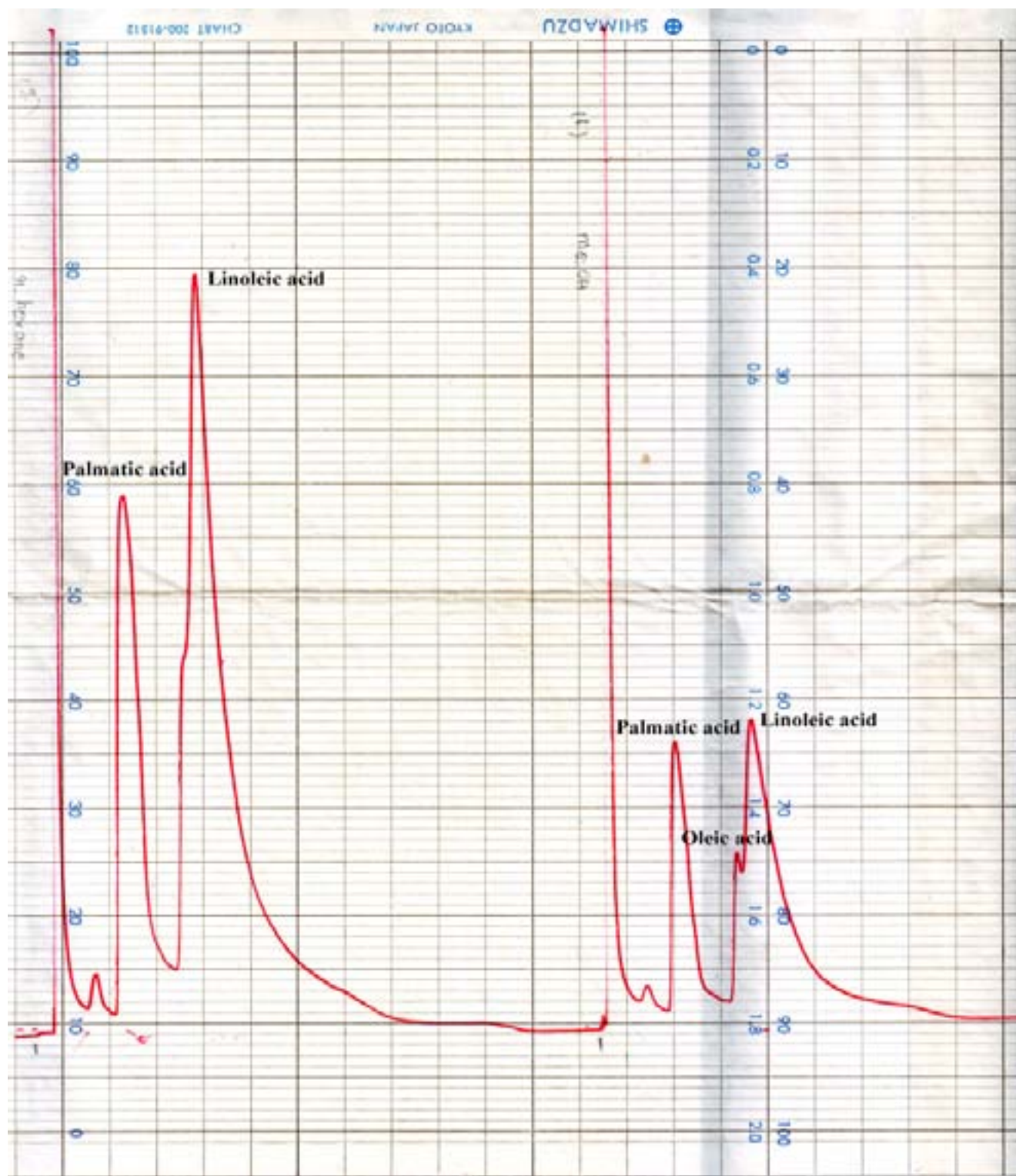


Figure 4:



Figure 5:



Figure 6:

1

Figure 7: Table 1 :

2

[Note: Properties of the Prepared Biodiesels from Helianthus annuus and its ASTM Standard Data Global Journal of Researches in Engineering () Volume XVIII Issue I Version I 21 Year 2018 C © 2018 Global Journals Characterization of Biodiesel From Gossypium barbadense linn. and helianthus Annuus Seeds Oil]

Figure 8: Table 2 :

Figure 9: your guides:

5. Use the internet for help:

Figure 10: 4. Use of computer is recommended:

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Figure 11: :

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Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

.9 Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table ??, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

.10 Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain." o You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea. o Give details of all of your remarks as much as possible, focusing on mechanisms. o Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted.

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