DIFFERENT CHARACTERISTICS PARAMETERS OF MAHUA OIL ARE CALCULATED USING MAHUA OIL METHYL ESTERS ON COMPRESSION IGNITION ENGINE

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ABSTRACT
In this study, an alternative fuel for a diesel engine—a Mahua-diesel blend—is taken into consideration for examination. Mahua oil's various qualities are estimated using several metrics. First, a procedure called transesterification is used to turn mahua oil into mahua oil methyl esters (MOME). Plotting of graphs follows the calculation of various performance metrics for single-cylinder diesel engines using blends like B5, B10, B20, and B30 in addition to normal diesel. Then, using diesel, the parameters acquired from the aforementioned experiments are compared to the initial data. The ideal Mahua oil blend B10 is then obtained. The selected mixture exhibits the highest performance with increased efficacy and decreased fuel use specifically for the brakes. Results obtained shows that Mahua oil methyl esters can be an effective alternate fuel for C.I. engine.
Keywords: C I e n g i n e, Brake power, Compression ignition engine, MOME (Mahua oil methyl esters).

1. INTRODUCTION

With a high proportion of young people and one of the fastest-developing economies, India has seen a sharp rise in its fuel consumption over the past three decades. The automotive, industrial, and agricultural sectors all contribute to the consumption. The depletion of fuels like coal, diesel, and gasoline is a result of this usage. It has been established that car emissions are a major contributor to more than half of the pollution. The biggest contributor to pollution is the 85-87% carbon content of gasoline and diesel. People's health is being negatively impacted by the poisonous chemicals and carbon monoxide included in these emissions. We thus believed that this is the ideal time to provide an alternative fuel for the petrol and diesel. There have been many investigations going on alternate fuels at present with Sunflower, Soya bean, Peanut, Neem etc. In this present report we selected Mahua as a substitute component for the preparation of bio diesel as it is easily available and cheaper in cost compared to many more oils. We are blending the vegetable oil with diesel instead of directly injecting it into engine because vegetable oil consists of strong fatty acids which causes engine to break down and also in knocking. We follow a special process called transesterification process to remove these bonds and to make oil usable.

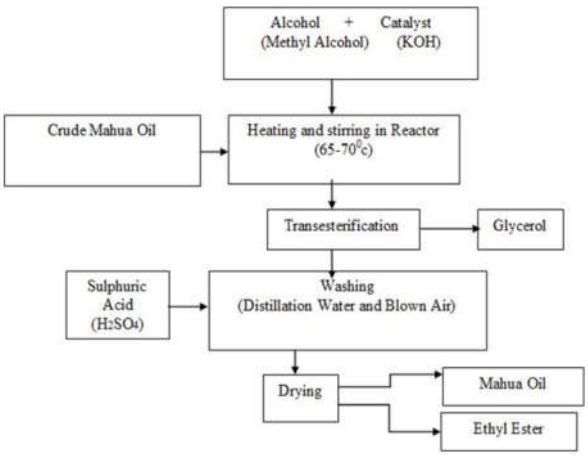
2. MATERIALSANDMETHODS

Mahua oil sample is collected from Mahua seeds through Mechanical press process. As the crude oil consists of several impurities, it hasto be purified using Serigraphy papers. A sample of Mahua oil is taken into a beaker and preheated up to 55-60^{0}C using magnetic stirrer for removal of water vapors. Transesterification process is carried on the preheated oil. The transesterified oil is collected in a Separation funnel and allowed it to settle for 36-48 hrs. After removal of unsaturated and saturated fatty acids from separation funnel, the obtained oil is further treated with hot water for complete purification.

Figure 1 Heating Process **Figure2** Separation process

Figure3 Triglyceride separation

Figure4 Hot Water bath



3. TRANSESTERIFICATION PROCESS

The vegetable oils contain strong fatty acids and methyl esters which are not suitable inproduction of bio diesel. Transesterification process is carried with methanol and acid or base as a catalyst. Methanol is used because it reacts with triglycerides in the vegetable oil to form glycerol and methyl esters (bio diesel). Methanol is used because of its low cost and its effective reaction with triglycerides. The common catalyst used are Potassium hydroxide (KOH) and Sodium hydroxide (NaOH) as these are easily available bases and base catalyst gives more prominent reaction. During Transesterification process the mouth of the lid has to be closed in order to restrict Methanol vapors

Mahua oil is preheated up to 55-60^{0}C. For 300ml of Mahua oil 75ml of Methanol is used along with 5.5gms of Potassium Hydroxide (KOH). KOH pallets are made in to powder and mixed with Methanol until it is

completely dissolved. This solution is mixed with preheated Mahua oil again up to 60-65^{0}C with top of the heating beaker sealed with Aluminium foils in order to cease Methanol Vapors.

4. PROPERTIES OF MAHUA OIL BY OBSERVATION

Table1 Denotes the comparison of various properties between Mahua and Diesel.

Properties	**Units**	**Diesel oil**	**Mahua Oil**	**IS Limits for Grade A and B diesel**
Specific Gravity		0.828	0.904	
Kinematic viscosity at 40° Celsius	C&T	2.44	37.18	2.0 -7.5 at 38°C Grade A
CalorificValue	Mj/kg	44.03	38.963	
Pour Point (°C)		-5	15	6 max grade A 12-8max grade B
Flash Point (°C)	°C	47	238	55 min grade A 66 min grade B
Carbon Residue	%	0.033	0.4215	0.2max grade A 1.5 max grade B
Water Content	°C	Trace	Trace	0.05 max grade A 0.25 max grade B
Ash Content	%	0.006	0.021	0.01 max grade A 0.02 max grade B

5. PREPARATION OF MAHUA SEED OIL BLENDS

Mahua oil is blended with Diesel in the proportions B5 (5ml MOME+95ml Diesel), B10 (10ml MOME + 90ml Diesel), B20 (20ml MOME + 80ml Diesel) and B30 (30ml MOME + 70ml Diesel) as shown in fig below.

Figure5 Diesel and Mahua oil blends

6. DIESEL ENGINE EXPERIMENTAL SET UP

Experimental setup consists of water cooled single cylinder vertical diesel engine coupled to a electrical loading dynamometer as shown in fig below. A fuel measuring system consists of fuel tank mounted on a setup, burette and a three way cock. Air consumption is measured by using pipe which is fitted with an orifice and a U-tube manometer that measures the pressure inside the tank.

Figure 6 &7 Computerized Diesel Engine set up

Table2 Specifications of Diesel Engine Test Rig

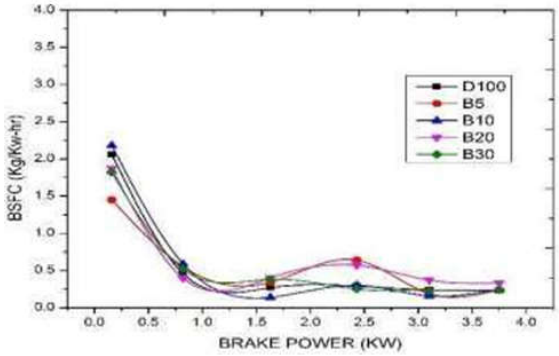
Make	**Kirlosker**
No. of cylinders	1
Strokes	4
B.H.P	5KW
Cooling	Water cooled
Dynamometer	Eddy Current
Bore	80mm
Stroke	110mm
Speed	1500rpm

Compression ratio	16.5:1
Type of Ignition	Compression Ignition
Method of start	Crank shaft

7. RESULTS AND DISCUSSION

The variation of Brake Specific Fuel Consumption with Brake Power is given in belowgraph.

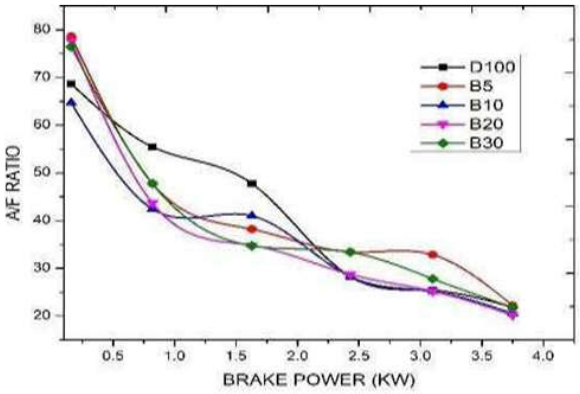
Graph1 Brake Specific fuel Consumption vs. Brake Power



As the Brake Specific fuel consumption is one of the main variables to measure engine performance. The low B.S.F.C. value leads to low fuel consumption and the blend that has low B.S.F.C. value will be the suitable blend. From the observation we found the B-10 blend to be suitable among all other.

The variation of Air Fuel ratio with Brake Power is given in graph below.

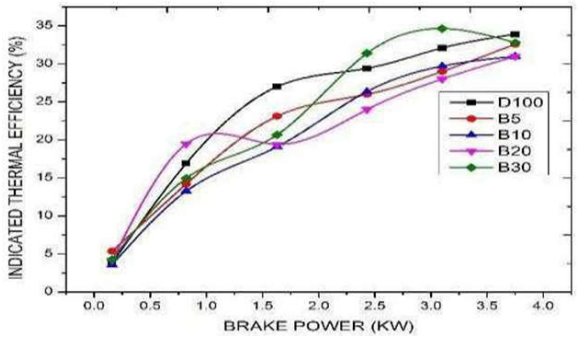
Graph2 A/F Ratio vs. Brake Power



The Air Fuel ratio denotes the amount of air in kg, required for 1 kg of fuel to combust.The lesser the air fuel ratio the efficient will be the engine. The blend with less air fuel ratio compared to output power is selected. From the observation we found the B-10 blend to be suitable among all.

The variation of Indicated Thermal Efficiency with brake power is given in below graph

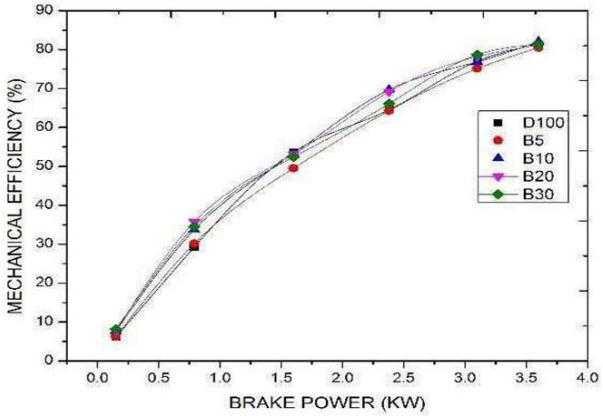
Graph4 Indicated Thermal Efficiency vs. Brake Power



Indicated thermal efficiency is defined as the ratio of Indicated power to the input fuel power. The greater the value of value of the Indicated thermal efficiency the better the blend will be. From the entire above considerations B-30 blend is better when compared with results of blends and diesel.

The variation of Mechanical Efficiency with Brake power is given in below graph

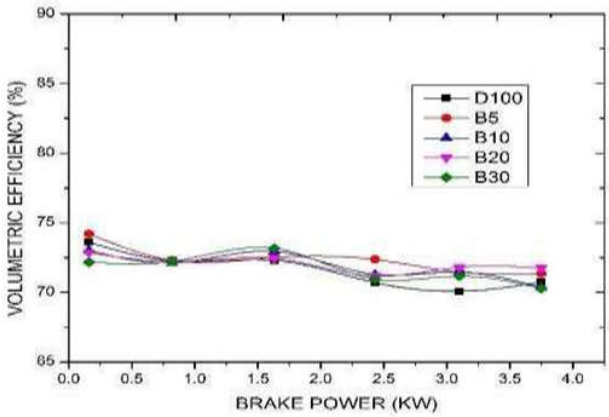
Graph5 Mechanical Efficiency vs. Brake Power



The Mechanical efficiency is the vital parameter in calculating the performance of engine.The higher the Mechanical efficiency, the proper the engine is working. The blend which has good efficiency compared to diesel will be selected. From the above graph B-10 blend is better when compared with results of blends and diesel.

The variation of Volumetric Efficiency with Brake Power is given in below graph

Graph6 VolumetricEfficiencyvs.BrakePower



The volumetric efficiency denotes that how freely the volume flows in to the cylinder. It determines viscosity factors of the oil. The blend with reasonable volumetric efficiency is selected. From the above results B-10 blend is better when compared with results of blends and diesel

CONCLUSIONS

The following conclusions have been reached in light of the aforementioned research on the internal combustion diesel engine using diesel mixed Mahua oil.

1. 1. The main finding is that Mahua oil mixed with diesel may be utilized as a substitute fuel.
2. 2. All diesel mixes and pure diesel have greater B.S.F.C. values initially, but when the load is increased, the B.S.F.C. values fall. The blend that recorded the lowest value, B-10, is chosen.
3. 3. Compared to other blends, the B-10 blend has shown impressive results in the air fuel ratio.
4. 4. The findings for the indicated specific fuel consumption blends B-5 and B-10 have been very similar.
5. 5. Blend B-30 has demonstrated higher thermal efficiency in the indicated areas results even compared to the diesel.BlendsB-10 and B-20 have shown nearly the same results in Mechanical efficiency investigation.
6. In Volumetric efficiency investigation blends B-5, B-10 and B-20 have shown the similar results.

REFERENCES

[1] Dr. Hiregoudar, Yerrennagoudaru, Manjunatha K Shivarudra, K. Shashidhar MS An Experimental Investigation of using Ethanol as additive to coconut oil on the performance and Emission characteristics of a Diesel engine at different loads Volume **02** Issue (01) May 2016 IJERAT.

[2] Purna C Mishra , Swarup K Nayak, Durga P Ghosh, Manoj Ukamanal, Sushanta, K. Sahu Performance Characteristics of a Diesel Engine fuelled with Biodiesel produced from Mahua oil using additive Volume **08**Issue(02) Jul-Aug 2013 pp 26-34 IOSR-JMCE.

[3] Sateesh Yalavarthi, Anil Kumar Chintalapudi and Satya Dev Performance and Emission Analysis of Diesel Engine using Oxygenated compounds Volume **61** pp 9-16 IJAST.

[4] Saurabh Sharma, Rohit Singh, Mayank Mishra, Gaurav Kumar Mitra and Rakesh Kumar Gang war Performance and Emission analysis of Diesel Engine using Biodiesel and preheated Jatropha oil Volume **02** Number (6) June-2014 pp 229239.

[5] A.K.Azad, S.M.AmeerUddin and M.M.AlamA Comprehensive study of Diesel Engine performance with Vegetable oil: An Alternative Bio fuel source of energy Volume **05** pp576-586 Jan-Jun2012 IJAME.

[6] K.Srinivasa Reddy, Y.PurnachandraRao, V.Nagaraju Experimental Investigation on the Performance of Single Cylinder Diesel Engine using Tobacco Diesel Blends Volume **04** Issue(04) Apr2016 IJMPE.

[7] S.Sarvanan, G.Nagarajan, G.Lakshmi Narayana Rao, S. Smapath Role of Biodiesel blend in sustaining the energy and environment as a C.I. Engine fuel Volume **02** Issue(01) 2011pp179-190 IJEE.

[8] Dr. Hiregoudar Yerrennagoudaru, Chandragowda M, Manjunatha K, Nagara jBasvantappa Hugar Experimental Investigation of Multi Cylinder Diesel Engine using Rubber seed oil and Diesel Volume **03** Issue (01) July2014 IJRDET.

[9] S. Jaichandar and K.AnnamalaiThe Status of Biodiesel as an Alternate fuel for DieselEngine AnOverview 2011pp 71-75 JSEE.

[10] DilipKumarBoraPerformanceofSingleCylinderDieselEnginewithKarabiseedbiodieselVolu me**68** pp 960-963 Nov2009 JSIR.

[11] L.Panwara,HemantYShrirama,N.S.Rathore,SudhakarJindal,andA.K.KurchaniaPerformanc e evaluation of a diesel engine fuelled with methyl ester of Castor seed Oil pp245-249,2010, AppliedThermalEngineering.

[12] K.SrinivasaReddy,J.Naveen,K.M.V.RaviTejaExperimentalInvestigationofPerformance and Emission Parameters of Single Cylinder Diesel Engine using Castor seedMethyl Ester blends Volume**04**Issue(09) Sep 2016 IJMPE.

[13] Ravinder Kumar and Navdeep Sharma Dugala. Exhaust Gas Analysis and TemperatureEffect of Mahua Oil Bio-Diesel on Single Cylinder Diesel Engine. International Journal ofMechanicalEngineeringand Technology, 8(7), 2017,pp. 140–144.

[14] A.V.KrishnaChaitanya, S.Girish and T.Monica, Experimental Investigation On VariableCompressionRatioDieselEngineFuelledWithMahuaOilandDieselBlends,Internatio nalJournalofCivilEngineeringandTechnology, 8(4),2017, pp.313–324.