Performance and Emission Analysis of Sesame, Cotton Oil Mixed with Diesel Fuel as a Source of Biodiesel in C.I Engine

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Abstract **- The overview of the experiment studies the performance& emission of a single cylinder four stroke 3.5kw test on a diesel engine with blends of cotton & sesame biodiesel. The examination utilizes the research with blends of 20%, 40%, 60%, 80% & 100% of cotton & sesame ester diesel mix B20, B40, B60, B80 & B100. The discharge of substance & burning attributes in diesel motor at a steady speed of 1500 RPM. The outcomes results performances & emission. The blend of diesel, biodiesel & cotton sesame oil can be used as a source of alternative fuels in a C.I engine.**

Index Terms **- Nonedible oils, Biodiesel, transesterification, cotton & sesame, performance, emissions.**

I.INTRODUCTION

Now a days we are seeing that the day today the population is growing fast & requirement of fuel or diesel & cost if growing & causing the pollution of fuel [1]. So there is an alternative solution which can make the cost low & the pollution less & increasing population [2]. The alternate is biodiesel which is very much requirement in today`s population. The best biodiesel is derived from vegetable oils or animals fats through transesterification [3]. Biodiesel is successfully experimented with a rather cotton seed oil or sesame seed oil which has given both performance & emission which our previous researcher has done [4].But both the dual fuel mixing of cotton seed oil & sesame oil with the ratio of diesel will give the improved performance & emission in a C.I engine in today`s life [5]. But our aim is to improve the performance continuously & less emission also. The blends of B10, B15, B20, B50 & B100 are mixed in diesel with above percentage [6]. A cotton seed oil & sesame oil together mixed with diesel in a C.I engine to increased performance & decreased emission. In all over the world the increasing the demand of biodiesel is growing fast & causing less cost even in small countries all four wheelers like bus, trucks & heavy automobiles are running using the biodiesel [7-8]. In India also we are growing population the biodiesel is requirement. The crude oil of both cotton seed oil & sesame oil is prepared as biodiesel with there extraction machine step by step which will explained in methodology.

II. PREPARATION OF BIO-DIESEL

The cotton seed & sesame seed were gathered in India. The cotton seed was gathered from shahapur taluka of yadgiri region of the Karnataka state, and another sesame seed was gathered that near to my state is Andra Pradesh. The both cotton seed & sesame seed is extracted in a extraction machine.Firstly we have to find out the free fatty acid (FFA) of both the oil 0.1 Normalized (N) sodium hydroxide (NaoH) Burette then add 10ml oil with 5 drop (0.1N NaoH solution). With 30 or 50 isoprophenol alcohol & heat at 50°c & then cool.FFA of both oils can be determined. First we have to take 40ml of isopropanol in a beaker & neutralized with point 0.1N sodium hydroxide & heat it till reaches 40-50°c & then weigh 10gm of oil in erylmayer flask. Next dissolve oil in preheated isoprophenol & add 2-3 drops of phenolphthalein indicator & then drop wise (0.1N NaoH) changes the colour in pink & we have take reading of burette. Then FFA is less than 4% follow the next steps .Figure(1)Transesterification Process First 1litre of crude oil of non-refined oil adding with 300ml of

methanol & mixing with 5 or 7 grams NaoH in a 3 necked flask & heat it till 60-65°c which is called oil charging & stir the oil & then add 300ml & 5gm NaoH solution when heated & condenser ON & then the after ½ hr colour changes total time is 1 ½ hr. Glycerol separation The glycerol process is completed after the 1 ½ hr. Pour the mixture in an separating funnel & allow it to settle. The glycerine layer settled down & is drained OFF from mixture & the upper is liquid oil. Washing of biodiesel the layer obtained after separation is crude biodiesel which contains amount of sodium hydroxide (NaoH), methanol & traces of glycerol. These can be removed of all impurities by washing the biodiesel. Wash using Luke warm water (50°c) with min 5-8 times wash till the PH=7 then separation. Drying the biodiesel: To remove the moisture content of the biodiesel heated up to 110°c, don`t close the cover because water evaporate at last non-edible biodiesel is ready to use in diesel engines.

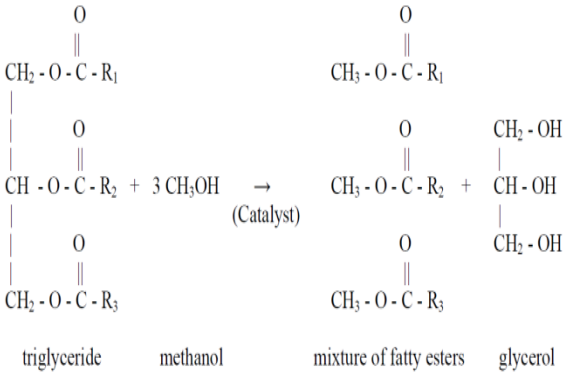
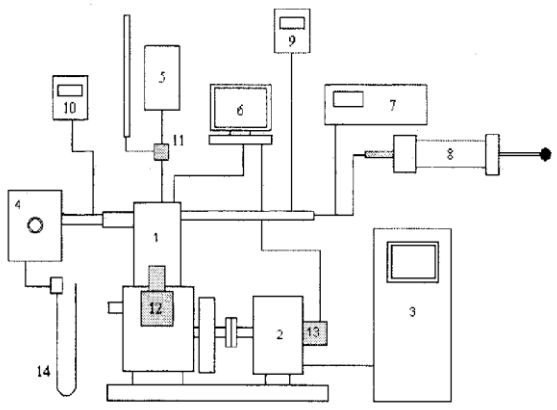


Figure 1Transesterification reaction of cotton & sesame oil biodiesel

III. EXPERIMENTAL SET UP OF ENGINE



Nomenclature:

1	Diesel Engine		Exhaust gas Calorimeter
2	Eddy current Dynamometer		Exhaust temperature indicator
3	Dynamometer Control		Air inlet temperature
4	Anti-pulsating drum		Two way valve
5	Fuel Tank		Fuel injection pump
6	Computer with DAQ		Crank angle encoder
7	Smoke meter		Manometer

The setup of engine consists of single cylinder, four stroke with eddy current dynamometer. The setup of engine is specified in table 1. The engine connected to a ENGINE-SOFT to analyse the performance and combustion. The fuels used are three fuels pure diesel (D), pure biodiesel (B), and the blends of biodiesel with diesel.

Specifications	Details
Number of cylinders	One
Number of strokes	Four
Bore× Stroke	87.5mm × 110 mm
Compression ratio Range	12:1 to 18:1
Connecting rod length	234mm
Orifice diameter	20mm
Dynamometer arm length	185mm
Power	3.5KW
Speed	1500 RPM

Table 1. Engine Specifications

Properties	D100	B20	B40	B60	B80	B100
Density kg/m³	830	839	848	857	866	875
C.V kj/kg	42000	41471	40942	40413	39884	39355
Flash Point °c	76	110.2	144.4	178.6	212.8	247
Fire Point °c	120.6	120.6	158.2	195.8	233.4	271

IV. METHODOLOGY

The experiment is to be conducted under different varying load. Firstly the diesel engine has to be run with diesel fuel under different variable load conditions. The readings must always be recorded after the engine must attains stability of operation 4-5

minutes of running the engine. Then the cotton seed oil & sesame oil biodiesel is used in place of diesel at different loads in the engine. The performance parameters such as Brake Thermal Efficiency, Brake Specific fuel Consumption (BSFC), Exhaust Gas Temperature (EGT) & Emission as Carbon monoxide, Hydrocarbon, Carbon dioxide, Nitrogen oxide & Smoke density. The Performance & Emission of oils to be compared to those of pure diesel.

V. RESULTS AND DISCUSSION

A. Performance Characterestics.

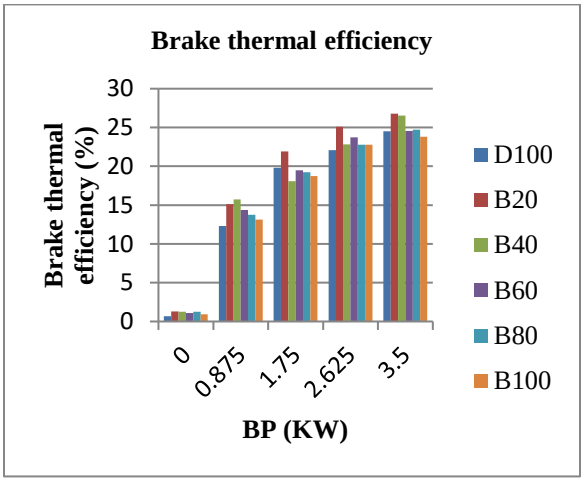


Fig.1.Variation of Brake thermal efficiency with Brake power

Figure1 shows the variation of Brake thermal efficiency with Brake power different blends of biodiesel. The brake warm productivity of diesel, biodiesel & B20 of full load is 24.53%, 23.81% & 26.79%. expansion of brake because presence of oxygen.

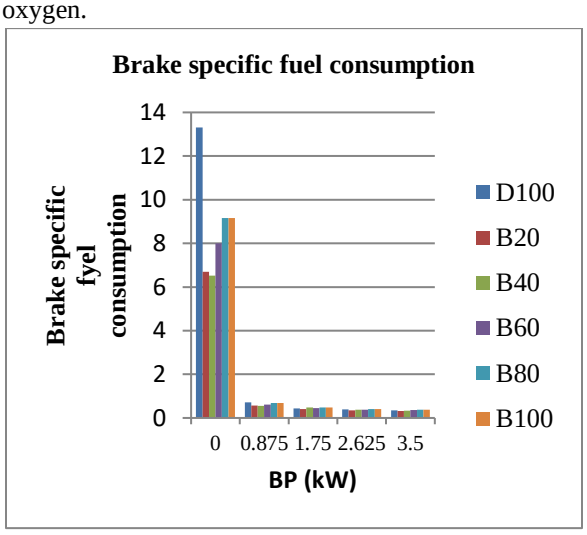


Figure 2. shows the variation of Brake specific fuel consumption with Brake power

Figure 2 shows the variation of Brake specific fuel consumption with Brake power different blends of biodiesel. The BSFC of B80 is same not exactly of biodiesel. The BSFC of diesel, biodiesel & B20 are 0.35, 0.38 & 0.32 kg/kW.h. Because lower calorific value.

B. Emission Characteristics

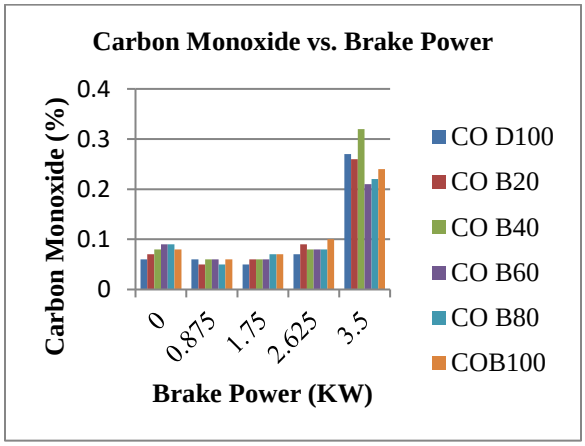


Figure 3. shows the variation of carbon monoxide with Brake power

Figure shows the variation of carbon monoxide with Brake power for different blends, the CO emission increases with increasing the load. From this graph we can say that diesel, biodiesel and B60% are 0.27, 0.24 & 0.21 of CO emission is less for full load as compare to other blends. This is because of high viscosity & poor automization tendency of cotton & sesame biodiesel which leads poor combustion & higher carbon monoxide

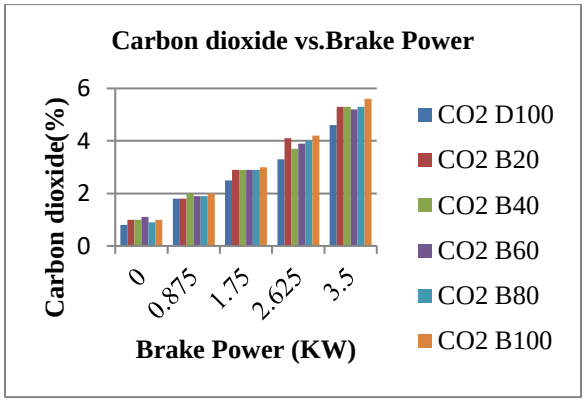


Figure 4 shows the variations of carbon dioxide with brake power.

Figure 4. shows the variations of carbon dioxide with brake power different blends of biodiesel & diesel.

CO2 emissions increase with increase in load. The diesel, biodiesel & B60% are 4.6, 5.6 & 5.2 gives high emission for full load.

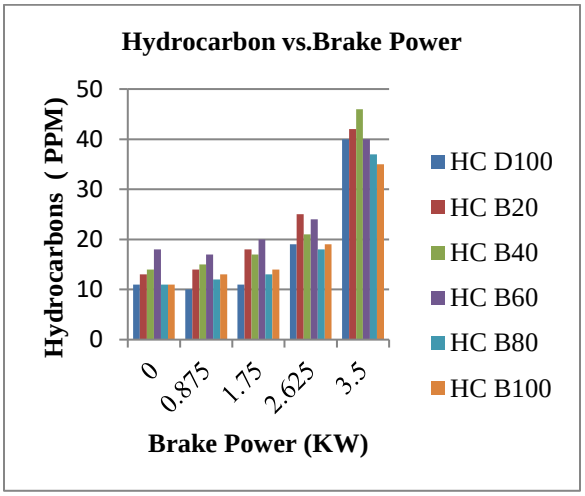


Figure 5 shows the variation of HC emissions against brake power.

Figure 5. shows the variation of HC emissions against brake power variations. The exhaust of unburnt hydrocarbon is due to incomplete combustion of carbon compounds in blends. The HC emission value increases with increase in biodiesel proportions in the fuel blends as in the graph it is observed that the diesel, biodiesel & B80 are 40, 35 & 37 PPM at full load load condition the HC emission is more as compare to the blends.

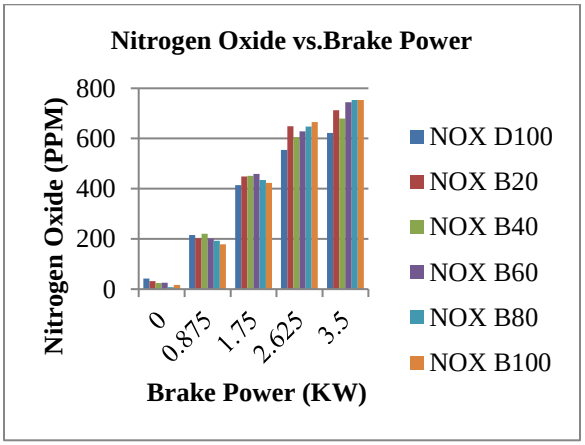


Figure 6. shows the variation of Nitrogen oxide with brake power.

Figure 6 shows the variation of Nitrogen oxide with brake power different blends of biodiesel & diesel. It is observed that NOX emission increased with increase in load & increase in nozzle opening pressures at diesel, biodiesel & B40 are 622, 754 & 680 PPM at full load NOX emission.

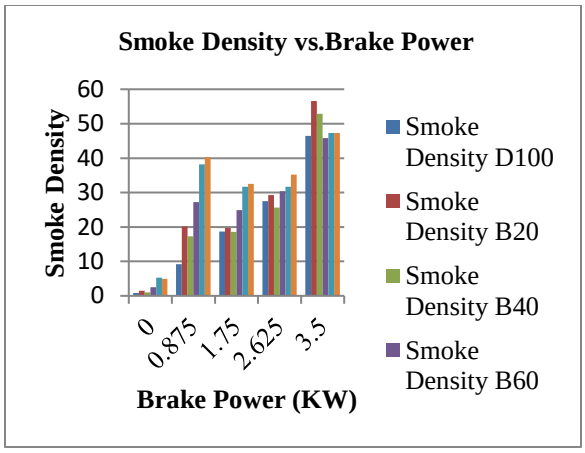


Figure 7. shows the variations of Smoke density with brake power.

Figure 6 shows the variations of Smoke density with brake power different blends of biodiesel & diesel. For diesel, biodiesel & B20 are 46.5, 47.3 & 56.6 has increased as there might be oxygen level high during combustion full load. Smoke is formed due to incomplete combustion of the engine cylinder.

VI. CONCLUSION

The experimental results which obtained while operating a single cylinder four stroke diesel engine which fuelled with a biodiesel from cotton seed & sesame oils & their blends of diesel as follows.

1 The performance of Brake thermal efficiency of B20 is higher than the diesel & biodiesel by 2.26% & 2.98% respectively full load.
2 The performance of Brake specific fuel consumption of B20 is lower than diesel & biodiesel by 0.03 & 0.05 k/kW.h.
3 The properties of blends of different biodiesel are close to the diesel.
4 The emissions of the carbon monoxide of B60 is 0.06% less than that of diesel & slightly lower than the pure biodiesel for full load.
5 The emission of the hydrocarbon of B80 are lower by 3PPM of diesel fuel & higher by 2PPM of biodiesel for full load,
6 The emission of the carbon dioxide of B60 are higher by 0.6% of diesel fuel for full load.
7 The emission of the Nitrogen oxide of B40 is higher by 58PPM of diesel fuel & lower by 74PPM to biodiesel for full load.

8 The emission of Smoke B60 is 1.5% less than the pure biodiesel & also less than the diesel 0.7% for full load.

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