# PERFORMANCE ANALYSIS AND CHARACTERISTICS OF 4-STROKE SINGLE CYLINDER DIESEL ENGINE COMBINE WITH KARANJA OIL AND COCONUT OIL

Ramesh Ganugapenta[1], K.V.N.V.N Rao[2], B.R. Satheesh Raja[3], M. Dora Babu[4]
[1]M.Tech (Ph.D),Asst. Professor, Dept. of Mechanical, Vemu Institute of Technology, Chittoor.
[2]Professor & principal, Dept. of Mechanical, Vemu Institute of Technology, Chittoor.
[3 4]Asst. Professor, Dept. of Mechanical, Vemu Institute of Technology, Chittoor.

**Abstract**

**Day by day constantly increasing of cost of fuel and falling of petroleum products. Moreover, pollutions and green house effect can a main motivation is heavily using of petroleum products. highly using for heavy machineries and some of petroleum products using vehicles are heavy vehicles and light vehicles and medium also. those are all have release high emissions and un burn oxides. the emission of oxides of nitrogen and particulate matter are higher in a diesel engine. Karanja oil (pongamia pinnata) is non edible in nature and is abundantly available in India. The presentation parameters are found to be very close to that of mineral diesel. The brake thermal efficiency and mechanical efficiency were better than mineral diesel but the emission characteristics are higher. coconut oil for the invention of alternative renewable and environmental friendly biodiesel fuel as an alternative to predictable diesel fuel .So that pre heated coconut oil have a excellent place in both fuel efficiency and reduced emissions. The aim of this study is to potential use of Pongamia oil and pre heated coconut oil methyl ester as a substitute for diesel fuel in diesel engine. Various proportions of mixed pongamia oil with pre heated coconut oil and little amount of diesel are used in diesel engine. To study the performance and emission characteristics of these fuels and compared with neat diesel fuel. The engine tests have been passed out with the endeavor of obtaining the brake thermal efficiency and mechanical efficiency were improved than mineral diesel for some detailed combination ratios under certain loads. The result showed a better presentation.**

**Keywords: Diesel engine have 5HP, Potassium hydroxide or NaOH, Coconut oil methylester, Biodiesel, Pongamia methyl ester, Transisterification, Performance, Emission.**

## I. INTRODUCTION.

Various researches are going on for the improvement of fuel economy of engines. However as the certain condition and available nature for petrol and diesel is somewhat unbalanced and there is a want to control since that is mainly happen an cause of heavely increase in number of vehicles. If the same situation continues then the scenario will be more disastrous and petrol and diesel will be more costly and limited. With increased use and the depletion of fossil fuels, today more emphasis is given on the alternate fuels.There is an essential need of alternate fuels in a way may be another form. Today intensive search for the alternative fuels for both spark ignition (SI) and compression ignition (CI) engines. it has been have a out that the biomass derived fuels are suited for the alternate fuels. In SI engines fuels like eucalyptus oil and orange oil are the best suitable substituents for the petrol engines. They can be blended with diesel over a wide range of percentage according to the requirement. Another reason for the need of alternate fuels for

IC engines is the emission problems. Combined with other air polluting factors and the large number of automobiles is a major reason to the air quality problems of the world wide. As these fuels cannot be run directly in the engines these are blend with some gasoline at various percentages. One of the main reasons for selecting these fuels is the similarity in the properties of different with and without of gasoline and they are miscible with gasoline without any phase separation. The engines used for these blend by using of an using of alternate fuels may be on are modified engines which were originally designed for gasoline fuelling. The eucalyptus oil can be used in spark-ignition engines and some of heavy models also with very small engine modification as a blend with gasoline. Since the octane number is which have a eucalyptus oil is more than gasoline, so it enhances the octane value of the fuel when it is blend with an minimum level of octane gasoline content. At the same time the compression ratio (CR) which is dependent on knock can be increased when these fuels are blended with gasoline.

Highlight a section that you want to designate with a certain style, and then select the appropriate name on the style menu. The style will adjust your fonts and line spacing. **Do not change the font sizes or line spacing to squeeze more text into a limited number of pages.** Use italics for emphasis; do not underline.

## II. WORKING PRINCIPLE

The objective of the present investigation is to use one of the non-edible oil, namely, Pongamia methyl ester and coconut methyl ester. Initially these pongamia and coconut oil have a high viscosity so it should be reduce by using transisterification process fuel or oil is called as pongamia methyl ester. It is blend with diesel fuel used as fuel in a diesel engine. To conduct an experiment to selected compression ignition engine have single cylinder four stroke water cooled direct injection diesel engine. By using single fuels and different or multiple mixed form of fuels. In our experiment to detail about different equipment used and their range like type of engine, fuels, air flow measuring instrument, exhaust gas measuring instruments etc,

## III. EXPERIMENTAL WORK

To Conduct an experiment to selected compression ignition engine by using single fuels and different or multiple mixed form of fuels to calculate the speed, performance, exhaust gas temperature and different parameters of the exhaust gases. Before on that transisterification of pongamia oil and coconut oil.

### *A. Transisterification process:*

The easiest way to reduce the viscosity is transesterification process or method. In the transisterification process first vegetable oils like pongamia, sunflower oil, Mohua oil, etc., Take one litre or 1000 ml Pongamia oil is added with 300 ml of methanol in a round bottom flask. And additional to that add a 8 to 10 grams of NaOH or KOH (Potassium Hydroxide) is added into the fuel present in the round flask.


Figure 1 : methanol and KOH.


Figure 2 : Pongamia, Diesel and coconut oils

Starts stirring process continuously the particles are heated at a temperature of 700c continuously after some time nearly 45 minutes to 50 minutes to maintaining the room temperature to form a methyl ester solution. But it have a mixture of mud particles and glycerol. The mixture of all have cooled into room temperature and add a some drops of HCL(hydrochloric acid) added to form a neutralized it. This mixture oil is washed

with an distilled water or hot water. And keep a separate vessel full night After a full night it can form a layer the bottom was glycerol and water and the top was the ester. The bottom layer is separated by throughout side a separate valve is connected bellow section. For removing of remaining water to heat full certain time at the temperature of 1000c.The remaining methyl ester is the best transparent liquid it is look like a pale yellow colour. Similarly transisterification process are take by using coconut form coconut oil methyl ester. Another method is pre heating the coconut oil it is also reduced the viscosity of coconut oil.

*B. Blend ratio of different Biodiesel:*

Blends of pongamia methyl ester, coconut oil and diesel are prepared on the volume basis.

Pure diesel
D70% P20% C10%
D65% P25% C10%
D55% P30% C15%
D40% P40% C20%

The splitting or dividing of blends is basis of volume and its calorific value and some of physical and chemical properties of pongamia, coconut and diesel listed below.

*C. Properties of different oils:*

| s.no | Parameters | Diesel | Pongamia oil | Coconut oil | COME | POME |
|---|---|---|---|---|---|---|
| 1 | Calorific value (kj/kg) | 43750 | 39250 | 38730 | 41250 | 42950 |
| 2 | Viscosity Cst at $30^0$C | 3.6 | 65.6 | 24.25 | 7.8 | 16.2 |
| 3 | Flash point $^0$C | 68 | 225 | 195 | 132 | 160 |
| 4 | Specific gravity $30^0$C | 0.82 | 0.932 | 0.91 | 0.85 | 0.87 |
| 5 | Cloud point $^0$C | 6.5 | 8.3 | 8.1 | 6.9 | 7.6 |
| 6 | Pour point $^0$C | 3.2 | 6.6 | 5.8 | 3.9 | 4.8 |
| 7 | Cetane number | 48.7 | 42.4 | 36.8 | 41.7 | 46.9 |

*D. Engine Specification:*

The test rig consists of a 4-stroke single cylinder diesel engine, to be tested for performance, is connected to rope brake dynamometer with exhaust gas analyzer.

| s.no | Specifications | Details |
|---|---|---|
| 1 | Engine type | 4-stroke single cylinder diesel engine water cooled water ignition |
| 2 | Make or company | Kirloskar |
| 3 | Rated power output | 5 HP 1500 rpm |
| 4 | Bore and Stroke | 80mm X 110 mm |
| 5 | Cylinder Capacity | 553 cc |
| 6 | Compression Ratio | 16.5 :1 |
| 7 | Starting | By Hand Cranker |

The arrange is made for the following measurements of the set up : the test rig consists of 4-stroke single cylinder diesel engine, to be tested for for performance is connected to rope brake dynamometer with exhaust gas calorimeter. The arrangement is made for the following measurements: the rate of fuel consumption is measured by using the pipette reading against the known time.

Figure 3 : Engine

Air flow is measured by the manometer connected to air box. The different mechanical loading is achieved by operating the spring mounted on the brake drum of the dynamometer. Engine speed (rpm) is measured by the electric digital rpm counter. Temperature at different points is measured by electric digital temperature indicator. The force developed is measured by spring balance on the brake drum. Water flow rate through engine and calorimeter

is measured by water for table operation and the whole setup mounted on a sturdy steel frame with vibration mounts. Initially take sample of diesel so check the diesel fuel in the diesel tank. Allow diesel, start the engine by using hand cranking. The engine set to the speed of 1500 rpm. Apply load from the mechanical dynamometer by operating the hand wheel on the spring balance of the brake drum in steps.

Figure 4 : Digital indicator

Formulas:

Fuel consumption in Kg/min

Mf= fuel consumed for ml X density of diesel X60 / 1000X time taken

T.F.C. total fuel consumed in Kg/hr

T.F.C. =mf X 60 Hg/hr.

Air fuel consumption in Kg/min. ma= 0.6 X A0 X Va X 1.29 X 60

Air to fuel ratio A/F=Ma/mf

Brake power (B.P) = 2N(f1-f2) X 9.81 X0.91 / 60000

Where N= Speed of engine in rpm.

F1 & F2 = force on spring balance in kgs

0.156 = radius of brake drum in mts.

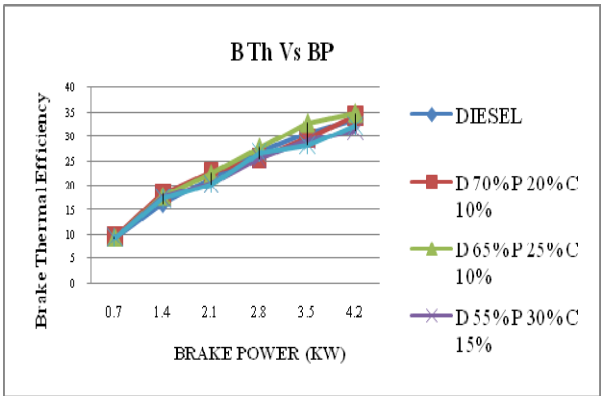
S.F.C= T.F.C/ B.P. Kg/Kw hr

Heat input Kw H.I.=T.F.C X CV/ 60 X 60 KW

Brake thermal efficiency %ή B.ther = B.P./ H.I X 100.

Allow some time so that the speed stab uses. now take down spring balance readings. Put down the time taken for particular quantity of fuel consumed by the engine. Note down the water meter and temperature reading at different points. Repeat the procedure above points for different loads. Similarly next we apply biodiesel of mixed different fuel ratios. And calculate the obtain values and by using above formulas calculate the following parameters like brake thermal efficiency, S.F.C., etc.,

## IV. RESULT AND DISCUSSION

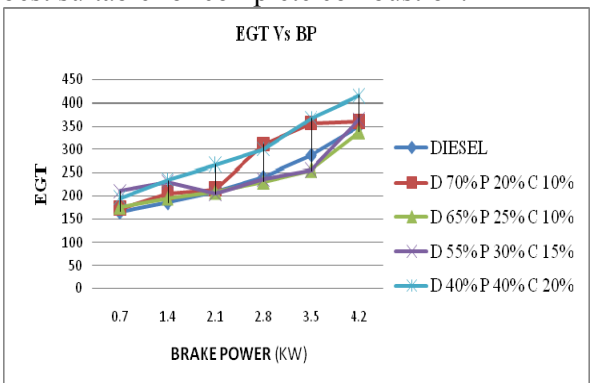



### *A. Brake thermal efficiency with brake power :*

In the brake thermal efficiency have increases at the point of 1.4 of BP and decreases at point of 2.8 BP. The third reading of D65% P25% C10% have a maximum thermal efficiency in increasing load nearly it can increase a 4-6 % of when compare with the diesel engine.

### *B. Exhaust gas temperature with brake power:*

In the exhaust gas temperature have a minimum exhaust temperature is D65% P25% C10%. In the remaining particle ratio have a maximum amount of exhaust gas temperature. In the particle of P25% are best suitable for exhaust temperature control. In the Pongamia oil have range of 25-30 % are the best suitable for all working process and less exhaust temperature. And additional to that coconut oil have a range oil of 10-20 % much suitable And additional to that coconut oil have a range oil of 10-20 % are best suitable for complete combustion.




Exhaust gas temperature with brake power.

## V. CONCLUSION

In the experiment have done successfully by using basic fuel of diesel. Later used mixed fuel of pongamia oil and coconut oil blend with

diesel. In the blend fuel are different proportions of fuels is used. Leads to cause a efficiency improves slightly. Performance and emissions are equal to diesel engine without modification of engine parts.

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In the brake specific fuel consumption less fuel consumption is D40% P40% C20% by increasing of coconut oil fuel consumption is reduced. And minimum fuel consumption is D65% P25% C10%. The above average of fuel consumption is D55% P40% C15%. as a result is obtain a increasing of coconut oil content some better less fuel consumption compare with the diesel.

In the exhaust gas temperature have a minimum exhaust temperature is D65% P25% C10%. In the remaining particle ratio have a maximum amount of exhaust gas temperature. In the particle of P25% are best suitable for exhaust temperature control. In the Pongamia oil have range of 25-30 % are the best suitable for all working process and less exhaust temperature. And additional to that coconut oil have a range oil of 10-20 % much suitable And additional to that coconut oil have a range oil of 10-20 % are best suitable for complete combustion.

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