Experimental Analysis of a Ci Engine with the Effect of Different Injection Pressures using (Nome) Biodiesel

Sangeetha Krishnamoorthi, L. Prabhu, Deepak Mohanan, Harshadev, Nithin Antony

Abstract: The biodiesel production in our country has a large scope in the upcoming years and can be made available in plenty which has a main role in controlling the more number of uses of fossil fuels. By blending ethanol with the diesel the amount of usage of the fossil fuel can be reduced in a drastic level which can pave the way for development in producing biodiesel using more nonedible oils which is available in the different places of the country. In this paper experiments were done with the biodiesel which is produced from neem oil. The seeds of the neem tree contain certain % oil and this can be made into use by converting it in to non edible oil with the help of transesterification process. More number of studies has been already done by using the neem oil and so the current study gives the concert as well as also the various release characteristics of neem oil methyl ester by testing at different injection pressures. The specific injection pressure may be including 200 bar, 225 bar and also at 250 bar.

Keywords : Diesel engine, Neem lubricates methyl ester, Emissions, inoculation pressure, performance.

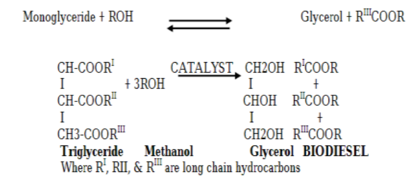
I. INTRODUCTION

Avinash Kumar Agarwal et al. showed that the test fuels thermal efficiency can be increased by slight increase with the fuels injection pressures. So the comparison of the different characteristics of the CI engine should be analysed by performing the test at various injection pressures [1]. S.V.Channapattana et al., explored the cause of inoculation pressure at different values along with evaluated the performance as well as the various emissions obtained at the exhaust. The brake mean effective pressure was increased for all the values of the indicated power. The emission level was increased slightly when the blend ratio is going to be higher.B20 was used for all the different pressure values and also they indicated that the NOx values were higher while comparing with the diesel base value [2]. P. Mohamed Shameer et al., evaluated the performance characteristics with respect to CI engine operating parameters powered by different biodiesel to effectively adapt the engine. They also studied that it is essential to study the effects of inoculation timing along with inoculation pressure variation on the performance of different biodiesel for optimal use in the CIDI engine [3]. Abhijeet Balasaheb Ranveer et al.,revealed that the stress of fuel inoculation is playing a major task in the incineration process along with therefore also influences the concert of the engine. Inoculation pressure is usually set at a recommended level for diesel and petroleum. They also discussed the effect of injection pressure variability on the quality of biodiesel mixtures and smoke levels at the appropriate temperature. This will provide important insight in to how biodiesel blends can provide comparable performance to the fossil fuels [4]. Amar Pandhare et al., focused on investigating the crash of solidity part along with inoculation pressure on Jatropha blended fuelled engine performance and their emissions along with their combustion specifications. Owing to the remnant fuel catastrophe along with also the crash of GHG utilize of alternative fuels for IC engine has attracted a lot of attention. Strict regulkations are levied on the automotive sector by the national government to limit and reduce the emissions of PM [5].

II. METHODS AND MATERIALS

The process of transesterification helps in conversion of the oil which is available into biodiesel which can be then directly used in the engines. In the being there of the means sodium hydroxide to manufacture glycerol as well as greasy acid ester requires making tryglycerides of neem oil to react with methanol which is shown with the help of chain reactions in Table I.

Table- I: Construction of biodiesel from neem oil



Revised Manuscript Received on December 16, 2019.

Sangeetha Krishnamoorthi *, Associate Professor, Department of Mechanical Engineering Aarupadai Veedu Institute of Technology**,** Vinayaka Mission Research Foundation, Tamil Nadu,Chennai. Email:sangeethas@avit.ac.in

L.Prabhu, Assoc. Professor, Department of Mechanical Engineering Aarupadai Veedu Institute of Technology, Vinayaka Mission Research Foundation,Tamil Nadu, Chennai.

Deepak Mohanan, UG Student, Department of Mechanical Engineering, Aarupadai Veedu Institute of Technology, Vinayaka Mission Research Foundation, Tamil Nadu, Chennai.

Harshadev, UG Student, Department of Mechanical Engineering, Aarupadai Veedu Institute of Technology, Vinayaka Mission Research Foundation, Tamil Nadu, Chennai.

Nithin Antony, UG Student, Department of Mechanical Engineering, Aarupadai Veedu Institute of Technology, Vinayaka Mission Research Foundation,Tamil Nadu, Chennai.

The neem lubricate was generally produced from the process of either acid esterification or sometimes alkaline esterification. In the process of acid esterification methanol along with small amount of sulphuric acid is added. At last stage the neem oil is collected at the down surface whereas the other particles are will be collected through the top. In the alkaline esterification process a small amount of Potassium hydroxide is dissolved in methanol and then preheating is done and is then mixed with the non edible oil and finally allowed to separate and collected in the flask. This can be directly mixed with diesel and made use in the engines[6]-[7]. The transesterification process helped in improving the properties of the oil which is given in Table.II.

Table- II: Properties of diesel,Neemoil,NOME

Properties	Diesel	Neem oil	NOME
Specific gravity	0.830	0.920	0.860
Kinematic Viscosity at 40°C (cSt)	3.720	38	4.5
Flash point (°C)	62	350	152
Fire point (°C)	64	365	180
Calorific value (kJ/ kg)	42500	39500	38500
Cetane No	48	38	51

III. MATERIALS AND METHODS

The Specifications of the engine which is used to do the experiment is exposed in Table.III. By a speed of 1500 rpm the experiment was done with base value of diesel. The NOME was mixed in the ratio of 20% along with diesel 80% generally called as B20. The diesel and the biodiesel was kept in a separate containers from which it was allowed to flow and was measured by using a burette and the flow rate was controlled by using a stop watch. The gas analyser and smoke meter was used to measure the emissions. The untried system is shown below in the fig.1.

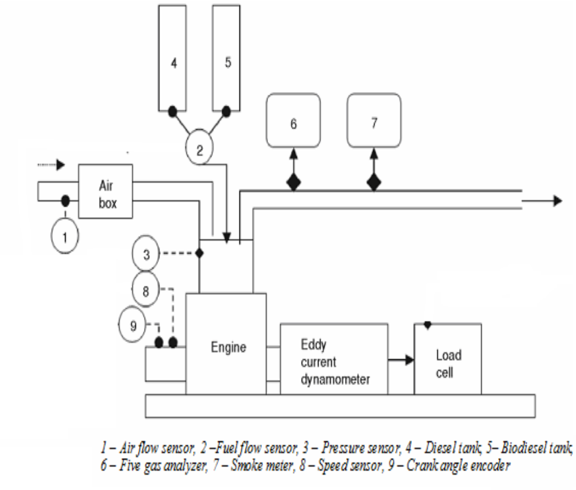


Fig. 1.Schematic of the investigational setup.

Table- III: Test engine specifications

Engine	Kirloskar, AV-I,
Power	4.4 kW
Bore (mm)	87.5
Stroke(mm)	110
Compression ratio	17.5:1
Speed (rpm)	1500
Injection pressure(bar)	200
Injection timing	23°bTDC

IV. RESULTS AND DISCUSSION

A. Brake Thermal Effectiveness

This BTE value goes on increasing as the load value and the injection pressure value increases. The fig.2 shows the different values of BP for the BTE values. When the pressure was of 225 bar the BTE was found to be closer to the base diesel value and also when compared with the remaining two pressure values. The Brake thermal efficiency when the pressure is around 225 bar is 28.24% and for the base diesel value it was 30.48%. There was a 2.1% increase in the efficiency when the pressure was 225 bar when compared with full load value with a pressure of 200 bar. The atomization and also the vaporization may be the cause for the augment of the BTE values when the injection pressure is increased.

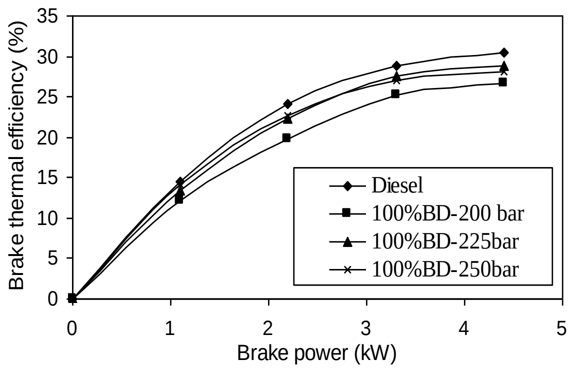


Fig. 2.Difference of Brake thermal effectiveness among BP.

B. Brake explicit oil utilization

The fig. 3 shows the BSFC for different Brake power values. The value of Brake explicit fuel spending decreases for every one the load value. When comparing with 200 bar injection pressure the load value is found to decrease for the remaining pressure values. There is 10% decrease in the BSFC value when operated at 225 bar while comparing with 200 bar. The brake explicit fuel utilization value was somewhat enlarged for the 250 bar pressure and when it was run at full load.

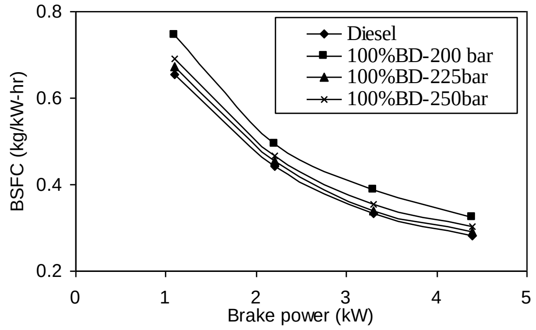


Fig. 3.Difference of BSFC among BP.

C. Carbon monoxide emission (CO)

The difference of Carbon monoxide value for the POME is shown in the fig.4. When the neat biodiesel was tested the CO value decreased as the inoculation pressure was enlarged. The carbon monoxide emission value was found to be decreased by 30% when the injection pressure was of 225 bar when compare with a pressure of 200 bar. The oxygen molecules in biodiesel and also due to the combustion properties the carbon monoxide value tends to decrease at full load values.

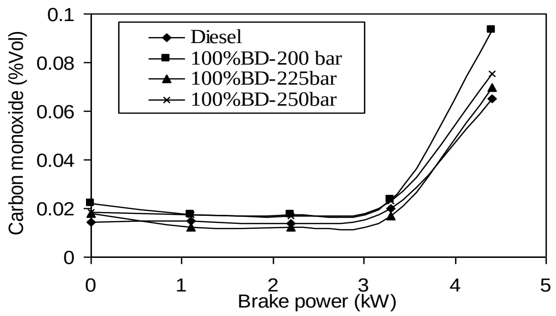


Fig. 4.Difference of CO emissions among BP.

D. Hydrocarbon release (HC)

Fig. 5 below gives the various HC emission value of for the different injection pressure values at occupied load. The value of HC release is closer to the diesel value when the pressure is of 225 bar. The decrease in percentage of the POME value when the pressure is of 225 bar is 10% when comparing with 220 bar pressure value. The hydrocarbon is a major reason for the formation of SMOG and so it has to be decreased up to the maximum level.

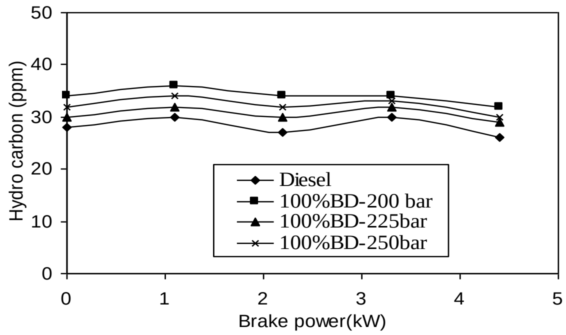


Fig. 5.Difference of HC emissions among BP.

E. Nitrogen Oxide Emission (NO)

Nitrous oxide emission value mainly depend on the gas temperature of the cylinder and also on the amount of oxygen atoms present during the combustion process. The fig. 6 shows the various NOx values for different injection pressure values. The NOx value increased as the load increases and also due to difference in increasing nozzle opening pressures. The NOx value mostly increses for all types of biodiesel and the reason is at higher injection pressures the atomization is done in a better way due to which heavy amount of oxygen is present which leads to NOx values. There is an increase in 6% of the Nitrous oxide emission value at a pressure of 225 bar while comparing with a pressure of 200 bar.

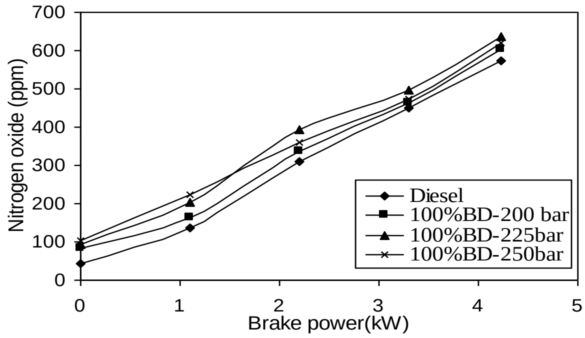


Fig. 6.Difference of NO emissions among BP.

F. Smoke release

The diesel engine exhaust has hard carbon elements produced during combustion in the fuel wealthy zones inside the container. At all load values the values of smoke density was increased. The smoke values also tend to decrease when the inoculation pressure values enlarged. There was reducing in 28% of the smoke value when tested at 225 bar pressure evaluated with 200 bar pressure. This happens because of the number of oxygen values increases when the combustion process is carried out effectively. The difference of Smoke for dissimilar load values is depicted in fig. 7 below.

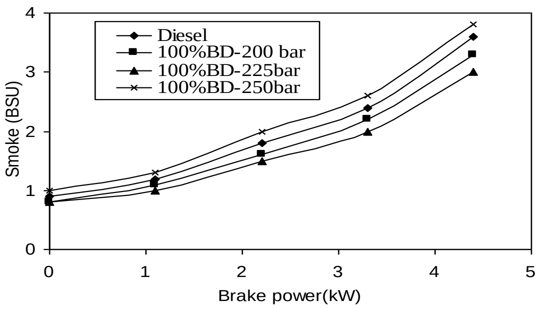


Fig. 7.Difference of Smoke releases among BP.

V. CONCLUSION

Based on the investigational results, the following conclusions were drawn.

a) The Brake thermal effectiveness is enlarged by 2.1% for IP 225 bar for 100% NOME evaluated through extra inoculation pressures.

b) The brake exact fuel utilizations are also reduced for biodiesel owing to elevated inoculation pressures.

c) The CO and Smoke releases are reduced about 30% and 15% for NOME at 225 bar IP.

d) The NO emissions are increased about 6% for NOME at IP 225 bar.

On the entire, it can be finished that the engine is giving improved concert along with more release decreased at Injection Pressure 225 bar with neat NOME fuel.

REFERENCES

1. A. K. Agarwal ,A. Dhar,J. K. Gupta ,W. I. Kim ,K. Choi ,C. S. Lee, S. Park," Effect of fuel injection pressure and injection timing of Karanja biodiesel blends on fuel spray, engine performance, emissions and combustion characteristics", *Energy Conversion and Management*,Vol.91,Feb.2015,pp.302-14.
2. S. V. Channapattana, A. A. Pawar, P. G. Kamble," Effect of injection pressure on the performance and emission characteristics of VCR engine using honne biodiesel as a fuel", *Materials Today: Proceedings,Vol.2,No.4-5,Jan*.2015,pp.1316-25.
3. P. M. Shameer ,K. Ramesh ,R. Purnachandran ,R. Sakthivel ," Effects of injection timing and injection pressure on biodiesel fuelled engine performance characteristics: a review", *Asian Journal of Research in Social Sciences and Humanities,*Vol.7,No.2,2017,pp.310-30.
4. A. B. Ranveer , "Evaluation of biodiesel as a fuel for a diesel engine & analysis of smoke level at different injection pressure", *International Journal of Emerging Technologies and Innovative Research*,Vol.1, No.7,Dec.2014, pg.651-655.
5. A. Pandhare ,A. Padalkar," Investigations on performance and emission characteristics of diesel engine with biodiesel (Jatropha Oil) and its blends", *Journal of Renewable Energy,Vol.*2013,pp.1-11.
6. M. C. Sekhar,V. R. Mamilla,M. V. Mallikarjun,K. V. Reddy ," Production of biodiesel from neem oil", *International journal of engineering studies*,Vol.1,No.4,2009,pp.295-302.
7. A.Aravindkumar,"CFD ANALYSIS OF GAS FLOW BEHAVIOR IN VARIOUSECONOMIZER DUCT", *International Journal of MC Square Scientific Research* ,Vol.6, No.1 Nov 2014,pp.61-65

AUTHORS PROFILE

Sangeetha Krishnamoorthi, Associate Professor, Department of Mechanical Engineering Aarupadai Veedu Institute of Technology, Vinayaka Mission Research Foundation. sangeethas@avit.ac.in

Prof.L.Prabhu, Assoc. Professor, Department of Mechanical Engineering Aarupadai Veedu Institute of Technology Vinayaka Mission Research Foundation

Deepak Mohanan, UG Student Department of Mechanical Engineering, Aarupadai Veedu Institute of Technology, Vinayaka Mission Research Foundation

Harshadev, UG Student Department of Mechanical Engineering, Aarupadai Veedu Institute of Technology, Vinayaka Mission Research Foundation

Nithin Antony, UG Student, Department of Mechanical Engineering, Aarupadai Veedu Institute of Technology, Vinayaka Mission Research Foundation

Retrieval Number: B12111292S419/2019©BEIESP
DOI:10.35940/ijitee.B1211.1292S419

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication