

Study and Analysis for Formation of Bio - Diesel with Combination of Waste Frying Oil and Sodium Hydroxide

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ABSTRACT: Waste frying oil trans-esterification was studied with the purpose of achieving the best conditions for bio-diesel production trans-esterification reactions where carried out for one hour using waste frying oil (WFOs), methanol, and sodium hydroxide as catalyst in order to determine the best condition for bio-diesel production, series of experiments were carried out, using methanol/waste frying oil molar ratio between 3.6 and 5.4 and catalyst / waste frying oil weight ratios between 0.2% and 1.0%. for oils with an acid value of 0.42mg NaOH/gm, results so that a methanol/WFO ratio of 4.8 and a catalyst/WFO ratio of 0.6% gives the highest yield of methyl esters. Furthermore, an increase in the amount of methanol or catalyst quantity seems to simplify the separation/purification of methyl esters phase, as showed by a viscosity reduction and an increasing purity to values higher than 98% for methyl esters phase.

KEYWORDS: Waste Frying Oil, Methonal, Trans-esterification, NaOH

I. INTRODUCTION

Biodiesel fuel is a clean burning alternative fuel that comes from 100% renewable resources. Many people believe that Biodiesel is the fuel of the future. Sometimes it is also known as Biofuel. Biodiesel which is derived from triglycerides by trans-esterification and from the fatty acids by esterification has attracted considerable attention during the past decade as a renewable, biodegradable, ecofriendly and non-toxic fuel. Biodiesel is recently used as a substitute for petroleum based diesel due to environmental considerations and depletion of vital resources like petroleum and coal. Further as petroleum is a fast depleting natural resource, an alternative renewable way to petroleum is a necessity.

II. LITERATURE REVIEW

Nagarhalli M.V et al. (2010)

This work considers the use of coconut oil for the production of alternative renewable and environmental friendly biodiesel fuel as an alternative to conventional diesel fuel. Test quantities of coconut oil biodiesel were produced through Trans-esterification reaction using 100g coconut oil, 20.0% ethanol (wt% coconut oil), 0.8% potassium hydroxide catalyst at 65°C reaction temperature and 120 min. reaction time. The experiment was carried out three times and average results evaluated. Low yield of the biodiesel (10.4%) was obtained.

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H.Raheman and A.G.Phadatara et al.,

This journal was that to study the prospects and opportunities of introducing vegetable oils and their derivatives as fuel in diesel engines. Some fuel properties are always available in vegetable oils. In this investigation Cottonseed oil, Mosna oil and Sesame oil are chosen for producing biodiesel as an alternative fuel for diesel engine. Biodiesel from cottonseed oil has various fuel properties which are similar to diesel. The cost of biodiesel production is also analyzed. This paper discusses in a general a perspective of biodiesel.

NitinShrivastava et al.,(2012)

This paper is consider of Biodiesel can be produced from vegetable oils and also from waste fats. Biodiesel is a mono-alkyl-ester of long chain fatty acids derived from renewable feedstock such as vegetable oils by Trans-esterification process. The esterified cotton seed oil, rice bran oil, and tamanu oil are chosen as the alternative..

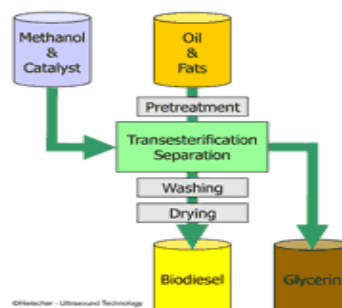
N.Panigrahi,M.K. Mohanty, A.K.Pradhan et al.(2012)

They said that the results of the performance of a compression ignition engine (direct injected, 4-stroke 2- cylinder engine) by using WASTE FRYING OIL methyl ester from non-edible vegetable oil (*MadhucaIndica*) and its blends with diesel fuel have been presented in this paper. Short-term engine performance tests were conducted using four different blends of Waste frying oil ethyl ester oil with diesel fuel from 20% to 100% by volume at three fuel temperatures (30, 50 and 700-C) and at two injection pressures (17640 kPa and 24010 kPa). The engine performance parameters studied were power output, brake specific fuel consumption (BSFC), brake thermal efficiency (BThE) and exhaust gas temperature (ExGT) by using diesel fuel alone and the above mentioned blend fuels.

III. OBJECTIVES

- To make the biodiesel from Waste frying oil via two stage catalytic trans- esterification process.
- To determine the performance analysis of the biodiesel in diesel engine by varying its blend level characteristics.

PROCESS OF BIO-DIESEL PRODUCTION:



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SAMPLE OF BIO DIESEL Fig 2

PROPERTIES COMPARISON OF WASTE FRYING OIL AND DIESEL

| Properties | Diesel | Waste frying oil | Bio-diesel |
|------------------------------------|--------|------------------|------------|
| Kinematic Viscosity | 3.9 | 4.2 | 5.39 |
| Density kg/m ³ | 0.83 | 0.927 | 0.8884 |
| Fire point °C | 65 | 6.2 | 171 |
| Flash point °C | 56 | 225 | 158 |
| Calorific value kcal/kgm | 42000 | 8742 | 40828 |
| Specific gravity kg/m ³ | 0.860 | 0.9396 | 0.8895 |

IV. PERFORMANCE TESTING OF BIO-DIESEL B100

BIO-DIESEL 100 %

Constant speed = 1500 rpm Density = 0.850

Specific gravity = 0.917 calorific value = 40828

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| Sl no | Weight W1 kg | W W2 kg | W W newton | Speed (S) Rpm | Time (T) Sec | B.P kw | T.F.C | S.F.C | I/P kw | I.P kw | B.T.E % |
|-------|--------------------|---------------|------------------|---------------------|--------------------|-----------|-------|-------|-----------|-----------|------------|
| 1 | 0 | 0 | 0 | 1500 | 60 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 2 | 0.5 | 14.715 | 1500 | 50 | 0.351 | 0.66 | 1.88 | 1.951 | 7.38 | 4.88 |
| 3 | 4 | 1.1 | 28.44 | 1500 | 45 | 0.678 | 0.741 | 1.092 | 2.278 | 8.29 | 8.17 |
| 4 | 6 | 2 | 39.24 | 1500 | 40 | 1.123 | 0.825 | 0.873 | 2.545 | 9.76 | 9.5 |

| SL no. | M.E % | I.T.E % |
|--------|----------|------------|
| 1 | 0 | 0 |
| 2 | 17.99 | 26.64 |
| 3 | 29.76 | 27.81 |
| 4 | 39.76 | 28.81 |

Where ,

W1 = weight 1 in kg

W2 = weight 2 in kg

W = weight in Newton

N = speed in rpm

TFC = Total fuel consumption

SFC = Specific fuel consumption

B.P = Brake power in KW

I/P = Input power in KW

I.P = Indicated power in KW

BTE = Brake thermal efficiency in %

M.E = Mechanical efficiency in %

ITE = Indicated thermal efficiency in %

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V. MODEL CALCULATION

TEST FOR B100 RATIO

1. Brake power

$$\begin{aligned} \text{Brake power} &= 2\pi NT / 60 * 1000 \text{ Kw} \\ &= 2 * 3.14 * 1500 * (14.715 * 0.152) / 60 * 1000 \end{aligned}$$

$$\text{Brake power} = 0.351 \text{ KW}$$

2. Total fuel consumption

$$\text{TFC} = 10 * S * 3600 / t * 1000 \text{ kg/hr}$$

$$= 10 * 0.917 * 3600 / 50 * 1000$$

$$= 0.66 \text{ kg/hr}$$

3. Specific fuel consumption

$$\text{SFC} = \text{TFC} / \text{BP} \text{ kg/kw hr}$$

$$= 0.66 / 0.351$$

$$= 1.88 \text{ kg/ kw.hr}$$

4. Indicating power :

$$\text{I.P} = \text{B.P} + \text{F.P}$$

$$\text{F.P} = \text{Friction power} = 1.6$$

$$= 0.351 + 1.6$$

$$= 1.951 \text{ kw}$$

5. Input power

$$\text{I/P} = \text{TFC} * \text{CV} / 3600 \text{ kw}$$

$$= 0.66 * 40828 / 3600$$

$$= 7.38 \text{ kw}$$

6. Output power

$$\text{O.P} = \text{B.P}$$

$$\text{BTE} = (\text{OP}/(\text{I/P})) * 100$$

$$= 0.351 / 7.38 * 100$$

$$= 4.88 \%$$

7. Brake thermal efficiency

$$\text{ITE} = \text{I.P} * 3600 * 100 / \text{TFC} * \text{CV}$$

$$= 1.951 * 3600 * 100 / 0.66 * 40828$$

$$= 26.64 \%$$

8. Indicating thermal efficiency :

$$\text{M.E} = (\text{OP}/\text{IP}) * 100$$

$$= (0.351 / 1.951) * 100$$

$$= 17.99 \%$$

MAXIMUM LOAD CALCULATION

$$\text{BHP} = 2\pi N T / 60 * 1000$$

$$= 2\pi N (W.Re) / 60 * 1000$$

$$5 = 2\pi * 1500 * W * 0.152 / 60 * 1000$$

$$W = 5 * 60 * 1000 / 2\pi * 1500 * 0.152$$

$$W = 219.52 \text{ N}$$

$$= 219.5 / 9.81$$

$$= 22.37 \text{ kg}$$

$$\text{Safe load} = 80 \% \text{ of } W$$

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$$= 22.37 * (80/100)$$
$$= 17.8 \text{ kg}$$

VI. APPLICATION

- Internal combustion engines are most commonly used for mobile propulsion in vehicles and portable machinery.
- In mobile equipment, internal combustion is advantageous since it can provide high power-to-weight ratios together with excellent fuel energy density.
- Generally using fossil fuel (mainly petroleum), these engines have appeared in transport in almost all vehicles (automobiles, trucks, motorcycles, boats, and in a wide variety of aircraft and locomotives).
Where very high power-to-weight ratios are required, internal combustion engines appear in the form of gas turbines. These applications include jet aircraft, helicopters, large ships and electric generators.

VII. CONCLUSION

The performance and emission characteristics of biodiesel derived from waste frying oil and its blends are compared with the conventional diesel fuel. Results are summarized as follows:

- Diesel engine can perform satisfactorily with waste frying oil methyl esters and their blends without any engine modifications.
- The performance of biodiesel-fueled engine was marginally better than the diesel-fueled engine in terms of mechanical efficiency.
- The emissions of the biodiesel is nearly equal to the diesel.
- Thus, results indicate that waste frying oil methyl ester can be used as an alternative and environment friendly fuel for a diesel engine.

REFERENCES

- [1] Nagarhalli M.V. et al. 2010 Emission and Performance Characteristics of Karanja Biodiesel and its blends in C.I. Engine and its economics. Vol.5 No.2 Feb.2010, ARPN Journal of Engineering and Applied Sciences.
- [2] H.Raheman and A.G. Phadatare et al., Emissions and Performance of Diesel Engine from Blends of Karanja Methyl Ester)Biodiesel and Diesel.
- [3] NitinShrivastava et al., 2012, A comparative study of the behavior of biodiesels of different origins on the diesel engine performance and emission. IRACST Vol-2 No.4 August 2012 Page 766-770
- [4] N.Panigrahi, M.K.Mohanty, A.K.Pradhan Non-Edible Karanja Biodiesel- ASustainable Fuel for C.I. Engine Vol. 2, Issue 6, November-December 2012 International Journal of Engineering Research and Applications (IJERA)