Comparison Study of Combustion Parameters with Two Turbochargers in Biodiesel Engine for Genset Applications

B. Vignesh*, S. Madhu

Department of Automobile Engineering, Saveetha School of Engineering, Chennai-602 105

***Corresponding author: E-Mail: Vigneshreddy927@gmail.com**

ABSTRACT

Naturally Aspirated engine runs with the mixture of ambient air and gas. Turbocharger runs with Pressurized air from the turbo mixing with the gas to kind a more compressed cost for extra energy. Attaching a turbo boosts the engine Emissions from the Exhaust. On this Comparative be trained we investigate the change in Emission phases of a turbochargers in engine assessment to a naturally Aspirated Genset engine. Also the rationale of the reward work is to calculate the emission parameters like the torque, fuel consumption, HC, NOx, CO, CO_2 and so forth. Founded on the measured parameters, precise analyses had been applied on cylinder stress, heat release fee and brake distinctive gasoline consumption (BSFC). It analyses the ways of air cost formation within the diesel engine as well because the principles of cylinder stress trade throughout the combustion approach. The article offers the cylinder pressure traits of the engines on exceptional working regimes, and compares the principles of pressure change within the unique positions of crank perspective degrees.

KEY WORDS: Diesel engine, Turbocharger, Bio-diesel, Comparative performance.

1. INTRODUCTION

World's power quandary, world warming, diminishing fossil fuel reserves are elevating considerations and inevitability to find more economic and extra eco friendly solutions to meet the current vigor consumption. Periodic broaden in crude oil costs as a result of extra demand, stringent emission norms, and feared shortages of crude oils due to fast depletion and web production of carbon dioxide from combustion sources have rekindled interest in renewable vegetable oil fuels.

Within the up to date occasions, the diesel engines grew to be predominantly used engine than petrol engines as science has improved and the invention of turbo-charged direct injection engines in the 1980s performed a imperative function to lengthen the elevate of its reputation in all sectors that entails personal auto causes and agriculture machinery. The usage of biodiesel in CI engines is a promising transfer to curb the fossil gas use and alleviate the worldwide warming considering that biodiesel are extra Eco - friendly than every other fossil gas. Fuels which are derivatives of renewable biological and biodegradable resources and can be employed in diesel engines are founded as biodiesel fuels. Animal fats, neat and recycled vegetable oils derived from crops can be utilized in the construction of biodiesel fuels. The study on vegetable oils as biodiesel used to be started extra than century ago and the research is stay the fascinating topic among the researcher to find a suitable and economically feasible biodiesel and literature revealing that extra study and technological trends are regarded essential. The primary cost of construction of biodiesel is feed inventory and thus, making a choice on the paramount feed stock is main to ensure low creation rate. It has also been discovered that the continuity in trans esterification approach is a further option to cut back the production fee. Biodiesel is presently not economically viable, and more research and technological progress are needed. For this reason helping policies are principal to promote biodiesel study and make their costs aggressive with other conventional sources of vigor. Currently, biodiesel can also be mightier if used as a complement to other vigor sources.

Using sunflower seed is determined in the meals and nutraceutical industries due to its high oil and protein contents. Contemporary reviews on biodiesel construction from sunflower oil differ from optimization of the trans esterification process conditions, version in catalysts, and mixing with different oils prior to biodiesel construction Safflower, on the other hand, is a drought-resistant oil seed, whose oil is flavorless and odorless and just like sunflower oil in terms of dietary worth. Stories on biodiesel construction from safflower oil mostly worried parameter and optimization reports.

Engine Specifications: Simpson tractor engine is used to analyze the emission parameters the specifications of the engine are explained in table no.1.

Table.1.Tractor engine specification (Model: S 217)

MODEL	S 217
Capacity	21 kW (28 bhp @ 2000 rpm)
Type / Configuration	Vertical in-line Diesel Engine
Bore	91.44 mm
Stroke	127 mm
No. of Cylinders	2
Displacement	1670 cc
Compression ratio	18.5:1

Cycle	4 Stroke
Rotation	Clockwise (viewed from front)
Aspiration	Natural
Combustion System	Direct Injection
Fuel Pump	MICO Bosch In-line Pump
Governing	Mechanical
Engine Starting System	Electrical
Cooling System	Water
Electrical System	12 Volts (Dynamo/Alternator)
Flywheel Housing	SAE 1 or SAE 3
Flywheel	Can be made to suit application
Weight (Bare Engine)	200 kg
Length x Width x Height	489 x 536 x 756nmm
Fan Centre from Crank Centre	282.6 mm
Power Take-off	From Crankshaft axially or radially. Gear driven PTO Training gears on LHS beneath Fuel Pump
Air-compressor	Optional

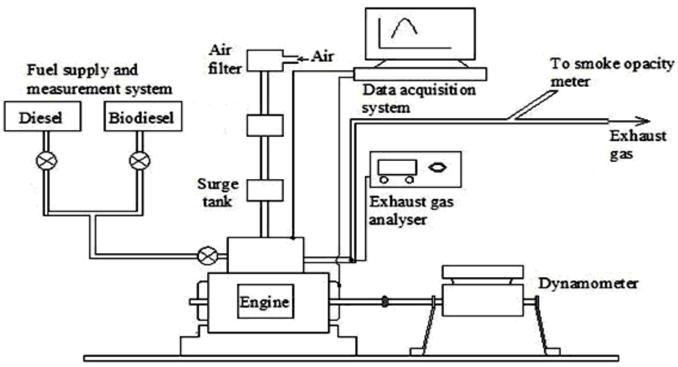

Figure.1.Fuel supply system

Exhaust Gas Analyzer: Using a five gas exhaust analyzer (AVL 444 DIGAS) can be used to measure the exhaust fuel emissions comparable to CO, CO_2, HC, O_2 and NO in the exhaust. A photographic vision of the exhaust gasoline analyzer showing a sample influence for the reward research work is shown in figure and the photographic vision of the exhaust gasoline analyzer used is proven in determine the specified specifications of the AVL 5 fuel analyzer are awarded in Appendix.

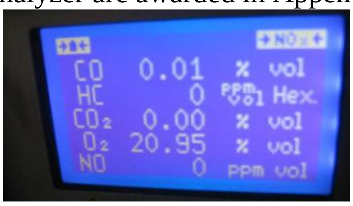

Figure.2.Measurement of exhaust gas analyzer

Figure.3.Gas analyzer instrument

Table.2. Specifications of the Exhaust Gas Analyzer and Smoke Meter Exhaust Gas Analyzer (Avl-444)

S.No.	Details	Specifications
Exhaust Gas Analyzer Measuring Ranges		
1	Oxygen (O_2)	0 – 25.00% vol
2	Carbon monoxide (CO)	0 – 15.00% vol
3	Carbon dioxide (CO_2)	0 – 20.00% vol
4	Hydro carbon (HC)	0 – 20,000 ppm n-hexane
5	Nitrogen oxide (NOx)	0 – 2,000 ppm
6	Excess Air calculated According to Brett Schneider Temperature	-40°C to +650°C
7	Oxygen (O_2)	0.1% or 3%
8	Carbon monoxide (CO)	0.06% or 5% of measured value
9	Carbon dioxide (CO_2)	0.5% or 5% of measured value
10	Hydro carbon (HC)	12 ppm or 5% of measured value

11	Nitrogen oxide (NOx)	5 ppm or 5% of measured value
12	Temperature (T>250ºC)	1% (T<150ºC) 2% (T<250ºC) 3%
Resolution		
13	Oxygen (O_2)	0.01%
14	Carbon dioxide (CO_2)	0.1%
15	Carbon monoxide (CO)	0.01%
16	Hydro carbon (HC)	1 ppm
17	Nitrogen oxide (NOx)	1 ppm

Smoke measurement: The exhaust smoke level used to be measured via using a standard AVL smoke measuring apparatus. This measuring instrument includes a sampling pump that sucks a precise number (330cc) of exhaust sample by way of a white filter paper. The reflectivity of the filter paper used to be then measured utilizing a common Bosch smoke meter that contains a light supply and an annular photo detector surrounding it. Earlier than every sampling, it was once ensured that the exhaust from the previous size used to be entirely pushed off from the tube and pump. The photographic vision of the smoke meter is proven in figure. The necessities of the smoke meter are given in Appendix.

Table.3. Technical specification of AVL 437 Smoke Meter

S. No	Particulars	Specifications
1	Accuracy and Reproducibility	± 1% full scale reading.
2	Measuring range	0-100% capacity in % 0-∞ absorption m-1
3	Measurement chamber	effective length 0.430 m ± 0.005 m
4	Heating Time	220 V …….approx. 20 min
5	Light source	Halogen bulb 12 V/ 5W
6	Colour temperature	3000 K ± 150 K
7	Detector	Selenium photocell dia. 45 mm Max. sensitivity in light,
8	In Frequency range	550 to 570nm.Below 430 nm and above 680 nm sensitivity is less than 4% related to the maximum sensitivity
9	Maximum Smoke	2100 C Temperature at entrance.

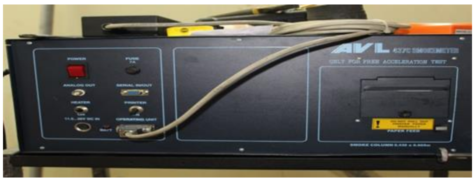

Figure.4.AVL 437 smoke meter

Turbochargers used: Dost vehicle turbocharger; Tel waste gated turbocharger.

2. EXPERIMENTAL PROCEDURE

On this part, the main points of experiments performed in various modes of operation are presented. All of the checks had been carried on the rated velocity of 2000 rpm. All readings are taken best after the engine attained steady operation. The gasoline analyzers were switched on before starting the experiments to stabilize them earlier than starting the measurements. All the devices have been periodically calibrated. The injector opening pressure and injection timing have been kept consistent on the rated value during the experiments.

The injection timing is stored constants in the entire experiments. The dynamic injection timing used to be used to calculate the ignition delay. The engine output was assorted from no load to full load in steps of zero%, 25%, 50%, seventy five% and one hundred% in the usual operation of the engine. At every load the gasoline flow rate, air flow fee, exhaust gas temperature, emissions of carbon monoxide, hydrocarbon and oxides of nitrogen and smoke readings have been noted. The pressures crank perspective history of fifty cycles used to be additionally recorded through making use of the information acquisition procedure and the individual computer. The data used to be processed to get the normal strain crank angle variation. The experimental work are given beneath.

3. RESULTS AND DISCUSSION

Performance characteristics: In case of engine with turbocharger, Brake thermal effectivity is greater than traditional engine at full load. It is because of proven fact that, engine with turbocharger displays higher stress and temperature resulting greater break thermal efficiency for whole load operation. In case of engine with turbocharger, precise gas consumption is at the beginning higher at no load stipulations compared with traditional engine at load condition. It is because of indisputable fact that, engine with turbocharger exhibits lowers pressure and temperature resulting reduce SFC for no load stipulations. The graphs for Torque, CO, HC, NOx, CO_2 and Smoke are shown below.

Torque: When the engine is tested with two different turbochargers using biodiesel the torque is equally produced. The graphs are shown below,

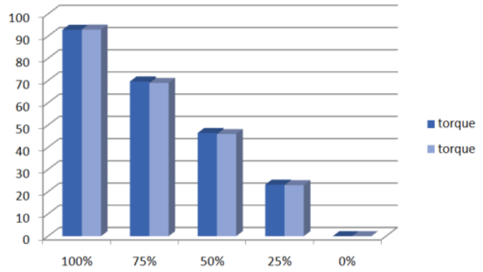

Figure.5(a).Comparison of two different turbocharger

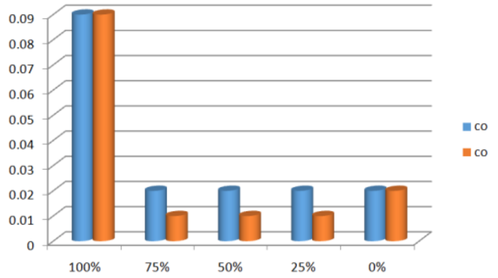

Figure.5(b).Torque analysing graph

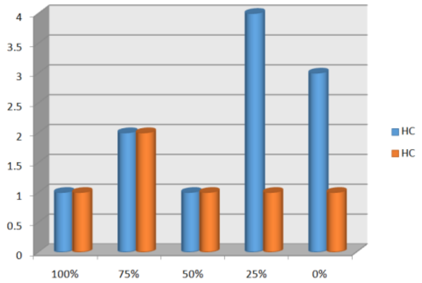

Figure.5(c).Carbon analysing graph

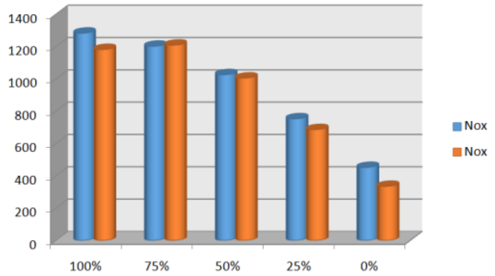

Figure.5(d).NOx emission graph

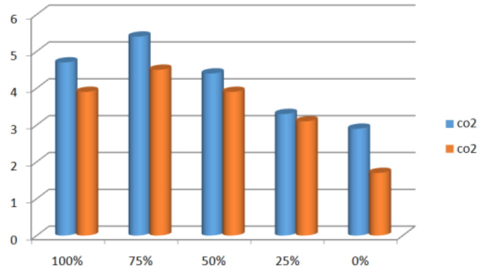

Figure.5(e).CO_2 graph

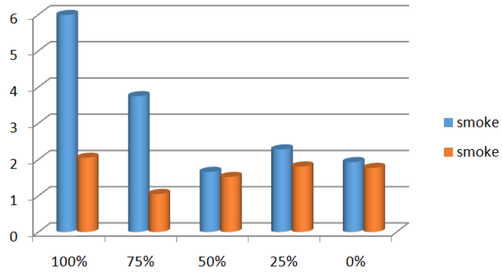

Figure.5(f).Smoke analyser

4. CONCLUSION

This work is victorious following the objective that enhances with two exceptional turbochargers in off street Bio Diesel Engines at more than a few load stipulations. The perform of this challenge is fully run good and smoothly towards measuring the combustion parameters of the engine. The Torque is equal in two turbochargers. And in CO, HC, NOx, CO_2 the dost vehicle used turbocharger produces extra emission then the Tel waste gated turbocharger in quite a lot of load stipulations o the bio diesel engine And the gas consumption additionally lowered and the power additionally multiplied in Tel turbocharger.

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