Golden Research Thoughts
Volume 2, Issue. 3, Sept 2012
ISSN:-2231-5063

Available online at www.aygrt.net

ORIGINAL ARTICLE

Performance Analysis Of A Ci Engine Using Biodiesel As An Alternative Fuel

R.D.GORLE[1] and A.V.KOLHE[2]

[1] M. Tech Student,
[2] Assistant Professor
[1, 2] Mechanical Engineering Department, KITS College of Engineering,
Ramtek.441106 (India)

ABSTRACT:

Experiments are carried out by biodiesel blends and compared it's with diesel fuel characteristics. The literature was focused on single biodiesel and its blends. So far a very few dual biodiesel blends of oils have been tried on diesel engine leaving a lot of scope in this area. This paper investigated the performance and emission characteristics of various blends of Jatropha biodiesel with diesel on a Single cylinder four stroke diesel engine. The acquired data were analyzed for various parameters such as brake thermal efficiency (BTE), brake mean effective pressure (BMEP), brake specific fuel consumption (BSFC), exhaust gas temperature (EGT).The blends of BJ-10 and BJ-20 have superior emission characteristics than other blends and closer to diesel value.

KEYWORDS:

Diesel Engine, Transesterification, Engine performance and emission.

1.INTRODUCTION

Progress of a nation invariably depends on the optimum utilization of its natural resources. India is ranked fourth at the global level on the overall consumption of fossil fuel. Fossil fuel are non renewable in nature and India imports almost 85% of its crude oil consumption by spending billon of dollars and uncontrolled burning of fossil fuel contributes significantly to the environment pollution and global warming. All these lead to us to search for ecofriendly and sustainable alternative. The liquid fuel derived from various oil seeds, starch, molasses and various cellulosic material and any kind of fats from biological sources is defined as biofuel.It is possible to produce biodiesel from seeds of vary familiar tree species such as pongamia,neem,mahua,jatropha etc.Jatropha is the one of the oil bearing genuses which can replace diesel oil.Alos jatropha is used for making biodiesel fuel without impact on food consumption .Many researches reveal that jatropha is an oil bearing plant, which can be used directly with diesel engine without modifying the engine but has to reduces the viscosity. This can be done by blending the diesel oil. Therefore

Please cite this Article as : R.D.GORLE[1] and A.V.KOLHE[2] , Performance Analysis Of A CI Engine Using Biodiesel As An Alternative Fuel : Golden Research Thoughts (Sept ; 2012)

the oil from jatropha is one of the alternatives to produce fuel and replace the oil imported from aboard. This is because jatropha can be planted in almost any regions and give quick yield, which is very beneficial to the farmer for home usage or village usage. Especially agriculturists with low income can grow jatropha and make diesel oil form jatropha oil for small engine. This help agriculturist to reduce the fuel cost and become independent. Ultimatly, the goal is to find the suitable blending ratio for using jatropha oil with high speed diesel engine with consideration on the engine performance and emission.

2. PREPARATION OF BIODIESEL BY TRANSESTERIFICATION PROCESS:-

Transesterification: Widely used and accepted process to reduce the viscosity of triglycerides is Transesterification. In the Transesterification of vegetable oils, a triglyceride reacts with an alcohol in the presence of a strong acid or base, producing a mixture of fatty acid alkyl esters and glycerol. The preparation of Biodiesel is as follows; About 6 gms of catalyst (NAOH) is dissolved in 200 ml of methanol to prepare methoxide solution, which is required to activate the alcohol. Then stirring is done vigorously in a covered container until the NAOH is dissolved completely. The alcohol-catalyst (NAOH) mixture is then transferred to the reactor containing moisture free vegetable oil. Stirring of the mixture is continued for two hours at temperature between 600c - 650c. Provision is made to the reactor to condense the evaporating methyl alcohol.

This separates the methyl ester from the glycerin. It is observed that there were two distinct layers formed, one is pale yellow at the top and the other being dark brown at the bottom. Without disturbing the funnel the bottom layer is separated out, which is glycerol, which can be sold as a resource Material for soap or paint industry. The layer, which is retained in the funnel, is Methyl ester of Jatropha oil. Water washing is done to remove any moisture. To do this, water about 30% by volume of the ester is added and heated the mixture to 1200c for about one hour to make the ester free from moisture. After heating the mixture is once again transferred to the separating funnel wherein again the water with any emulsion formed settled at the bottom. The upper layer is pure methyl ester that is bio-diesel, ready for the use in diesel engine. The chemical reaction involved in this process is as shown in the Figure 1.

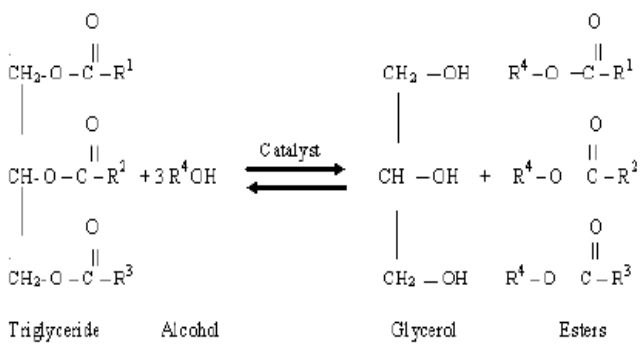


Fig1. Basic scheme for Bio-diesel production

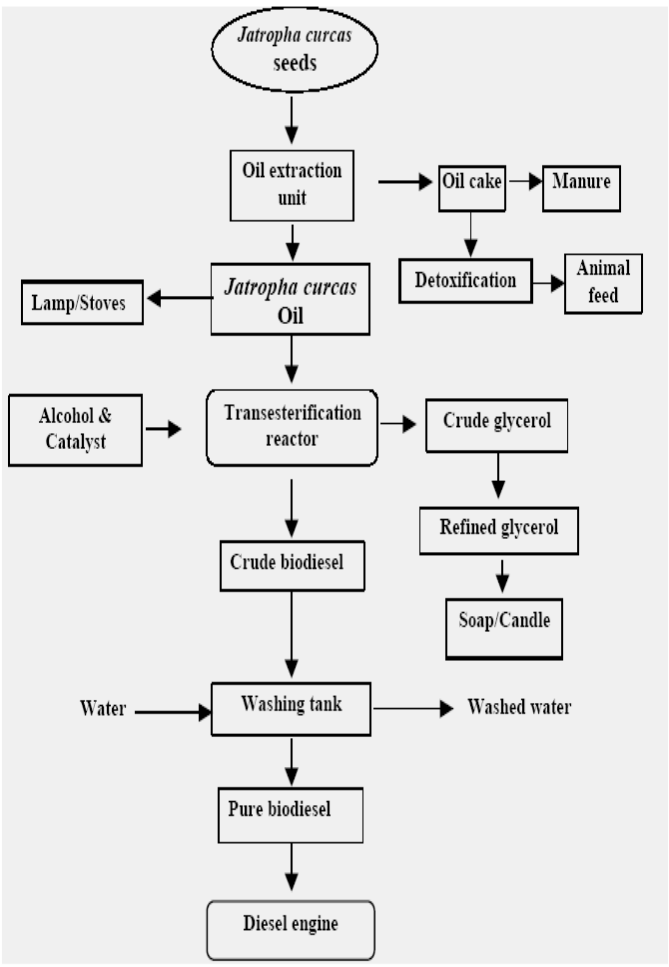


Fig2: Process flowchart for biodiesel production from Jatropha seeds and byproducts

3. PROPERTIES OF PURE BIODIESEL AND IT'S BLENDS.

Properties of pure biodiesel was supplied by Indian biodiesel corporation; Baramati, Maharashtra (India).

SR NO.	PROPERTIES	ASTM STANDARDS	BJ-100
1	Density in gm/cc	ASTM D	0.876
2	Ostwald'S Viscosity cST	ASTM D 445	3.57
3	Flash point ^{0} C	ASTM D 93	148
4	Pour Point ^{0}C	ASTM D 2500	4
6	Calorific Value (MJ/Kg.)	ASTM D 6751	39.00

Table 1: Properties of pure biodiesel.

3.2Preparation of biodiesel blends:

The biodiesel from Jatropha oil were blended with diesel in five different portion, 10%, 20%, 30%, 40%, and 50% by volume respectively.

B10 or BJ 10: It contains 10% biodiesel and 90% Diesel by volume.
B20 or BJ 20: It contains 20% biodiesel and 80% Diesel by volume.
B30 or BJ 30: It contains 30% biodiesel and 70% Diesel by volume.
B40 or BJ 40: It contains 40% biodiesel and 60% Diesel by volume.
B50 or BJ 50: It contains 50% biodiesel and 50% Diesel by volume.

Figure 3: Various blends of Jatropha Biodiesel.

3.3 Properties of biodiesel blends

The various properties of prepared blend samples were measured at Nikhil Analytical & Research Laboratory (Approved by Govt. of India) using standard methods at room temperature. The properties of various Jatropha Blends are as follows.

Sr no.	parameter	Units	BJ10	BJ20	BJ30	BJ40	BJ50
1	Density	Kg/m^3	885	860	876	880	891
2	Total Ash	%	0.10	0.058	0.033	0.17	0.20
3	Flash Point	^0c	33	55	60	62	65
4	Fire Point	^0c	34	60	68	70	74
5	Kinematic Viscosity	Cst	1.883	1.211	1.255	1.297	1.304
6	Calorific Value	Kcal/ Kg	9464	9231	9051	8752	8322

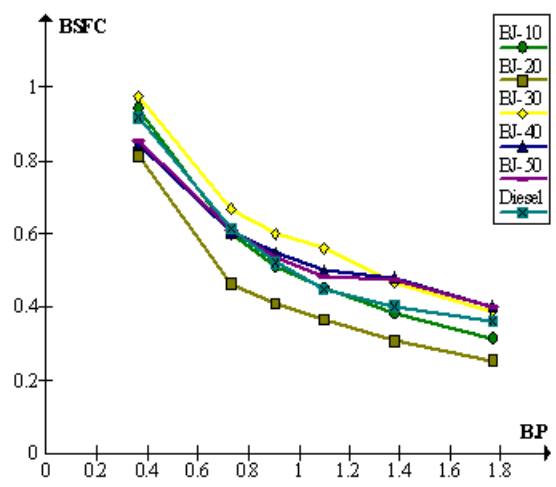
Table 2: The properties of various Jatropha Blends

Figure 4. Single Cylinder four stroke diesel engine

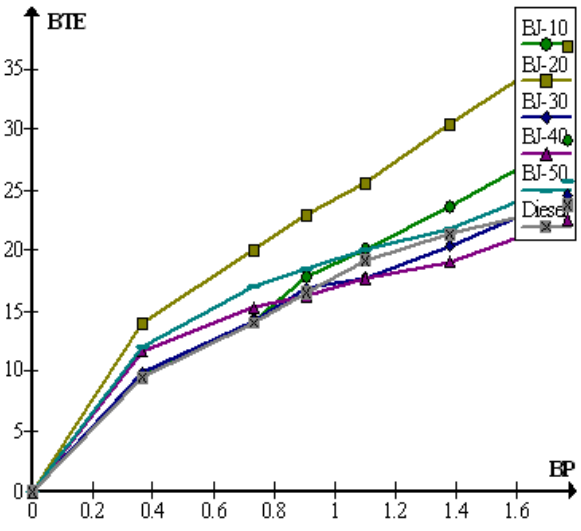
4. EXPERIMENTAL SET UP:

The schematic diagram of experimental set up as shown in figure4. The engine set up shown is single cylinder water cooled diesel engine. The engine has rated output 5.2kw at speed 1500rpm with compression ratio 17.5, injection pressure 180kg/cm3 and coupled with rope break dynamometer. The detailed specification of engine are given in table no. Performance test are carried out on compression ignition engine using various blends of biodiesel and diesel as fuel.

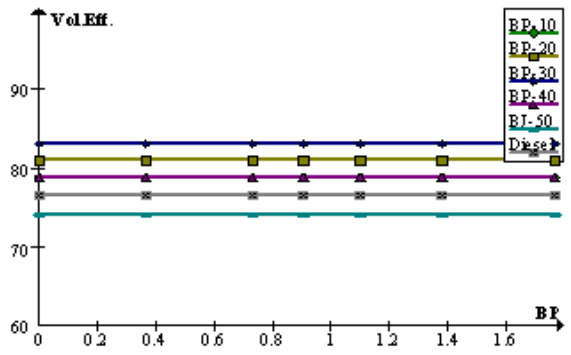
4.1 Engine performance and emission parameters for Jatropha biodiesel blend compared with diesel:



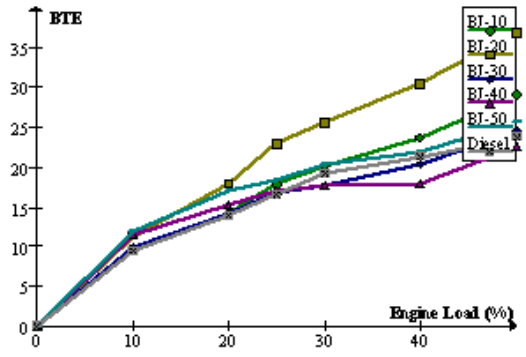
Graph 4.1: BP V/S BSFC



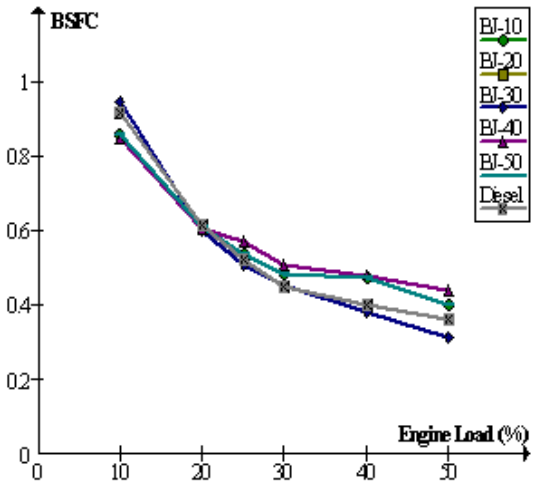
Graph 4.2: BP V/S BTE



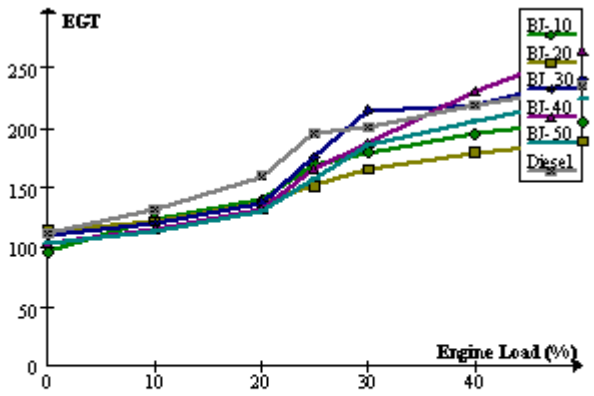
Graph 4.3: Bp v/s volumetric efficiency



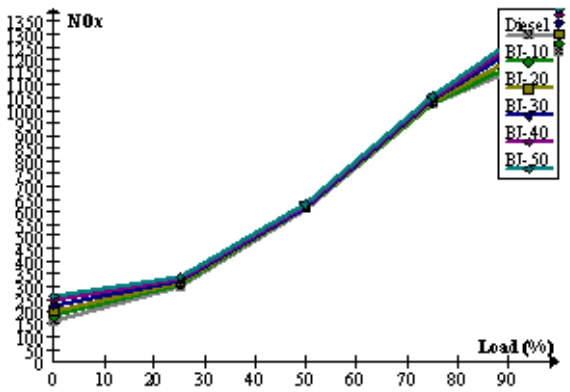
Graph 4.4: Engine load V/S BTE



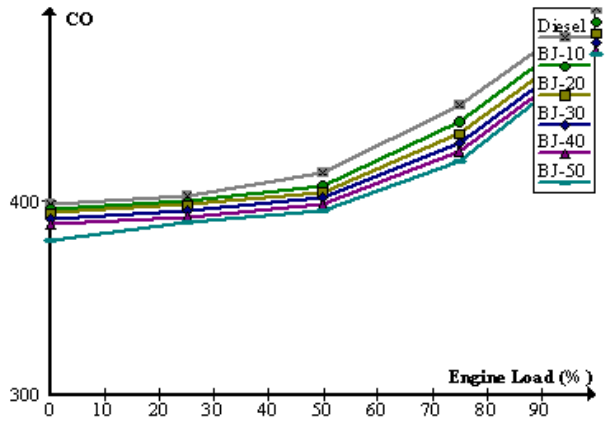
Graph 4.5: Engine load v/s BSFC



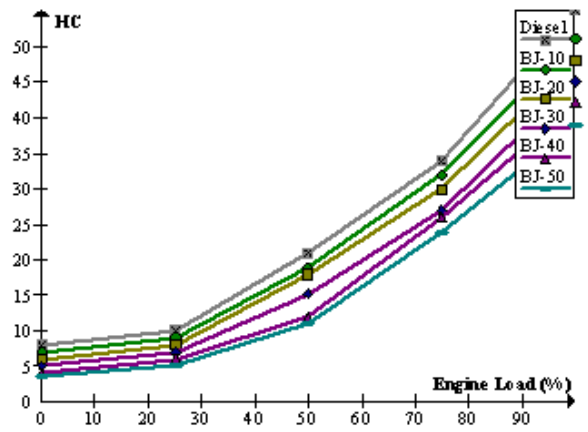
Graph 4.6: Engine load V/S Exhaust gas temperature (EGT)



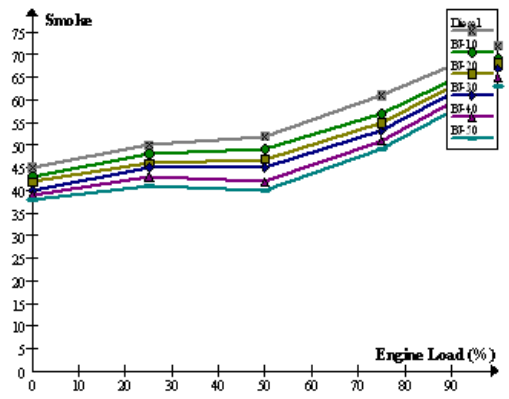
Graph 4.7: Engine load v/s NOx



Graph 4.8: Engine load v/s CO.



Graph 4.9: Engine load v/s HC



Graph 4.10: Engine load v/s Smoke

5. CONCLUSION:

These investigation leads to conclude that Jatropha biodiesel blended with diesel fuel can be use as an alternative fuel which has low smoke emission that diesel.

1.BJ-20 has less brake specific fuel consumption and more brake thermal efficiency.
2.BJ-20 and BJ-30 has nearer volumetric efficiency.
3.If engine load increases brake thermal efficiency slightly increases in BJ-20 as compared to other. In exhaust parameter NOx is increases with increase in blend proportion and CO, HC, smoke decreases with blend proportion

6. REFERENCES:-

[1] Ratchaphon Suntivarakorn, W. Poonnakhun, S. Theerakulpisut"A Suitable Blending Ratio for using Jatropha Oil as Fuel in High Speed Diesel Engine", KKS Res 15 (1), January 2010, pp 9-19
[2] K.Arun Balasubramanian, "Duel Biodiesel Blends in Diesel Engine- Performance and Emission Analysis", European Journal of Scientific Research, ISSN 1450-216X, Vol.75, 2012, pp 400-408.
[3] Deepak Agarwal, Avinash Agarwal,"Performance and Emission Characteristics of Jatropha Oil in a Direct Injection Compression Ignition Engine", Applied Thermal Engineering, 2007, pp 2314 – 2323.
[4] De. S.K. Dhagat, P.V.Joshi, " Experimental Investigation of Diesel Engine Characteristics Using Jatropha Curcas Blended Biodiesel", Journal of The Institute of Engineers, JULLY 18, 201, Vol. 91, PP 22 – 26.
[5] Adebayo G. B., Ameen O.M and Abass L.T, "Physico – chemical properties of biodiesel produced from jatropha curcas oil and fossil diesel", Journal of Microbiology and Biotechnology Research, 2011, pp 12 – 16.