March - April 2020
ISSN: 0193-4120 Page No. 8751 - 8755

Performance and Emission Characteristics of an IC Engine Fuelled with Biodiesel Blend

Mr.V.Kondusamy[1], S Kavin Raja[2], D Vijin3, R Elangovan[4], B Lokesh[5]
[1]Assistant Professor, Department of Automobile Engineering, Karpagam College of Engineering , Coimbatore – 641032
[2,3,4,5] UG Scholar, Department of Automobile Engineering , Coimbatore-641032.

Article Info
Volume 83
Page Number: 8751 - 8755
Publication Issue:
March - April 2020

Abstract
Biodiesel is a conventional coal,fossil fuel and alternative fuel. Straight vegetable oil, animal oil and fats, sugar and waste cooking oil can be produced with biodiesel. The process used in converting these oils into biodiesel is transesterification. The following is a further listing of this process. The biggest source of suitable oils are oil crops such as rapeseed, palm and soy. The majority of currently generated biodiesel consists of vegetable oil waste processed in restaurants, chip shops, industrial farmers like Birdseye etc. Although it is not merely produced commercially because the raw oil is too costly, it is the most potential oil source directly from agricultural industry. After it has been applied to biodiesel, it is simply too expensive to compete with fossil fuel. The goal of addressing biodiesel environmental concerns was to encourage a reduction in harmful emissions such as unburnt hydrocarbon, particulates and carbon monoxide. The biodiesel blender has a similar fuel properties to diesel and can be used in Diesel engines without modification to the engine: density, movable viscosity, warmth value, etc. Biodiesel mixtures minimize BP and improve BSFC than gasoline.The emissions of CO and HC are reduced as diesel because of the higher content of oxygen in biodiesel and thus the combustion improves..

Article History
Article Received*: 24 July 2019*
Revised*: 12 September 2019*
Accepted*: 15 February 2020*
Publication*: 09April 2020*

Keywords**:** *Biodiesel, Performance, Emissions, Waste vegetable oil,Diesel*

I. INTRODUCTION

The Variable Compression Ratio (VCR) principle guarantees better engine output, efficiency and emissions. Due to higher compression ratio, the high cylindrical pressures and temperatures during early combustion and small residual gas fractions give faster laminar flame speed. The ignition delay is therefore shorter. As such, the shorter the time of combustion at lower loads the greater the compression ratio. The loss of time will be minimized afterwards. Therefore, with a high compression ratio at part load, it seems fair that the fuel consumption is lower. The thermodynamic efficiency of VCR may play an important role. Depending on the vehicle performance requirements, the main feature of the VCR engine works with various compression ratios. The compression ratio can be constantly changed by adjusting the chamber volume of a VCR motor. Thermodynamic benefits in a VCR engine emerge across the motor. At low power, the VCR engine works at a higher compression rate to achieve high fuel efficiency, while at high power the engine operates at a low compression rate to avoid impact. As safe, non-toxic, biodegradable and sustainable diesel fuel, biodiesel should receive greater exposure. The transesterification of plant oil or fat by small alcohol chains such as methanol or ethanol is usually provided by biodiesel.The biodiesel It has a higher oxygen content than conventional diesel and has a significant reduction in oil, carbon monoxide, sulphur, polyaromatic, hydrocarbon, smoke, and noise pollution in the diesel engines….. Therefore, the combustion of vegetable oil-based fuel does not add to the net amount of CO2 in the atmosphere since such a fuel is made of agricultural materials created through the photosynthetic fixation

March - April 2020
ISSN: 0193-4120 Page No. 8751 - 8755

of carbon. . Biodiesel has a relatively high flash point, making the transport and storage of petroleum fuel less unpredictable and safer.Engine wear and long life are benefits that biodiesel can provide as it has lubricating properties.

1.2.Biodiesel an Alternative Fuel

Biodiesel, an alternative petroleum diesel fuel, is used mainly to reduce emission impacts without engine modification. It has been found that the efficiency of both biodiesel fuels (mostly torque and brake power) is reduced with an ever more mixing ratio that is due to lower biodiesel energy content. As predicted, common fuel consumption for both biodiesels increases in comparison with diesel fuel. Many emissions of greenhouse gases were higher than diesel oil, while some were lower. Overall, biodiesel A produces fewer overall emissions than diesel and biodiesel.The engines running on biodiesel have lower emissions like CO2, PM, SOx and the HC, but the comparison of diesel fuel with nitrogen oxides has increased.

1.3.Production of Biodiesel

Almost all biodiesel is provided by base catalyzed transesterification as this is the most cost effective process that only requires low temperatures and presses. These include vegetable and animal fats and oils that are usually methanol reacted with short-chain alcohols. Alcohols of low molecular weight should be used. Because of the low cost of ethanol, however, it is the most widely used for greater conversions to biodiesel with methanol. While either acids and bases that catalyze the transesterification reaction, the base catalyzed reaction is more prevalent. The reaction times are lower and the cost of the catalyst are lower than the acid catalyst. Nevertheless, the downside of alkaline catalytic action is that both the water and fatty acids in the oil are highly sensitive. The properties of biodiesel such as kinemato-viscosity, cetane amount, water sediments, cloud rate, acid number, total glycerine, alkaline metals, blend fraction, stability and so on calculated by the efficiency and the emissions characteristics of the diesel engine.The alcohol reacts to the monoalkyl ester or biodiesel using fatty acids. The transesterification process causes drastic changes in vegetable oil viscosity. Glycerol is separated from the high-viscosity portion and thus it has a low viscosity like fossil fuels. The triglyceride in the presence of a catalyst, normally strong alkaline such as sodium hydroxide, reacts with alcohol during the transesterificationmethod.You can visually observe when the transestherification reaction is performed that not all the materials can be mixed easily. A term commonly used is two phases for this phenomenon. You will see that methanol and vegetable oil don't combine readily at the beginning of the reaction. At the end of the reaction, two layers (phases) can be noticed: one mainly composed of glycerol and the other of methyl esters. Of example, glycerol is not readily combined with methyl esters. It depends on the structural properties of compounds, such as the presence of OH groups, how easily one compound is dissolved in another.The fact that vegetable oils are mixtures of triglicerides from various fatty acids is extremely important. Vegetable oils vary according to the source of the plant.

II. EXPERIMENTAL SETUP

Figure 1.Experimental Setup2.1.Engine Specifications

No. of cylinder	1
No. of strokes	4
Cylinder diameter	87.5mm
Stroke length	110mm
Connecting rod length	234mm
Orifice diameter	20mm

March - April 2020
ISSN: 0193-4120 Page No. 8751 - 8755

PROPERTIES	BIODIESEL
Density at 15°C (kg/m3)	860-900
Viscosity at 400°C (Mm^2/s)	2.5-6.0
Flash point (°C Mins)	120
Sulphur content (mg/kg)	50
Carbon residue (% mass)	0.05
Acid number (mg KOH/gm)	0.5
Cetane number (Min)	51
Ash content (% mass)	0.02
Moisture content (mg/kg)	500
Total contaminations (mg/kg)	24
Dynamometer Arm length	185mm

III. RESULTS AND DISCUSSION

3.1. Performance characteristics

The performance of an IC engine can be measured in Brake Power. In an IC engine is tested for biodiesel and performance characteristics are given below:

3.1.1. Brake Power (BP)

If BP also increases to 3500 rpm when the RPM of the diesel engine decrease, so BP decreases due to the increased frictional power. The peak BP for diesel has been estimated as the biodiesel blends kW at a speed of 3500 rpm. The BP was decreased by bio diesel blends at an engine speed of 3500 rpm by 8.15 percent compared with diesel.

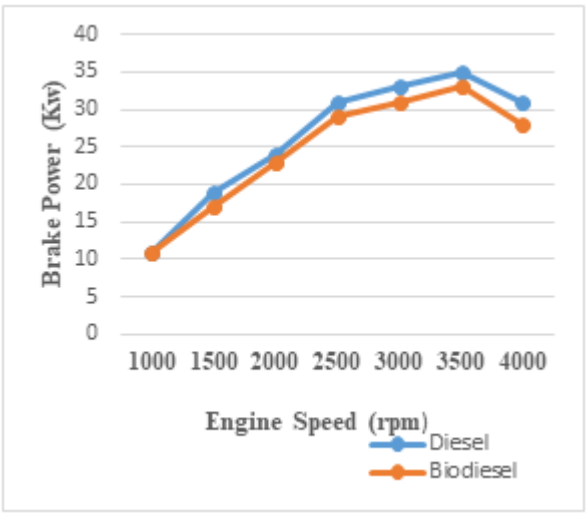

Figure 2. Brake power variation with engine speeds

3.2. Emission characteristics

The emission characteristics of the diesel engine are characterized by a diesel engine emission of CO, HC and NOx. The emission of CO and HC is decreased with the use of biodiesel and the NOx emission at different engine speeds as opposed to diesel fuel.

3.2.1. Carbon monoxide (CO) emission

An incomplete fuel combustion in engine cylinder and partially oxidized carbon particles produces CO during operation. Of biodiesel mixtures, CO emissions over the entire range are minimal than diesel fuel. Fig.4 indicates that, as opposed to diesel fuel, biodiesel blends decreased the CO emission by 43.45%. Higher cetane and oxygen are to be reduced due to biodiesel CO emissions than gasoline which rely on the degree of biodiesel saturation.

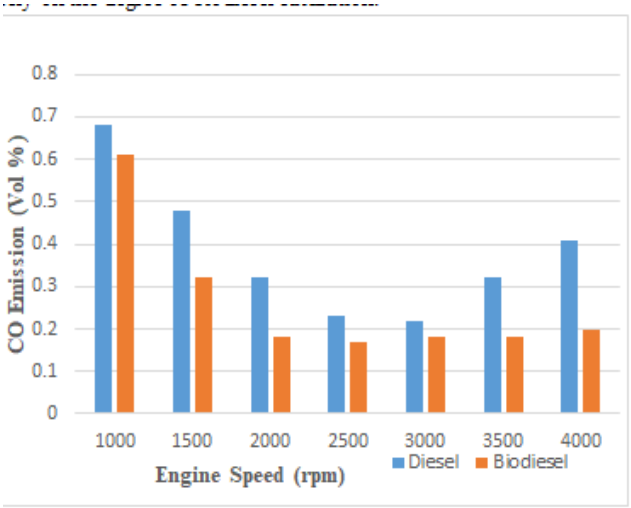

Figure 3. CO emissions variation with engine speeds

3.2.2. Hydrocarbon (HC) emission

Where the fuel molecules do not completely burn the hydrocarbon emissions of the engine cylinder HC. Biodiesel mixtures limit HC pollution over the entire range of engine speeds relative to gasoline. Fig.4. shows that, at 3500 rpm level, biodiesel mixtures decreased HC emissions by 38.6%. The total HC emission comes from all biodiesel mixtures. Higher biodiesel cetane number decreased

March - April 2020
ISSN: 0193-4120 Page No. 8751 - 8755

the ignition delay, there by reducing HC emissions.

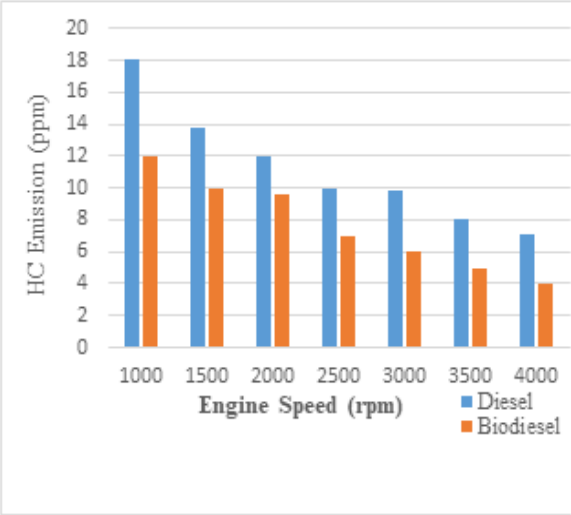

Figure 4. HC emissions variation with engine speeds.3.2.3. Nitric oxide (NOx) emission

The production of NOx depends mainly on fuel combustion temperature, fuel oxygen and reaction time shows that all biodiesel mixtures increase the NOx emissions in comparison to dieselthroughout the engine. If the same engine results are checked for camelina biodiesel. Biodiesel blends have decreased emissions of NOx by 5.27 percent in engine speed from 3500 rpm. The high oxygen content in biodiesel increases engine cylinder flame temperature combustion.

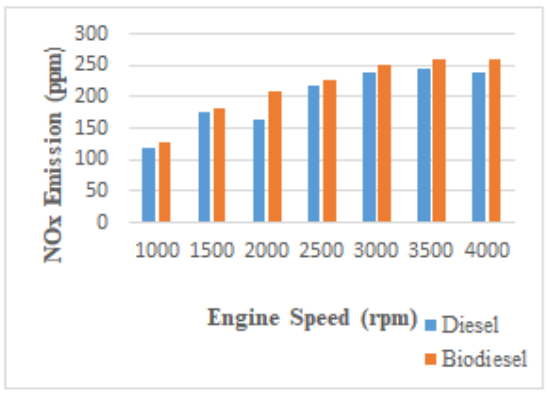

Figure 5. NOx emissions variation with engines speed

IV. CONCLUSION

The goal is to find appropriate biodiesel blends for the production of maximum power and lower BSFC and lower emissions in CO2, HC and NOx for the diesel engine operation. The following conclusions are drawn from the analysis report as biodiesel fuel's average BP is just slightly less than 8.15 percent, and BSFC is 8.60 percent greater than diesel fuel since it has a lower heat value compared to diesel and biodiesel blending.Biodiesel blends decrease CO emissions by 43.45% and HC 38.6%, as well as increase NOx emissions by 5.27% compared to diesel because biodiesel blends with higher oxygen contents improve the combustion cycle performance, primarily affecting the combustion temperature and NOxemission.Biodiesel mixture displays higher performance than other biodiesel mixtures in all biodiesel mixtures

REFERENCES

[1]. Verma P, Sharma M.P. Performance and Emission Characteristics of Biodiesel Fuelled Diesel Engines, IJRER, 2015:1-4.

[2]. Liaquat A. M., Kalam M. A., Masjuki H. H., Jayed M. H., Engine Performance and Emissions Analysis using “Envo-Diesel” and Coconut Biodiesel Blended Fuel as Alternative Fuels, IPCBEE, 6; 2011.

[3]. Shahid E.M., Jamal Y., Production of biodiesel: A technical review, Renewable and Sustainable Energy Reviews, 15(9); 2011:4732–4745.

[4]. Deshmukh S. J., Bhuyar L. B., Thakre S. B., Investigation on Performance and Emission

[5]. Verma P., Sharma M.P., Dwivedi G., Impact of alcohol on biodiesel production and properties, Renewable and Sustainable Energy Reviews, 56;2016:319–333.

[6]. Biodiesel Handling and Use Guide, fourth edition, NREL/TP-540-43672 Revised January 2009; accessed July 23, 2015.

[7]. Palash, S.M., Masjuki, H.H., Kalam, M.A., Atabani, A.E., Rizwanul Fattah, I.M., Sanjid,A., 2015. Biodiesel production, characterization, diesel engine performance, and emission characteristics of methyl esters from Aphanamixispolystachya oil of

Bangladesh. Energy Conversion and Management, 91; 2015:149–157.

[8]. Ozturk, E., Performance, emissions, combustion and injection characteristics of a diesel engine fuelled with canola oil-hazelnut soap stock biodiesel mixture. Fuel Processing Technology, 129; 2015:183–191.

[9]. Xue, J., Grift, T.E., Hansen, A.C., Effect of biodiesel on engine performances and emissions. Renewable & Sustainable Energy Reviews, 15 (2); 2011:1098–1116.

[10]. Rao, P.V., Experimental investigations on the influence of properties of jatropha biodiesel on performance, combustion, and emission characteristics of a DI-CI engine. World Academy of Science, Engineering and Technology, 75; 2011:855–868.