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COMPARATIVE ANALYSIS OF DIFFERENT TYPE OF BIODIESEL BLAND WITH DIESEL

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Abstract - The objective of this research work is 'Comparative analysis of different type of Biodiesel with Diesel.' A complete study was performed to estimate and evaluate the combustion, performance and exhaust emissions individuality of different type of biodiesel (ratanjot, karanja, mahua, WCO) blend (B10 and B20) which were used to fuel an Internal direct ignition diesel engine. Engine examine runs were conducted by using the chosen fuels at constant 80 N-m torque with variable engine brake power ranging from 0kW to 5kW. The B10 and B20 Mahua biodiesel gives better and WCO give low brake thermal efficiency with comparison to other sample and Brake Specific Fuel Consumption value is high of WCO and low consumption of fuel is mahua and karanja Hydrocarbon contain is also less. Emission content (HC NOx CO and OPACITY) is also less of mahua and karanja. now We can say Mahua biodiesel is best then other sample.

Key Words: B10, B20, karanja, mahua, Jatropha, wco,

1. INTRODUCTION

In 1911 Dr. Rudolf Diesel wrote, "The diesel engine can be fed with vegetable oils and would help considerably in the development of the agriculture of the countries which will use it" He demonstrated the use of a variety of vegetable oils, and more have been tried since.

Bio fuels appear to be more environment friendly in comparison to fossil fuels considering the emission of greenhouse gasses when consumed. Examples of those gasses are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Those gasses pose risks as they tend to warm the earth's surface. The energy content of bio fuels differs from conventional fuels. Total energy output per litter of bio fuel is determined by the feedstock used, region where the feedstock is grown and production techniques applied, for example, energy contents of biodiesel and bio Ethanol. 'Biodiesel has an energy ratio compared to diesel of about 1.1 to 1, which means that its energy contents are 87% of those of diesel. BioEethanol has an energy ratio compared to gasoline of 1.42 (67% of gasoline)'.The amount that is similar to the amount of energy content of one litres gasoline is referred to as gasoline equivalent.

The objective of this research work is to determine Comparative analysis of different type of Biodiesel with Diesel, Now compare non-edible produced biodiesel (ratanjot, karanja, mahua, WCO) bland to diesel B10 (10 % of biodiesel and 90 %diesel) and B20 (20 % of biodiesel and 80 %diesel)

1.2 TYPES OF VEGETABLE OILS.

1.2.1 EDIBLE VEGETABLE OILS

1.2.1.1 SUNFLOWER OIL

It is obtained both by mechanical and solvent extraction from sunflower seed (Helianthus annus). By biotechnological methods different varieties of sunflower has been developed. The original oil contains high levels of linoleic acid. The crude oil contains a high percentage of waxes. The waxes have to be removed from the oil. The refined oil has a crystalline appearance and yellow colour.

Fig 1.1 Sunflower oil

1.2.1.2 SOYBEAN OIL

Fig 1.2 Soyabean oil

Soybean oil is obtained from soy bean (Glycine max). The production of soy bean in the world is very high. Soybean oil is obtained both by solvent extraction and by mechanical methods. The crude oil contains between 2.5 to 3.0% of phospholipids. The phospholipids have to be removed from the oil by refining process and chemical degumming. The oil contains unsaturated fatty acids especially linoleic and linolenic acid. The crude oil is refined, bleached and deodorizes ready for bottling.

1.2.1.3 CORN OIL

The crude oil from the germ of corn (Zea mays) is obtained by mechanical and / or solvents. The oil is refined, bleached and deodorized. The refining includes also winterization (the removal of waxes). The finished oil looks clear and reddish yellow with a flavour very well accepted by consumers

Fig 1.3 corn oil

1.2.2 NONEDIBLE VEGETABLE OILS

1.2.2.1 JATROPHA (RATANJOT CURCAS)

Jatropha curcus is a drought-resistant perennial, growing well in marginal/poor soil. It produces seeds with an oil content of around 37%. The oil can be combusted as fuel without being refined. It burns with clear smoke-free flame, tested successfully as fuel for simple diesel engine. The by-products are press cake a good organic fertilizer, oil contains also insecticide. It is found to be growing in many parts of the country, rugged in nature and can survive with minimum inputs and easy to propagate.

Fig 1.4 Jatropha seed and oil

1.2.2.2 MAHUA (MADHUCA INDICA)

Fig 1.5 Mahua oil and seed

Bio diesel from mahua seed is important it is found abundantly in tribal areas. The annual production of mahua is nearly. Mahua is a non-traditional & non edible oil also known as Indian butter tree. Mahua seed contain 30- 40 percent fatty oil called mahua oil. Mahua is a medium to larger tree. In India the mahua plant is found in most of the state Orissa, Chhattishgarh, Jharkhand, Bihar, Madhya Pradesh, Tamil nadu. Mature seeds can be obtained during June to July.

1.2.2.2 KARANJA (PONGAMIA PINNATA)

The botanical name of Karanja seed Oil and is Pongamia glabra of Leguminaceae family. Pongamia is widely distributed in tropical Asia and it is non edible oil of Indian origin. It is found mainly in the Western Ghats in India, northern Australia, Fiji and in some regions of Eastern Asia. The plant is also said to be highly tolerant to salinity and can be grown in various soil textures viz. stony, sandy and clayey. Karanja can grow in humid as well as subtropical environments with annual rainfall ranging between 500 and 2500 mm. This is one of the reasons for wide availability of this plant species.

Fig 1. 6 Karanja seed and oil

1.2.2.3 WASTE COOKING OIL

Biodiesel can be produced from vegetable oil, and also from waste cooking oil. The largest possible source of suitable oil comes from oil crops such as cotton seed, soya bean or sunflower. The cost for the raw materials too expensive and the post production for the preparation for the biodiesel will be more than the fossil fuel, so we comes with an alternate solution , by using waste vegetable oil as a better source for the preparation of biodiesel.

Fig 1.7 Waste cooking oil

3 METHODOLOGY

3.1 PREPARATION OF BIODIESEL BLENDS

For this experimental investigation four blends i.e. B10 and B20 are prepared and tested for different characterization. The blends are shown in figure and are as follows

- B10 – 10% Biodiesel and 90% Diesel
- B20 – 20% Biodiesel and 80% Diesel

3.2 ENGINE SET-UP

This experimental investigation was carried out on single cylinder, 4-stroke, Kirloskar made (Model TV1), DI Diesel Engine. It was connected with the control panel unit which consists of rotameter, water temperature indicator, loading switch, speed indicator and fuel flow transmitter etc. The following engine performance and combustion parameters such as brake power (BP), brake specific fuel consumption (BSFC), brake thermal efficiency (BTE), exhaust gas temperature (EGT), cylinder pressure and heat release rate were determined by engine performance analysis software (EnginesoftLV).

Fig 3.1: CI Engine used for Performance Analysis

3.3 EDDY CURRENT DYNAMOMETER

The eddy current dynamometer coupled with the engine output shaft for measuring the power and torque. The dynamometer connected with a load cell and different load applied on the engine (0-12 kg) by load cell. These load cells joined with the load sensors which signaled the load indicator.

Fig. 3.2 Eddy current dynamometer

3.4 FIVE GAS ANALYSER

AVL make 5-Gas analyzer is used to measure emissions of CO, HC, CO_2, O_2 and NO_x. It measures CO, HC, and CO_2 using infrared measurement and O_2 and NO_x using electrochemical measurement technique.
The AVL DiGas 4000 five gas analyzer was used to measure NO_x, CO_2, UBHC, CO and O_2 of CI engine exhaust gas in a measurement chamber. An infrared exhaust gas analyzer was used for the measurement of HC/CO/CO_2 in the exhaust. For measuring NO_x/O_2, an electrochemical analyzer was utilized. The AVL DiGas 4000 gas analyzer used for exhaust gases as shown in figure

Fig 3.3: AVL DiGas 4000 Five Gas Analyzer

4 RESULT ANALYSIS

4.1 PERFORMANCE

4.1.1 BRAKE THERMAL EFFICIENCY vs BRAKE POWER

The assessment brake thermal efficiency with Brake Power is shown in fig.4.1 and 4.2 Thermal Efficiency is the ratio of brake power rising to the energy generated by fuel Injected. In this tentative work to utilize in single cylinder four stock diesel engines in dissimilar kind of fuel and get as much as different value of Brake Thermal Efficiency of pure diesel and B10 and B20 blended biodiesel.

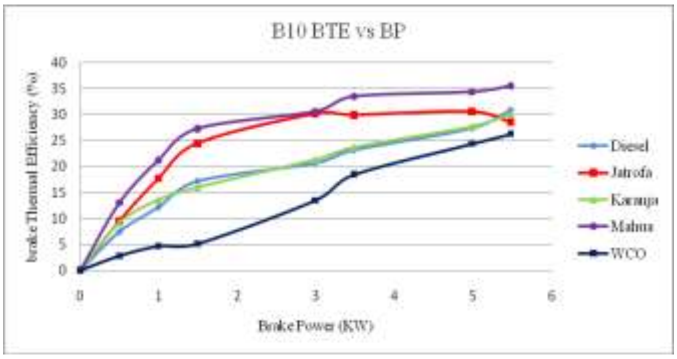

Fig 4.1 B10 Brake thermal efficiency vs Brake power

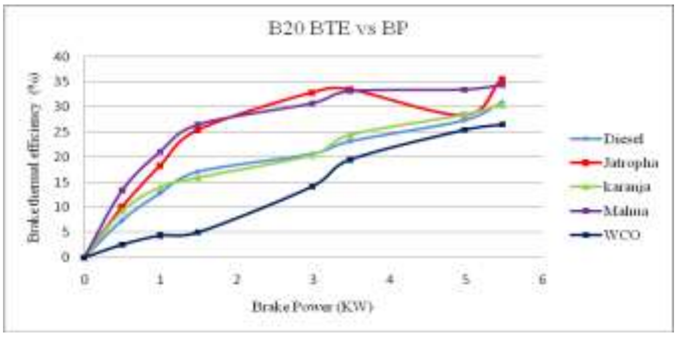

Fig 4.2 B20 Brake thermal efficiency vs Brake power

4.1.2 BRAKE SPECIFIC FUEL CONSUMPTION vs BRAKE POWER

The fig.4.3 and fig 4.4 shows the Brake Specific Fuel Consumption for all test fuel at different brake power at compression ignition engine. Brake Specific Fuel Consumption for blend Diesel to biodiesel 10% (B10) and 20% (B20) decreased by concentration respectively also diesel. This contributes to decreasing in the Brake Specific Fuel Consumption, finding that is concordant with previous experimental results. A Brake Specific Fuel Consumption is decreasing in varying brake power.

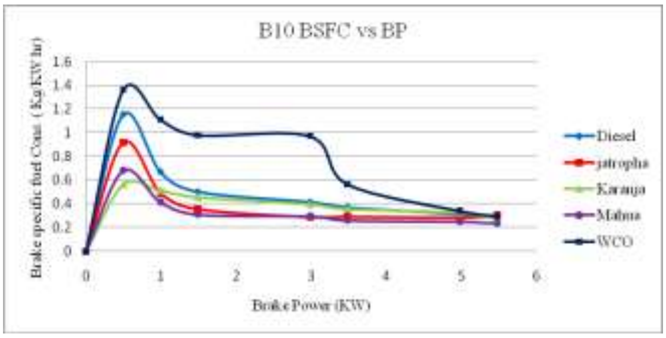

Fig 4.3 B10 Brake specific fuel consumption vs Brake power

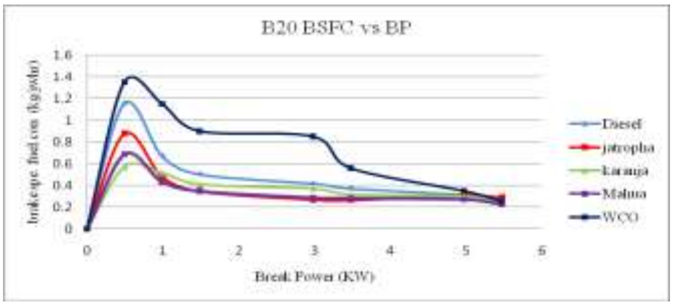

Fig 4.4 B20 Brake specific fuel consumption vs Brake Power

4.1.3 VOLUMETRIC EFFICIENCY V/S BRAKE POWER

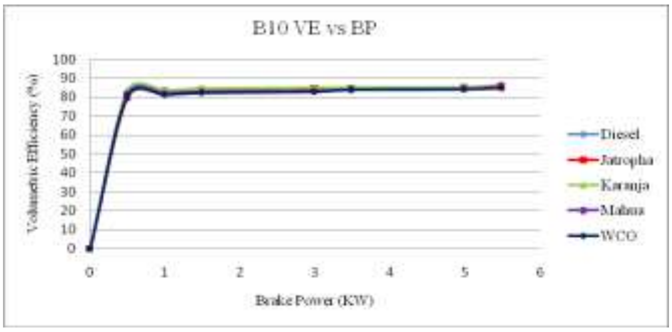

Fig 4.5 B10 Volumetric efficiency v/s Brake power

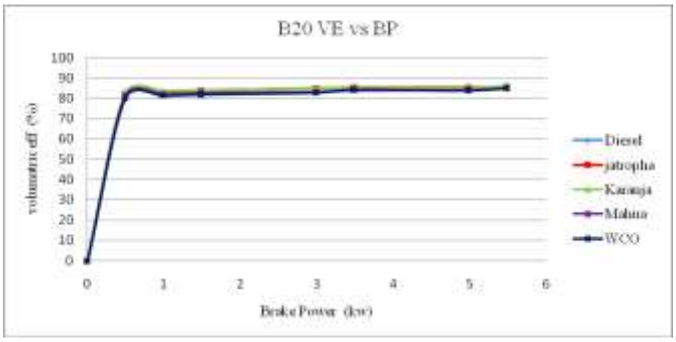

Fig 4.6 B20 Volumetric efficiency v/s Brake power

The assessment of volumetric efficiency (Vol.eff) with Brake power is ratio of Brake power rising to the energy generated from fuel Injected. The fig.4.5 and fig 4.6 show the Volumetric Efficiency increases in varying brake power at increase in 2 kW brake power than also increase a brake power volumetric efficiency is slightly decrease. Blend Diesel, Biodiesel 10% (B10) and 20% (B20) blend Diesel to give good result as compared to neat diesel fuel to use in CI engine.

4.2 EMISSION

4.2.1 HYDRO CARBON VS BRAKE POWER

Comparative HC emissions from the test fuels at even with dissimilar engine brake power. There are quantities of motives for the HC emission through combustion. Fuel trapping in the split volumes of the combustion chamber is one of the main motives of HC emission. It can be seen from the fig.4.7 and fig 4.8

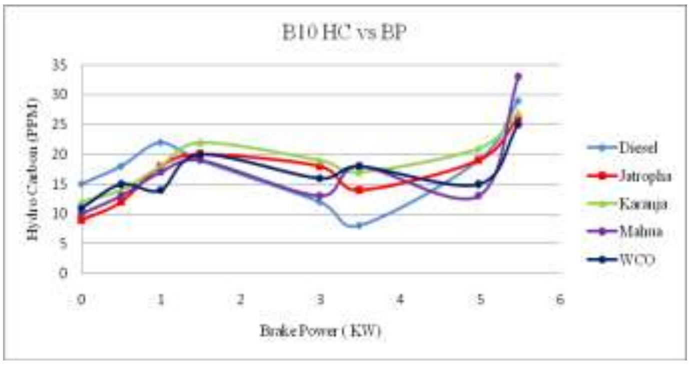

Fig 4.7 B10 Hydro carbon vs Brake power

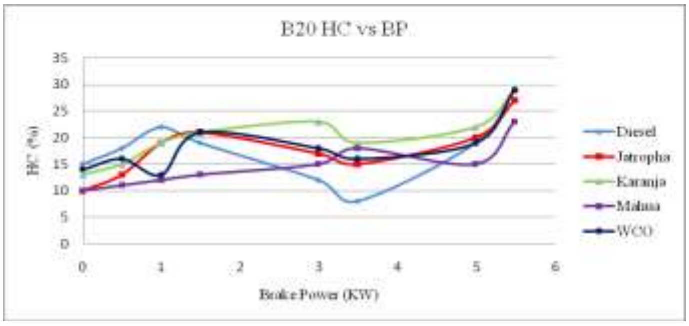

Fig 4.8 B20 Hydro carbon vs Brake power

4.2.2 CARBON MONO-OXIDE VS BRAKE POWER

In two ways carbon mono-oxide (CO) can be created, through an overly lean blend or an overly rich blend. Flame cannot propagate from end to end blend in overly lean blends; consequently fuel paralysis with imperfect oxidation creators CO. The fig. 4.9 and fig 4.10 shows about decrement on average was noticed for B20 than diesel It can be attributed to higher oxygen content of biodiesel which assisted to achieve also complete combustion. Therefore, lower density and viscosity of the adjusted alloys increased the atomization efficiency and on highest of that advanced oxygen content really assisted all oxidation of the fuels, accordingly abbreviated CO emission.

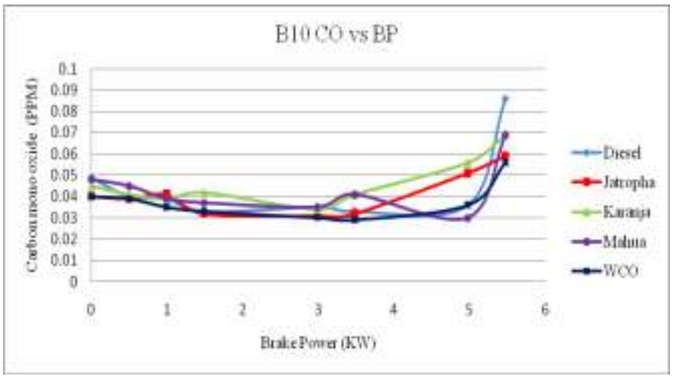

Fig 4.9 B10 Carbon mono oxide vs Brake power

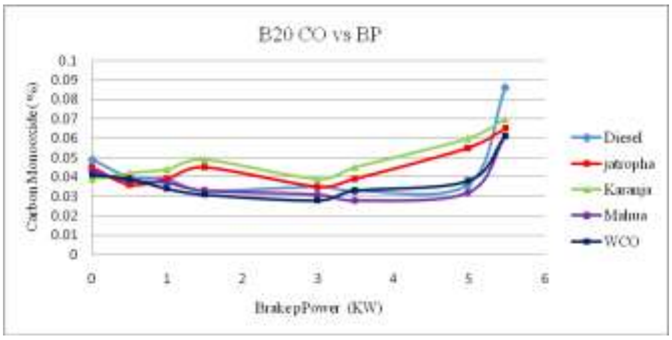

Fig 4.10 B20 Carbon mono oxide vs Brake power

4.3.3 NOx VS BRAKE POWER

The mechanisms which typically take part in the cylinder for NO configuration are thermal mechanism and the fuel bound nitrogen. NO configuration usually depends on oxygen concentration, air extra coefficient, in cylinder temperature and abode time. In this investigation fig.4.11 and gig 4.12 shows, B20 twisted 8.2% advanced NO emission on normal than diesel. Higher NO for B20 can attribute to higher fuel leap oxygen

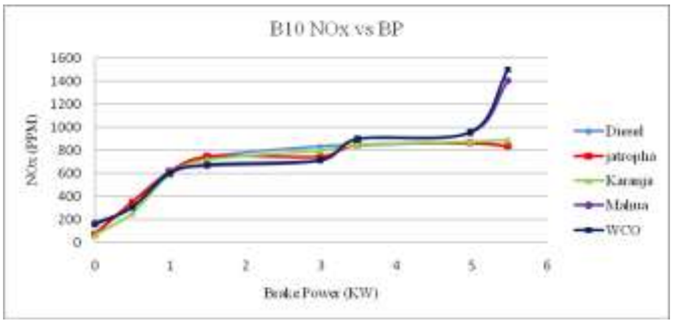

Fig 4.11 B10 NOx vs Brake power

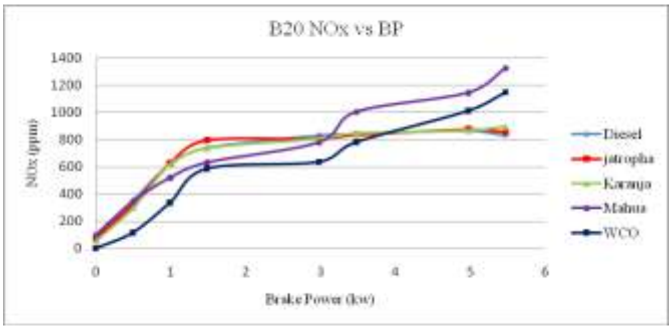

Fig 4.12 B20 NOx vs Brake power

4.2.4 OPACITY VS BRAKE POWER

Smoke opacity indicates the stain content of the exhaust gas which is one of the main mechanisms of particulate substance. Hence, the fig.4.13 and fig 4.14 indicated that structure can be connected with fuels tendency to form particulate matter through combustion. It can be credited to highly developed found of combustion of B20 for higher certain number. Hence, the burning started early, it permissible also time for the oxidation of stain

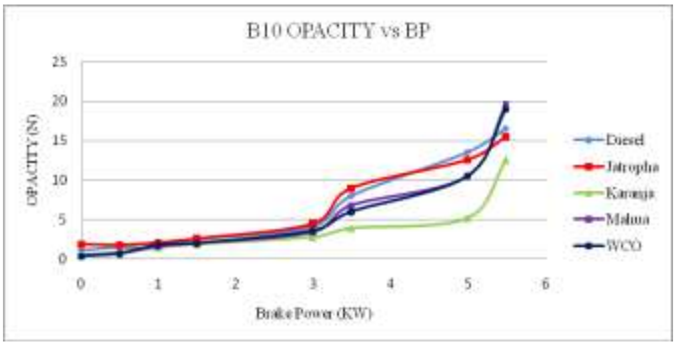

Fig 4.13 B10 Opacity vs Brake power

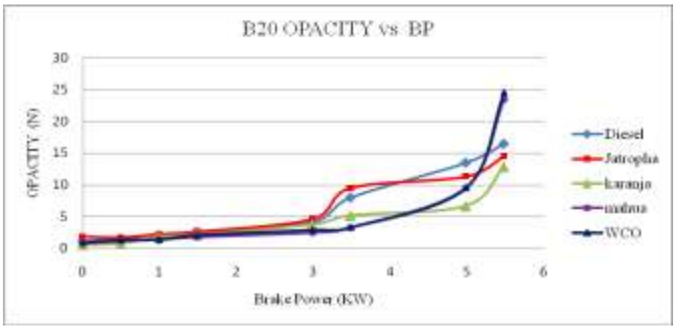

Fig 4.14 B20 Opacity vs Brake Power

5. CONCLUSIONS

5.1CONCLUTION

The objective of this research work is 'Comparative analysis of different type of Biodiesel with Diesel.' A complete study was performed to estimate and evaluate the combustion, performance and exhaust emissions individuality of different type of biodiesel (ratanjot, karanja, mahua, WCO) blend (B10 and B20) and its adapted mixed with 10 and 20 percentages of biodiesel which were used to fuel an Internal direct ignition diesel engine. Engine examine runs were conducted by using the chosen fuels at constant 80 N-m torque with variable engine brake power ranging from 0kW to 5kW. Exhaust emissions such as total unburned HC, NO, CO and smoke opacity were calculated for each test fuel and compare all the properties. Brake specific fuel consumption, Brake thermal efficiency, and Volumetric Efficiency were deliberate and calculated to contrast the engine performance characteristics. Heat release rate examine revealed some noteworthy features of combustion mechanisms, which progressive the performance and emissions aspects. Thus, the following conclusions are peaked:

- Brake thermal efficiency increases with respect to load increases as shown in the fig 4.1 and fig 4.2 The B10 and B20 Mahua biodiesel gives better and WCO give low brake thermal efficiency with comparison to other sample.
- WCO biodiesel Brake specific fuel consumption is high with respect to load increases and other sample as shown in the fig 4.3 and fig 4.4 The B10and B20 Mahua and Karanja is the best of other sample.
- Volumetric efficiency is almost same for all samples to the respective load as show in fig 4.5 and fig 4.6
- Hydrocarbon emissions is dissimilar from the test fuels at even with Dissimilar Engine brake power as show in fig 4.7 and fig 4.8. There are quantities of motives for the Hydrocarbon emission through combustion diesel B10 WCO and B20 mahua sample is low hydrocarbon content.
- Carbon mono oxide percentage of test fuels at even similar Engine brake power at B10 as show in fig 4.7 and B20 test sample Carbon mono oxide percentage is non similar as show in fig 4.8 the low carbon mono oxide percentage test sample isDiesel and B10 WCO biodiesel.
- NOx emissions from the test fuels at even with Dissimilar Engine brake power as show in fig 4.11 and fig 4.12 B20 WCO sample is low NOx content.
- B10 Karanja and B20 mahua is best sample of biodiesel.

5.2 FUTURE SCOPE

Biodiesel test performance on CI engine was short duration endurance test with blend and reducing the viscosity and carried out and then test performance and reducing NOx and CO emission.

Increase in production of biodiesel and reduces of cost.

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