# PERFORMANCE AND EMISSION TEST OF DIESEL ENGINE USING MIXTURE OF HONGE OIL, WASTE MILK SCUM AND WASTE COCONUT OIL

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**Abstract**

**At present the power generation of India is mainly depends on imported fossil fuels. To reduce the dependency on imported fuel, the use of renewable sources has become more popular. In India waste coconut oil & waste milk products are thrown after its use, so it will be utilized these waste oils by using as Biodiesel. Especially in the southern part of the country a large area will be found where honge plant is found especially in the regions of Karnataka. So, endeavor was to use the honge oil as a renewable and alternative fuel. The mixture of honge oil, waste coconut oil and waste diary scum as an alternative fuel of diesel fuel. An experimental set up is then made to study the performance of a small diesel engine using different blends of bio diesel converted from respective oil. It is found that bio diesel has slightly different properties than diesel. With biodiesel the engine is capable of running without difficulty. Different blends of bio diesel (i.e. B15, B30 and B45 etc.) have been used to avoid complicated modification of the engine or the fuel supply system. Finally, a comparison of engine performance for different blends of biodiesel has been carried out to determine the optimum blend for different operating conditions.**

**Keywords: Honge oil, waste coconut oil, waste dairy scum, diesel engine**

## 1. INTRODUCTION

India is the fifth largest primary energy consumer (as per international energy annual) and forth largest in the petroleum consumer in the world. India is the second largest in the population. But currently India is not very prominent in the global bio-fuel map. However India has planned to expand the use of biodiesel. In order to meet energy consumption demand in India, biodiesel is used as one of the alternative fuel for diesel engines.

Soya, Honge, Jatropha, Neem, Mahua, Cotton seed, tobacco seed and Simarouba biodiesels are considered as alternate to diesel fuel. Amongst them honge being newly found oil. Honge seed contains 60-70% of the oil; the present work is involved to blend waste diary scum and waste vegetable oil like coconut oil.

Fig (a)

Fig (b)

Fig 1.1. (a) PongamiaPinnata Seed (Honge Seed) and (b)Waste Milk Scum Storage tank in Milk Diary house.

Fig 1.2 used/waste coconut oil

## 2. LITERATURE SURVEY

Researcher made a conclusion that, Biodiesel has potential as an alternative energy source. And also Biodiesel operates in compression ignition (diesel) engine, which essentially requires very little or no engine modifications because biodiesel has properties similar to petroleum diesel fuels [2].

Researcher conducted experiment on "Performance &Characteristics of Diesel Engine Using Mixture of waste Milk Scum & Honge oil as Bio Diesel" It is carried out in series procedure starts with pickup seeds and raw scum to final esterification process. Taking out methanol from bio-diesel in name of recovery. Then all Fuel properties are found out for both biodiesel. BTE, BSFC are finding out at different load conditions. Engine performance is carried out for all blends and as result B20 is optimum blend among them. By using biodiesel which decreases emission of environmental pollution gases [6].

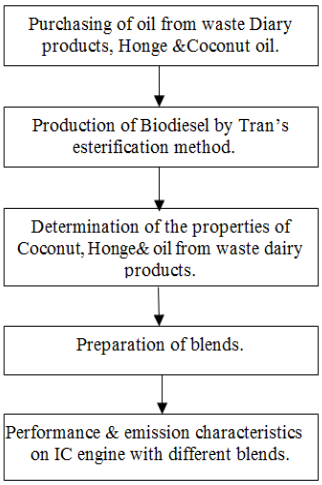
Researcher conducted experiment on "Performance Test on Honge oil Bio diesel" From their study the crude oil extracted from Pongamiapinnata seed was used to synthesize biodiesel (fatty acid methyl esters) by Tran esterification with methanol in the presence of two different base catalysts viz. NaOH and KOH at a predetermined optimum temperature of 60˚C, FThen stirring speed of 300 rpm for 45 minutes. A percentage conversion of 68% and 73% respectively was achieved by NaOH and KOH catalyzed Trans esterification reaction.

The fuel properties of the Trans esterified oil (biodiesel) obtained using the two catalysts were compared with crude Pongamia oil and a biodiesel blend (B20).And Fuel properties taken into consideration [4].

## 3. METHODOLOGY

Initially found that Honge oil, diary scum oil & coconut oil which are easily available almost all regions of Karnataka. Honge Oil is extracted from Honge seeds from oil extracting machines. The diary scum is obtained from the milk products such as ghee, butter etc. The waste coconut oil is obtained from canteen or hotels. Instead of throwing these oils and making pollution, make use of these waste oils.

A. Block Diagram for methodology




B. Mechanism of Trans esterification

Fig3.1Transesterification Machine

Fig3.2Separation of biodiesel from glycerin

C. Blending Process

Fig 3.3 Blending process

This work is involved to conduct a test on performance & emission characteristics of the blending oil with various proportions along with the Diesel fuel. And taking equal amount of mixture of 3 oils along with diesel. Initially will take 5% each of Honge, Diary scum & coconut diesel and rest 85% is Diesel under Full load condition and Unmodified Pressure Ratio. The Different Blending Ratio used for testing purpose is:

- B100: 100% Diesel and 0% Biodiesel.
- B15: In this Blend, will take 5% each of 3 oils (5+5+5) and rest 85% is diesel.
- B30: In this Blend, will take 10% each of all 3 oils and rest 70% is diesel.
- B45: In this Blend, will take 15% each of all 3 oils and rest 55%is diesel.

The Trans esterified honge, diary scum; vegetable biodiesel is blended with pure diesel volumetrically by using measuring jar with equal proportion.

## 4. EXPERIMENTAL RESULTS/ANALYSIS

Table 4.1 Performance parameters for D100 with 200 bar IP

| Sl no | load N-m | Speed rpm | BP kW | IP kW | BSFC kg/kW-hr | BTHE (%) | Mech. eff(%) | Vol. eff(%) |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1510 | 0.02 | 1.89 | 246.64 | 0.03 | 1 | 56.29 |
| 2 | 5 | 1486 | 0.85 | 2.85 | 7.22 | 1.16 | 29.72 | 55.99 |
| 3 | 10 | 1473 | 1.56 | 4.02 | 3.04 | 2.75 | 38.82 | 54.84 |
| 4 | 15 | 1445 | 2.28 | 4.53 | 1.87 | 4.48 | 50.3 | 55.91 |
| 5 | 18 | 1423 | 2.72 | 4.92 | 1.39 | 6.02 | 55.24 | 55.5 |

Table 4.2: Performance parameters for B30 with 200 bar IP

| Sl no | load N-m | Speed rpm | BP kW | IP kW | BSFC kg/kW-hr | BTHE (%) | Mech. eff(%) | Vol. eff(%) |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1516 | 0.03 | 1.94 | 231.21 | 0.04 | 1.39 | 56.07 |
| 2 | 5 | 1483 | 2.51 | 3.15 | 3.41 | 2.51 | 26.8 | 56.1 |
| 3 | 10 | 1469 | 4.38 | 4.38 | 1.95 | 4.38 | 37.51 | 56.63 |
| 4 | 15 | 1539 | 4.47 | 4.94 | 1.91 | 4.47 | 48.82 | 52.49 |
| 5 | 18 | 1429 | 4.6 | 4.74 | 1.86 | 4.6 | 57.11 | 55.27 |

Table 4.3: Emission parameters for D100 with 200 bar IP

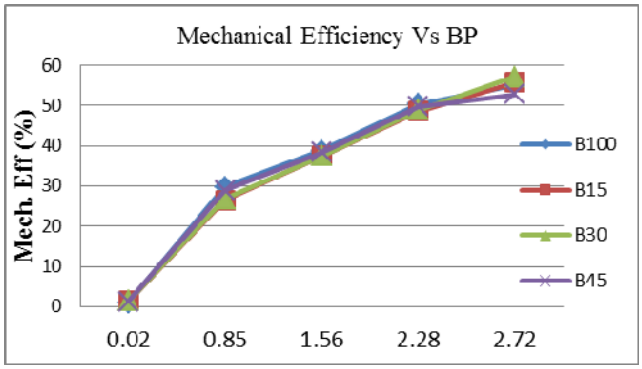
| Sl. no | Load (N-m) | CO(% volume) | HC (PPM volume) | $CO_2$(% volume) | $O_2$(% volume) | $NO_x$(PPM volume) |
|---|---|---|---|---|---|---|
| 1 | 0 | 0.08 | 9 | 2.4 | 19.43 | 57 |
| 2 | 5 | 0.08 | 10 | 3.1 | 17.03 | 150 |
| 3 | 10 | 0.04 | 11 | 3.9 | 15.8 | 333 |
| 4 | 15 | 0.04 | 10 | 4.2 | 15.08 | 486 |
| 5 | 18 | 0.05 | 16 | 5.7 | 13.14 | 683 |

Table 4.4: Emission parameters for B30 with 200 bar IP

| Sl.no | Load (N-m) | CO(% volume) | HC (PPM volume) | $CO_2$(% volume) | $O_2$(% volume) | $NO_x$(PPM volume) |
|---|---|---|---|---|---|---|
| 1 | 0 | 0.06 | 19 | 1.9 | 18.43 | 57 |
| 2 | 5 | 0.06 | 17 | 2.7 | 17.7 | 148 |
| 3 | 10 | 0.04 | 14 | 3.8 | 15.81 | 344 |
| 4 | 15 | 0.06 | 21 | 5.4 | 13.85 | 688 |
| 5 | 20 | 0.06 | 24 | 5.8 | 13.05 | 698 |

*A.The performance characteristic curves are as follows:*

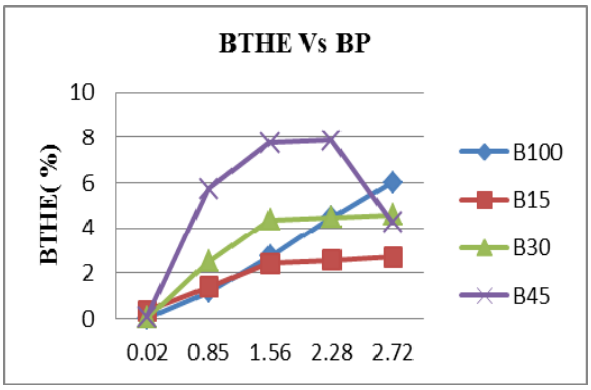
Graph 4.A.1: mechanical efficiency vs. Brake power for biodiesel & diesel.




BRAKE POWER (KW)

From the above chart For Higher value of Brake Power, B30 blend is having higher mechanical efficiency compared to other Biodiesel blend and diesel. So B30 blend is somewhat better compared to other Biodiesel blend and diesel at 200 bar pressure. B45 biodiesel blend is having least mechanical efficiency compared to all other blends and diesel

Graph 4.A.2: Brake Thermal Efficiency vs. Brake Power for biodiesel & diesel.

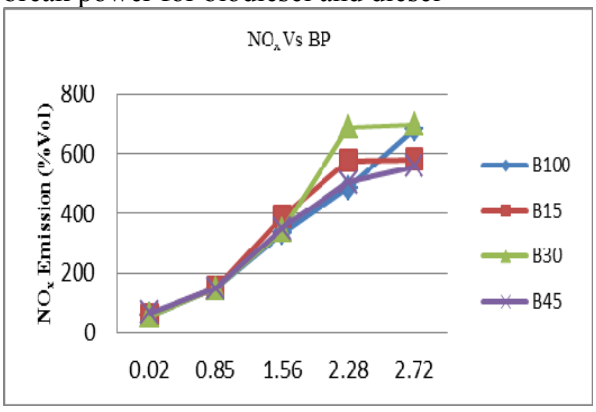



BRAKE POWER (kW)

From the above chart Brake Thermal efficiency of B45 is higher for lower Brake power & it decreases for higher value of Brake power. The probable reason for increase in BTHE may be due to better atomization of the fuel because of presence of inherent oxygen molecule resulting in improved combustion. The B15 blend is having lowest BTHE for increasing value of Brake power.

*B.The Emission characteristic curves are as follows*

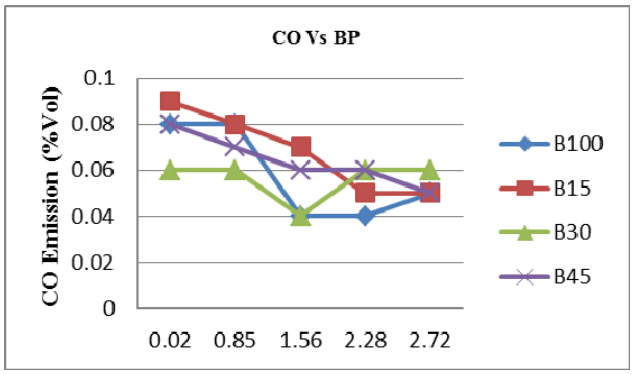
Graph 4.B.1: Nitrogen oxides emission vs. break power for biodiesel and diesel




BRAKE POWER (kW)

The Biodiesel Blend B45 emits less NOx emission than any other biodiesel blend and even less than Diesel and it is produces less pollution comparing to Diesel. B15 is also having less NOx emission comparing to diesel for higher Brake Power at 200 bar pressure. B30 blend is having highest NOx emission than all other blends and diesel fuels.

Graph 4.B.2: Carbon di Oxide Emission vs. Brake Power for biodiesel & diesel




BRAKE POWER (kW)

From the above graph shown that B30 is having lower CO emission for lower value of brake power and it gradually increases with increasing value of Brake power. At Higher Brake power the B15 is having lower CO emission comparing to other Biodiesel blends. Increase in CO emission at higher loads may be because of incomplete combustion due to lower calorific value and higher viscosity of biodiesel.

## 5. Conclusion and Future Enhancement

The present work evaluates the performance of combination of Honge, Dairy scum and Coconut oil and sodium hydroxide as catalyst and emission characteristics of Biodiesel compared with ordinary diesel in a diesel engine under normal pressure, injection timing and compression ratio. The following conclusions were drawn

Break thermal efficiency of biodiesel B30 follows the ordinary diesel but deviate down words after half load.

Mechanical efficiency of Bio diesel B30 is little higher

The biodiesel B30 gives less emission of CO up to some extent

The Biodiesel Blend B45 emits less NOx emission than any other biodiesel blend and even less than Diesel

### Future Enhancement

The project work may be extended on the following aspects:

- Experiments may be conducted with different ratios of biodiesel blends (B60, B80 and B100).
- Performance of engine with biodiesel may be analyses at varying injection pressure,

injection timings and varying compression ratios.

 Low Heat Rejection diesel engine concept may be applied in order to improve the performance of diesel engine using biodiesel with Exhaust Gas Recirculation technique.

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