International Journal of Applied
and Natural Sciences (IJANS)
ISSN(P): 2319-4014; ISSN(E): 2319-4022
Vol. 8, Issue 3, Feb - Mar 2019; 55-62

International Academy of Science,
Engineering and Technology
Connecting Researchers; Nurturing Innovations

EXPERIMENTAL INVESTIGATION OF CI ENGINE USING BIO-DIESEL BLEND TO STUDY EMISSIONS UNDER DIFFERENT LOADING CONDITIONS

Bhagyalaxmi. R[1] & S. Kumar[2]

[1]Assistant Professor, Sardarkrushinagar Dantiwada Agricultural University, Palanpur, Gujarat, India

[2]Agroforestry Research Centre, Sardarkrushinagar Dantiwada Agricultural University, Palanpur, Gujarat, India

ABSTRACT

Pollution in the environment is increasing the global warming effect. We are also looking forward for alternative fuel because of increasing the demand and usage of fossil fuel. While using alternative fuel it's also increase in some percentage of emissions and decreases the efficiency. Bio diesel blend using in engine will affects all parameters of the engine like Brake power, emissions, and heat release. But here we are considering only emissions. Here we are also study for which percentage the bio diesel should have optimum value.

KEYWORDS: *Bio Diesel, Emission, Single Cylinder, Diesel Engine, Exhaust Emissions*

Article History

Received: *18 Mar 2019* **|** ***Revised:*** *23 Mar 2019* **|** ***Accepted:*** *27 Mar 2019*

INTRODUCTION

As civilization is growing, transport becomes essential part of life. The biggest problem is the growing population and depletion of fossil fuel. About 100 years ago, the major source of energy shifted from recent solar to fossil fuel (hydrocarbons).technology has generally led to a greater use of hydrocarbon fuels making civilization vulnerable to decrease in supply. This necessitates the search for alternative of oil as energy source. Biodiesel is an alternative fuel for diesel engine. Biodiesel is an alternative fuel for diesel engine. The esters of vegetable oils and animal fats are known collectively as biodiesel. It is a domestic, renewable fuel for diesel engine derived from natural oil like Jatropha oil. Biodiesel has an energy content of about 12% less than petroleum-based diesel fuel on a mass basis. It has a higher molecular weight, viscosity, density, and flash point than diesel fuel. Alternative fuels, other than being renewable, are also required to serve to decrease the net production of carbon dioxide (CO2), oxides of nitrogen (NOx), particulate matter etc. from combustion sources [1]. Diesel engine manufacturers face major challenges to meet emissions norms with high combustion efficiency. Moreover how to decrease fuel consumption has put focus on the automobile industry and forced them to produce engines with new Technology. This has led to development of new combustions systems. Lot of research works are going on to meet the above challenges. Today the diesel engine is one of the most exciting and promising technologies in the hunt for new engine solutions for an increasingly eco-aware and resource efficient world [2].

MATERIAL AND METHODS

The setup consists of single cylinder, four stroke, multi-fuel, research engine connected to eddy type dynamometer for loading. The operation mode of the engine is Diesel. Rota meters are provided for cooling water and

calorimeter water flow measurement. Detailed specifications of the test engine are shown in Table 1.

FUEL DELIVERY SYSTEM

The Fuel from the tank is connected to a solenoid valve. The outlet of the solenoid valve is connected to a glass burette and the same is connected to the engine through a manual ball valve. The fuel solenoid of the tank will remain open until the burette is filled to the high level sensor, during this time the fuel is flowing to the engine directly from fuel tank and also fills the burette. We used 20% blend jetropha biodiesel.

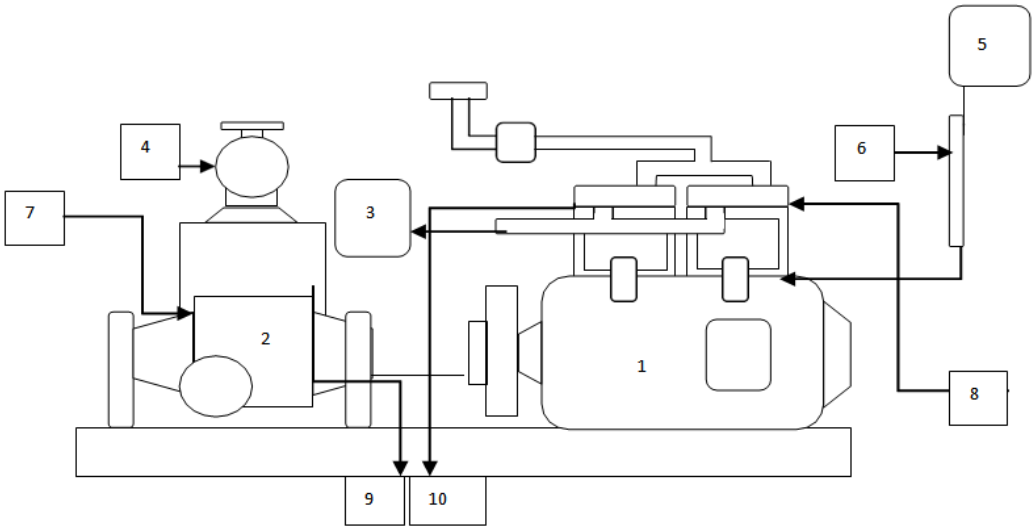

Figure 1: Schematic Diagram of the Experimental Setup

1, Engine, 2. Hydraulic dynamometer, 3. Exhaust Gas Analyzer, 4. Loading Unit, 5. Fuel Tank, 6. Measuring Burette, 7. Inlet water for dynamometer, 8. Inlet water for engine, 9. Water outlet from dynamometer, 10. Water outlet from engine

When the fuel level reaches the high level optical slot sensor, the sequence running in the computer records the time of this event. Likewise when the fuel crosses the low level optical slot sensor, the sequence running in the computer records the time of this event. And immediately the fuel solenoid opens filling up the burette and the cycle is repeated. Here the injection is direct with multi nozzle. The gross calorific value is 9100 Kcal/kg. and the Flash point is 208 Deg.cent where the specific gravity was 0.85 for the jetropha biodesel.

Figure 2: Experimental Set Up

Diesel Combustion VS 20% Bio Diesel Combustion

Combustion in diesel engines is more complex and its detailed mechanisms are not well understood. Its complexity seems to challenge researcher's attempts to release its many secrets despite. Computational power of contemporary computers and the many mathematical models designed to take off combustion in diesel engines because of the complex chemical composition in combustion and other parameters which are not in theoretical but in actual consideretion.

RESULTS AND DISCUSSIONS

Carbon Monoxide(CO)

CO emission is due to improper combustion of fuel and it mainly depends on engine temperature, and A/F ratio [3]. Figure 3 explains variation of CO exhaust emissions for different values are founded for pure diesel, 20% blend jetropha. The CO is in the ppm which was determined with use of the exhaust gas analyzer. For deferent load the values of the CO are different. As we can see from the fig. The CO emission are same for all load for pure diesel and the 20% blend jetropha but at the 7 kg its different for the pure diesel the values of the CO is 0.04 ppm where in the 20% blend the value of the CO is 0.04 ppm where in the 20% blend the value of the CO is reduced its 0.03 ppm.

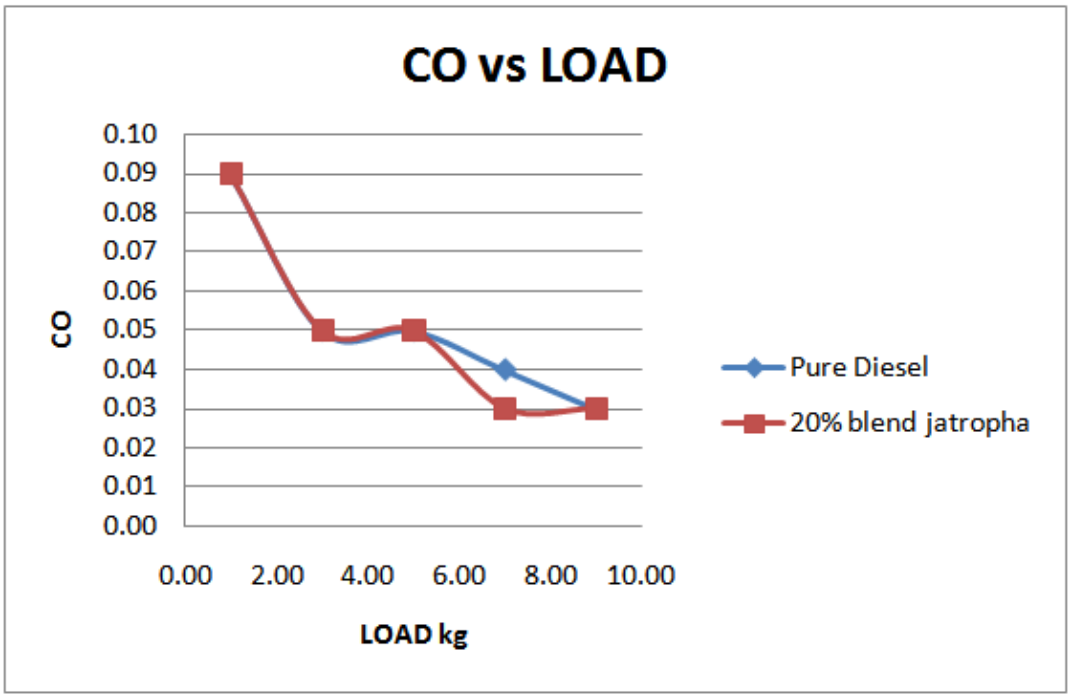

Figure 3

Hc Emissions

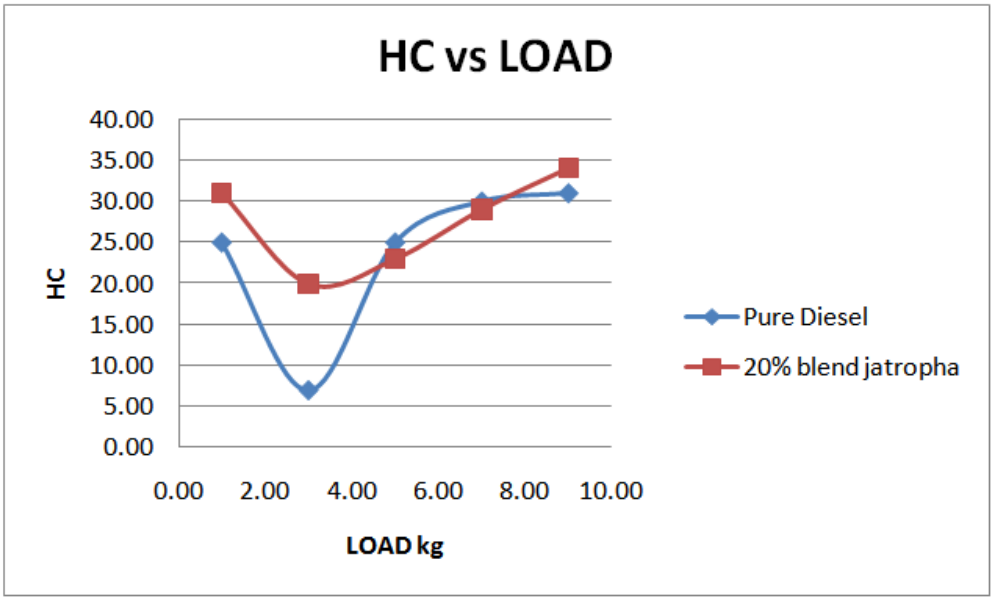

Figure 4

The HC emissions from the experimental taken values are putted into the graph the two types of the different values are founded for pure diesel, 20% blend jetropha. The HC is in the ppm which was determined with the use of gas analyzer. The HC emission first increase the its decrease as shown in the graph.(figure 4). As we can see from the figure.From the graph the HC formation in the combustion process is get higher from load 1 kg and reduced in the 3 kg load.

No_x Emissions

Main factors for NOx are equivalence ratio, oxygen concentration, combustion temperature and time. NOx are produced in cylinder areas where high temperature peaks appeared during the uncontrolled combustion. The NOx from bio-diesel are found greater than petroleum diesel at all load conditions [3].

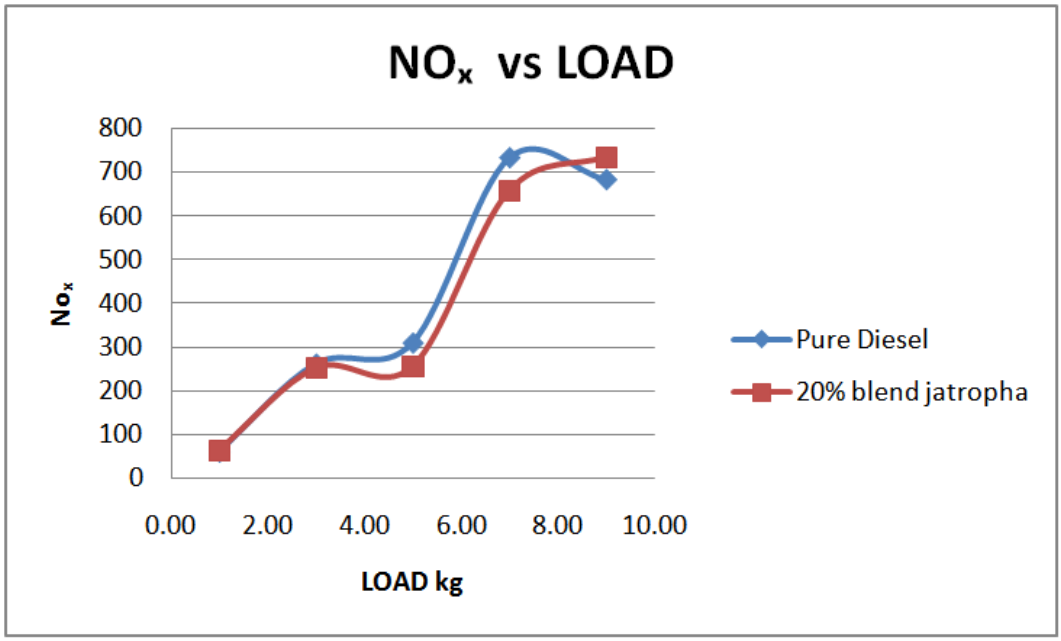

Figure 5

CONCLUSIONS

The diesel engine work with the different blend of biodiesel as we shown from the figures the emission get little more than the regular engine may it have because less calorific value of bio diesel and its works on higher compression ratio there for it is compulsory to design the particular engine which will works with this type of fuels and then we can reduce the emission of the engine. For higher load the engine temperature get higher there for some time it get pre ignition and ignition delay problem the for the unborn carbon contents will get more and it also reduce the engine efficiency. For the emission for reduce the un burn carbon content we can also go for oxygen enrichment process which will gives less emission and higher the efficiency not only the performance but it also help in the increase in thermal efficiency.

REFERENCES

1. *Punit Verma and M.P.Sharma "Performance and Emission characteristics of Bio-diesel Fuelled Diesel engines" Feb,2015.*
2. *Shamal Indulkar,Sayali Dongre and Sachin Waghmare,"Power enhancement using oxygen enriched Air :A critical review" E-ISSN 0976-3945 International Journal of Advanced Engineering Technology.*
3. *Yan Shi, Yong Feng LIU and Shengzhuo Yao,"Simulation study of oxygen enriched cylinder combustion in zero emissions internal combustion engine",5th International conference on Education, Management,Information and medicine, china,EMIM,2015.*

4. *Li, H, Biller,P.Hadavi,SA,Andrews,GE,Lea-Langton and Pryzbyla "Assessing combustion and emission performance of direct use of SVO in a diesel engine by oxygen enrichment of intake air method", 2013*
5. *Dimitris Tziourtzoiumis,Loucas Demetriades,Olympia Zogou,Tassos Stamatelos, "Experimental investigation of effect of a B70 Biodiesel blend on a common rail,passenger Car Diesel engine" GR – 383 34 Volos.*
6. *Heng Wang, Weiun Liu,"Simulation Studies of Diesel engine combunstion Characteristics with oxygen enrichment Air" 31,july,2015*
7. *Sunit Jadhav,S.N.Waghmare,Suraj Dalvi and Vinit Kamble, "Power enhancement using Oxygen Enriched Air for multi cylinder Diesel engine" Vol.3,Issue-4,April-2004*
8. *Katherine O. Blumberg Michael P. Walsh Charlotte Pera "Low-sulfur gasoline & diesel: the key to lower vehicle emissions".*
9. *Mark Z. Jacobson "Control of fossil-fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming". Journal of geophysical research, vol. 107.*
10. *Chien Wang and Ronald G. Prinn "Impact of Emissions, Chemistry, and Climate on Atmospheric Carbon Monoxide: 100-year Predictions from a Global Chemistry-Climate Model"*
11. *Terry L. Ullman "Diesel Emissions Testing" Asian Vehicle Emission Control Conference 2004, Southwest Research Institute.*
12. *Bharath.P, Kamalakkannan.K "Analysis of Brake Thermal efficiency and Oxygen in exhaust using oxygen enriched air in Compression Ignition engine." Department of Automobile engineering, Hindustan University, Chennai, India, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)*
13. *Vipul Jain1, Dipesh Singh Parihar2, Vaibhav Jain3 and Irfan H Mulla "Performance of Exhaust Gas Recirculation (EGR) System on Diesel Engine"*
14. *Varadaraja Setty, "the effect of oxygen-enriched air on the performance and*

a. *Exhaust emissions of internal combustion engines"*

15. *R.Senthilkumara and S.Sivaprakasamb "Performance Combustion and Emission Characteristics on DI Diesel Engine using Bio Additive" International Journal of Engineering and Technology Volume 3 No. 1, January, 2013*
16. *Kuppusamy Rajkumar and Palanisamy Govindaraja "Impact of Oxygen Enriched Air Intake on the Exhaust of a Single Cylinder Diesel Engine" American Journal of Environmental Sciences 7*
17. *Duraid F. Maki, P. Prabhakaran "An Experimental Investigation on Performance and Emissions of a Multi Cylinder Diesel Engine Fueled with Hydrogen-Diesel Blends" ME Department, Faculty of Technology and Engineering, The M. S.University of Baroda.*
18. *Mrs.Charula H. Patel,Mr. Amit B. Solanki,Jignesh V. Khokhani, Dharit K. Dholakiya "Efficiency Improvement of Diesel Engine Pump sets through Oxygen Enrichment by Vacuum Swing Adsorption Method-A Overview" SSRG International Journal of Mechanical Engineering (SSRG-IJME) – volume 1 Issue 7 Nov 2014*

19. *Fredrik Normann, Klas Andersson, Filip Johnsson, Bo Leckner "Reburning in Oxy-Fuel Combustion: a Parametric Study of the Combustion Chemistry" Chalmers Publication Library.*

20. *Gaurav Paul, Ambarish Datta, Bijan Kumar Mandal "An Experimental and Numerical Investigation of the Performance, Combustion and Emission Characteristics of a Diesel Engine fueled with Jatropha Biodiesel" 4th International Conference on Advances in Energy Research 2013, ICAER 2013*

21. *Kazi Mostafijur Rahman, Mohammad Mashud, Md. Roknuzzaman and Asadullah Al Galib, "Bio diesel from jetropha oil as alternative fuel for diesel engine" International journal mechanical & mechatronics engineering IJMME-IJENS VOL-10 NO.03*