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Experimentation of Palm Biodiesel with Additive on Performance and Emission Characteristics of Diesel Engine

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ABSTRACT

Ever increasing drift of energy consumption due to growth of population, transportation and luxurious lifestyle has motivated researchers to carry out research on biofuel as a sustainable alternative fuel for diesel engine. Biofuel such as biodiesel produced from renewable feedstock, are the most appropriate alternative of petroleum fuels. Therefore, in this paper the views and openings of using various blends of palm biodiesel as fuel in an engine with the effect of Copper oxide nanomaterial fuel additive. The experimentation was carried out on a four stroke, single cylinder diesel engine with Diesel and various blends (percentages of 20%, 40%, 60%,80% and 100%) of Palm oil biodiesel with copper oxide as an additive.. The effect of fuel additive was tested out on the optimum blend ratio of the bio-diesel so as to achieve further reduced emissions. From the experimentation it is observed that the blend B20 with copper oxide nanomaterial as additive diminishes BSFC by on an average 1 to 1.5% and BTE increases by 2-2.5 %. As well as reduction in emission of the CO,HC and NOx by 31%, 10% and 35% respectively as compare to all other blend..

Keywords: Biodiesel, Blend, Additive, Performance and Emissions..

I. INTRODUCTION

The fossil fuels like coal, oil and natural gas are the principal energy sources that have powered modern industrial advancement. The corresponding global consumption of these is finite, non-renewable and in the case of oil, we are rapidly using the sources which can be recovered from the ground. The most promising alternates available for compression ignition engines are biodiesels which are essentially fatty acids of vegetable or non-edible oils. Other alternates include compressed natural gas, E-Diesel (Ethanol based). Bio-Diesel can also be extracted from various sources of oils ranging from edible sources (palm oil, vegetable oil, rapeseed, rice bran oil) to non-edible sources. From the alternative fuels, biodiesel has expected more awareness due to their attractive features becoming a renewable in nature and decreasing environmental pollution effect on HC and CO emissions. It consists of no petroleum products and it can be used in 100% pure form or blended with petroleum

diesel. Bio-diesel can be used in compression ignition engine directly without any engine modifications because bio-diesel has properties similar to petro-diesel fuels. Biodiesel who absence in optimum thermo-physical properties mainly calorific Value, viscosity, fire point etc. which limits the combustion scenario. Palm biodiesel is said to be clean fuel since it has almost no sulphur, no aromatics. Palm bio Diesel has good oxygen content in the blend which helps in better combustion. Comparing to performance biodiesel is bests but in emissions it misses the mark in NOx. The alternative solution to overcome some of these complications is use of additives in small quantity. Examinations have been carried out on Copper oxide in the biodiesel – diesel blend as a additives to advance the performance and emission characteristics. The objective of this work is to test palm biodiesel and its blends with petroleum diesel under different loading conditions, constant C.R. to determination of an optimum fuel blend in terms of performance and emissions.

M. Mofijur, M.G. Rasul, J. Hyde work on the effect of mixed blends of biodiesel alcohol and diesel on engine performance and emission parameters of a diesel engine. Most of the scientists reported that adding ethanol into biodiesel-diesel blend in diesel engines expressively reduce HC, PM, NOx and smoke emissions but slightly increase fuel consumption. They concluded that biodiesel-diesel-ethanol blend can be used as alternative fuel for petro-diesel fuel to decrease dependency on fossil fuel as well as the exhaust emissions of the engine [3]. S. Senthilkumar , G. Sivakumar, Siddarth Manoharan, conduct an experimental tests on a diesel engine with diesel and various blend percentages of 20%, 40%, 45%, and 50% under. The effect of fuel additive was tested out on the optimum blend ratio of the bio-diesel so as to achieve further reduced emissions. Comparison of results shows that, reduction in emission of hydrocarbon, carbon monoxide, carbon dioxide are 73%, 46%, 1% respectively. The blend ratio of 40% bio-diesel with MFA fuel additive creates reduced emission and nominal power drop due to effective combustion even the calorific value is relatively lower due to its higher cetane number [5].

C,Srinidhi , S.V.Channapatna , explain experimentally the performance and exhaust emission characteristics of a CI engine when fuelled with Palm oil methyl ester biodiesel (PB10,P B20,PB30) addition of ethanol (E5% and E10%) over the various loading conditions on the engine. The result shows that decreases the CO emissions and exhaust gas temperatures[6]. M. Shahabuddin , H. H. Masjuki, etc. conclude that the bio diesel with some additives (B20+1%) shows best performance and reduce the exhaust emission including NOx and suggested that 20% blended bio diesel with 1% additive as a best alternative fuel considering all the view aspects and alternatives[7]. S.Imtenan, H.H. Masjuki, etc. work with the help of ethanol, n-butanol and diethyl ether as additives 80% diesel, 15% palm biodiesel and 5% additive which improved brake power, decreased BSFC and increased BTE. Diethyl ether showed highest 6.25% increment of brake power, 3.28% decrement of BSFC and about 4% increment of BTE than 20% palm biodiesel-diesel blend when used as additive[8].

II. EXPERIMENTATION

The test setup comprise of Diesel motor, vortex current dynamometer, control board, temperature marker and so forth as appeared in figure no.1. The experimentation was directed to determine the outflow constituents of palm oil biodiesel. Diesel (B0), bio-diesel (B100) and its mixes B20, B40, B60, B80, with copper oxide as an added

substance were utilized to test the motor. The investigations were done on a solitary chamber, single acting, vertical, 4-stroke, water-cooled, fast pressure start motor. The details of motor are appeared in Table no.1. The emanation attributes of the motor were learned at various motor burdens. At each heap, the motor get to be distinctly steady for 8-10 minutes and after that perusing were recorded. The fuel consumption was measured by buret methodology for 10cc fuel consumption employing a timer. The emissions contents (CO, HC, CO2, and NOX) were recorded by gas analyzer by inserting probe in exhaust port of engine. From to the result obtained, the graph between NOx vs. Torque, CO vs. Torque, HC vs. Torque, BSFC vs. Torque and BTE vs. Torque are plotted

Fig. 1 Experimental Setup

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Table 1.Engine Specifications

Sr. No	Description	Unit	Specifications
1.	Name of the engine manufacturer	KIRLOSKAR OIL ENGINES LTD.	
2.	Number of cylinders	_	1
3.	CR	_	16.5:1
4.	Stroke	Mm	110
5.	Bore	Mm	80.0
6.	IS rating at 1500 rpm	kW(BHP)	3.7(5.0)
8.	Method of cooling	_	Water cooled

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III. RESULTS AND DISCUSSIONS

Brake Specific Fuel Consumption

The variation of brake specific fuel consumption is shown in Fig. 2. For all blends tested, brake specific fuel consumption decreases with increase in load. The overall characteristics of palm oil biodiesel and diesel are approximately similar. At full load the BSFC for B20 is 0.2416 Kg/Kwh and for minimum load 0.5798 Kg/Kwh. The lowest Brake specific fuel consumption is predicted for the blend with additive B20 at full load. Also, highest Brake specific fuel consumption is observed at low load. This is due to the combined effect of low heating value and high density of palm oil biodiesel.

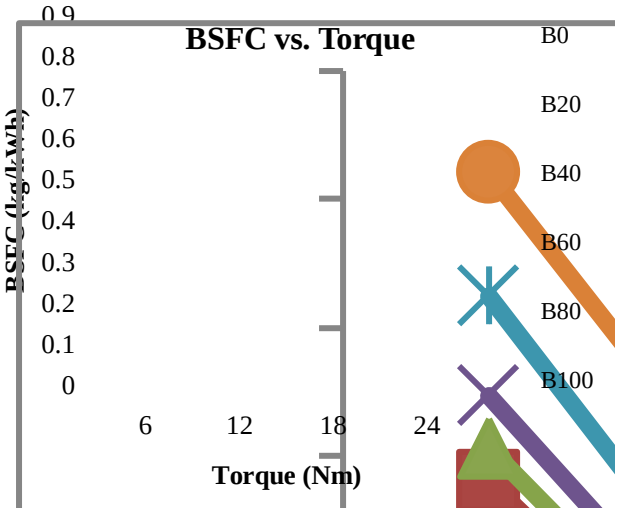

Fig. 2 BSFC VS Torque

Brake Thermal Efficiency:

The variation of BTE with torque for different blends is shown in Fig. 3. In all cases Brake thermal efficiency increases with increase in torque. The maximum BTE for biodiesel with additives is observed for the blend (B20) is 36.30% and for net petroleum diesel (B0) 33.59% at full load. This is due to atomization of blend during ignition or stability of mixture of fuel during storage, pumping and ignition as well as higher temperature for the combustion.

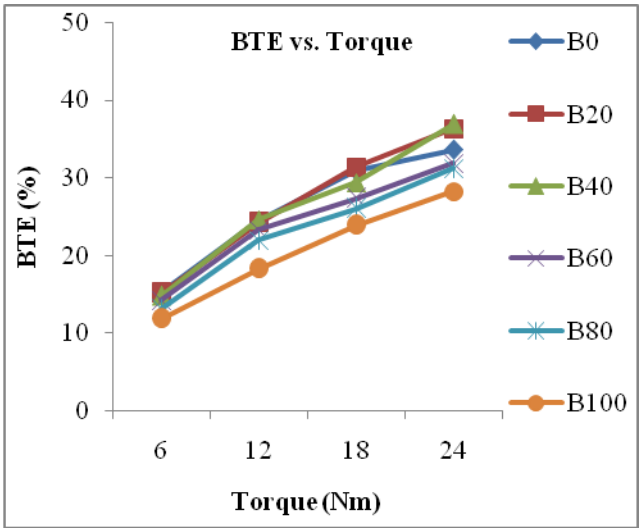

Fig. 3 BTE VS Torque

Emissions of CO

The variation of CO emission is shown in Fig. 4. The emission of CO is due to incomplete combustion inside the combustion chamber. Because of both time lack for combustion or amount of air/oxygen available for combustion .It is higher for B0 and decreases by 31% on an average for all blend with additives, due to high oxygen content and lower carbon to hydrogen ratio.

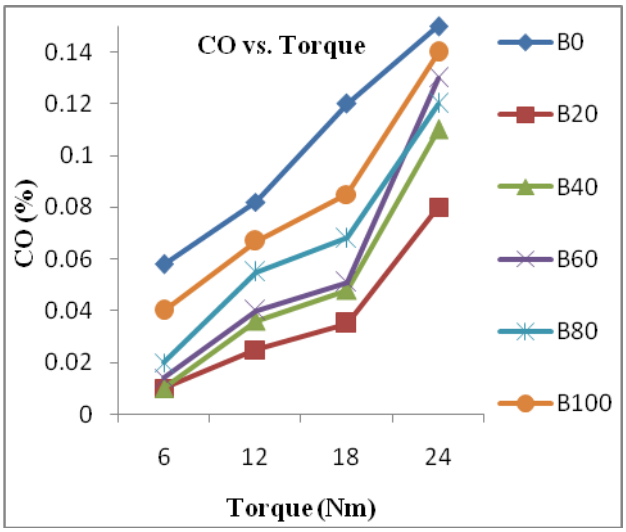

Fig. 4 CO vs. Torque

Emissions of NOx :

For all blends tested NOx increase with load because more percentage of oxygen is present in biodiesel. It is highest for B100 at full load and lowest for B0 at no load as shown in fig. 3. By using the additives NOx emission reduces by 35% on an average for all blends. But blend B20 shows lower emission as compare to all

other blend. The variation of NOx is shown in Fig. 5. Emission of NOx is depending on temperature of combustion chamber of engine. As the temperature of exhaust gas increase then NOx emission also increases [4].

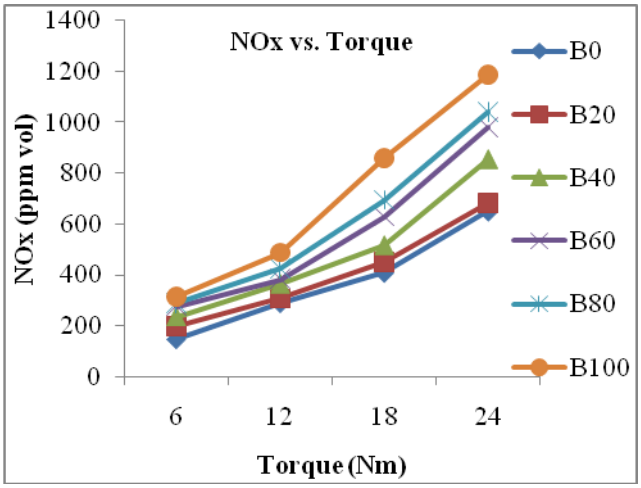

Fig. 5 NOx vs. Torque

Emissions of HC

The emission of HC is because of incomplete combustion. From the tested blend shows the 10 % reduction in HC on an average for all blends with additives, as shown in Fig. 6. The hydrocarbon emission was lower for biodiesel blends with additives. The oxygen content in the molecular structure responsible for complete combustion and HC emission reduces. The blend B20 shows lower emission as compare to all other blend.

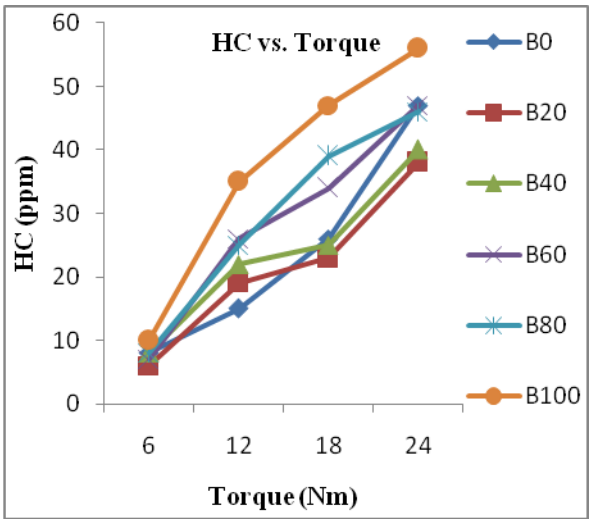

Fig. 6 HC vs. Torque

IV.CONCLUSIONS

It was found that palm biodiesel with additive shows significant drop in emission of IC engine and quite better performance parameter than diesel. From the experimental result reduction in the CO,HC and NOx by 31%, 10% and 35% respectively. Generally BSFC increased with the increase in biodiesel percentage in the fuel blend. But by using additives BSFC is reduced by on an average 1 to 1.5% and that Brake thermal efficiency increases by approximately 2-2.5 %. From the experimentation it is concluded that the blend B20 Palm biodiesel with Copper Oxide as additives gives better performance as well as a lesser amount of emission as compare to petroleum diesel.

Abbreviation

B0 - Diesel

B20 - palm Biodiesel 20% + Diesel 80%

B40 - palm Biodiesel 40% +Diesel 60%

B60 - palm Biodiesel 60% +Diesel 40%

B80 - palm Biodiesel 80%+Diesel 20%

B100- palm Biodiesel 100%

BSFC - Brake Specific fuel Consumption (kJ/kWh)

BTE- Brake thermal efficiency

REFERENCES

[1.] M. H. mosarof, M.A. Kalam, H.H. Masjuki, etc. (2015) Implementation of palm biodiesel based on economic aspects, performance, emission and wear characteristics, Energy conservation and Management 105-617-629.

[2.] M. Mofijur, M.G. Rasul, J. Hyde, (2015) Recent Developments on Internal Combustion Engine Performance and Emissions Fuelled With Biodiesel-Diesel-Ethanol Blends , 6th BSME International Conference on Thermal Engineering, Procedia Engineering 105 , 658 – 664.

[3.] compatibility, Performance, emission and engine durability,

[4.] Renewable and Sustainable Energy Reviews 15,1314–1324.

[5.] Nubia M. Rebeiro, Angelo C. Pinto, (2007)

[6.] The role of Additives for Diesel and Diesel Blended (Ethenol or Biodoesel)

[7.] Fuels: A Review, Energy and Fuels, 21, 243-2445.

[8.] H.H.Masjuki,M.A. Kalam,M. Mofijur,M.A.Hazrat, A.M.Liaquat , (2012), Effect of Additive on Performance of C.I. Engine Fuelled with Bio Diesel , 2011 2nd International Conference on Advances in Energy Engineering, Energy Procedia 14 ,1624 – 1629

[9.] C,Srinidhi, S.V.Channapatna, Dr. A.A.Pawar, Performance And Emissions Of Diesel Engine Fuelled With [3] M.A. Fazal, A.S.M.A. Haseeb, H.H. Masjuki, (2011) Biodiesel feasibility study: An evaluation

of material Ethanol And Palm Oil Methyl Ester (IRJET) e-ISSN: 2395 -0056 Volume: 03 Issue: 04 | Apr-2016 p-ISSN: 2395-0072.

[10.] S. Senthilkumar , G. Sivakumar, Siddarth Manoharan, Investigation of palm methyl-ester bio-diesel with additive on performance and emission characteristics of a diesel engine under 8-mode testing cycle , Alexandria Engineering Journal (2015), 31 March 2015.

[11.] S.Imtenan,H.H. Masjuki, M. Varman, M.I. Arbab, H. Sajjad,(2014) Emission and performance improvement analysis of biodiesel-dieselblends with additives , 10th International Conference on Mechanical Engineering, Procedia Engineering 90 ,472 – 4