International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 10, October 2013)

Practical Performance of Internal Combustion Engine Using Jatropha Oil as A Bio-Fuel

Sachindra Dhakad[1], Upendra Parashar[2], Devendra singh Dandotiya[3], Vivek Dhakad[4], Jogendra singh Gurjar[5]

[1,2]*M.Tech Student (Thermal System & Design), SRCEM, Banmore, Morena, (M.P.)*
[3]*Asst.Prof. (Mechanical Engineering), SRCEM, Banmore, Morena, (M.P.)*
[4]*M.Tech Student (Thermal Engineering), NITM, Gwalior (M.P.)*
[5]*M.Tech Student (Automobile Engineering), RJIT, Takanpur (M.P.)*

***Abstract*— Due to gradual depletion of world petroleum reserves and impact of increasing exhaust emissions, which have given rise to global warming issues so there is an urgent need for renewable alternative fuels for use in automotive engines. In recent years systematic efforts have been made by several researches to mono-alkyl ester of vegetable oils, i.e. biodiesel, as fuel in CI engines. Biodiesel have lower viscosity as compare to vegetable oils, and gives performance compare to petro diesel.**

In this study edible and non- edible vegetable oils of Mustard and Jatropha seeds were extracted. A single cylinder, water cooled 5 HP CI engine was tested under variable load conditions with different blends of petro diesel and Biodiesel. The performance characteristics of the engine had been evaluated using varying proportions blend. 30 B Jatropha has been suggested for use in CI engine.

***Keywords*— Brake thermal efficiency, CI engine, Biodiesel, Jatropha Carcus, Mustard.**

I. Introduction

The gradual depletion of world petroleum reserves, increase in crude oil prices, and impact of environmental pollution results in renewed focus on vegetable oils and other renewable lipid source. These resources have less environmental impact than the traditional ones. Therefore, in recent years systematic efforts have been made by several researchers to use vegetable oils and their esters (biodiesel) as fuel in CI engines. Vegetable oils have already been directly used in CI engines as they have a high Cetane number and calorific value very close to diesel. However, the brake thermal efficiency was lower to that of petro diesel. [1]

II. Importance Of Jatropha Bio-Fuel

Jatropha is a valuable multi-purpose crop to alleviate soil degradation, desertification and deforestation, which can be used for bio-energy to replace petro-diesel, for soap production and climatic protection, and hence deserves specific attention.

Jatropha can help to increase rural incomes, self-sustainability and alleviate poverty for women, elderly, children and men, tribal communities, small farmers. It can as well help to increase income from plantations and agro-industries. [2]

Fig -1 Jatropha fruits in tree.

III. Biodiesel Production Methods

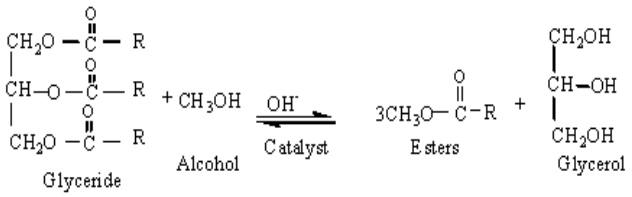
Biodiesel can be produced from straight vegetable oil, animal oil/fats, and tallow and waste oils. There are basic routes to biodiesel production from Jatropha and mustard oils.

1. Base catalyzed transesterification of the oil.
2. Direct acid catalyzed transesterification of the oil.
3. Conversion of the oil to its fatty acids and then to Biodiesel.

Transterification of The Bio-Fuel

The Transesterification process is the reaction of a triglyceride (fat/oil) with an alcohol to form esters and glycerol. A triglyceride has a glycerine molecule as its base with three long chain fatty acids attached.

International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 10, October 2013)



The products of the reaction are the biodiesel itself and glycerol. [3]

The characteristics of the fat are determined by the nature of the fatty acids attached to the glycerin form the mono-alkyl ester, or biodiesel and crude glycerol. In most production methanol or ethanol is the alcohol used (methanol produces methyl esters, ethanol produces ethyl esters) and is base catalyzed by either potassium or sodium hydroxide. Potassium hydroxide has been found to be more suitable for the ethyl ester biodiesel production; either base can be used for the methyl ester. [4]

IV. DESCRIPTIONOF EXERIMENTAL SETUP

Fig.2 Engine Setup

Fig.3 Rope Brake Dynamometer

Fig.4 Tachometer

V. TECHANICAL SPECIFICATION OF THE ENGINE

Sr. no.	Items	Specifications
1	Model	KIRLOSKAR, AV1
2	Compression ratio	19:1
3	Method of starting	Hand starting
4	Type, no. of cylinders	Vertical – 4 stroke, 1 cylinder
5	Bore x stroke(mm)	87.5x110
6	Cubic capacity	624
7	Maximum power	5 Hp
8	Nominal speed	1500 rpm
9	Cooling system	Water-cooled
10	Fuel filter	Present
11	Lube oil filter	Present

VI. EQUIPMENT USED FOR THE EXERIMENT

1. Single - cylinder four stroke diesel engine,
2. Tachometer
3. Stop watch
4. Bio-diesel (Jatropha oil)
5. Diesel

International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 10, October 2013)

VII. Results And Discussion

The basic performance parameters that were Determined for performance Evaluation of Engine are:

1) Variation of BSFC with BP for different blend of Jatropha oil with Diesel.

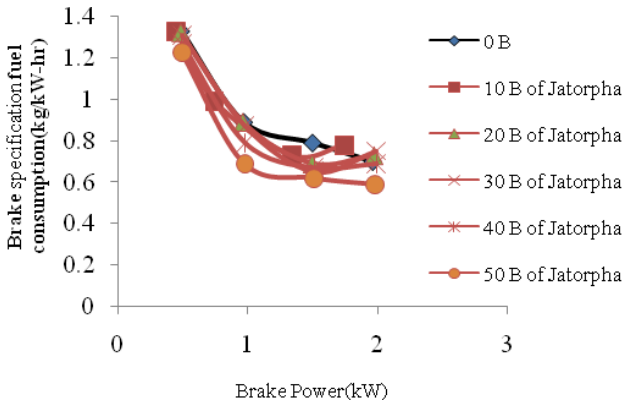


Fig.5 BSFC with BP for different blend of Jatropha oil with Diesel.

Figure 5 shows that variation of BSFC with BP. The curve shows that, BSFC for biodiesel blends is higher at low load and it decreases with the increase in load. It is also observed from the curve that, specific fuel consumption decreases with the increase in biodiesel blend. In these curve are shows the B50 BSFC is lower than the other blends.

2) Variation of Brake thermal Efficiency with Brake Power for different blend of Jatropha oil with Diesel.

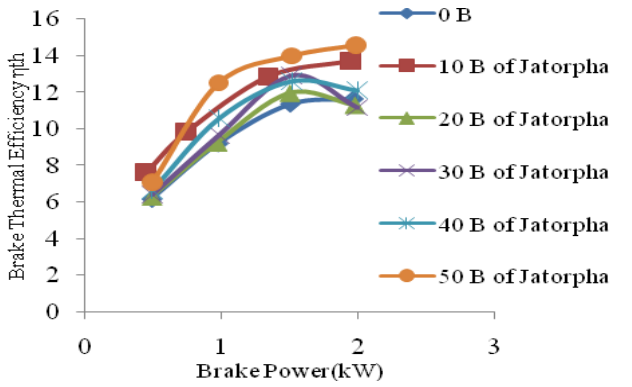


Fig.6 BTE with BP for different blend of Jatropha oil with Diesel.

Figure.6 shows the relation in between BP and brake thermal efficiency η_b for different fuels. BSFC is a measure of overall efficiency of the engine.

BSFC is inversely related with efficiency. So lower the value of BSFC, higher is the overall efficiency of the engine. This is because biodiesel has lower heating value than conventional diesel fuel. One other cause for lower ηb for biodiesel blends is the poor atomization which is attributed to higher density and kinematic viscosity of biodiesel blends. [5]

3) Variation of TFC with BP for different blend of Jatropha oil with Diesel.

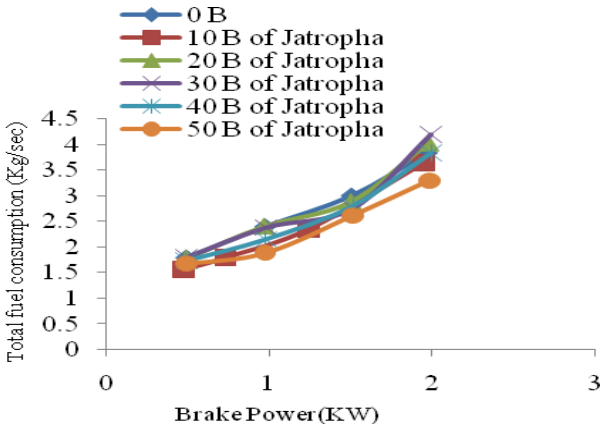


Fig.7 TFC with BP for different blend of Jatropha oil with Diesel.

Figure 7 shows the variation of TFC with BP for different fuels. The TFC has same value at low load, as load increase the value of TFC is lower for 50 B Jatropha oil.

4) Comparison of Results of Jatropha and Mustard Oil Blend with Of Diesel.

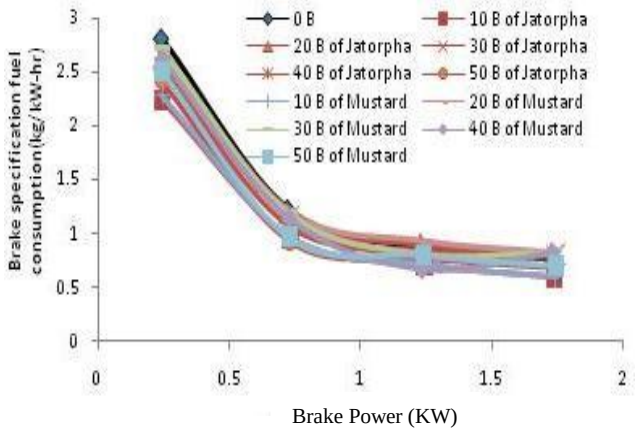


Fig 8 Comparison of BSFC with Brake Power for different Diesel fuel blend with Jatropha oil, Mustard oil

International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 10, October 2013)

Figure.8 The result for variation in the specific fuel consumption with increasing brake power on the engine for the various fuels. Results are plotted for 0-50 % blends of SVO of Jatropha and Mustard oil with petro diesel. Fig 8 shows the comparison of all fuels. It can be noticed from this fig. that Jatropha based have lower fuel consumption as compare to mustard oil based fuel.

5) Comparison of Variation of BTE with BP for different Jatropha oil and Mustard oil blend with Diesel fuel.

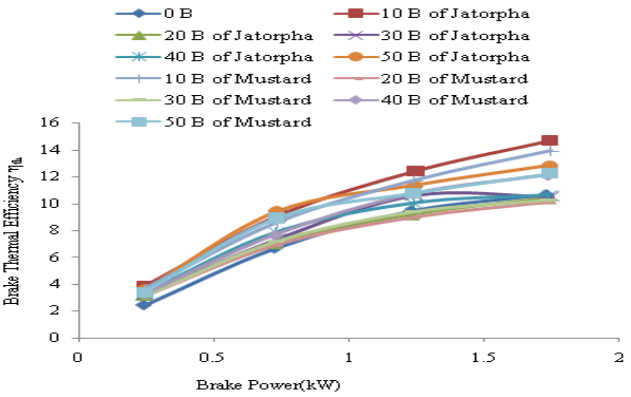


Fig-9 Comparison of Variation BTE with BP for different Jatropha oil and Mustard oil blend with Diesel fuel.

From figure 9 it is observed that as the load increases, it is also observed from the curve. BSFC is a measure of overall efficiency of the engine. BSFC is inversely related with efficiency. This is because biodiesel has lower heating value than conventional diesel fuel. Further it is noticed that the Brake thermal efficiency for Jatropha B10 found more optimum than any other else.

VIII. CONLUSION

a) It has been found by using Jatropha Carcus and mustard oil with pure diesel IC engine can run with optimum performance

b) It is also found from the experiments that 30 B Jatropha has good result as compared to 30 B mustard oil in Brake power v/s BSFC.

c) India has gone biggest importer of edible oil so it is not favour to use mustard as bio diesel

d) Blending of mustard cost as higher than the cost of blending of Jatropha biodiesel.

e) In the engine test rig tests were carried out using diesel and biodiesel to find out the effect of various blends on the performance of the engine.

f) Investigations are carried out on the engine mainly to the effect of brake specific fuel consumption, bake thermal efficiency and exhaust gas temperature.

g) From the experimental analysis it was found that the blends of the Jatropha oil with diesel could be successfully used with acceptable performance on 20 B.

IX. SCOPE FOR FUTURE WORK

1. The experimental analysis it was found that the blends of Jatropha oil with diesel could be used with higher performance up to certain extent.
2. Analysis of composition of exhaust emission can be done with prolonged service with neat bio-diesel.
3. Performance of engine can be compared for various blends of biodiesel with neat diesel; present study is focused only to blend bio-diesel fuels.
4. By computation analysis performance parameters can be extrapolated and compared with experimental results.
5. Performance can be measured after with preheating fuels and/or mixing additives in them.
6. Design changes can be studies and can be proposed after studying the problems encountered after prolonged service of engines with these alternate fuels.
7. Emission studies can also be done.

REFERENCES

[1] Kushwah Yogendra, 2005, Production of biodiesel by base catalyzed transrerification and evaluation" of its dissertation report IIT, Guwahati

[2] Sotolango angel Jose, Beaton Pedro."Jatropha curcas L. As a sourace for the production of Biodiesel; a Cuban Experience", Royal institute of technology (KTH), S-100 44 Stockholm Sweden.

[3] Kushwah Yogendra, 2005, "Production of biodiesel by base catalyzed transrerification and evaluation of its dissertation report IIT, Guwahati.

[4] Kushwah Yogendra, 2005, Production of biodiesel by base catalyzed transrerification and evaluation" of its dissertation report IIT, Guwahati.

[5] Sharma Gaurav, 2013, "Experimental Investigation of Performance Parameters of Single Cylinder IC Engine using Mustard Oil", M. Tech. Dissertation report SRCEM, Morena.