PERFORMANCE, EMISSION AND COMBUSTION TEST ON CI ENGINE BY USING SIMAROUBA BIODIESEL AND DIESEL BLENDS

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***Abstract** :The depletion of world petroleum reserves and increased environmental concern has stimulated the search of alternative fuel which is to be environment friendly. Bio-fuels have the potential to become alternative fuel for fossil fuels. Biodiesel is renewable, reliable, biodegradable and regarded as a clean alternative fuel to reduce exhaust emissions. In recent years, much research has been carried to find suitable alternative fuel to petroleum products. In the present investigation experimental work has been carried out to analyze the performance and emissions characteristics of a single cylinder compression ignition DI engine fuelled with the blends of mineral diesel and biodiesel. The simarouba biodiesel is considered as alternative fuel to diesel. A large amount of tree borne oils and fats are available for biodiesel production in developing and under develop countries. Simarouba glauca oil is one of these oils.*

***KeyWords**: Diesel, Biodiesel ,Simarouba biodiesel(SOME), transesterification, Performance, Emission Characteristics.*

1. INTRODUCTION

Befouls are a serious option to compete with oil in the transport system compared to other technologies such as hydrogen, because biofuel technologies are already well developed and available in many countries. Bioethanol and biodiesel can be mixed with the petroleum products (gasoline and diesel) they are substituting for and can be burned in traditional combustion engines with blends containing up to 10 per cent biofuels without the need for engine modifications.

Biofuel development and use is a complex issue because there are many biofuel options which are available. Biofuels, such as ethanol and biodiesel, are currently produced from the products of conventional food crops such as the starch, sugar and oil feed stocks from crops that include wheat, maize, sugar cane, palm oil and oilseed rape. Some researchers fear that a major switch to biofuels from such crops would create a direct competition with their use for food and animal feed, and claim that in some parts of the world the economic consequences are already visible, other researchers look at the land available and the enormous areas of idle and abandoned land and claim that there is room for a large proportion of biofuel also from conventional crops.

Biofuels are considered among the most promising and economically viable alternative option, as they can be produced locally, within the country, and can be substituted for diesel and petrol to meet the transportation sector's requirements. Then there wouldn't be dependency on foreign oils, helping boost the country's overall economy.[1,8]

India is a diesel-deficit nation and demand has far out striped supply. India's diesel production will not be able to keep pace with the rapidly growing demand. Government's pricing policy now allows oil companies to decide prices. Diesel is not much cheaper than petrol any more. Diesel demand in the country is growing at an annual rate of 8%. At this rate India will need a brand new 9 Million Tons per year refinery every year. The automobiles industry has estimated that the share of diesel vehicles, in overall vehicle sales has crossed the 40% mark. The price of fuels is now going to be in line with price of crude oil. Hence the Petrol and Diesel prices are now in line with international price levels, which makes befoul economically attractive.

2. <u>Material and Methodology</u>.

Common Process of Biodiesel Production:

Biodiesel derived from biological resources is a renewable fuel, which has drawn more and more attention recently. A fatty acid methyl ester is the chemical composition of biodiesel. Transesterification is widely used for the 1transformation of triglyceride into fatty acid methyl ester. The manufacturing process is based on the transesterification of triglycerides by alcohols to fatty acid methyl esters, with glycerol as a byproduct. The base catalyzed production of biodiesel generally has the following processes.

Transesterification: This is most commonly used process in production of biodiesel. It is most commonly used and important method to reduce the viscosity of vegetable oils. In this process triglyceride reacts with three molecules of alcohol in the presence of a catalyst producing a mixture of fatty acids, alkyl ester and glycerol. The process of removal of all the glycerol and the fatty acids from the vegetable oil in the presence of a catalyst is called esterification.

Fig1 .Transesterification Process

Table 1 Simarouba biodiesel blends compare with diesel

properties	diesel	Some B10	Some B20	Some B30	Some B100
Flash point(⁰c)	57	61	60	64	154
Fire point(⁰c)	63	66	64	66	173
Density(Kg/ m³)	830	833.7	837.4	841.1	867
Viscosity (Cst)	2.9	3.09	3.28	3.47	4.8
CV(KJ/Kg)	42500	42230	41960	41690	39800

Fig 2.Engine setup

Engine Specification

Product	VCR Engine test setup 1 cylinder, 4 stroke, Diesel (Comp.)
Engine	Make Kirloskar, Type 1 cyl. 4 stroke Diesel, water cooled, power 3.5kW at 1500rpm, stroke 110mm, and bore 87.5mm. 661cc, CR17.5, Modified to VCR engine CR 12 to 18. with electric start arrangement, battery and charger
Dynamometer	Type eddy current, water cooled,
Load sensor	Load cell, type strain gauge, range 0-50 Kg
Compression ratio	17.5:1

3.RESULTS AND DISCUSIONS

3.1 PERFORMANCE CHARECTERSTICS (SOME)

3.11 LOAD VS BREAK THERMAL EFFICIENCY

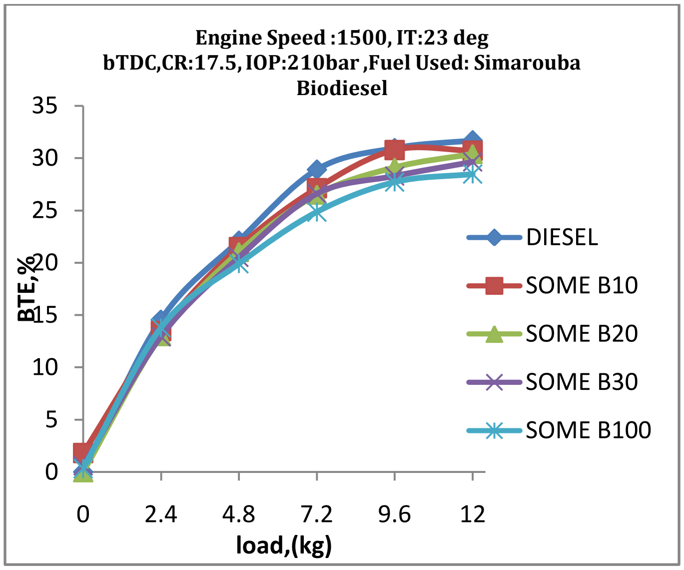

Fig 3. LOAD VS BTE

3.12 LOAD VS SFC

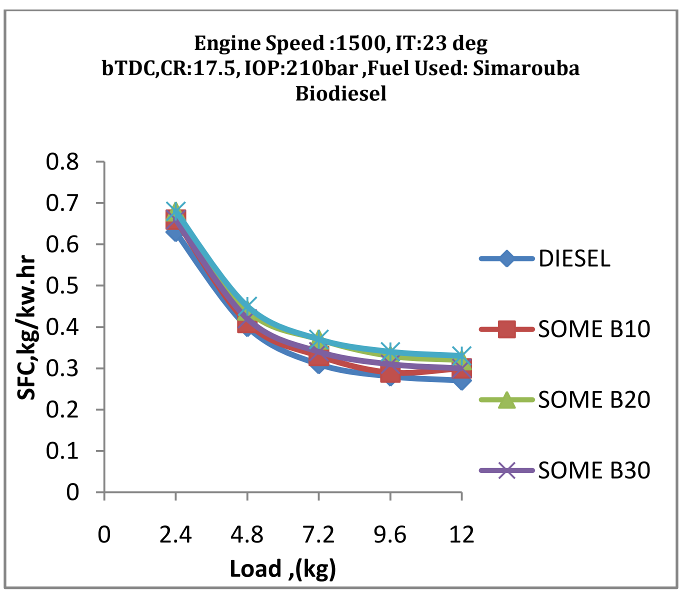

Fig 4.LOAD VS SFC

3.13 LOAD VS VOLUMETRIC EFFICIENCY

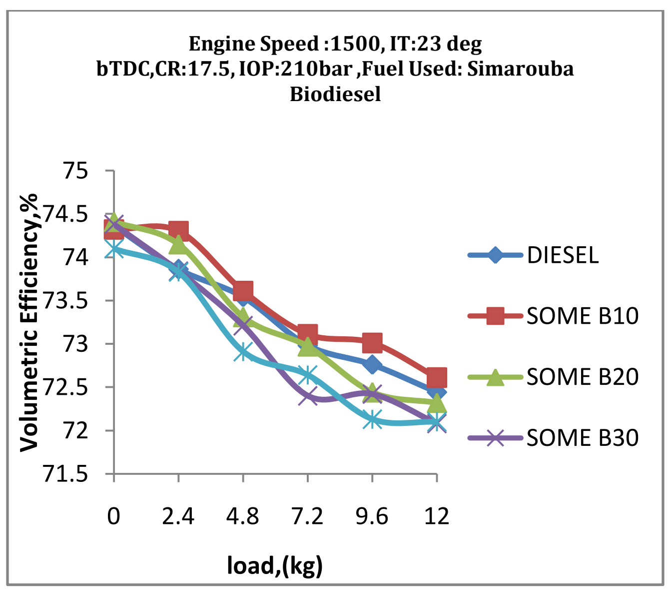

Fig 5 .LOAD VS VOL EFF

3.14 LOAD VS EGT

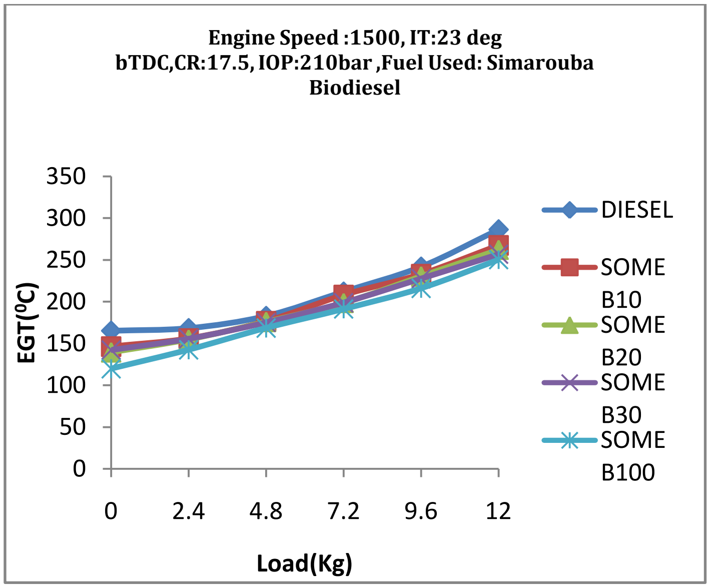

Fig 6.LOAD VS EGT

3.2 EMISSIONS CHARECTERSTIC (SOME)

3.21 LOAD VS HC

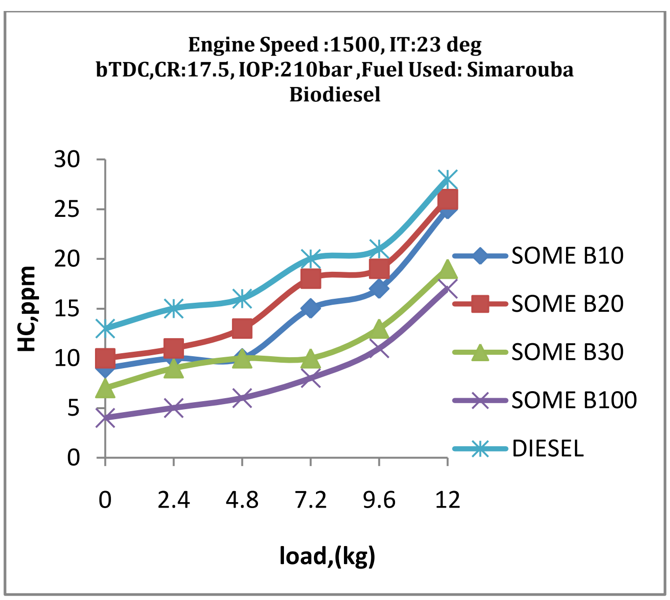

Fig 7.LOAD VS HC

3.22 LOAD VS CO

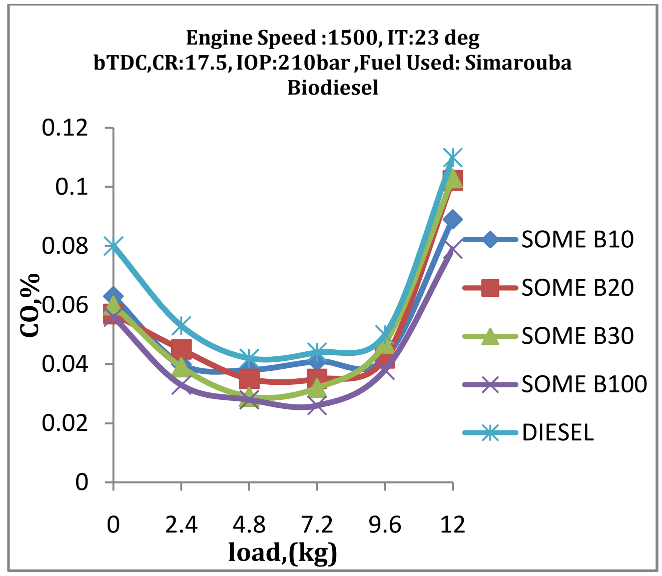

Fig 8.LOAD VS CO

3.23 LOAD VS NO_X

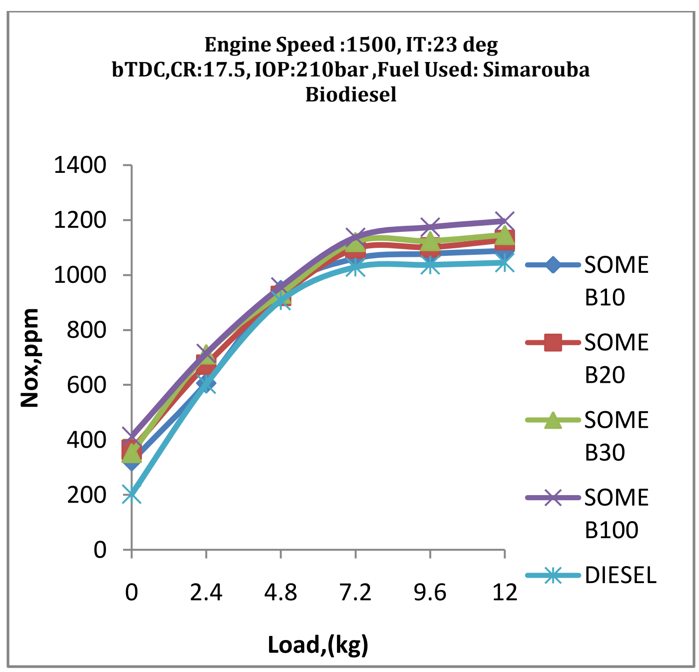

Fig 9.LOAD VS NO_X

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3.24 LOAD VS CO_2

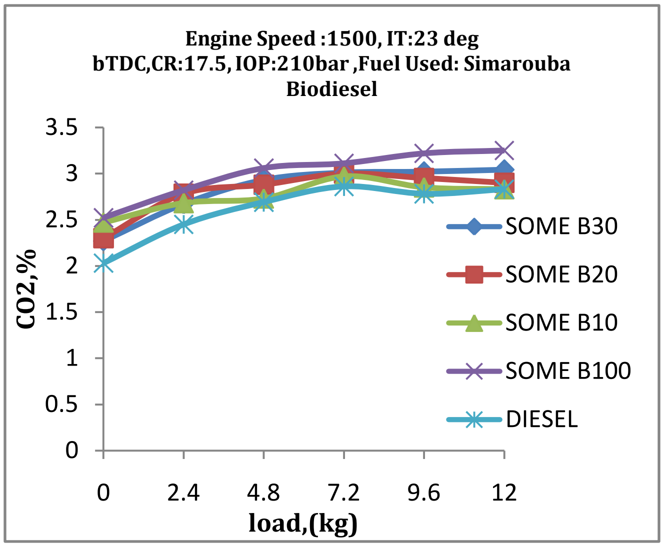

Fig 10. LOAD VS CO_2

3.25 LOAD VS O_2

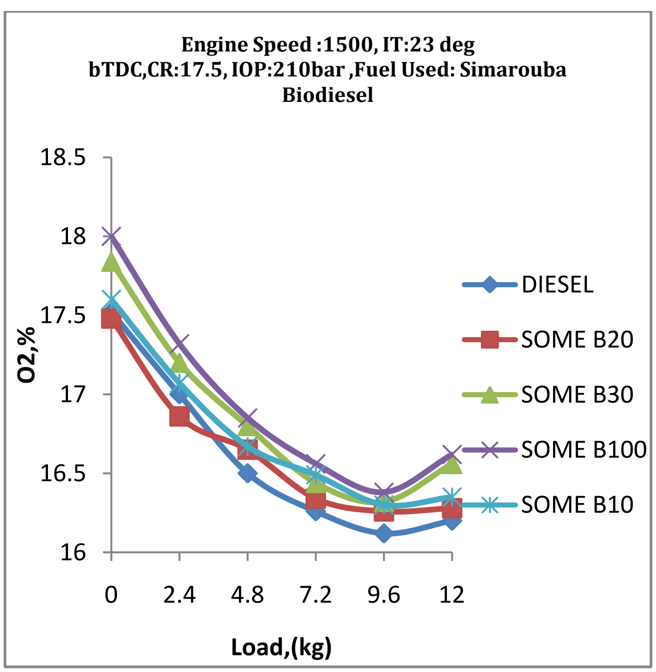

Fig 11.LOAD VS O_2

3.3 COMBUSTION PARAMETERS (SOME)

3.31 CRANK ANGNLE VS CYLINDER PRESSURE

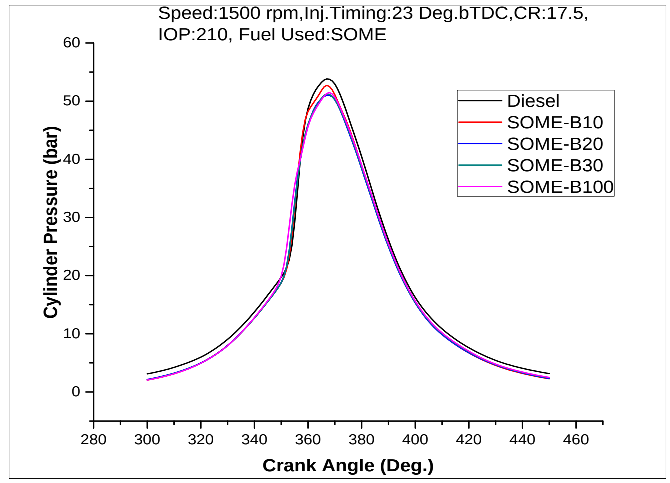

Fig 12.CRANK ANGLE VS CYLINDER PRESSURE

3.32 CRANK ANGLE VS NET HEAT REALEASE

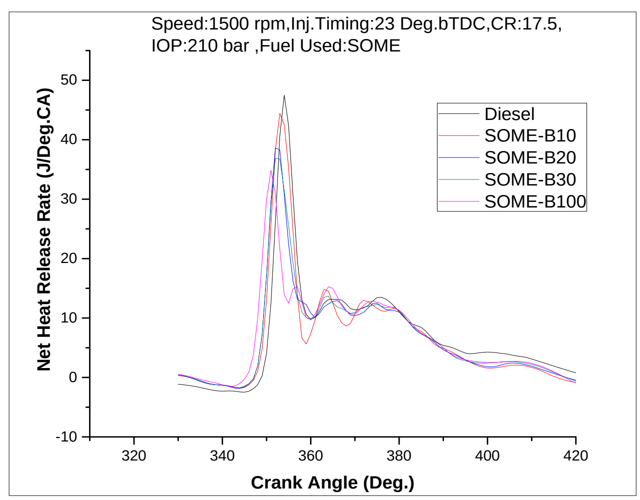

Fig 13.CRANK ANGLE VS NET HEAT RELEASE

CONCLUSION

1. Performance, combustion and emission characteristics of SOME B20 blend. The maximum brake thermal efficiency of SOME B20 and DIESEL are respectively 31.67%, and 30% .
2. The BSFC decreased with an increase in engine load. For biodiesel and its blends the BSFC are higher than that of diesel fuel. The BSFC values for biodiesels, SOME B20 is 0.30 which is higher than diesel fuel.
3. The NO**x** emission is higher than diesel fuel for all modes of test fuels. This is due to higher oxygen content of biodiesel, which would result in better combustion and maximum cylinder temperature. The maximum value of NO**x** emission is 8% of SOME at full load conditions, which is higher than diesel fuel.
4. For biodiesel and its blends, it was found that CO and HC emissions were lower than that of pure diesel. The lowest CO and HC emissions were obtained for neat biodiesel (B100).The maximum reduction in CO and HC emission with neat biodiesel and at full load are 16% and 20% respectively which is lower than diesel fuel.
5. On the whole, the methyl esters of Simarouba biodiesel and its blends can be used as an alternative fuel in diesel engines without any engine modifications. It gives lower HC, CO emission when compared with the diesel fuel. But the addition of higher percentage of biodiesel blend with diesel fuel which decreases brake thermal efficiency and increases specific fuel consumption.
6. It is found that CO2 emissions are more for simarouba biodiesel than that of diesel. Higher CO2 emissions reduce harmful CO emissions. The percentage reduction in HC emissions for simarouba and waste cooking biodiesel is about 60% as compared to that of Diesel. Due to higher NOx emissions with pure Simarouba biodiesel, suitable blends can become a striking balance between NOx emissions on one end and all other emissions along with performance on the other hand.

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