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EMISSION CHARACTERISTICS OF DIESEL ENGINE USING PALM BIODIESEL WITH COPPER OXIDE NANOMATERIAL AS AN ADDITIVE

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ABSTRACT

The resources of petroleum fuel are diminishing day by day and simultaneously increasing demands of fuels, as well as more and more inflexible emission regulations create challenges to science and expertise. By considering these aspect researchers must be concentrating to preserve the oil reserves and environmental injuries by conducting research on alternative fuels. Due to this, 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 outcome of fuel additive was tested on the best blend ratio of the bio-diesel so as to recognize further reduced emissions. From the experimentation it is observed that the blend B20 with copper oxide additive produces less emission as compare to all other blend.

Keywords: Biodiesel, Blend, Additive, Emissions

I INTRODUCTION

The constantly increasing energy demands in the power generation and transport sectors together with the restricted availability of fossil fuels and the undesirable environmental effects causing from their use have concerned researchers towards finding alternative fuels to progressively substitute conventional ones. From the alternative fuels, biodiesel has expected more responsiveness due to their attractive characteristics becoming a renewable in nature and decreasing environmental pollution effect on HC and CO emissions. The major difficulties related with the use of biodiesel are higher densities and viscosities, lesser engine power, higher BSFC due to their lower calorific values. NOx emission also increases with the use of biodiesel for larger fuel bound oxygen. To overcome some of these difficulties use of additives in small proportion has come out with great probable in recent times. Investigations have been carried out on Copper oxide in the biodiesel - diesel

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blend as a additives to improve the 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 drive an optimum fuel blend in terms of emissions and performance.

S.Imtenan,H.H. Masjuki, M. Varman,M.I, Arbabetc Work on comparative improvement of palm biodiesel-diesel blend (20%palm biodiesel-80% diesel) with the help of ethanol, n-butanol and diethyl ether as additives regarding emission and performance characteristics. The improved blends consisted 80% diesel, 15% palm biodiesel and 1% additive. All the blends with additives show decreased NOx and CO,HC emission. However, this experiment reveals comparative suitability of these additives on improving biodiesel-diesel blend.[1]

M.Shahabuddin, H.H.Masjuki,M.A. Kalam ,carried experiment data analysis of different parameter such as break power, break specific fuel consumption, emission characteristic (NOx, HC,CO. etc.) and exhaust temperature, is done through bio diesel fuel and also compared with ordinary diesel which is also known as petro diesel. The emission characteristics are observed using Bosch and Bacharach exhaust analyzers. And finally the result is compared with diesel engine which is run by ordinary diesel. The final result implied that the bio diesel with some additives (B20+1%) shows best performance and reduce the exhaust emission including NOx. Thus the decision may be taken, 20% blended bio diesel with 1% additive as a best alternative fuel considering all the view aspects and alternatives. The additives share in the world market should increase in the next few years as long as energy sources become cleaner and renewable. [2,3]

S. Senthilkumar, G. Sivakumar, Siddarth Manoharan, deal with diesel motor with diesel and different mix rates of 20%, 40%, 45%, and 50%under the 8 mode testing cycle. The impact of fuel added substance was tried out on the ideal mix proportion of the bio-diesel to accomplish additionally lessened discharges. Examination of results demonstrates that, 73%reduction in hydrocarbon outflow, 46% lessening in carbon monoxide discharge, and around 1% reduction in carbon dioxide emanation attributes. So it is watched that the mix proportion of 40% bio-diesel with MFA fuel added substance makes decreased emanation. [4]

Karoon Fangsuwannarak, Ponrawe Wanriko and Thipwan Fang suwannarak, did the trial and its outcomes demonstrate that the B40 mix with 0.1g bio-polymer added substance the best change of properties included kinematic thickness, particular gravity, streak point, and midpoint bubbling temperature. In any case, it was found that gas fumes discharges clearly diminished in diesel motor fuelled palm biodiesel mixes added substance. When contrasted with B2 reference test, B40with 0.1g dose acquires the considerable lessening in NOx, CO, and CO2emissions by 63.17%,14.33%, and 53.25%, individually under the motor speed at 3000 rpm.The contemplate proposes that B40 or different less palm biodiesel divisions with bio-polymer added substance has the high possibility for as a cleaned elective fuel.[5,8]

M. Shahabuddin, H.H.Masjuki, M.A. Kalametc, chip away at an investigation information examination of various parameter, for example, discharge trademark (NOx, HC ,CO .etc.)and fumes temperature is done through bio diesel fuel and furthermore contrasted and common diesel which is otherwise called petro diesel and the emanation attributes are watched utilizing Bosch and Bacharach fumes analyzers. Lastly the outcome is contrasted and diesel motor which is controlled by common diesel. The last outcome suggested that the bio diesel with a few added substances (B20+1%) demonstrates best execution and diminish the fumes outflow

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including NOx. In this manner the choice might be taken, 20% mixed bio diesel with 1% added substance as a best option fuel considering all the view angles and alternatives.[7]

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 discover the outflow components 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.

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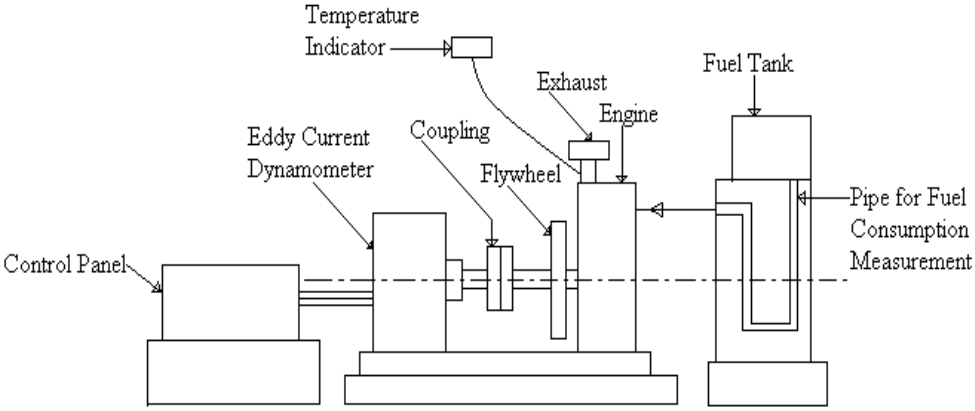

Fig.1 Experimental Setup

The fuel consumption was measured by burette method for 10cc fuel consumption using a stopwatch. On every loading, smoke density was measured. The emissions contents (CO, HC, CO_2, and NO_X) were recorded by gas analyzer by inserting probe in exhaust port of engine. From to the result obtained, the graph between CO vs. Torque, CO2 vs. Torque, NO_x vs. Torque, HSU vs. Torque are plotted.

Table 1 Engine Specifications

Make	Kirloskar
Type	Single Cylinder, 4 Stroke, C.I. diesel engine
Stroke	110 mm
Bore	80 mm
C.R.	16.5:1
Rated output	3.7 kW
Rated speed	1500 rpm
Dynamometer	Eddy current, water cooled with loading unit

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III RESULT AND DISCUSSION

3.1 Emissions in HSU

The variation of HSU is shown in figure no.2. For all blends tested, HSU increases with load. It is highest for B100 and lowest for B20 at full load. B100 shows sudden rise in HSU up to full load and formed due to incomplete combustion of fuel. The emission of HSU is decreases by 18% on an average for all blends with additives.

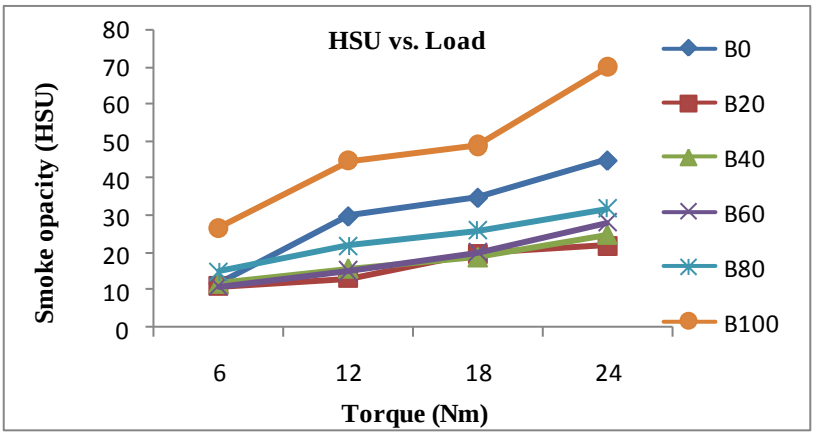

Fig 2.HSU vs. Load

3.2 Emissions of NO_x

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 NO_x 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 NO_x is shown in figure no.3. 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].

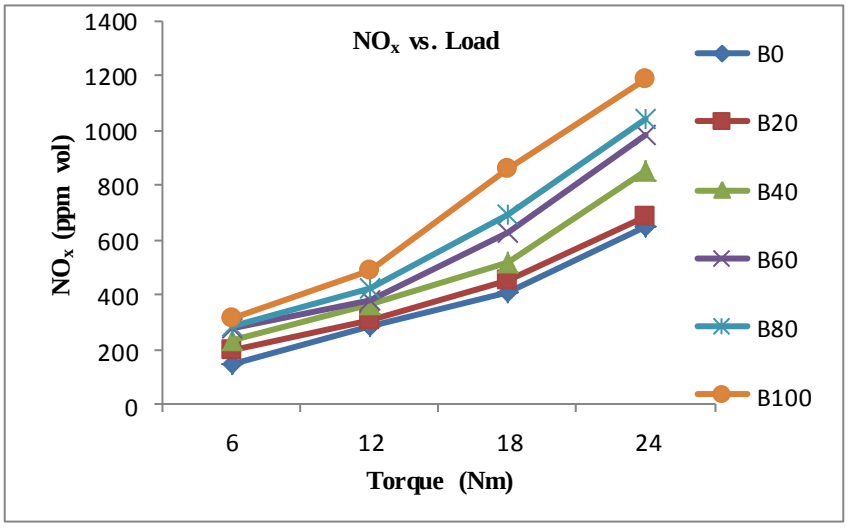

Fig 3.NO_x vs. Load

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3.3 Emissions of CO

The variation of CO emission is shown in figure no. 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.

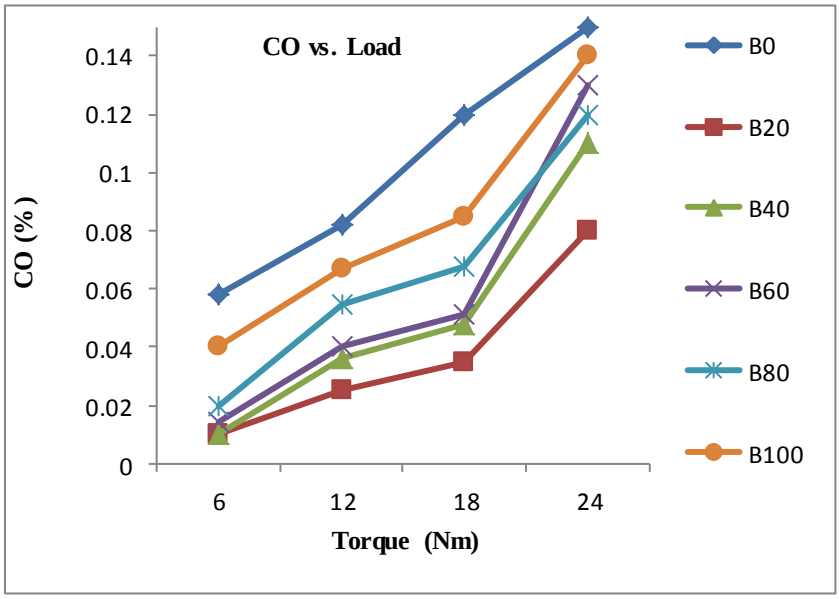

Fig 4.CO vs. Load

3.4 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 figure no.. 5. 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.

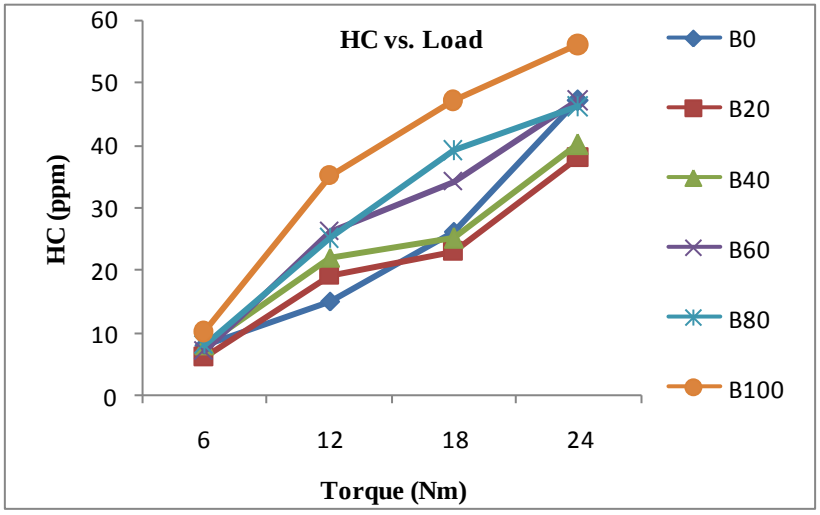

Fig 5.HC vs. Load

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IV CONCLUSION

It was found that palm biodiesel with nanomaterial additive shows substantial reduction in emission of IC engine. From the experimental result the HSU reduce by 18%, CO by 31%, HC by 10% and NOx by 35%. The blend B20 Palm biodiesel with Copper Oxide as additives gives less emission as compare to petroleum diesel. The use of nanomaterial as an additive works as an ecological combination to reduce environmental pollution.

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