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Effects of Exhaust Gas Recirculation and Linseed Biodiesel Blend on Performance and Emission in Constant Speed Diesel Engine

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Abstract :- The basis of attractive up a major programmer for the production of bio-fuels for blending with gasoline and diesel in our country emanates from a variety of factors. First, there is no alternative to the petroleum based fuels i.e., motor spirit or gasoline and constant Speed Diesel for the transport sector which is the major consumer of petroleum products. Secondly, bio-fuels are environmentally superior fuels and their use becomes compelling if the prescribed emission norms are to be achieved. Also there is need to meet the global environmental concern about climate change, ensure energy security, reduce imports, generate employment for the poor and achieve a number of other objectives. India has limited reserve of petroleum based fuel. To control air getting polluted by engine exhaust stringent emission norms are to be followed. These reasons have forced us to find suitable alternate fuels.

•Biofuel has come as another option to be used with diesel to get optimum result while achieving considerable decreases in the cost effectiveness etc. but only when prescribed emission norms are to be achieved.

•Besides; there is a need for such biofuels which are having specific quality for helping in reduction of pollution and controlling environmental condition. India has limited reserve of petroleum based fuel.

•To control air getting polluted by engine exhaust, stringent emission norms are to be followed. These reasons have forced us to find suitable alternate fuels with reduced harmful gas emissions, specially NOx

•Sadly, the fresher diesel engine design couldn't keep running on conventional vegetable oils, because of the much higher consistency of vegetable oil contrasted with petroleum diesel fuel.

Rising fuel price, continuous addition of on road vehicles, fast depleting petroleum resources, continuing accumulation of greenhouse gases are the main reason for the development of alternative or blended fuels. Many alternative or blend fuels are identified and tested in the existing engine with and without engine modification. Research is still continuing in this field to find the best alternative fuel for the existing diesel fuel.

The blend of linseed oil and diesel improve the engine performance and emission characteristics. The properties of the linseed oil are comparable to diesel. Therefore we can say that the linseed oil has ability to blend with diesel in diesel engines. The main purpose of this project is to find out alternative fuel for diesel. The blend of linseed and diesel improve the engine performance and emission characteristics. The properties of the linseed are comparable to diesel. Therefore we can say that the linseed oil has ability to blend with diesel in diesel engines Effects of Diesel linseed oil blend are known for adverse NOx emissions. In present work, using blend of Diesel and linseed and to find out the most economical blend which gives improved performance and emission characteristics with help of Exhaust gas recirculation.

[1] S.Bari et al (2002)

In this paper, the research is done on has taken crude palm oil for the alternative fuel of diesel. He found that the viscosity of crude palm oil (CPO) at room temperature has been 10 times higher than that of diesel. To reduce this viscosity up to comparable to diesel viscosity, heating temperature of 92˚C is needed.

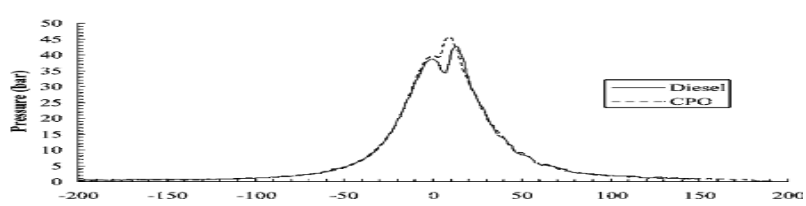

Fig-2.3 . Pressure vs. Crank angle diagram for combustion of CPO and Diesel

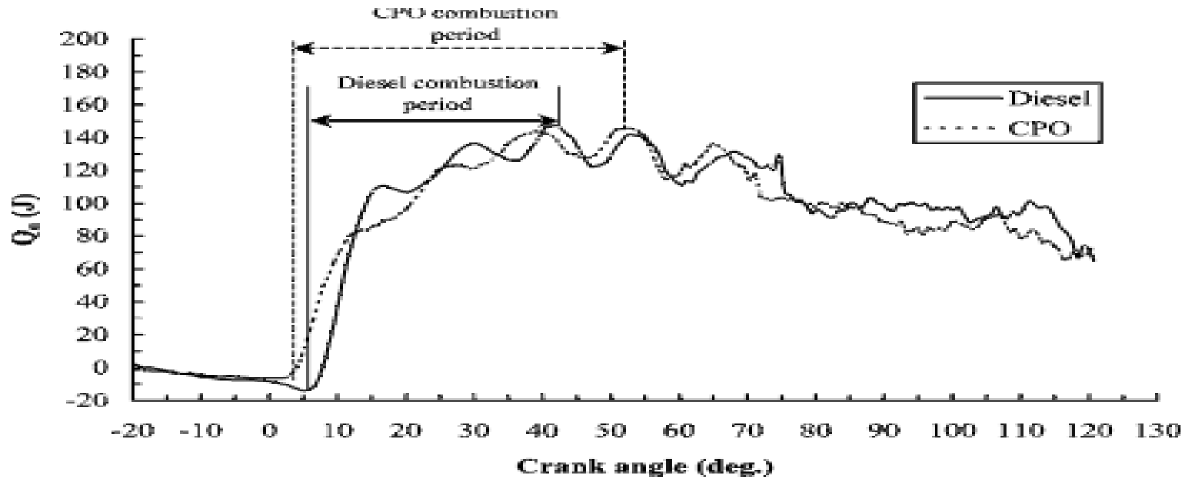

Fig-2.4. Net Heat Release Rate for Combustion of CPO and Diesel

The comparison of CPO and diesel found that CPO produced a higher peak pressure of 6 %(in fig-2.3) and longer combustion period (in Fig.-2.4).also, CPO combustion produced emission of CO and NOX were 9.2 and 29.3%, respectively.

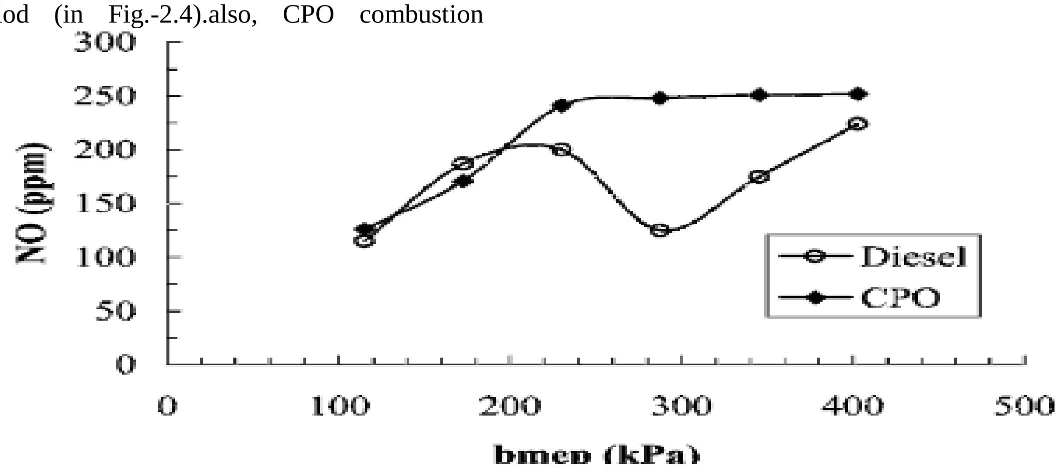

Fig-2.6. NOX emission for combustion of CPO and Diesel

[2] A.S. Ramadhas et al (2005)

The research on using bio-diesel was taken an experimental investigation on the effects of using pure rubber seed oil, diesel and biodiesel are used as fuels in the diesel engine and the performance and characteristics of the engine were analyzed.

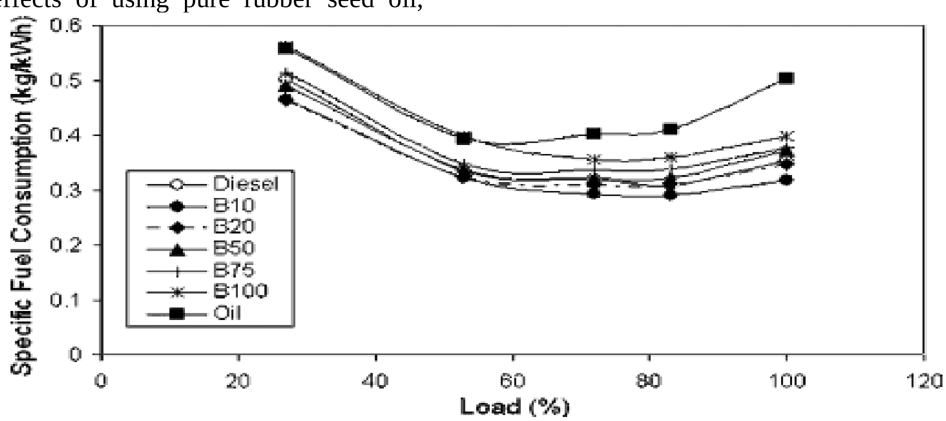

Fig 2.7. Specific Fuel Consumption vs. Load for the Combustion of Pure Rubber Seed Oil, Diesel and Biodiesel

[4] D.H.Qi et al (2009)

The paper represented by and they evaluate the effect of using blends of soybean crude oil with diesel fuel on the performance of a diesel engine. The fuel properties of biodiesel are slightly different from those of diesel. The viscosity of biodiesel is evidently higher than that of diesel, especially at low temperatures. The specific gravity of the biodiesel is approximately 6.1% higher than that of diesel. The flash point is higher than that of diesel. Due to the different properties of biodiesel and diesel, both fuels exhibit different combustion characteristics with the variation of engine loads. At lower engine loads, the peak cylinder pressure, the peak rate of pressure rise and the peak heat release rate are slightly higher for biodiesel. At higher engine loads, the peak cylinder pressures for both fuels are almost same, but the peak rate of pressure rise and peak heat release rate are lower for biodiesel. The crank angles at which the peak values occur are in advance for biodiesel. Combustion for biodiesel starts earlier owing to a shorter ignition delay and advanced injection time at all engine loads. The power output for biodiesel is almost the same as that for diesel under speed characteristic at full load. The BSFC for biodiesel is higher than that for diesel. The higher fuel consumption reflects its lower heating value. Both fuels give nearly identical BSEC.

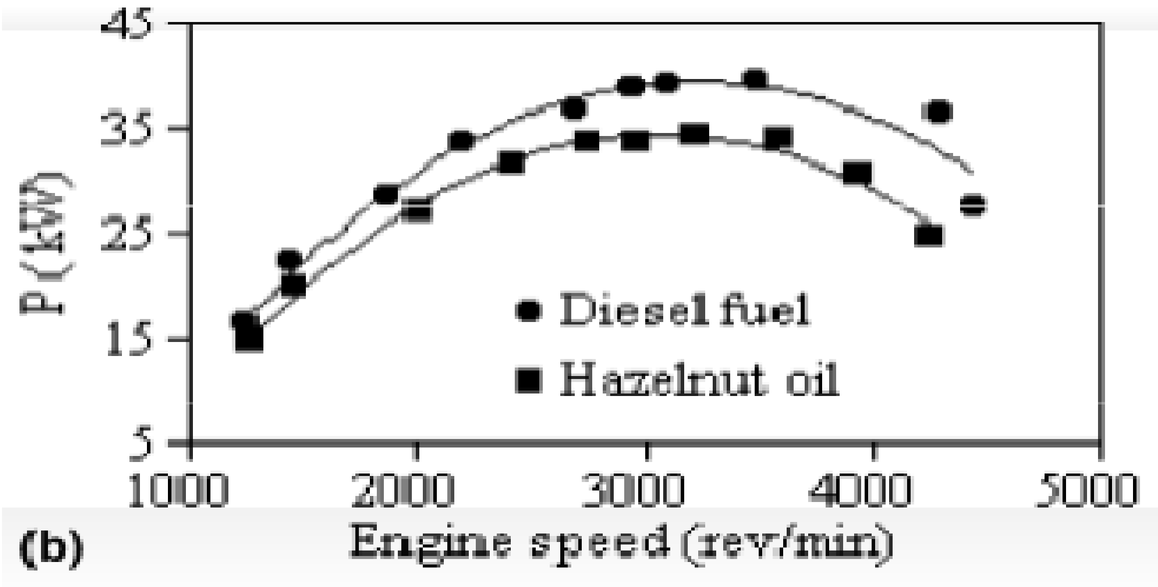

Fig 2.9. Engine Power vs. Engine Speed for Hazelnut Oil and Diesel

[5] Sharanappa Godiganur et al (2009)

In this paper, were taken the blend like 20%, 40%, 60%and 100% biodiesel with diesel for heavy duty diesel engine. The brake specific fuel consumption for Cummins engine for different load as shown in Fig.-2.13.the BSFC was obtained higher in the blend of B100.The calorific value of biodiesel was lower compared to diesel. This is the main reason for BSFC for other blends was higher than compared to diesel. The variation in brake specific energy consumption for different load as shown in fig-2.8.in all cases it decreases sharply with increasing in percentage load for all fuels. The BSEC for B20 blend was observed lower than diesel. Other blend like B40, B60 and B100 the BSEC was higher than diesel.

[6] P.K. Devan et al (2009)

In their study**,** taken a blend of 50% methyl ester of paradise oil and 50% eucalyptus oil and evaluating its effect on the performance. The results show a 49% reduction in smoke, 34.5% reduction in HC emissions and 37% reduction in CO emissions for the Me50–Eu50 blend with a 2.7% increase in NOx emission at full load. There was a 2.4% increase in brake thermal efficiency for the Me50–Eu50 blend at full load. The combustion characteristics of Me50–Eu50 blend are comparable with those of diesel. From the combustion analysis it was found that the performance of the Me50–Eu50 blend was as good as that of diesel. Taking these facts into account, a blend of 50% methyl ester of paradise oil and 50% eucalyptus oil can be used as an alternative suitable fuel in DI diesel engines.

[7] H. Sharon et al (2012)

In this paper was investigated experimentally the performance and exhaust emission characteristics of a diesel engine. Biodiesel produced from used palm oil was blended with diesel by different volume proportions.

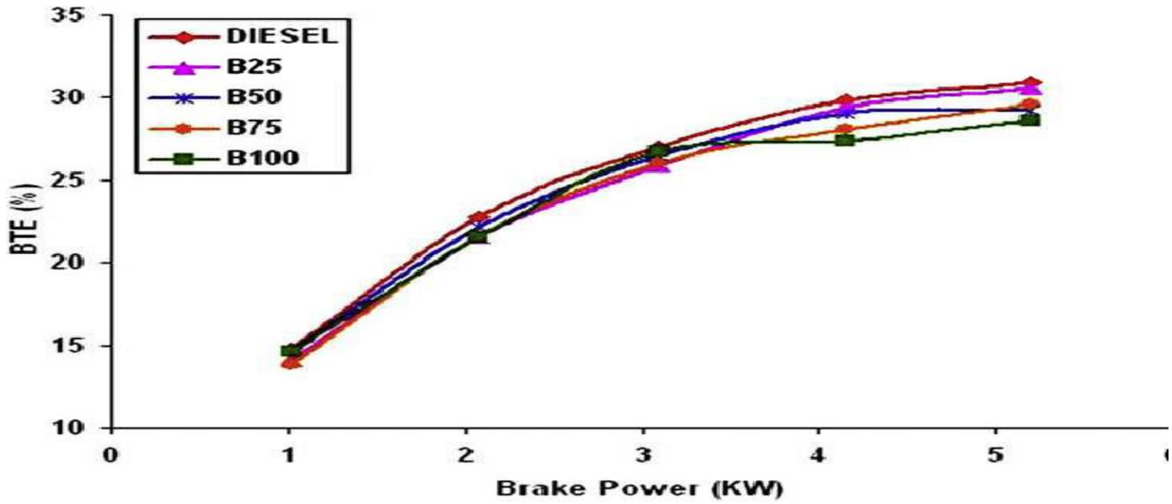

Fig 2.12. Brake thermal efficiency vs. brake power for combustion of palm oil and diesel

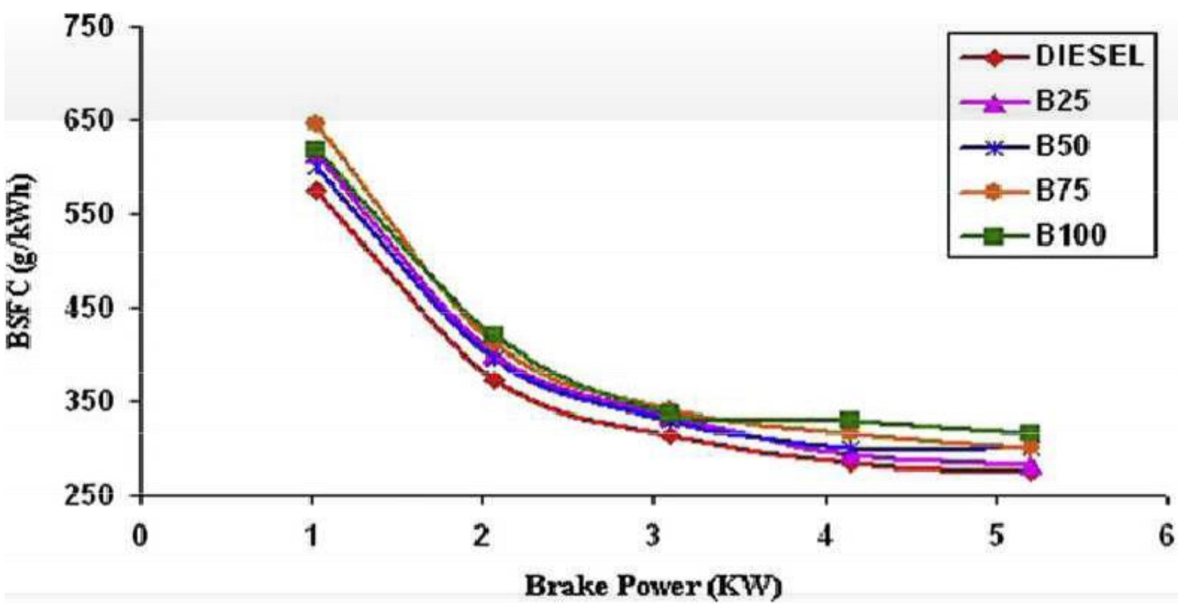

Fig 2.13. Brake specific fuel consumption vs. brake power for combustion of palm oil and diesel

In Fig 6 and Fig 7 we show the BTE and BSFC vs. BP for test fuels. Biodiesel produced from used palm oil and its blends with diesel showed positive results on performance, emission and combustion while tested on a DI diesel engine. The fuel properties of the biodiesel produced used palm oil were within ASTM standards. B25 and B50 showed better performance. B75 showed huge reductions in emissions. Ignition delay was lower for biodiesel and their blends. B50 produced peak cylinder pressure. No knocking problem was sensed during the entire test.

The results Obtained during the test confirmed that biodiesel from used palm oil and its blends could be used as a fuel in DI diesel engine.

[8] Murat Karabektas et al (2009)

In this paper, using isobutene–diesel fuel blends were investigated and compared to those with baseline diesel fuel. The blends containing 5, 10, 15 and 20% isobutene were prepared and tested in a direct injection diesel engine. Isobutene was mixed with diesel fuel easily and homogenous blends were achieved. Moreover, no phase separation was observed with all of the blends. The break power with all of the isobutene–diesel fuel blends decreased mainly due to the lower energy content of isobutene. Operating conditions; smoke emissions decreased with ethanol–diesel blended fuel, especially with E10–D and E15–D.CO and NOx emissions reduced for ethanol– diesel blends, but THC increased significantly when compared to neat diesel fuel.

[9] Ismet Sezer et al (2011)

In their study, the use of dimethyl ether and diethyl ether as alternative fuels in a diesel engine are investigated by means of a thermodynamic diesel engine cycle model. Engine performance decreases and specific fuel consumption increases for dimethyl ether and diethyl ether in case of the same fuel injection rate due to lower heating values of these alternative fuels so the decrements in brake power at 4200 rpm are about 32.1% and 19.4% and also the increments in brake specific fuel consumption at 2200 rpm are about 47.1% and 24.7% for dimethyl ether and diethyl ether, respectively.

However, brake thermal efficiency of dimethyl ether and diethyl ether is better than or close to diesel due to their favorable combustion characteristic. Improvements in engine performance, brake thermal efficiency and brake specific fuel consumption are gained by both dimethyl ether and diethyl ether for the same equivalence ratio conditions while amount of fuel injection of the alternative fuels increases about 64% for dimethyl ether and 32% diethyl ether due to their lower Stoichiometric air fuel ratio.

The gains obtained are about 13.6% and 6% in brake power at 4200 rpm, 5.1% and 1.1% in brake thermal efficiency at 2200 rpm for dimethyl ether and diethyl ether respectively compared to diesel. However, brake specific fuel consumption is still higher about 43.5% for dimethyl ether and 23.6% for diethyl ether than diesel.

In brief, a large amount of dimethyl ether and diethyl ether is injected in order to maintain the same power output so some modification is required in fuel injection system. On the other hand, oxygen content of these alternative fuels improves the combustion process making it more complete. Thus, generally lower pollutant emissions are emitted with these fuels.

[10] Ismet Sezer et al (2011)

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I. CONCLUSIONS

Both EGR and biodiesel have increased the specific fuel consumption (SFC).

Linseed oil has lower oxidative stability and linseed oil esters have better stability compared to the linseed oil.

Other emissions such as CO and HC also found to have decreased simultaneous with the use of

biodiesel fuel.

An experimental setup was developed to measure the combine effect of increasing inlet air pressure and EGR system on engine performance and emission like brake thermal efficiency, brake specific fuel consumption, NOx, CO, CO_2 and HC. From the result following conclusion has been derived.

It was found from the experiment that combined effect of increasing inlet air pressure attachment and EGR system provided better result on engine performance. BSFC decreases and brake thermal efficiency increases by increasing inlet air pressure with EGR system than individual EGR system.

Combined effect of increasing inlet air pressure attachment and EGR system is also more beneficial way to reduce significantly NOx emission than individual EGR system because NOx is reduced as the combustion temperature decreases.

The increase in CO, HC, and CO_2 emissions can be reduced by using exhaust after-treatment techniques, such as diesel oxidation catalysts (DOCs) and soot traps.

References

[1]. Silvio C.A. De Almeida, Carlos Rodrigues Belchior, Marcos V.G. Nascimento, Performance of a diesel generator fuelled with palm oil. Fuel 81 (2002) 2097-2102.

[2]. M.Husnawan, H.H. Masjuki, T.M.I. Mahlia , M.G. Saifullah, Thermal analysis of cylinder headcarbon deposits from single cylinder diesel engine fueled by palm oil{diesel fuel emulsions. Applied Energy 86 (2009) 2107-2113.

[3]. Pedro Benjumea, John Agudelo , Andre 's Agudelo, Basic properties of palm oil biodiesel{diesel blends. Fuel 87 (2008) 2069-2075.

[4]. I.M. Rizwanul Fattah , H.H. Masjuki, M.A. Kalam, M. Mo jur, M.J. Abedin, Effect of antioxidant on the performance and emission char-acteristics of a diesel

engine fueled with palm biodiesel blends. Energy Conversion and Management 79 (2014) 265-272.

[5]. A.M. Ashraful, H.H.Masjuki, M.A. Kalam, H.K. Rashedul, H. Sajjad, M.J. Abedin, Influence of anti-corrosion additive on the performance, emission and engine component wear characteristics of an IDI diesel engine fueled with palm biodiesel. Energy Conversion and Management 87 (2014) 48-57.

[6]. T.F. Yusaf , B.F. Yousif , M.M. Elawad, Crude palm oil fuel for diesel-engines: Experimental and ANN simulation approaches. Energy 36 (2011) 4871-4878.

[7]. T.F. Yusaf , B.F. Yousif , M.M. Elawad, Crude palm oil fuel for diesel engines: Experimental and ANN simulation approaches. Energy 36 (2011) 4871-4878.

[8]. Pascal Ndayishimiye, Mohand Tazerout, Use of palm oil-based biofuel in the internal combustion engines: Performance and emissions characteristics. Energy 36 (2011) 1790-1796.

[9]. H.sheron et al (2012), A test on diesel engine fuelled with methyl esters of used palm oil".

[10]. Biplab K. Debnath, Niranjan Sahoo, Ujjwal K. Saha, Thermodynamic analysis of a variable compression ratio diesel engine running with palm