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Combustion, Performance and Emission Characteristics of A Single Cylinder Diesel Engine Operating On Diesel Fuel And Simarouba Glauca Biodiesel

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Abstract: *The rapidly exhaustion of fossil fuels due to the soaring industrialization and vehicles of the world. The journey for alternative fills has been able to be unavoidable, looking enthusiasm of diesel for transportation segment. Biodiesel has turned into a key source as utilization fuels for diesel engines. Biodiesel gotten from vegetable oils are entirely encouraging option fills for diesel engine. Utilization of vegetable oils in diesel engine prompts marginally second rate execution and more viscosity it effects major smoke rates. The execution of vegetable fuels can be enhanced by altering through the Transesterification procedure. The delivered Simaroubaglauca biodiesel is mixed with diesel fuel like (Simarouba biodiesel-SIM100, SIM80, SIM60, SIM40, SIM20, and SIM10).The combustion, performance and emission characteristics is evaluated at variable loads and constant rated speed 1500rpm, altered pressure proportion 16.5:1,fixed pressure 200 bar and result is compared with diesel fuel.*

Keywords: *Combustion, Diesel Engine, Emission Characteristics, Simarouba biodiesel, Transesterification.*

I. Introduction

Simaroubaglauca seed belongs to the family simaroubaceaeQuasia. It is also called as laxmitaru, paradise tree. The most destructive impact of our present day human advancement is an Earth-wide temperature boost and ecological contamination. The vehicle populace all through the universe is expanding quickly; in the country development rate of car companies is one of the biggest on the planet. It will very apparent that the issue can't be illuminated with the ordinary fossil foils, with the normal development speed of diesel fuel utilization of greater than 12% to15% for every year, contracting unrefined petroleum saves and constrained refining limit, India will be intensely subject to imports of rough petroleum and petroleum items. The main argument for its usage in internal combustion engines as it causes less pollution than diesel.

II. Materials And Method

2.1 Fuel Properties of Test fuel:

The properties of Simaroubaglauca biodiesel is fund as per Indian standards (IS) method in fuel testing laboratory. Determination of Viscosity, Density, fire point, flash point, Calorific value is carried out using redwood viscometer, pensky apparatus and Bomb calorimeter respectively.

Table- 1 Comparison of properties of Simaroubaglauca oil with diesel

Properties	Diesel	Simaroubaglauca
Density (kg/m3)	820	865
Calorific Value kj/kg	43500	37938
Viscosity cSt	3	4.7
Flash point in ^{0} c	56	160
Fire point in ^{0} c	65	171

III. Experimentation

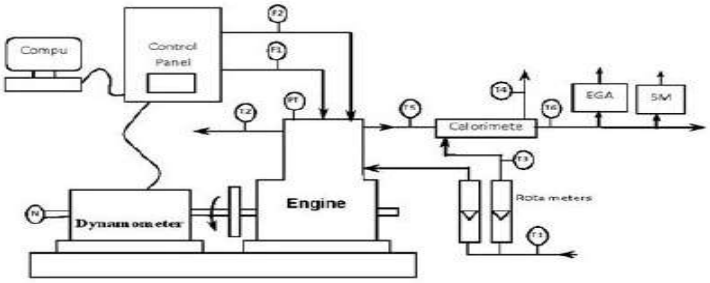

Fig -1 line diagram of Experimental setup

Table-2 Engine Specification

Manufacturer	Kirloskar oil engines Ltd, India
Model	TV-SR, naturally aspirated
Engine	Single cylinder, DI
Bore/stroke	87.5mm/110mm
C.R.	16.5:1
speed	1500r/min, constant
Rated power	5.2kw
Working cycle	four stroke
Injection pressure	200bar/23 def TDC
Type of sensor	Piezo electric
Response time	4 micro seconds
Crank angle sensor	1-degree crank angle
Resolution of 1 deg	360 deg with a resolution of 1deg

Table-3 Notations

PT	Pressure transducer
N	Rotary encoder
Wt	Weight
F1	Fuel flow
F2	Air flow
F3	Jacket water flow
F4	Calorimeter water flow
T1	Jacket water inlet temperature
T2	Jacket water outlet temperature
T3	Calorimeter water inlet temperature = T1
T4	Calorimeter water outlet temperature
T5	Exhaust gas to calorimeter temperature
T6	Exhaust gas from calorimeter temperature

IV. Results and Discussion

4.1 Performance Charactestics Graphs of Different Fuel Blends

4.1.1) Mechanical efficiency

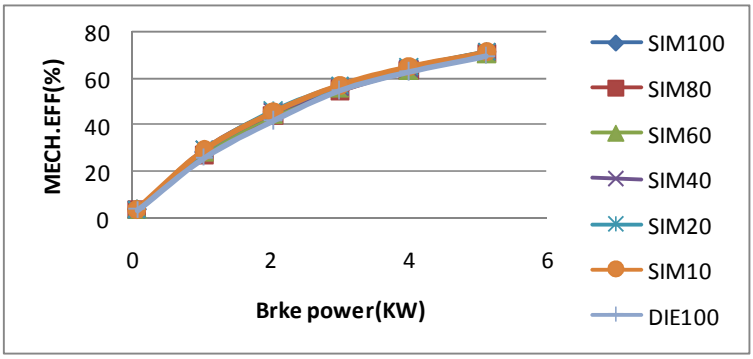

Figure-2 variation of Brake thermal efficiency (BTE) with Brake power (kW)

The above the figure shows that Simaroubaglauca biodiesel of the Mechanical Efficiency (%) is fairly lesser than that of diesel fuel. It can be observed that both the fuels like Simaroubaglauca biodiesel and diesel fuel "SIM 20" closer mechanical efficiency.

4.1.2) Specific fuel consumption

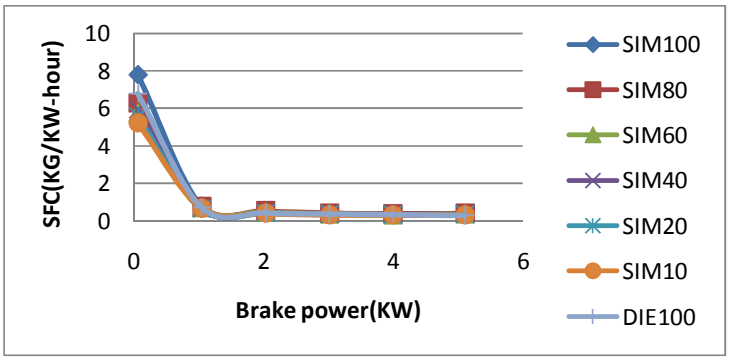

Figure-3 variation of Specific fuel consumption with Brake power (kW)

The above the figure shows that brake power (BP) with SFC. Initially diesel engines take more fuel consumption due to low temperature of the combustion. At higher brake power Specific fuel consumption decreases.

4.1.3) Brake thermal efficiency

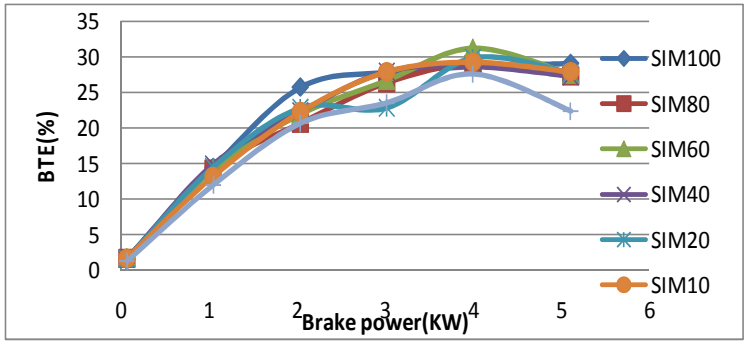

Figure- 4 variation of Brake thermal efficiency with Brake power (kW)

The above the figure shows that the Brake thermal efficiency gradually increases with brake power (BP).Simaroubaglauca biodiesel blend SIM 20 is given lower BTE (%) compare to diesel fuel.

4.1.4) Exhaust gas temperature

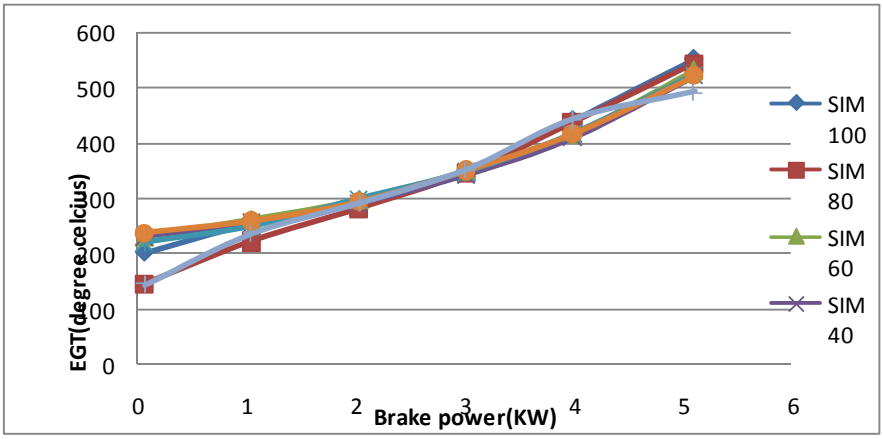

Figure-5 variation of Exhaust gas temperature with Brake power (kW)

The arrangement of the Brake power with EGT. Initially engine takes lower Exhaust gas temperature and brake power (BP). An engine load increases proportionally increases the EGT.

4.1.5) Volumetric Efficiency

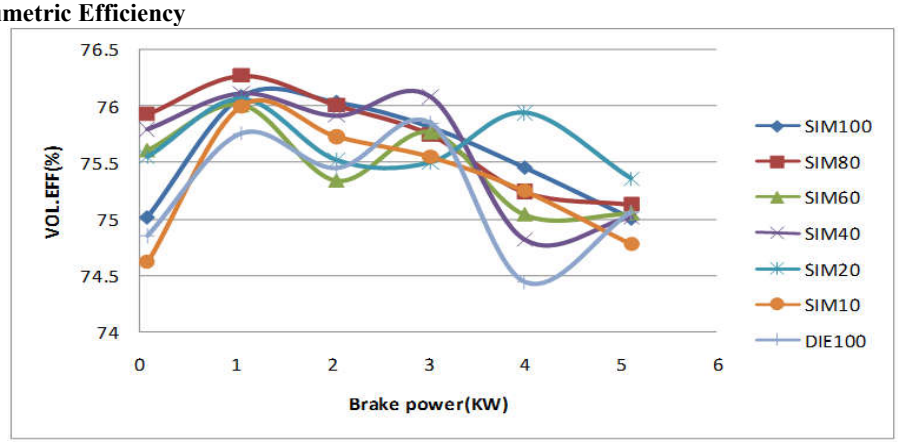

Figure-6 variation of Volumetric Efficiency with Brake power (kW)

It is seen from the figure shows that Simarouba biodiesel blends is practically gives lesser volumetric efficiency compare to diesel.

4.1.6) Air-fuel ratio

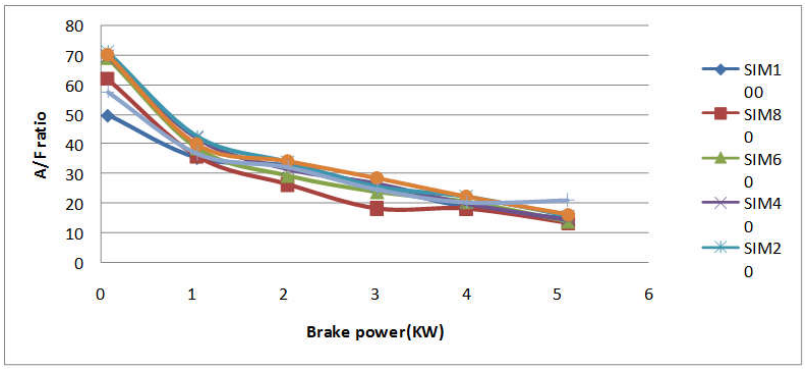

Figure-7 variation of Air-fuel ratio with Brake power (kW)

The above the figure appeared the Brake power with Air-fuel ratio. The blends of the Simaroubaglauca oil with diesel begins give higher A/F ratio and lower BP. The increases the Brake power simultaneously decreases the Air fuel ratio.

4.1.7) Brake means effective pressure

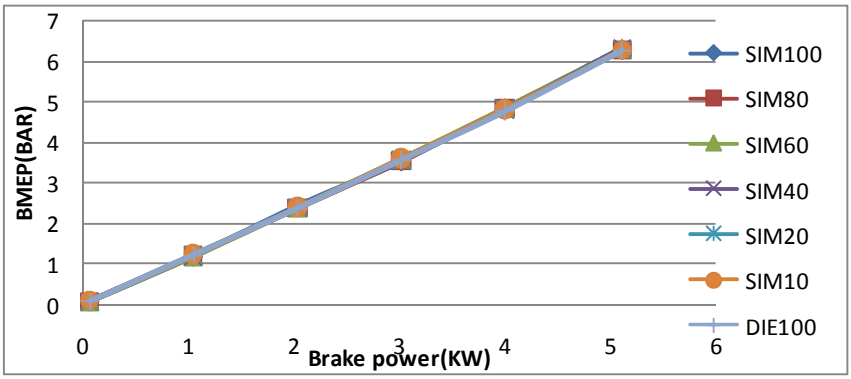

Figure-8 variation of Brake means effective pressure with Brake power (kW)

It is seen from the figure Brake power with BMEP. Simarouba biodiesel with pure diesel continuous creases the load with increases BMEP.

4.2 Combustion Characteristics Graphs of Different Fuel Blends

4.2.1)Crank angle

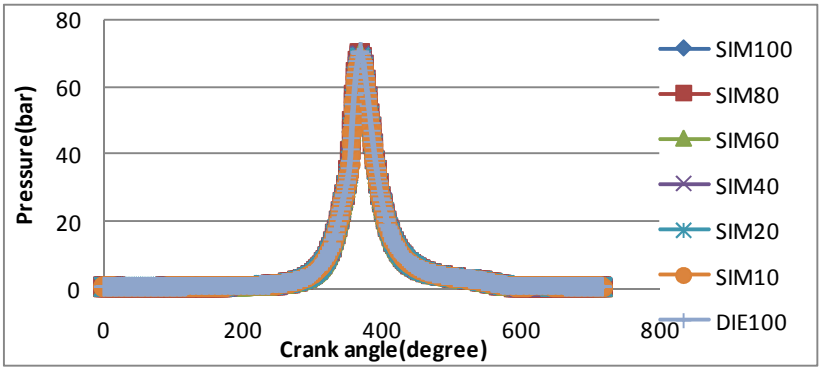

Figure-9 variation of Pressure (bar) with Crank angle (degree)

The above figure shows that the maximum pressure of 72 bars and 75 bars.Simarouba biodiesel with diesel of the blend "SIM20" gives maximum pressure.

4.3. Emission Charactestics Graphs of Different Fuel Blends

4.3.1) Hydrocarbon

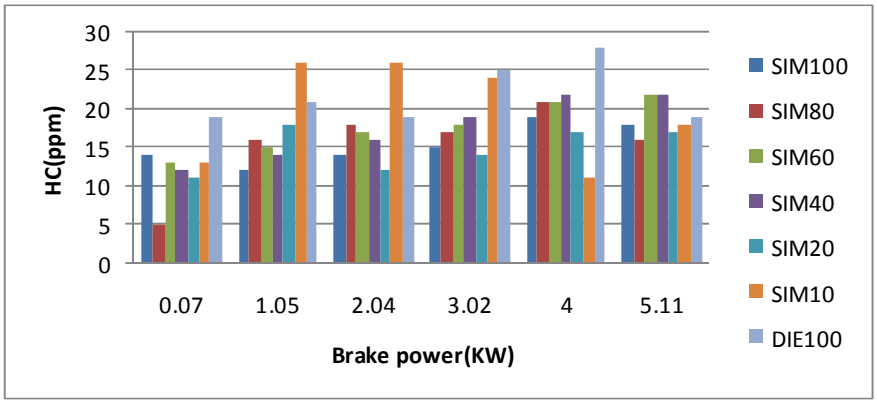

Figure-10 variation of Hydrocarbon with Brake power (kW)

It is seen that the various biofuel mixes of the emission of Hydrocarbon is not as much as that of the diesel with the exception of at the full load.

4.3.2) NOx emission

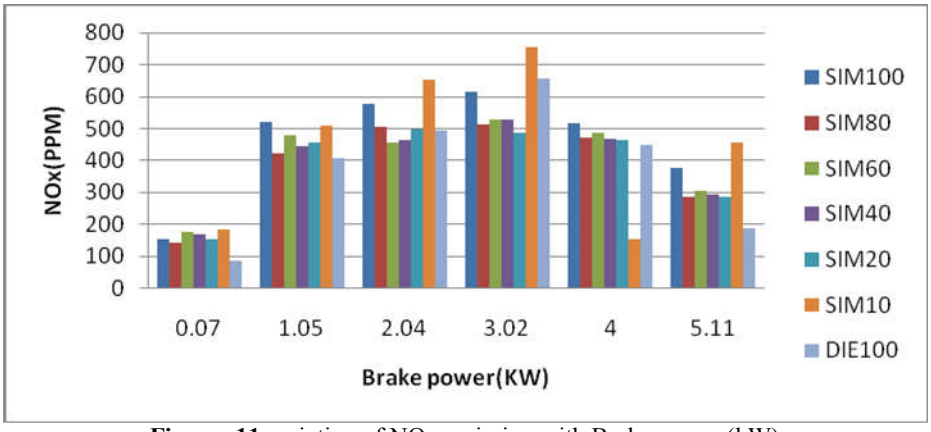

Figure- 11 variation of NOx emission with Brake power (kW)

The above graph figure the pure diesel NOx emission is lower than blends of simarouba biodiesel.

4.3.3) Carbon monoxide

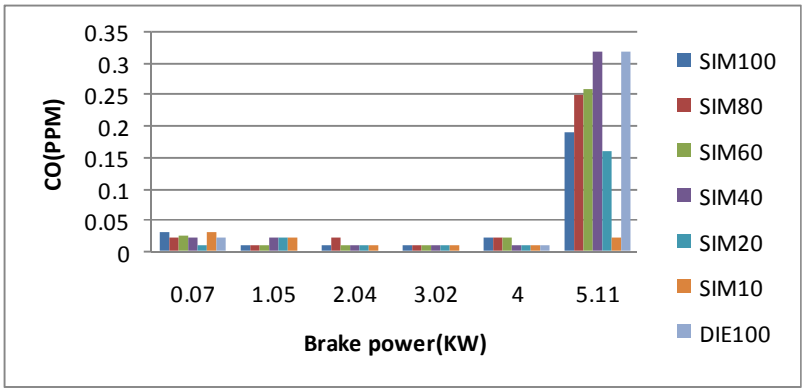

Figure- 12 variation of Carbon monoxide with Brake power (kW)

It is shown that the emission for various Simarouba oil blends gradually decreases with increases the brake power.S10 CO it is decreased with increases the BP.

4.3.4) Carbon dioxide

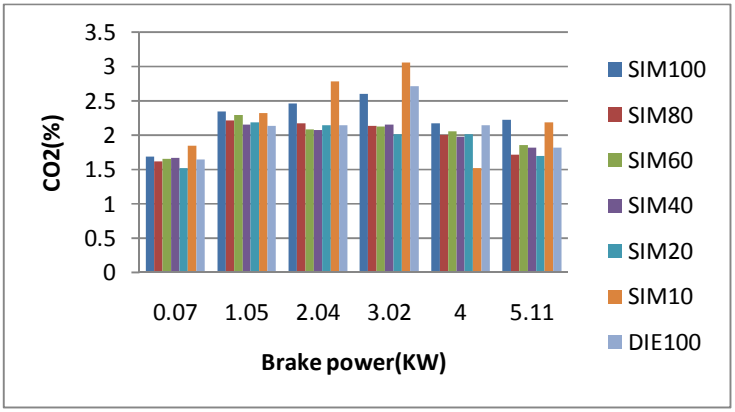

Figure- 13 variation ofCarbon dioxide with Brake power (kW)

It is shown that the emission of CO2 for various simarouba biodiesel blends decreases initially and gradually increases after full load condition it is decreased as shown in figure.

4.3.5) Smoke

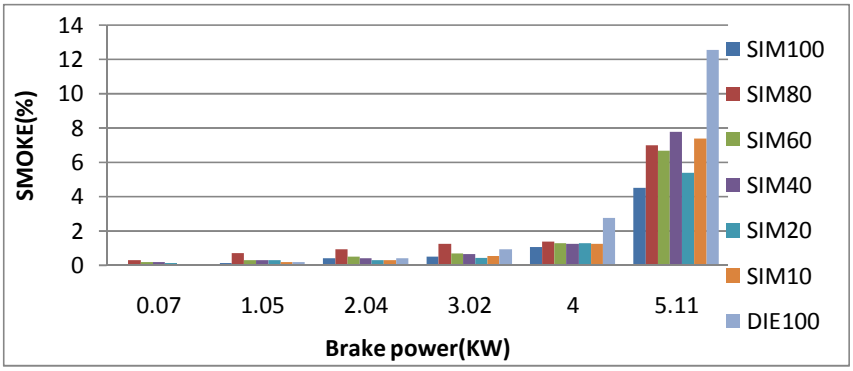

Figure- 14 variation of Smoke (%) with Brake power (kW)

It is seen that for Simaroubaglauca with the point simarouba biodiesel blends smoke emission is lesser than the pure diesel.

V. Conclusion

Simaroubaglauca biodiesel oil was used successfully operated single cylinder CI engine. The accompanying conclusions are made in view of the test results.

1. Simaroubaglauca biodiesel fulfills the essential properties of diesel fuel.
2. Thermal efficiency of Simarouba oil (SIM80) in an about equivalent to that of diesel.
3. Simaroubaglauca biodiesel EGT is decreased as compared to diesel.
4. The SFC of diesel nearly equal to SIM80 at lower loads however at higher loads at specific fuel consumption of all blends simarouba oil proportional to diesel.
5. The BMEP considerable number of blends of simarouba oil and additionally diesel increments with break power.
6. Simarouba oil blends have increased emissions like CO, SMOKE, NOx and it has decreased major emissions like HC, CO2.
7. The combustion characteristic of simarouba oil blends is nearly equal to SIM40 and diesel D100.

References

Journal Papers:

[1]. T.Thangaraj, K.M. Shereena, Biodiesel: Vegetable oils are used to produce as an alternative fuel by transesterification process‖, Electronic *Journal of Biology, 2009, Vol.5 (3): 67-74.*

[2]. Das S.P. Mishra S.R., Mohanty M.K, and Pattanaik A.K.- Simaroubaglauca oil Production by (methyl ester) biodiesel., *Vol. 2(5), 66-71, May (2012).*

[3]. Murugu Mohan Kumar Kandasamy et.al (2009) "Characteristics of o*perational using Ester Sunflower biodiesel with comparison with diesel operate on Diesel Engine." www.ccsenet.org*

[4]. ShaileshGolabhanvi2 Harish Astagi 3 OmprashHebbal(May 2014) "Conducted an experiment to studied the execution, Combustion, emission characteristics of Simarouba

[5]. Glauca oil and diesel" *Issue 4, VO.3 (May 2014) ISSN 2249-6149*

[6]. T. Elango et.al (2010) "*Emission Characteristics and combustion using Jatropha biodiesel blends with diesel fuel utilization of a Diesel Engine'* Automotive Research Centre, SMBS, VIT University, Vellore-14, Tamil Nadu, India.

[7]. N.R. Banapurmathet.al (2009) "*studies the Performance using non volatile vegetable oils operated on low heat rejection engine with EGR"* International Journals of Sustainable Engineering *Vol. 2, No. 4, December 2009, 265–274*

[8]. Mishra Sruti Ranjan1, MohantyMahendra Kumar, and Pattanaik Ajay Kumar, preparation of biodiesel from crude oil of simaroubaglauca using cao as a solid base catalyst" Department of Chemistry, C.V. Raman College of Engineering, Bhubaneswar, Odisha, INDIA, *Vol. 1(9), 49-53, September (2012).*