International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

Review on Thermal Analysis of Exhaust Gas of variable compression ratio CI Engine Using Diesel-Biodiesel Blend

Vivek Shirsath[1], V.S. Kulkarni[2]

[1]PG Student, Heat Power Engg. MCOERC, Nasik, India
[2]Asst. Professor, Mechanical Department, MCOERC, Nasik, Maharashtra, India

---

Abstract - *Energy is very useful for sustainable development. Decreasing energy sources becomes one of the global issues in front of us therefore it is necessary to find different alternative sources. Fossil fuels are helpful in completing energy needs but burning of fossil fuels leads to pollution. Most of the energy obtained by burning fossil fuels is wasted in to environment. Therefore it is important to analyze that how much variation takes place in exhaust gas expelled from IC engine in various working conditions where fuels are provided in different manner using diesel and biodiesel blend. In this method diesel is blended with different biodiesel to check its performance like brake power, Specific fuel consumption and emission characteristic like CO, HC, NO_x and exhaust gas temperatures.*

Key Words: BP, BSFC, CO, NO_x, Diesel, Biodiesel.

1. INTRODUCTION

An increase of the oil price often leads global and international conflicts. Biodiesel as one promising alternative to fossil fuel for diesel engines has become increasingly important due to environmental consequences of petroleum-fuelled diesel engines and the decreasing petroleum resources. For the upcoming energy crises it becomes necessary to provide attention on the alternative of conventional fuel. To overcome this extra energy due to which this crisis persist and to investigate these substitutes of conventional fuels it is also necessary to examine them in a well manner so that they can fulfill the requirement of energy in an economic way. We know that in IC engine energy supplied in the form of fuel as diesel, petrol etc. out of this energy most of the energy is wasted in the form of heats through different parts of the engine. It is generally observed that engines have efficiencies in the range of 25-30% and remaining is wasted in environment. The heat lost in the environment takes places through exhaust gas about 30% of total energy which increases entire temperature of our atmosphere. Heat lost through exhaust gases is measured in terms of temperature of gases which is measured by temperature sensing device like digital thermometer ,thermocouples etc.

2. LITERATURE REVIEW

S.Gomasta et. al. [1] in 'An Experimental Investigation of Ethanol Blended Diesel Fuel on Engine Performance and Emission of a Diesel Engine.' Studied that the engine is found to run cooler across the range of fuel proportions and load conditions. The reason being, lower calorific value of the fuel used. As the load is increased the exhaust gas temperature is also increased which means the engine is consuming more amount of fuel and same is translated in the BSEC and BSFC curve as well.

M.S.Gad, et. al. [2] in 'Performance of Diesel Engines Burning Used Cooking Oil (UCO) Biodiesel' observed that, Used cooking oil biodiesel can be used as alternative fuel for diesel engines. Used cooking oil biodiesel blends of 10 and 20% were tested in a four stroke, single cylinder, diesel engine at a constant speed of 1500 rpm and variable loads. Diesel- biodiesel blends showed increase in fuel consumption due to the lower heating value of the biodiesel. B20 and B10 showed an increase of 2.6 and 1.4 %, respectively in fuel consumption compared to diesel fuel. Biodiesel blends B20 and B10 showed increase in specific fuel consumption about 2.2 and 1.3%, respectively in comparison with diesel fuel. Biodiesel blends B20 and B10 showed decrease in engine thermal efficiency about 3.5 and 2.5%, respectively in comparison with diesel fuel. At full load, the values of CO2 emissions for diesel, B10 and B20 fuels were 6.5, 6.3 and 6.2, respectively. At full load, the maximum values of HC emission for diesel, B10 and B20 fuels were about 32, 27and 23 ppm, respectively. At full load, the decrease of CO emissions for B20 and B10 in comparison with diesel fuel was about 6 and 18%, respectively. Using neat used cooking oil biodiesel in conventional diesel engine is not recommended. Used cooking oil biodiesel blends can be used up to 20% with diesel fuel without any engine modifications. Performance and emissions of a diesel engine using biodiesel blends up to 20% with diesel fuel were closer to diesel fuel. Used cooking oils are very suitable as low cost feed stocks for biodiesel production. The environment will be cleaned by collecting and recycling these waste oils, human health will be protected and reducing the dependency on fossil fuel resources.

K. Muralidharan and D. Vasudevan [3] in 'Performance, emission and combustion characteristics of a variable compression ratio engine using methyl esters of waste cooking oil and diesel blends' observed that, exhaust gas temperature decreases for different blends when compared to that of diesel. At lower compression ratio 18 the exhaust

gas temperature of the blends are higher compared to that of standard diesel. As the compression ratio increases, the exhaust gas temperature of the various blends is lesser than that of diesel. The highest temperature obtained is 233.48 C for standard diesel for a compression ratio of 21, where as the temperature is only 200.61 _C for the blend B40. The reason for the reduction in exhaust gas temperature at increased compression ratio is due to the lower calorific value of blended fuel as compared to the standard diesel and lower temperature, at the end of compression. Lower exhaust loss may be the possible reason for higher performance.

Suvendu mohanty and Dr. Om prakash [4] in 'Analysis of exhaust emission of internal combustion engine using biodiesel blend' stated that the performance is slightly reduced while brake specific fuel consumption is increased when using biodiesels. Compared with conventional diesel, exhaust emissions of CO and HC are reduced while NO_x emissions are increased with biodiesel and its blends with diesel. Higher temperature of burnt gases in biodiesel fuel helps in preventing condensation of higher hydrocarbon reducing unburnt HC. The higher cetane number of biodiesel results decrease in HC emission due to shorter ignition delay.

S. Oberweis and T.T Al-Shemmeri [5] in 'Effect of Biodiesel blending on emissions and efficiency in a stationary diesel engine' observed that there is a small difference in break specific fuel consumption for different blends at various engine loads. There is a steady increase of temperature with engine load, as expected. It is observed that all the CO_2 emission of diesel fuels is higher than that of the blended fuels. It is observed that the NO_x emission increases directly with increased temperature. Increasing the amount of biodiesel has a proportional effect on the rate of NO_x production. The biodiesel contribution increases the power output and the amount of heat release is higher for increased proportion of biodiesel. The efficiency of electrical output increases with increased engine load. The net utilization factor is significantly higher than the efficiency of the system under single generation mode. Adding the heat exchanger to the system to extract additional heat from the exhaust gases increases the overall efficiency of the system between 15% and 25%.

A.m. liaquat et al. [6] in 'Effect Of Coconut Biodiesel Blended Fuels On Engine Performance And Emission Characteristics' stated that Compared to diesel fuel, engine torque and brake power for biodiesel blends were decreased, mainly due to their respective lower heating values. The BSFC values for biodiesel blends were higher when compared to diesel fuel due to lower heating values and higher densities. In case of engine exhaust gas emissions, HC and CO emissions were reduced whereas, CO_2 and NO_x emissions were increased for CB5 and CB15 when compared to diesel fuel at both engine operating conditions. In comparison with the diesel fuel, biodiesel blends produced lower sound levels due to many factors including increase in oxygen content, reduction in the ignition delay, higher viscosity, lubricity etc.

Gaurav Paul, Ambarish Datta and Bijan Kumar Mandal [7] in 'An experimental and numerical investigation of the performance, combustion and emission characteristics of a diesel engine fueled with jatropha biodiesel' studied that the use of jatropha biodiesel in a conventional diesel engine decreases its torque and brake thermal efficiency, the decrease being more with increase in the biodiesel share in the blends. BSFC increases with the percentage of biodiesel in the blended fuels. Cylinder peak pressure increases and ignition delay period decreases with the increase in biodiesel share in the blended fuels. An increase in the jatropha biodiesel share in the blends reduces the PM and smoke emissions which are primarily due to the complete combustion of the biodiesel, owing to the higher oxygen content in it. The addition of jatropha biodiesel into diesel engine causes higher amount of carbon dioxide at tailpipe. They show that biodiesel can be used as alternative fuel in diesel engine. This may lead to a slight decrease in performance but improves emission significantly which is the call of the day.

Raghavendra Prasada S.A and K V Suresh [8] in 'Pongamia Pinnata (karanja) Biodiesel as an Alternative fuel for Diesel Engine: A Review' stated that all experiments showed improved performance and reduced emission of harmful gases. They concluded that the blends of honge methyl ester with diesel up to 40% by volume could replace diesel for running the diesel engine for getting less emissions without sacrificing the power output and will thus help in controlling air pollution to a great extent. In this paper we study the properties of karanja oil, Biodiesel production process, properties and result of karanja Biodiesel as an alternative fuel for CI engine. Based on this study on karanja biodiesel, we can conclude that the karanja oil can be used as an alternative fuel for diesel engine without any modification.

Mihir J. Patel, Tushar M. Patel and Gaurav R. Rathod [8] in 'Performance Analysis of C.I. Engine Using Diesel and Waste Cooking Oil Blend' observed that the prospect of waste fried oil based fuel production is very attractive for energy conversion in a developing country like India. This type of blend of fuel can directly used in the engine without modification in the engine. As the waste cooking oil concentration increased in the diesel fuel the break thermal efficiency is to be decreased. The break thermal efficiency in the D90B10 blends which is nearest to the diesel fuel. Brake thermal efficiency decreased with all blends when compared

to the conventional diesel fuel. The Specific fuel consumption is increased with the blends when compared to diesel. In the D70B30 blend the fuel consumption is nearest to the diesel fuel. Also the concentration of Waste cooking Oil increased the fuel consumption also increased. The Brake specific energy consumption decreased with increasing load. Mechanical efficiency is high in D80B20 blend as compared to the conventional diesel fuel.

Neelesh Soni and Om Prakash [9] in 'thermal analysis of exhaust gas of compression ignition engine using diesel and WCO biodiesel blend.' stated that temperature of exhaust gas is gradually increasing with power and ranges from 110 °c for B20 to 295°c for B100 for Diesel, B5, B10, B20, B40, B60, B80, and B100. Minimum temperature is taken at no load and maximum temperature taken is at 3000 watt. Fuel consumption ranges from 0.47 kg/hr (for diesel) to 1.34 kg/hr (for B100). They concluded that the temperature of exhaust is minimum (110°C) for B20 blend and maximum (295°C) for B100 for the power variation 0 watt to 3000 watt. Fuel consumption is minimum (0.47 kg/hr) for diesel and maximum (1.34 kg/hr) for B100 for the power variation 0 watt to 3000 watt.

3. SUMMARY

1. Is is possible to use diesel biodiesel blend in diesel engine without many engine modifications.

2. It is observed that CO_2 and NO_x emission increases with increase in biodiesel blend in diesel fuel.

3. The Brake specific fuel consumption increases with increase in concentration of ethanol and biodiesel blend in diesel fuel.

4. The emission like HC and CO decreases with biodiesel blend in diesel fuel.

5. While it is observed that there is slight decrease in brake power when running with diesel-biodiesel blend as compared to fully diesel running engine.

ACKNOWLEDGEMENT

I would like to take this opportunity to express my honor, respect deep gratitude and genuine regard to my project guide Prof. V.S.Kulkarni for giving me all guidance and technical support required at each and every step. I am also thankful to Prof.J.H.Bhangale (Head of Department).I am thankful to all staff members of Mechanical department and my friends for giving me the helping hand.

REFERENCES

[1] S. Gomasta and S.K. Mahla, An Experimental Investigation of Ethanol Blended Diesel Fuel on Engine Performance and Emission of a Diesel Engine, International Journal on Emerging Technologies (2012) pp.74-79.

[2] M.S.Gad, F. K. El-Baz and O. S. El. Kinawy, Performance of Diesel Engines Burning Used Cooking Oil (UCO) Biodiesel, International Journal of Mechanical & Mechatronics Engineering IJMME-IJENS Vol:15 pp.74-80.

[3] K. Muralidharan, D. Vasudevan, Performance, emission and combustion characteristics of a variable compression ratio engine using methyl esters of waste cooking oil and diesel blends, Applied Energy 88 (2011) pp.3959–3968.

[4] Suvendu Mohanty, Dr. Om prakash, Analysis Of Exhaust Emission Of Internal Combustion Engine Using Biodiesel Blend, Volume 3, Issue 5, May 2013.

[5] S. Oberweis, T.T Al-Shemmeri, Effect of Biodiesel blending on emissions and efficiency in a stationary diesel engine, International Conference on Renewable Energies and Power Quality.

[6] A.M. Liaquat, H.H. Masjuki, M.A. Kalam, I.M. Rizwanul Fattah, M.A. Hazrat, M. Varman, M. Mofijur, M. Shahabuddin, Effect of coconut biodiesel blended fuels on engine performance and emission characteristics, Procedia Engineering 56 (2013) pp.583 – 590.

[7] 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, Energy Procedia 54 (2014) pp.455 – 467.

[8] Mihir J. Patel, Tushar M. Patel, Gaurav R. Rathod, Performance Analysis of C.I. Engine Using Diesel and Waste Cooking Oil Blend, IOSR Journal of Mechanical and Civil Engineering, Volume 12, Issue 2 Ver. VI (Mar - Apr. 2015), pp. 27-33.

[9] Neelesh Soni, Om Prakash, Analysis Of Exhaust Emission Of Internal Combustion Engine Using Biodiesel Blend, International Journal of Emerging Technology and Advanced Engineering, Volume 3, August 2013, pp.614-619.