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A SURVEY PAPER ON THE PERFORMANCE, EMISSION AND COMBUSTION OF IC ENGINE WITH KARANJA OIL BIO-DIESEL

Anil Kumar[1], Dr. M.K Chopra[2]
[1]M.Tech (Thermal), Assistant Professor, MBIT engineering college, Forbesganj araria Bihar
[2]Vice Principal Dean Academic & HOD, RKDF College Bhopal

Abstract: The diesel engine is a major tool in the day-to-day life of modern society. It powers much of our land and sea transport, provides electrical power, used for farming, construction and industrial activities. The fossil fuel scarcity and pollutant emissions from diesel engines have become two important problems of world today. One method to overcome the crisis is to find suitable substitute for the petroleum based fuels. Bio fuels have been gaining popularity recently as an alternative fuel for diesel engines. Bio fuels are derived from biomass, and are renewable either through agricultural processes or biological waste generation. Bio fuels can be used in any diesel engine, usually without any modifications. It boasts a reduction in toxic emissions (except NOx emissions) compared to diesel fuel. In India million tonnes non edible seeds are going in waste. Utilizing these seeds as an alternative fuel source will reduce the consumption of conventional fuels. The overall objective is to prevent waste, increase the value recovery of resource as bio fuel and minimize the amount of waste going for disposal.
Keyword: Bio fuels, petroleum fuels

I. INTRODUCTION

Energy is one of the major sources for the economic development of any country. India being a developing country requires much higher level of energy to sustain its rate of progress. According to the International Energy Agency (IEA), hydrocarbons account for the majority of India's energy use. Together, coal and oil represent about two-thirds of total energy use. Natural gas now accounts for a seven percent share, which is expected to grow with the discovery of new gas deposits. India had approximately 5.7 billion barrels of proven oil reserves as of January 2011, the second-largest amount in the Asia-Pacific region after China. The combination of rising oil consumption and relatively flat production has left India increasingly dependent on imports to meet its petroleum demand.To combat the present energy crisis, one of the important strategies need to be adopted is to develop and promote appropriate technology for utilizing non-traditional energy resources to satisfy energy requirements.Hence to overcome all these problems most combustion devices are modified to adapt gaseous fuels in dual fuel mode.

BIODIESEL AS DIESEL SUSTITUTE

For substituting the petroleum fuels used in internal combustion engines, fuels of bio-origin provide a feasible solution to the twin crises of 'fossil fuel depletion' and 'environmental degradation'. For diesel engines, a significant research effort has been directed towards using vegetable oils and their derivatives as fuels. In India, attempts are being made for using non-edible and under-exploited oils for production of esters. Several research institutions are actively pursuing the utilization of non-edible oils for the production of Bio-diesel, additives for lubricating oils, saturated and unsaturated alcohols and fatty acids and many other value added products. Biodiesel has received a good response worldwide as an alternative fuel to diesel. Biodiesel is a cleaner burning fuel because of its own molecular oxygen content. Again in place of diesel, biodiesel can be substituted as the pilot fuel in the dual fuel due to the diminishing reserves of petroleum fuels and rising awareness for protecting our environment. Biodiesel is produced by Transesterification process which involves a chemical reaction between an alcohol and triglyceride of fatty acid in the presence of a suitable catalyst leading to the formation of fatty acid alkyl esters (biodiesel) and glycerol. Biodiesel's viscosity is much closer to that of the diesel fuel than vegetable oil. Although biodiesel has many advantages over diesel fuel, there are several problems needs to be addressed such as its lower calorific value, higher flash point, higher viscosity, poor cold flow properties, etc. This can lead to the poor atomization and mixture formation with air that result in slower combustion, lower thermal efficiency and higher emissions.

II. ADVANTAGES OF USE OF BIODIESEL IN VCR ENGINE

It is renewable since it is produced from vegetable oils or from animal tallow. So adequate amount of biodiesel can be provided by cultivating the seeds of different vegetable oil plant.

- It is non-toxic. It does not contain sulphur and any aromatic compounds, but contains 10% to 11% oxygen.
- The use of biodiesel reduces CO, HC and smoke emission from the engine. The emission reduces due to the oxygen content of biodiesel.
- It can be used CI engine by blending with diesel or it can also be directly used in the engine without any engine modification.
- It has a higher flash point than diesel fuel hence it is less volatile, and is safer to store and transport the fuel.
- It has good lubricant properties with respect to petroleum diesel.

III. LITERATURE SURVEY ON BIO FUEL

Varuvel et al. [1] Compared the performance, combustion and emission characteristics of a single cylinder four stroke compression ignition engine fuelled with oil produced from waste fat .The brake thermal efficiency of neat bio fuel is 32.4% at 80% load which was veryhigh compared to neat diesel (29.98%). The combustion duration and ignition delay were decreased with neat bio fuel due to high oxygen content and high cetane number of bio fuel. The main problem with the use of neat bio fuel in diesel engine was high NOx emissions at all loads. Addition of diesel with bio fuel reduced the NOx emissions significantly from 917 ppm to 889 ppm at 80% load with an optimum blend of B80D20.

Swaminath et al.[2] Studied the performance and emission of single cylinder four stroke diesel engine using biodiesel(fish oil) at a constant speed 1500 rpm. Fuel was blended with oxygenate and EGR technique was also used to improve the performance. He found there is increased in break thermal efficiency. The percentage reduction was CO-91% ,CO2-62%,NOx-92% and CxHy-90% were attained when the engine was run at maximum load using BFOwith2%additive with EGR and there was reduction in all the percentages when the engine was run in other loads also. In the case of NOx, there was an increase of this emission by about 48%in the maximum load with BFO when compared with diesel, for obvious reasons and that was also reduced because of the addition of oxygenates and EGR.

K. Muralidhran et al.[3] studied the performance, emission and combustion of VCR engine using methyl esters of waste cooking oil and its blends with standard diesel in a compression ignition engine. Experiments were carried out for diesel, B20, B40, B60, B80. Maximum brake thermal efficiency for B40 at full load was found to be 4.1% higher than diesel. Brake specific fuel consumption of the blends B20, B40 at full load was found to be lower than diesel. Exhaust temperatures of blends were lower than diesel. Combustion pressure of B40 was found to be higher than that of diesel.From the analysis of exhaust emission of the blends, it was found that the hydrocarbon emissions of various blends were higher at higher loads except B20. The NOx emission for biodiesel and its blends was higher than that of standard diesel except B40 at lower loads. The CO emission of the blend B40 was closer to that of standard diesel and it was found to be higher for light and medium load.

K.Muralidhran et al.[4] studied the performance, emission and combustion of VCR engine using methyl esters of waste cooking oil and its blends with standard diesel at varying compression ratio and engine loading at a constant speed .Brake thermal efficiency of blend B40 was higher than that of diesel at higher compression ratio. The specific fuel consumption of B40 was lower than that of all other blends and diesel. Exhaust gas temperature of blends was found to be lower than diesel. Combustion pressure of waste cooking oil was found to be higher than diesel. The hydrocarbon emission of various blends was higher at higher compression ratios. The increase in compression ratio increases the HC emission for blend B40. The emission of oxides of nitrogen (NOx) from the waste cooking oil blend B40 is higher than that of diesel. The CO emission of the blend B40 is closer to the standard diesel and it is very higher at compression ratio. The CO_2 emission is also lesser at the same conditions.

Jindal et al. [5] studied that the effects of the engine design parameters viz. compression ratio and fuel injection pressure on the performance with regard to parameters such as fuel consumption, brake thermal efficiency and emissions of CO,CO_2,HC(hydrocarbon), NOx and Smoke opacity with Jatropha methyl ester as fuel. It is found that the combined increase of compression ratio and injection pressure increases the brake thermal efficiency and reduces brake specific fuel consumption while having lower emissions.

Saravanan et al. [6] studied that the combustion characteristics of a stationary diesel engine fuelled with a blend of crude rice bran oil methyl ester and diesel. It was observed that the delay period and the maximum rate of pressure rise for crude rice bran oil methyl ester blend were lower than those of diesel. The occurrence of maximum heat release rate advanced for crude rice bran oil methyl ester blend with lesser magnitude when compared to diesel. This investigation ensures that the suitability of crude rice bran oil methyl ester blend as fuel for CI engines with higher fuel cost.

PremAnand et al. [7] calculated the combustion performance and exhaust emission
Characteristics of turpentine oil fuel blended with conventional diesel fuel in a diesel engine.

YousefHeik et al. [8] carried out an experimental study to use raw Algae oil and its methyl esters in a Ricardo E6 variable compression ratio engine. Effects of engine speed, engine load output, injection timing of the algae bio fuel and engine compression ratio on the engine output torque, combustion noise(maximum pressure rise rate), maximum pressure and maximum heat release rate have been studied. However, its use reduced the engine output torque slightly and increased the combustion noise. The engine output can be increased and the combustion noise canbe reduced by controlling the engine design parameters e.g. injection timing and compression ratio.

Kalam et al. [9] evaluated the emission and performance characteristics of a multi-cylinder diesel engine operating on waste cooking oil such as 5% palm oil with 95% ordinary diesel fuel and 5% coconut oil with 95% ordinary diesel fuel. B0 was used for comparison purposes. The results shows that there are reductions in brake power of 1.2% and 0.7% and reduction of exhaust emissions such as unburned hydrocarbon (HC), smoke, carbon mono-oxide(CO), and nitrogen oxides (NOx) is offered by the blended fuels.

Mani et al. [10] studied the effect of using waste plastic oil and diesel blends in compression ignition engine. It is observed that the engine could operate with 100% waste plastic oil and can be used as fuel in diesel engines. Oxides of nitrogen (NOx) was higher by about 25% and carbon monoxide (CO) increased by 5% for waste plastic oil operation compared to diesel fuel operation. Hydrocarbon was higher by about 15%. Smoke increased by 40% at full load with waste plastic oil compared to diesel. Engine fuelled with waste plastic oil exhibits higher thermal efficiency up to 80% of the full load and the exhaust gas temperature was higher at all loads compared to diesel fuel operation.

Gumus and Kasifoglu[11] studied the performance and emissions of a compression ignition diesel engine without any modification, using neat apricot seed kernel oil methyl ester and its blends with diesel fuel and found that lower concentration of apricot seed kernel oil methyl ester in blends give a better improvement in the engine performance and exhaust emissions.

IsmetCelikten et al. [12] compared the performance and emissions of diesel fuel from rapeseed and soybean oil methyl esters injected at different pressures (250,300 and 350 bar). It has been found that the torque and power of diesel fuel engine reduced with increasing injection pressure. Smoke level (%) and CO emission also reduced while NOx emission increased as the injection pressure is increased.

Raheman and Ghadge[13] studied the performance of Ricardo E6 engine using bio diesel obtained from mahua oil (B100) and its blend with high speed diesel at varying compression ratio, injection timing and engine loading. The brake specific fuel consumption and exhaust gas temperature increased, whereas brake thermal efficiency decreased with increase in the proportion of bio diesel in the blends for all compression ratios (18:1–20:1) and injection timings (35–45_ before TDC). The authors concluded that, bio diesel could be safely blended with HSD up to 20% at any of the compression ratio and injection timing tested for getting fairly accurate performance as that of diesel.

IV. CONCLUSION

The performance, emission and combustion characteristics of a dual fuel variable compression ratio engine with Karanja oil bio-diesel and diesel blends have been investigated and compared with that of diesel. The experimental results confirm that the BTE, SFC, exhaust gas temperature, mechanical efficiency and torque of variable compression ratio engine, is a function of bio diesel blend, load and compression ratio. For the similar operating conditions, engine performance reduced with increase in bio-diesel percentage in the blend. However by increasing the compression ratio the engine performance varied and it becomes comparable with that of diesel.

REFERENCE

[1] VaruvelEG, MradN, TazeroutM, Aloui F. Experimental analysis of bio fuel as an alternative fuel for diesel engines. Applied Energy 2015; 94: 224-231.

[2] Swaminathan C, Sarangan J.Performance and exhaust emission characteristics of a CI engine fueled with biodiesel (fish oil) with DEE as additive. Biomass and bio energy 2015; 39:168-174

[3] Muralidharan K, Vasudevan D, SheebaK. N. Performance, emission and combustion characteristics of biodiesel fuelled variable compression ratio engine. Energy 2015; 36:5385-5393.

[4] MuralidharanK, Vasudevan D. Performance, emission and combustion characteristics of a variable compression ratio engine using methyl esters of waste cooking oil and diesel blends. Applied Energy 2014; 88:3959-3968.

[5] Jindal S,Nandwana BP, RathoreNS, VashisthaV. Experimental investigation of the effect of compression ratio and injection pressure in a direct injection diesel engine running on Jatropha methyl ester. Applied Thermal Engineering 2014; 30:442-8.

[6] Saravanan S, Nagarajan G, Lakshmi NarayanaRao G, Sampath S. Combustion characteristics of a stationary diesel engine fuelled with a blend of crude rice bran oil methyl ester and diesel. Energy 2014; 35:94-100

[7] PremAnand B, Saravanan CG, AnandaSrinivasan C. Performance and exhaust emission of turpentine oil powered direct injection diesel engine. Renewable Energy 2014;35:1179-84

[8] HaikYousef, Selim Mohamed YE, Abdulrehman Tahir. Combustion of algae oil methyl ester in an indirect injection diesel engine. Energy 2014; 36:1827-35.

[9] Kalam MA, Masjuki HH, Jayed MH, Liaquat AM. Emission and performance characteristics of an indirect ignition diesel engine fuelled with waste cooking oil. Energy 2015; 36:397-402.

[10] Mani M, Nagarajan G, Sampath S. Characterisation and effect of using waste plastic oil and diesel fuel blends in compression ignition engine. Energy 2015; 36:212-9.

[11] Gumus MA. Comprehensive experimental investigation of combustion and heat release characteristics of a biodiesel (hazelnut kernel oil methyl ester) fueled direct injection compression ignition engine. Fuel 2014; 89:2802-14.

[12] CeliktenIsmet, KocaAtilla, Arslan Mehmet Ali. Comparison of performance and emissions of diesel fuel, rapeseed and soybean oil methyl esters injected at different pressures. Renewable Energy 2015; 35:814-20.

[13] A.S. Ramadhas, C. Muraleedharan, S. Jayaraj, Performance and emission evaluation of a diesel engine fueled with methyl esters of rubber seed oil, Renewable Energy 30 (2014) 1789–1800.

[14] Arul MozhiSelvan V, Anand RB, Udayakumar M. Combustion characteristics of Diesel using bio diesel as an additive in a direct injection ignition engine under various compression ratios. Energy & Fuels 2014 ; 23:5413-22.

[15] Satyanarayana M, Muraleedharan C.A comparative study of vegetable oil methyl esters (biodiesels). Energy 2014; 36:2129-37.

[16] Devan PK, Mahalakshmi NV. Study of the performance, emission and combustion characteristics of a diesel engine using poon oil e based fuels. Fuel Processing Technology 2015;90:513-9

[17] Ramadhas AS, Muraleedharan C, Jayaraj S. Performance and emission evaluation of a diesel engine fueled with methyl esters of rubber seed oil. Renewable Energy 2014; 30:1789–800.

