Performance and Emissions Characteristics of VCR Engine Fueled with Mixed Biodiesel Blends

G.Antony Casmir Jayaseelan, A. Anderson, Mathialagan, Sheik Ashik, Srimugeshe

Abstract*: In recent years, research on alternative fuel which is an environmental friendly in nature has been carried out thoroughly by many researchers through their enormous experimental work. An experimental study was performed on VCR engine using neat diesel and mixture of JME and SME biodiesel-diesel blends. The performances of biofuels attained from the binary biodiesel and its different proportions with full load condition of the engine are analyzed in this paper with few fuel properties. The experimental work is conducted for different load conditions (No load, 30%, 60% and 90% at constant speed (1500 rpm). Engine performance (BSFC, BTE) and emissions (Hydrocarbon, CO & NOx) is measured to find out the nature of the engine running condition with two mixed biofuels. According to the results indicate the two mixed biodiesel Blend A (Diesel 80%, SME10% and JME 10% by vol); Blend B (Diesel 60%, SME20% and JME 20% by vol) is a appropriate alternative fuel for pure diesel and minimized air pollution in the atmosphere.

***Keywords* : Jatropha Methyl Ester and Soapnut Methyl Ester, Engine performance, Emissions.**

I. INTRODUCTION

The major natural resource used for commercial vehicles in the world is diesel fuel. This is one of the non-renewable energy resources depleting the oil resource in the world. Thus the various properties same as that of diesel properties. In recent years researches are made round the globe on Methyl Esters additives because of its oxygenated property. The several experiments are made to standardize the Bio diesel and diesel blend. In this present work one of such idea is implementing as a new approach on dual Bio diesel blended diesel is followed to improve its overall characteristics. Biodiesel is superior to diesel fuel because of its very low rated sulfur content the fire and flash point temperatures are also comparable to the neat diesel. Biodiesel can be served as an alternative fuel for the CI engine without and rework of the original engine configuration.

Deepanraj et al [1] he observed that lower value of biodiesel will increase the BTE and reduces SFC and addition to this lower the emissions than neat diesel. Venkatraman et al [2] he has conducted various experiments in a DI diesel engine fueled with a blend of PME for various proportions. The authors noted that there is a excellent change in performance. Kumar et al. [3] he carried out various experiments using JME, jatropha oil and blends of jatropha and CH3OH as additives. And he concluded that BTE for jatropha esters, dual fuel Functioning and diesel was 29%, 28.7% and 30.2% respectively in the results. VenkateswaraRao P et al [4] He experimented with various blends in mixing of binary fuels jatropha and pongamia along with pure diesel. He finally concluded that blend D90JP10 (Diesel 90%, pongamia and jatropha 10%) and D80PJ20 Diesel 80%, pongamia and jatropha 20%) is nearer to the pure diesel properties. hence both the fuels can be used as alternative fuel.

Nagaraja et al. [5] He performed that brake power of palm oil biodiesel blends with diesel is higher than regular fuel at all load conditions with maximum compression ratio. There is improvement in thermal and mechanical efficiency; there is slight decrease in Co and hydrocarbon with slight raise in co2 emission. Muralidharan et al.[6] conducted experiment on the overall characteristics of a VCR engine using methyl esters of waste cooking oil. He founded that Co and hydrocarbon reduces for the biofuels blends than compared to the pure diesel.

Prabhu et al [7] He investigated the overall characteristics of engine using neem biofuels and various blends with neat diesel. And author concluded that combustion pressure is high for biodiesel and its various blends. Nalgundwar et al [8] he experimented the emission and performances characteristics of CI engine using two mixed blended fuels of jatropha and palm. And he observed that 4.65% average increases in BP and slight drop in brake SFC for the blend B20.A.Sanjid et al. [9] he concluded that mustard biodiesel is much favorable biodiesel properties compared with other biodiesels. And from the experiments he has concluded that performance and emission analysis to be optimistic. From the work he has concluded that

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blends 10% and 20% can be used in engine without modifications.

S V Channapattana et al. [10] conducted various experiments on hone and its blends, the Nox increase with increasing in induction period as its blend increases. As the results show that there is increase in Nox as percentage of blends increases. Blend 20% gives good significant thermal performance compared with other hone biodiesel blends, exhaust emissions gives superior values.

II. MATERIALS AND METHODS

The raw Jatropha oil and soapnut oil were collected from cyrus enterprises, Chennai, Tamilnadu, to a purity of 99.5%. Diesel is brought in local bunk. The Jatropha methylester and soapnut methylester are prepared by the transesterification process. Since FFA of Jatropha is 14% and has to be reduced to less than 1%, CH3OH and acid catalyst H2SO4 transesterification is preferred. Hence Free Fatty Acids were initially transformed to esters. This product content from the above process was allowed to undergo transesterification process with CH3OH and KOH as an alkaline catalyst. Since FFA of soapnut oil is 9.1% and has to be reduced to less than 1%, CH3OH and acid catalyst H2SO4 transesterification is preferred. Hence Free Fatty Acids were initially transformed to esters. This product content from the above process was allowed to undergo transesterification process with CH3OH and KOH as an alkaline catalyst.

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Fig. 1.Engine Setup

The engine performances are calculated from binary biodiesel and its various blends. The experiments is carried out in the I.C engines Research lab in the Mechanical Engineering Department, Avit, Chennai. as shown in figure. A. The engine specifications include four-stroke, single cylinder VCR engine attached with eddy current dynamometer. The experiment was conducted for different loads (No load, 30%, 60% and 90% at constant speed conditions. The figure A represents the setup of the engine. The engine consists of an orifice at the air intake to calculated mass flow rate of air and U-tube manometer. The mass rate of biofuels was measured by use of calibrated glass burette connected with the fuel tank. The readings were obtained by the lab view software which is interfaced with the VCR engine. The exhaust emission is calculated by using AVL gas 444 analyser. The overall performance BSFC, BTE and emissions were determined and studied the behaviour of engine running with two mixed biofuels with diesel ach test was repeated thrice, and the results were averaged.Figure 2 shows the Technical Specification of engine.

Table 1.Technical specification of Engine

Manufacturer	Kirloskar, Av-1, 4 Stroke, Water Cooled
Type	Direct Diesel Injection
Fuel	Diesel
Power	4.44 kW
Bore * Stroke	87.5 * 110
Compression Ratio	6.1 - 10.1
Speed (RPM)	1500
Nozzle Opening Pressure (Bar)	200
Rated Power	6 – 8 HP
Injection Timing	23°C BTDC
Number Of Cylinders	1
Cycle	Four Stroke

Fig. 2.Technical Specification of Engine

III. RESULT AND DISCUSSION

The tests were carried out on a single cylinder CI engine. To calculate performance, emission & combustion characteristics for two mixed biofuels and its various blends and load conditions. The measured values is analyzed and presented in this section.

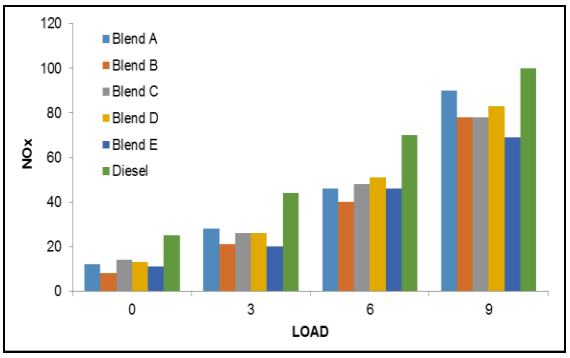

Fig. 3.NOx Emissions with load

Figure 3 indicates the Change of NOx with load. When the load increases NOx slightly decreases. For maximum load condition blend A and blend C reduces about 2% and 3% respectively.

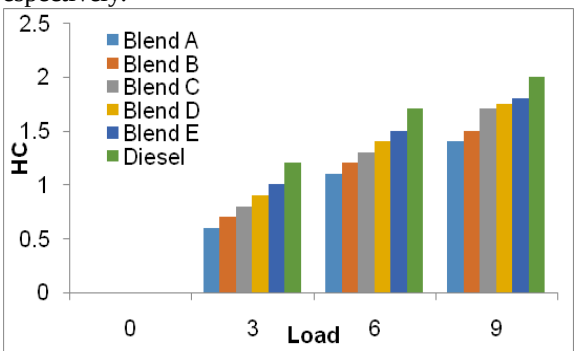

Fig. 4.HC with load

Figure 4 indicates the Change of Hydrocarbon with load. When load increasing HC emission slightly decreases. For maximum load condition blend A and blend B reduces about 1% and 2% respectively.

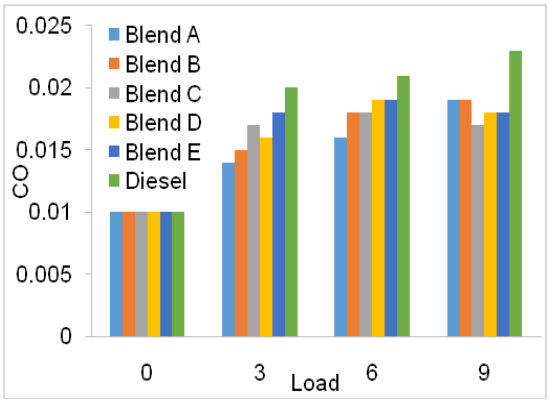

Fig. 5.CO with load

Figure 5 shows changes of BTE with load. When the load increases BTE also increases. For maximum load of 9kg, for diesel - 31.7 %, blend E and Blend B increase about 29%and 30% respectively.

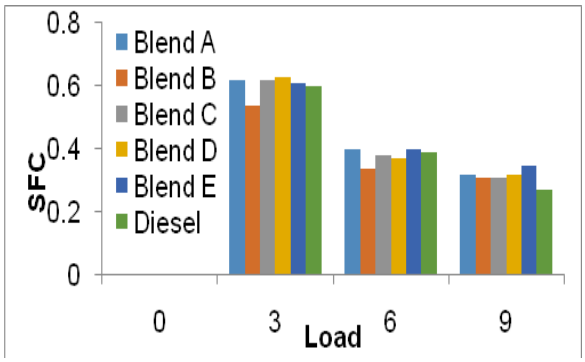

Fig. 6.SFC with load

Figure 6 indicates the changes of SFC with load. When the load raised, SFC also increases gradually.

IV. CONCLUSION

The engine tests have been conducted to test the overall performances of diesel engine using the various proportions of JME and SME with neat diesel. And it is finally concluded based on the experiments discussion is analysed with neat diesel, BTE for Blend A slightly nearer at maximum load condition. On overall the Blend A and B are very much suitable for running the engine without any modification.

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