

## Performance & Emission of C.I Engine Using Neem- Biodiesel With Additives



### Engineering

KEYWORDS :

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### ABSTRACT

*Bio-diesel is widely accepted as comparable fuel to diesel in compression ignition engines. It offers many advantages including; higher cetane number, reduced emissions of particulates, CO, NOX, and hydrocarbons, reduced toxicity, improved safety and lower lifecycle CO2 emissions. The objective of this research is to determine the relationship between engine performance and emissions using diesel, volumetric blends of Neem bio-diesel and additives as a fuel in a multi cylinder, four stroke, water cooled, direct injection CI engine.*

### Introduction

An enormous increase in the number of automobiles in recent years has resulted in greater demand for petroleum products. With crude oil reserves estimated to last only for a few decades, therefore efforts are made on way to research on alternative to diesel. Depletion of crude oil would cause a major impact on the transport sector. . . Energy conservation is important for most of the developing countries, including rest of world. The rapid depletion in petroleum reserves and uncertainty in petroleum supply due to political and economical reasons, as well as, the sharp escalations in the petroleum prices have stimulated in search for alternatives to petroleum fuels. The situation is very grave in developing countries like India which import 70% of the required fuel, spending 30% of her total foreign exchange on oil imports. In view of this, researcher found and analyze many energy sources like CNG, LNG, LPG, ethanol, methanol, hydrogen, bio-diesel and many more. Among these alternative fuels, India is having significant scope for development of bio fuel. Diesel engines are major source of transportation, power generation, marine application, agriculture vehicles etc. Bio-diesel is widely accepted as comparable fuel to diesel in compression ignition engine.

### Bio-diesel

Bio-diesel is fatty acid methyl or ethyl ester made from virgin or used vegetable oils (both edible & non-edible) and animal fats. The main commodity sources for bio- diesel in India can be non-edible oils obtained from plant species such as Jatropha Curcas, Karanj, Neem, Mahua etc. Bio-diesel contains no petroleum, but it can be blended at any level with petroleum diesel to create a bio-diesel blend or can be used in its pure form. Just like petroleum diesel, bio-diesel operates in compression ignition engine; which essentially require very little or no engine modifications because bio- diesel has properties similar to petroleum diesel fuels. It can be stored just like the petroleum diesel fuel and hence does not require separate infrastructure. The use of bio-diesel in conventional diesel engines results in substantial reduction of un-burnt hydrocarbons, carbon monoxide and particulate matters. Bio-diesel is considered clean fuel since it has almost no sulphur, no aromatics and has about 10% built-in oxygen, which helps it to burn fully. Its higher cetane number improves the ignition quality even when blended in the petroleum diesel. It provides significant lubricity improvement over petroleum diesel fuel. Lubricity results of bio-diesel and petroleum diesel using industry test methods indicate that there is a marked improvement in lubricity when bio-diesel is added to conventional diesel fuel. Even bio-diesel level as low as 1% can provide up to 65% increase in lubricity in distillate fuels. ). HC and CO emissions were also reported to be lower. Non-regulated emissions were also found to be lower. Bio-diesel has been accepted as clean alternative fuel by US and its production presently is about 100 million Gallons.

### Bio-diesel (NEEM)

A Neem tree can produce many thousands of flowers. In one

flowering cycle, a mature tree may produce a large number of seeds. Neem trees start bearing harvestable seeds within 3-5 years, and full production may be started in 10 years, and this will continue up to 150-200 years of age<sup>[7]</sup> A mature Neem tree may produce 30-50 kg of fruit each year<sup>[7]</sup> By rough estimate India has nearly 20 million Neem trees. Indian Neem trees have a potentials to provide one million tonnes of fruits per year and 0.1 million tons of kernels per years (assuming 10% kernel yield). Neem seeds yield 40-60% oil<sup>[7]</sup> Neem is a golden tree that has gained world-wide importance owing to its multiple uses. Besides agro forestry, it is used in pest control, toiletries, cosmetics, pharmaceuticals, plant and animal nutrition and energy generation. Neem trees are considered to be a divine tree in India because of their numerous valuable uses. The commercial value of Neem has been known since Vedic times. Every part of Neem tree viz., leaf, flower, fruit, seed, kernel, seed oil, bark, wood, twig, root etc. has been in use and traded in various purpose.

### Additives

These help the fuel in meeting environmental emission control standards and improve engine or vehicle performance. Apart from these qualities, the fuel additives serve other purposes such as reduction of corrosive effects, enhance combustion properties, and develop various grades of fuel blends required for various commercial, automotive, industrial, and aerospace sectors. Fuel additives are designed to meet the increasingly stringent environment norms as various countries are implementing regulations to control emissions. Stringent environmental regulations, increasing demand for clean and efficient fuel, and depleting crude reserves are the main market drivers of the fuel additives market. into another by interchange of ester groups. In the reaction one mole of triglyceride oils contained in vegetable oils, animal fats, or recycled greases, reacts with three moles of alcohol to form one mole of glycerol (glycerin) and three moles of the fatty acid alkyl ester (bio-diesel).

### OBJECTIVE OF STUDY

The objective of this research is to investigate effect of Neem bio-diesel blending with fuel additive on performance and emission of multi cylinder, four stroke, water cooled, direct injection, CI engine by:

- Determining the relationship between diesel engine performance and the percentage of Neem bio-diesel in fuel blends.
- Determining the relationship between pollutant concentrations in diesel engine exhaust and the percentage of Neem bio-diesel in fuel blends.
- Determining the relationship between diesel engine performance and the percentage of Neem bio-diesel in fuel blends with using different additives.
- Determining the relationship between pollutant concentrations in diesel engine exhaust and the percentage of Neem bio-diesel in fuel blends with using different additives.

RESULT

Brake Thermal Efficiency

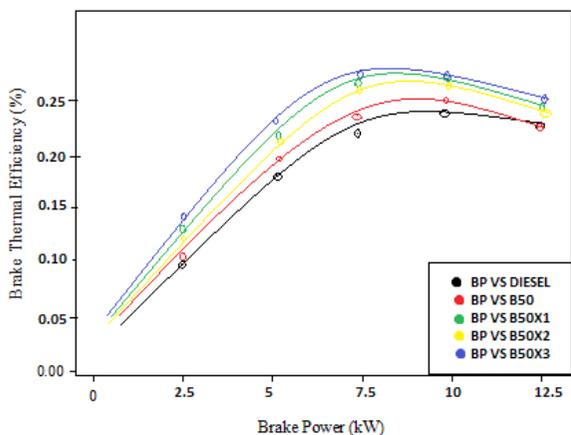


Figure 1 Variations in Brake Thermal Efficiency with Brake Power and different Additives using B50 Fuel.

Fig 1 shows variations in brake thermal efficiency with brake power using B50, B50X1, B50X2 and B50X3 fuels. Maximum brake thermal efficiency using diesel, B50, B50X1, B50X2 and B50X3 fuels are 34.67%, 34.84, 38.95%, 38.048 and 39.96% respectively. B50X1, B50x2 and B50X3 fuel with different additives show improvement in brake thermal efficiency by 1.9%, 1.6% and 1.75% respectively compared to diesel fuel. Also, various additives show improvement in brake thermal efficiency by 1.2%, 1% and 1.5% respectively compared to B50 fuel.

Brake Specific Energy Consumption

Figure 2 Variations in Brake Thermal Efficiency with Brake Power and different Additives using B50 Fuel.

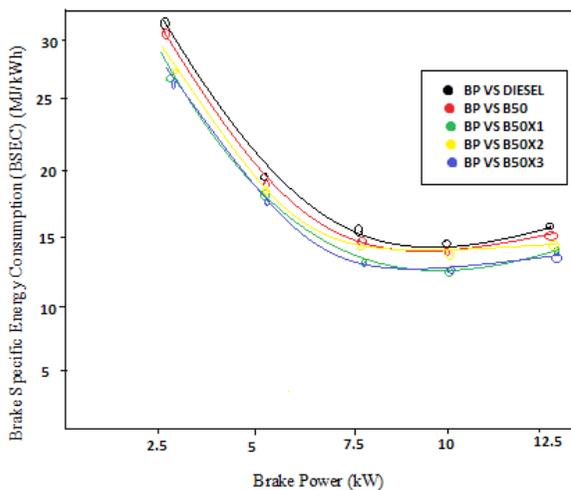


Figure 1.2 shows variations in BSEC with brake power for B50, B50X1, B50X2 and B50X3 fuels. BSEC for B50 fuel is achieved is 10.33 MJ/kWh at brake power of 15.25 kW. With using B50X1, B40X2 and B40X3 fuels, BSEC reduces to the value of 9.05 MJ/kWh, 9.27 MJ/kWh and 8.79 MJ/kWh respectively at brake power of 15.25 kW. B50X1, B50X2 and B50X3 fuel with different additives show reduction in brake specific energy consumption by 1.24%, 1.03% and 1.5% respectively compared to diesel fuel. Also, various additives show reduction in brake specific energy consumption by 1.28%, 1.07% and 1.53% respectively compared to B50 fuel.

Carbon Monoxide

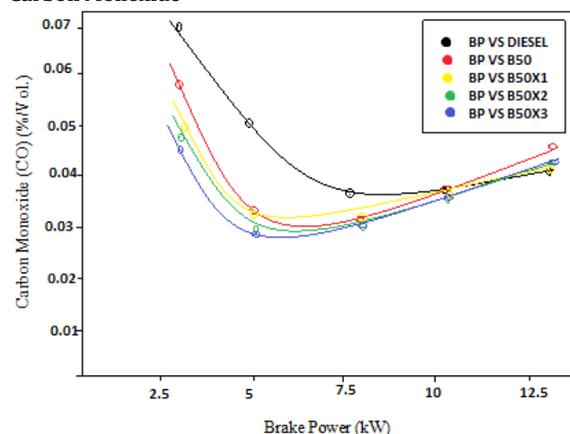


Figure 3 Variations in Carbon Monoxide Emission with Brake Power using B50 Fuel and different Additives

Fig 3 shows Minimum amount of CO emission is achieved for diesel, B50, B50X1, B50X2 and B40X3 fuels are 0.0348 %/Vol., 0.0327 %/Vol., 0.0324 %/Vol., 0.0326 %/Vol. and 0.0325 %/Vol. respectively at brake power of 5.08 kW. CO emission with B50X1, B50X2 and B50X3 fuel with different additives are lower by 0.9%, 0.3% and 0.67% respectively compared to B50 fuel.

Hydrocarbon

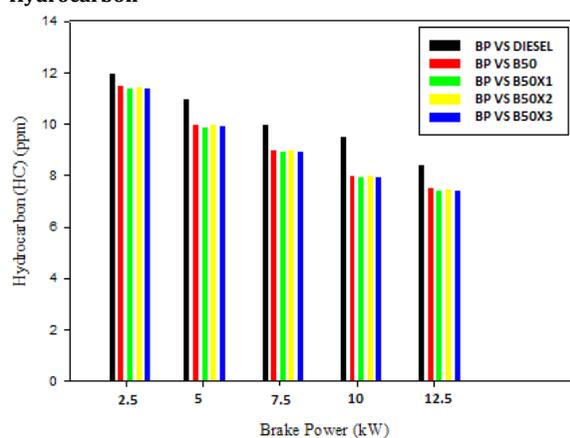


Figure 4 Variations in Hydrocarbon Emission with Brake Power and different Additives using B50 Fuel.

Figure 4 shows variations in HC emissions with brake power for diesel, B50, B50X1, B50X2 and B40X3 fuels. At no load, amount of HC emission for diesel, B50, B50X1, B50X2 and B50X3 fuels are 12 ppm, 10 ppm, 9.94 ppm, 9.96 ppm and 9.93 ppm respectively. HC emission is decreased by 17%, 17% and 17.3% for B40X1, B40X2 and B50X3 fuels respectively compared to diesel fuel at no load.

CONCLUSION

Brake thermal efficiency with B50 fuels are 34.85% r, which are higher compared to 34.67% of diesel. Minimum BSEC for diesel, B50 fuels are 10.12 MJ/kWh and 10.33 MJ/kWh respectively. CO emission with B50X1, B50X2 and B50X3 fuel with different additives are lower by 7%, 6% and 6.6% respectively compared to diesel fuel. HC emission is decreased by 17%, 17% and 17.3% for B50X1, B50X2 and B50X3 fuels respectively compared to diesel fuel at no load.

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