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PERFORMANCE AND EMISSION ANALYSIS OFDIESEL ENGINE USING KARANJA OIL BIODIESEL BLEND WITH DIETHYL ETHER AND BUTANOL

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ABSTRACT

In 21st century energy demand was increased by reason of development of industries, population, amount of vehicles. But availability of fuel is not sufficient to meet demands. In other routes to solve the energy demand and control the pollution under using of alternative fuels. The usage of fossil fuel is causes to more pollution and change environmental conditions. The use of biodiesel is one of the major solution for this kind of problems. This work is used Karanja biodiesel for potentiate the diesel. The Karanja oil is readily available in India and it has more potential to use as alternative fuel in diesel engine without modification. Experimental is going conduct to study the performance and emissions characteristics of biodiesel, additive used biodiesel and compared with diesel. Similarly, the properties like calorific value, flash point, viscosity c also going to study.

Keywords: Karanja Oil, Biodiesel, Calorific Value, Flash Point, Viscosity, Alternative Fuel And Fire Point.

I. INTRODUCTION

Environmental concern and availability of fossil fuels are greatly affecting the trends of fuels transportation vehicles. Global warming due to emission green house gases are hydro carbons, carbon monoxide and carbon dioxide. Biofuel is one of the options to fulfill the transport fuel. It provides an important option for meet clean energy demand for both industrials and non-industrials applications.

In recent years, due to fuel price hike and diminishing petroleum reserves, considerable concern has been raised over diesel-powered vehicles using biodiesel as fuel in many countries. Biodiesel is an alternative fuel which is generally extracted from plant oils and animal fat along with methanol and by transesterification process.

The raw materials for biodiesel production are non edible oils, animal fats and short chain alcohols. The oils most used for worldwide biodiesel production are rapeseed (mainly in the European Union countries), soybean (Argentina and the United States of America), palm (Asian and Central American countries) and non edible oils are also used and also animal fats. Methanol is the most frequently used alcohol although ethanol can also be used. Since cost is the main concern in biodiesel production and trading (mainly due to oil prices), the use of non-edible non edible oils has been studied for several years with good result.

Most of the automobiles around us use diesel to propel them which produces lot of harmful gases like carbon monoxide carbon dioxide (CO2), sulphur dioxide (SO2), oxides of nitrogen (NOx), hydrocarbons (HC) etc. which pollute the environment. With rise in number of vehicles on road, the demand of fossil fuels is also going up. This not only increases our dependence on fossil fuels but also harms the environment. So, we are in need of some other kind of fuel which will reduce the harmful emissions without any modification in the engine design.

Biodiesel and biodiesel blends can be a solution to this. But biodiesel blends can show an increase in water separation and fuel foaming. In addition blending with low stability biodiesel can lead to fuel system problems, such as higher levels of injector deposits and corrosion arising from the generation of low-molecular weight acids. Additives can be used to minimize such problems.

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II. METHODOLOGY

The setup consists of single cylinder, four stroke, VCR (Variable Compression Ratio) Electric start Diesel engine connected to eddy current type dynamometer for loading. The compression ratio can be changed without stopping the engine and without altering the combustion chamber geometry by specially designed tilting cylinder block arrangement. Setup is provided with necessary instruments for combustion pressure and crank-angle measurements. These signals are interfaced to computer through engine indicator for P PV diagrams. Provision is also made for interfacing airflow, fuel flow, temperatures and load measurement. The set up has stand-alone panel box consisting of air box, two fuel tanks for blend test, manometer, fuel measuring unit, transmitters

Properties of fuel

Flash point of the oil is the lowest temperature at which the oil gives sufficient amount of vapors resulting in a flash when a flame is brought near to it. **Fire point** is the lowest temperature at which the oil gives sufficient amount of vapors resulting in a continuous burning of the oil when the flame is brought near to it.

Bomb Calorimeter

A Bomb Calorimeter will measure the amount of heat generated when matter is burnt in a sealed chamber (Bomb) in an atmosphere of pure oxygen gas. A known amount of the sample is burnt in a sealed chamber. The air is replaced by pure oxygen. The sample is ignited electrically. As the sample burns, heat is produced. The rise in temperature is determined Since, barring heat loss the heat absorbed by calorimeter assembly and the rise in temperature enables to calculate the heat of combustion of the sample.

W Water equivalent of the calorimeter assembly in calories per degree centigrade(2330 cal / 0C)

T Rise in temperature in degree centigrade

H Heat of combustion of material in calories per gram

M Mass of sample burnt in grams Then W T = HM

"H" is calculated easily since W, T and M are known, H=WT/M

Viscosity is the property of a liquid to resist shearing or sliding of its layers. It arises from cohesion and interaction between the fluid molecules and is manifested only when the fluid is in motion, either by a body moving through a fluid or a fluid moving around a body. When the liquid layers move with different velocities, internal friction forces appear which depend upon the time rate of shear deformation. In this respect, the liquid differ from solid in which shear stress is a function of the shear deformation itself. Newton postulated that the shear stress within a fluid is proportional to the spatial rate of change of velocity normal to the flow. The spatial rate of change of velocity is called the velocity gradient (dV/dy). Then by Newton's Hypothesis

$$\tau = \mu \, (dV/dy).$$

Where τ is the internal friction shear stress, (dV/dy) is velocity gradient i.e. the change in the velocity per unit of distance between the adjacent layers of the fluid layers of the liquid (in a direction at right angles to the direction of motion); and μ is the proportionality constant depending upon nature of the liquid and called the viscosity coefficient, absolute viscosity or dynamic viscosity.

III. RESULTS AND DISCUSSION

Performance characteristics of bio diesel

Biodiesel Performance, Costs, and Use by Anthony Radich Biodiesel fuel for diesel engines is produced from vegetable oil or animal fat by the chemical process of esterification.

Brake Specific Fuel Consumption (BSFC)

The results of Brake Specific Fuel Consumption are evaluated with the help of various loading conditions like 0%, 25%, 50%, 75%, and 100% by running the engine with different blends prepared. From the graph, it can be concluded that the specific fuel consumption of the engine increases with increase in loads when the blend 2 (B20) is used and when addition of diethyl ether increases, the brake specific fuel consumption also increases

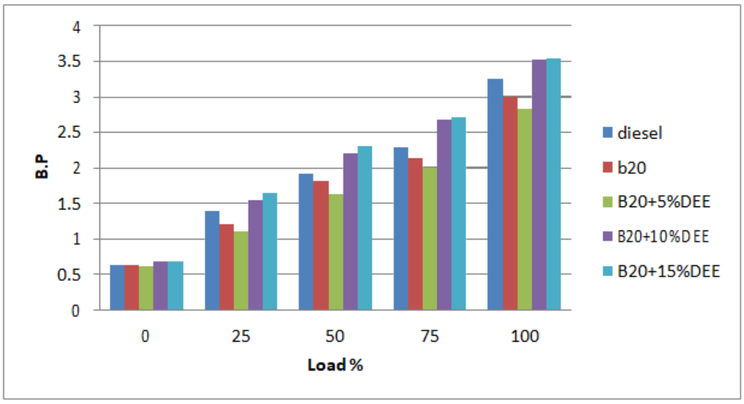

Figure 1: Effect of Brake Power with Load

Brake Thermal Efficiency (BTE)

The results of Brake Thermal Efficiency are evaluated with the help of various loading conditions like 0%, 25%, 50%, 75%, and 100% by running the engine with different blends prepared. From the graph, it can be concluded that the brake thermal efficiency of the engine increases with increase in loads when the blend 2 (B20) is used.

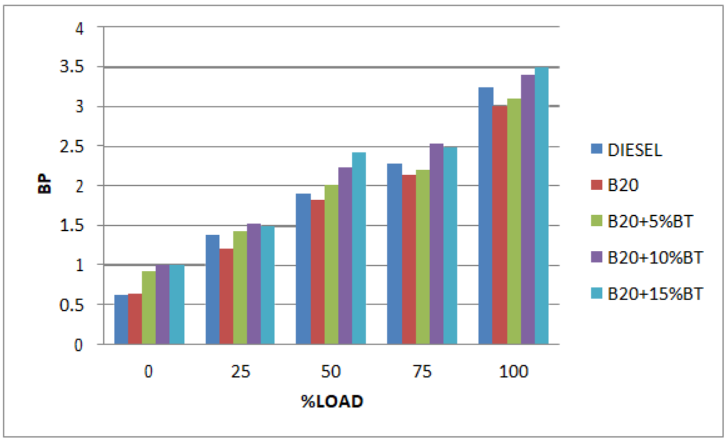

Figure 2: Effect of Brake Power with Load

Indicated Thermal Efficiency (ITE)

The results of Indicated Thermal Efficiency are evaluated with the help of various loading conditions like 0%, 25%, 50%, 75%, and 100% by running the engine with different blends prepared. From the graph, it can be concluded that the indicated thermal efficiency of the engine

Indicated Power (IP)

The results of Indicated Thermal Efficiency are evaluated with the help of various loading conditions like 0%, 25%, 50%, 75%, and 100% by running the engine with different blends prepared. From the graph, it can be concluded that the indicated thermal efficiency of the engine increases with increase in loads when the blend 2 (B20) is used.

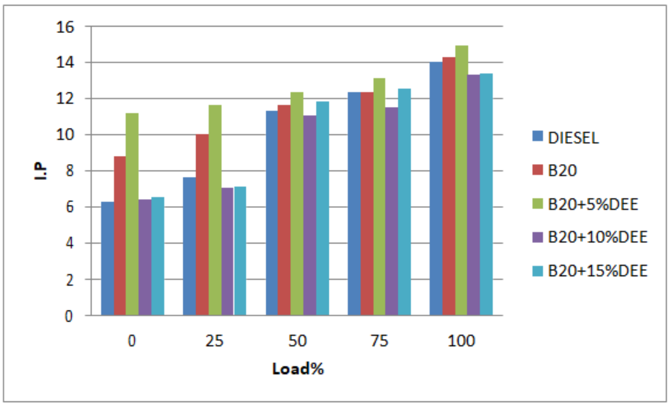

Figure 3: Effect of Break Thermal Efficiency with Load

Mechanical Efficiency (ME)

The results of Indicated Thermal Efficiency are evaluated with the help of various loading conditions like 0%, 25%, 50%, 75%, and 100% by running the engine with different blends prepared. From the graph, it can be concluded that the indicated thermal efficiency of the engine increases with increase in loads when the blend 2 (B20) is used.

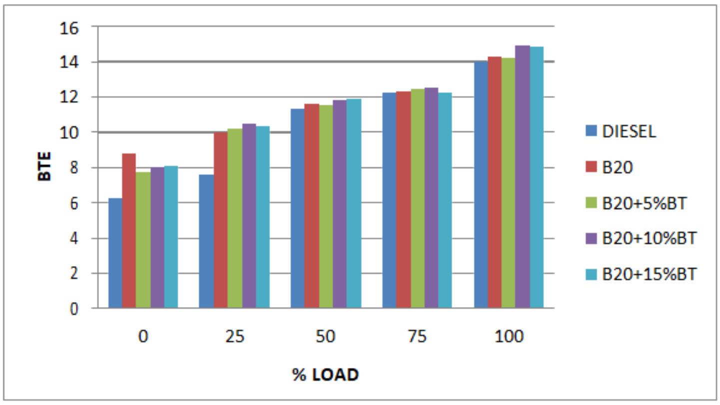

Figure 4: Effect of Break Thermal Efficiency with Load

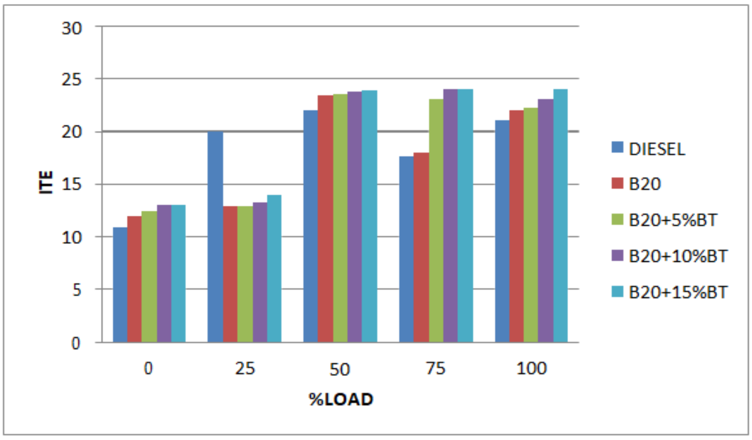

Figure 5: Effect of Indicated Thermal Efficiency with Load

Mecanical Efficiency (ME)

The results of Indicated Thermal Efficiency are evaluated with the help of various loading conditions like 0%, 25%, 50%, 75%, and 100% by running the engine with different blends prepared. From the graph, it can be concluded that the indicated thermal efficiency of the engine increases with increase in loads when the blend 2 (B20) is used.

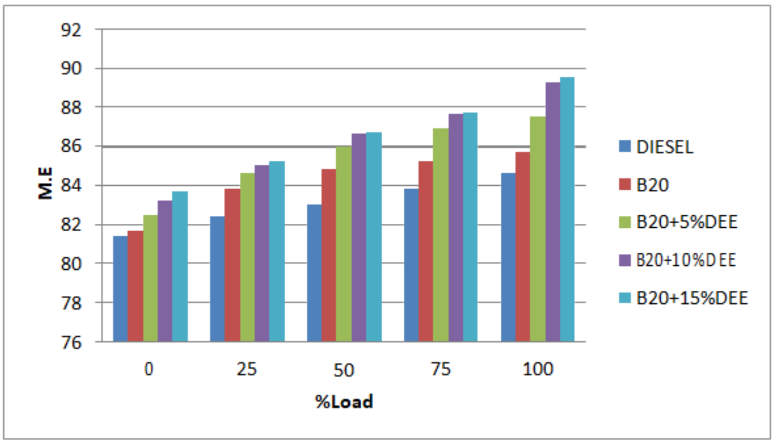

Figure 6: Effect of Mechanical Efficiency with Load

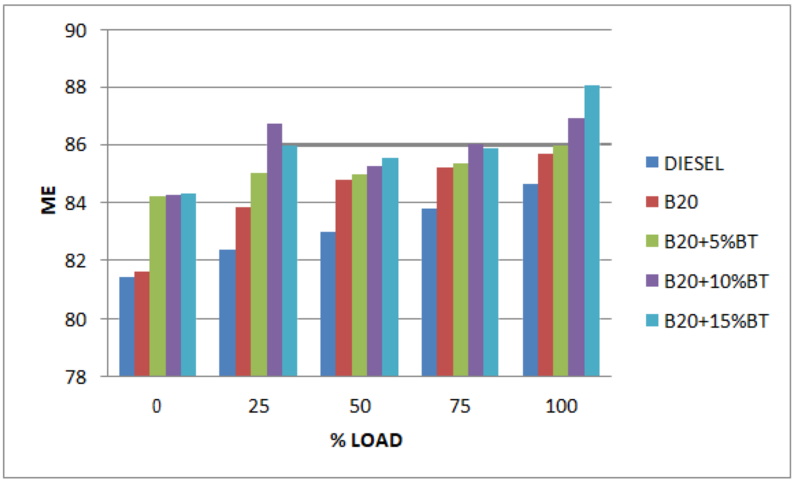

Figure 7: Effect of mechanical efficiency with load

Characteristics of emission for diethyl ether and butanol

CO and HC emissions are found to be higher at higher injection pressure. There is a reduction in smoke emission with addition of Diethyl ether and increased injection pressure.

Carbon Monoxide (CO)

It has been observed that CO emission was found to decrease with the increase in proportion of biodiesel in the blends. CO emissions are increased with increase in engine load. The lower CO emission of biodiesel compared to diesel is due to the presence of biodiesel which helps in complete oxidation of fuel.

$CO2$ is produced by all aerobic organisms when they metabolize carbohydrates and lipids to produce energy by respiration. It is returned to water via the gills of fish and to the air via the lungs of air-breathing land animals, including humans. Carbon dioxide is produced during the processes of decay of organic materials and the fermentation of sugars in bread, beer and wine making. It is produced by combustion of wood and other organic materials and fossil fuels such as coal, peat, petroleum and natural gas. It is an unwanted by product in many large scale oxidation processes.

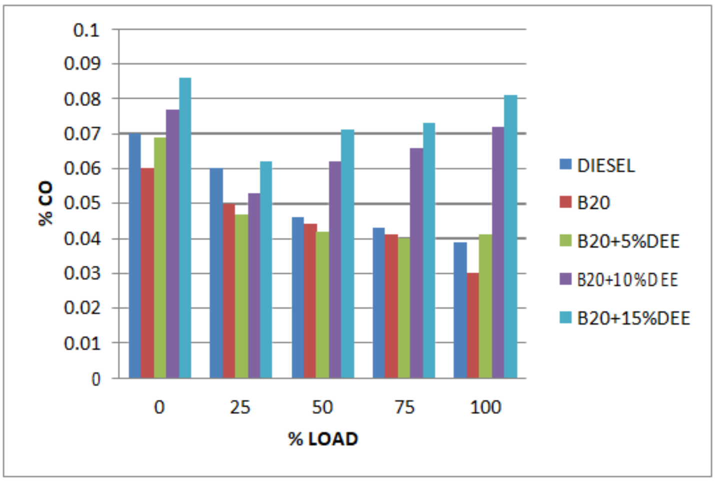

Figure 8: Emission of CO with Load

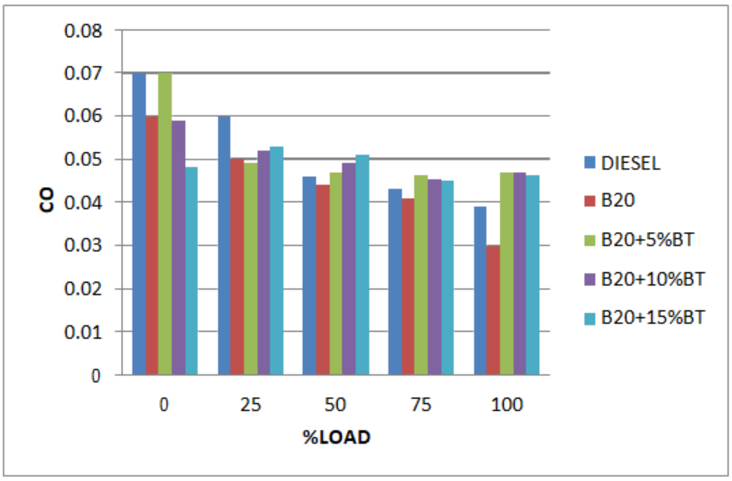

Figure 9: Emission of CO with Load Hydrocarbon (HC

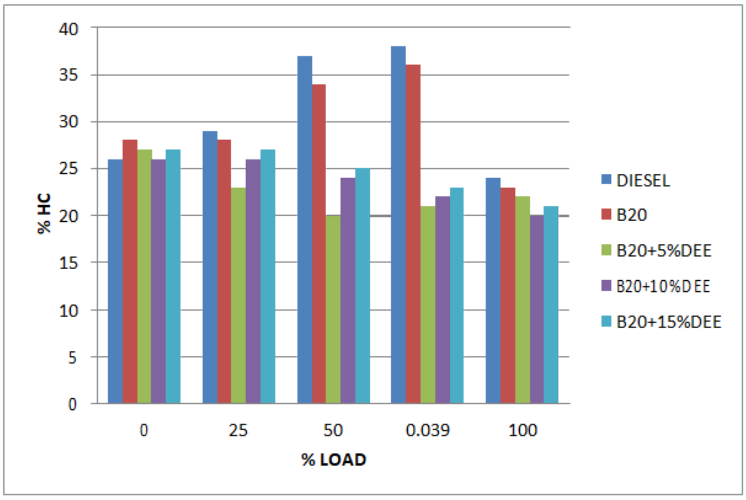

Figure 10: Emission of Hydrocarbon with Load

Hydrocarbons in exhaust are due to incomplete combustion of carbon compounds in the blends. The HC emission decrease with increase in proportion of biodiesel in the fuel blends. The possible reason for decrease in unbent HC may be higher cetane number and increased gas temperature. In organic chemistry, a hydrocarbon is an organic compound consisting entirely of hydrogen and carbon. Hydrocarbons are examples of group 14 hydrides. Hydrocarbons from which one hydrogen atom has been removed are functional groups called hydro corbels Because carbon has 4 electrons in its outermost shell carbon has exactly four bonds to make, Hydrocarbons are introduced into the environment through their extensive use as fuels and chemicals as well as through leaks or accidental spills during exploration, production, refining, or transport. Anthropogenic hydrocarbon contamination of soil is a serious global issue due to contaminant persistence and the negative impact on human health.

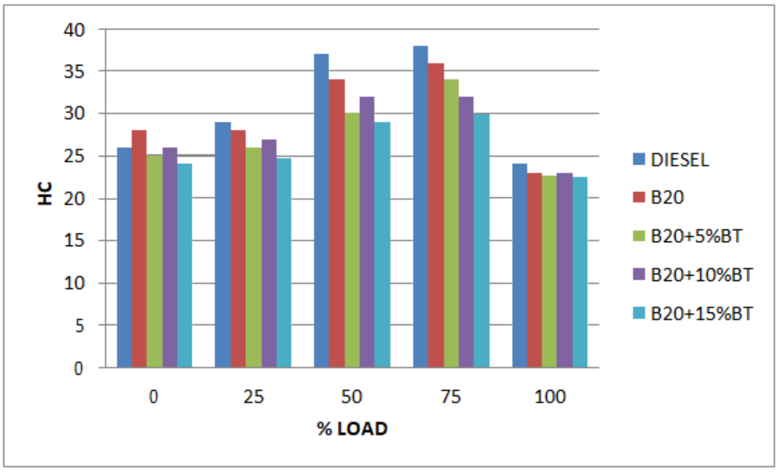

Figure 11: Emission of Hydrocarbon with Load Carbon Dioxide (CO2)

Carbon Dioxide in exhaust is due to incomplete combustion of carbon compounds in the blends. The CO2 emission decrease with increase in proportion of biodiesel in the fuel blends. The possible reason for decrease in CO2 may be higher cetane number and increased gas temperature CO2 is produced by all aerobic organisms when they metabolize carbohydrates and lipids to produce energy by respiration. It is returned to water via the gills of fish and to the air via the lungs of air-breathing land animals, including humans. Carbon dioxide is produced during the processes of decay of organic materials and the fermentation of sugars in bread, beer and wine making. It is produced by combustion of wood and other organic materials and fossil fuels such as coal, peat, petroleum and natural gas. It is an unwanted byproduct in many large scale oxidation processes, for example, in the production of acrylic acid (over 5 million tons/year)

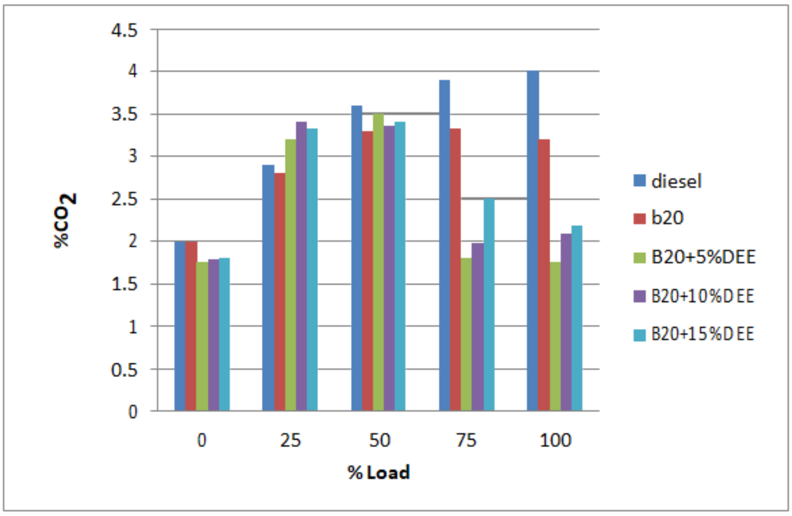

Figure 12: Emission of CO2 with Load

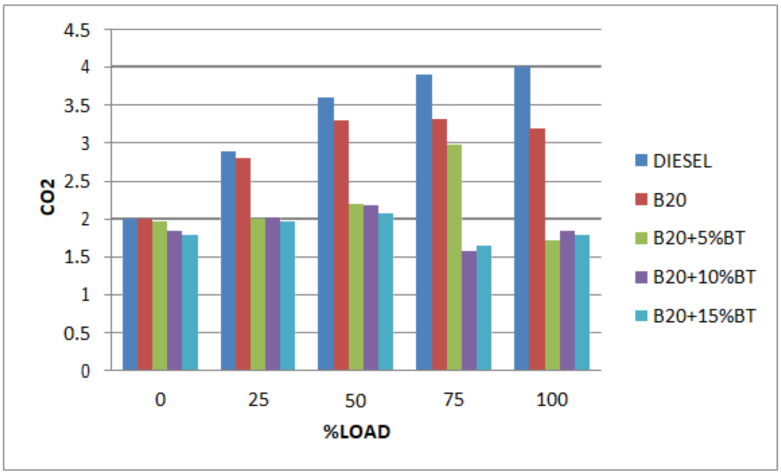

Figure 13: Emission of CO_2 with Load

Oxygen (O2)

Oxygen in exhaust is due to incomplete combustion of carbon compounds in the blends. The O2 emission decrease with increase in proportion of biodiesel in the fuel blends. The possible reason for decrease in O2 may be higher cetane number and increased gas temperature.

Oxygen is the chemical element with the symbol O and atomic number 8. By mass, oxygen is the third-most abundant element in the universe, after hydrogen and helium. Oxygen is the third most abundant chemical element in the universe, after hydrogen and helium. About 0.9% of the Sun's mass is oxygen. Oxygen constitutes 49.2% of the Earth's crust by mass as part of oxide compounds such as silicon dioxide and is the most abundant element by mass in the Earth's crust. It is also the major component of the world's oceans (88.8% by mass).Oxygen gas is the second most common component of the Earth's atmosphere, taking up 20.8% of its volume and 23.1% of its mass (some 1015 tonnes).

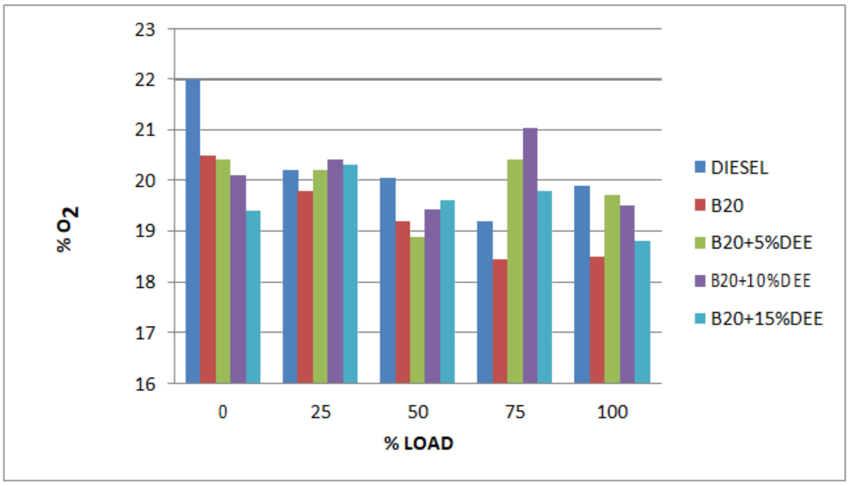

Figure 14: Emission of O2 with Load

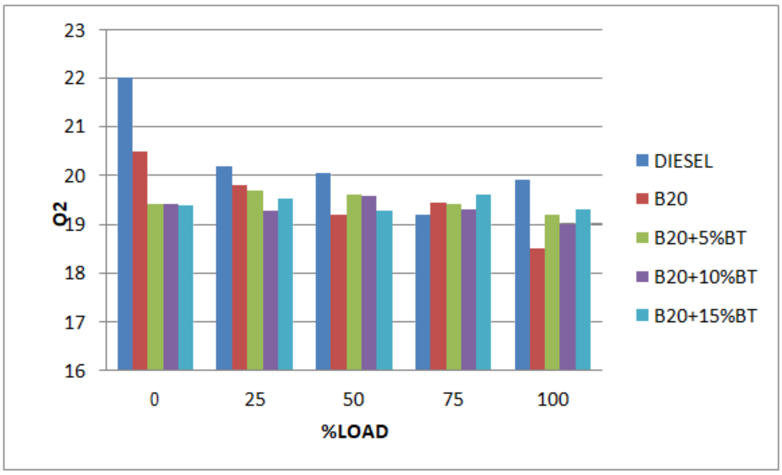

Figure 15: Emission of O2 with Load Nitrous oxide (Nox)

The slower burning character of the fuel causes a slight delay in the energy release, which results in higher temperature in later part of power stroke and exhaust stroke. This causes stable molecules such as N2 and O2 to convert into significant amounts of NO similar to the process that occurs during high temperature fuel combustion. NOx from lightning can become oxidized to produce nitric acid (HNO3), this can be precipitated out as acid rain or deposited onto particles in the air. Elevated production of NOx from lightning depends on the season and geographic location.

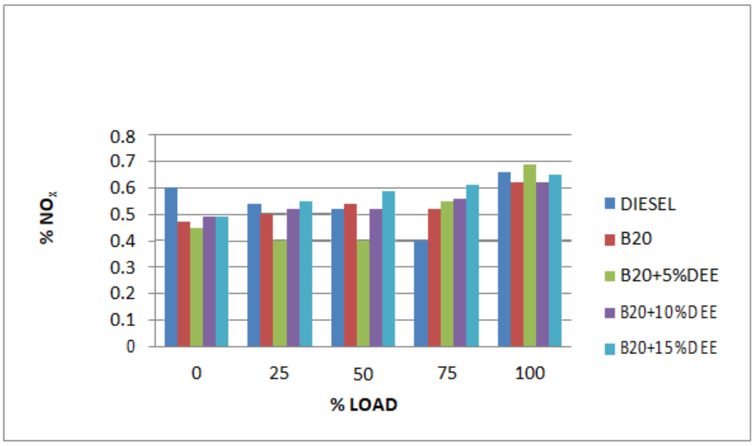

Figure 16: Emission of NOx with Load

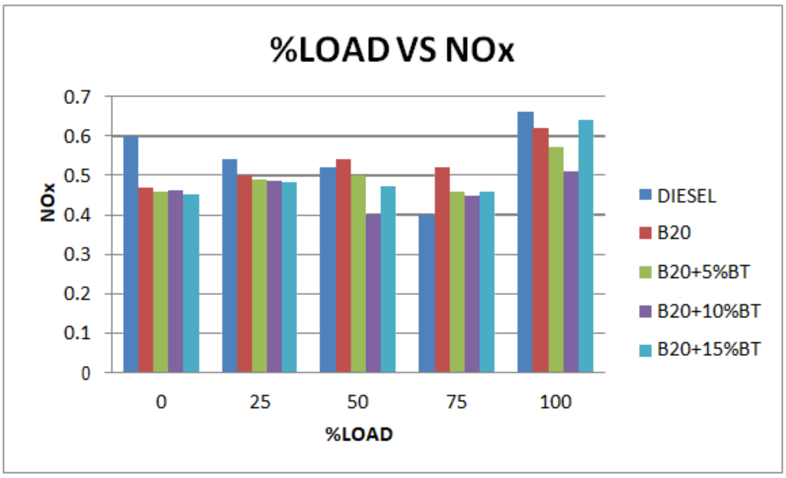

Figure 17: Emission of NOx with Load

IV. CONCLUSION

The performance and combustion characteristics of biodiesel derived from Karanja oil and its blends are compared with the characteristics of standard diesel. It shows that the diesel engine can perform effectively with Karanja oil and its blends without any modifications of the standard diesel.

The performance characteristics of Karanja oil are better when compared to conventional diesel. While using Blend 3, the brake power, brake thermal efficiency and mechanical efficiency are maximum compared to that of other blends. At the same time, on using Blend 4, maximum indicated power and minimum specific fuel consumption are obtained.

The emission characteristics of Karanja oil are better when compared to conventional diesel. The emission from the Karanja biodiesel satisfies the Bharat Stage-4 standard emission conditions. It is noticed that there is a significant reduction in emission of CO, unburned HC and smoke emission in Karanja biodiesel when compared to that of diesel. The NOx emission is marginally higher in Karanja biodiesel compared to diesel.

Thus the results show that the Karanja Oil Methyl ester with diesel in various proportions can be used as an alternative fuel source and it is also environment friendly fuel for a diesel engine. Further, detailed analysis of various more blends will definitely enable us to find a perfect suitable blend which can overcome all the disadvantages of petroleum diesel.

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