

## Parametric Optimization of Performance and Emission Characteristics of Diesel Engine Using Bio Fuel an Alternate Fuel-a Review Paper



### Engineering

**KEYWORDS :** Diesel, Bio-diesel, Diesel engine, Performance, Emission

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### ABSTRACT

*The present investigations will be taken in view that so far use of bio-diesel and blends with diesel have been taken up, but very limited work has been noticed in systematic and scientific manner to govern the parameters. Experiments will be carried out on four stroke, single cylinder, compression ignition, water cooled engine. Taguchi research methodology will be adopted after due observations. The aim of this work is focused on blends of petroleum diesel, bio-diesel and oxygenating additives (1% to 5%) for compression ignition engines. The motivational intentional point is to view better performance on the ground of Brake thermal efficiency, Volumetric efficiency, Brake specific fuel consumption and exhaust emission parameters is also looking to have opportunities related to rural development by way of providing additional job opportunities on renewable basis with reduction of global warming.*

### Introduction:

India is dependent on the supplies of petroleum fuels which are imported from Gulf countries due to lack of petroleum fuel reserves which have great pressures on the national economy. This results in search of an alternative source of energy so that pressure on the foreign budget can be reduced and at the same time it must match the running system with a consideration to environmental factors.

This is only possible by utilizing resources available within the country. As India is an agricultural based country, use of bio-fuels has a promising option to support the existing recession crisis at world level. Vast vegetation and availability of land is a viable source of bio-fuel for us. Recent researches and studies have made it possible to extract bio-fuel at economical costs and quantities.

The blend of bio-diesel with petroleum diesel has many benefits like reduction in emissions, increase in efficiency of engine, better Cetane ratings, reduction in engine wear, lower fuel consumptions. It is observed in the studies that biodiesel gives higher efficiencies and this will definitely give a path for great economical blocks.

### Bio-diesel standards:

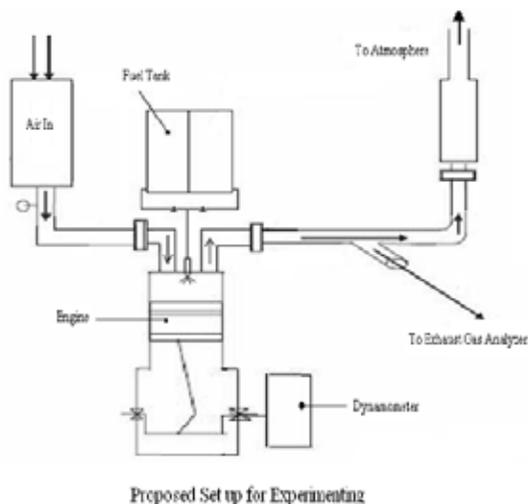
ASTM D-6751 / BIS standards for biodiesel	
Flash point (closed cup)	130°C min. (150°C average)
Water and sediment	0.050% by vol., max.
Kinematic viscosity at 40°C	1.9-6.0 mm <sup>2</sup> /s
Rams-bottom carbon residue, % mass	0.10
Sulfated ash	0.020% by mass, max.
Sulfur	0.05% by mass, max.
Copper strip corrosion	No. 3 max
Cetane	47 min.
Carbon residue	0.050% by mass, max.
Acid number -- mg KOH/g	0.80 max.
Free glycerin	0.020 % mass
Total glycerine (free glycerine and unconverted glycerides combined)	0.240% by mass, max.
Phosphorus content	0.001 max. % mass
Distillation	90% @ 360°C

### Literature review:

Metha H. et al.[1] Paper describes properties of synthetic oxygenates and their influence on exhaust emissions from diesel engines. Effective method for obtaining the reduction in the PM, CO and HC emissions without a significant increase in the NOx emission. Paper highlights the work of H. Hess, A. Boehman and J. Perez and observes 83% reduction in particulate mass emissions was observed and the impact of the additive on gaseous emissions is not as clear, with substantial scatter observed in CO and total hydrocarbon emissions. Emissions of NOx were consistently lower for all CETANER blend ratios, although the trend with increasing CETANER concentration is noisy and examination of the combustion process through in-cylinder pressure trace analysis showed only a slight decrease in peak pressure and a slight increase in combustion duration, with no significant change in ignition delay. Bunkar M. et al.[2] The investigation of performance parameters of direct injection diesel engine using methyl tertiary butyl ether (MTBE) blended with diesel. Investigation performed on diesel engine in two phases using the 100% diesel in the first phase and the MTBE blended with diesel fuels in the second phase. The MTBE blended diesel fuels are prepared in the different proportions of 5% & 10% MTBE blends. All the experiments are performed at a constant speed of 1500 rpm by varying the load and then data obtained from the experiments are used to evaluate the performance parameters of diesel engine. It is investigated that the brake thermal efficiency (BTE) of diesel engine using MTBE blends was decreased as the amount of blends increased in diesel. The BTE of diesel engine using 5% and 10% blends are 25.26 % & 24.65 % respectively that is less than 26.35% than that of diesel. The brake specific energy consumption of 5 & 10 percent of MTBE blends consumed higher energy in comparison to diesel fuel during testing on diesel engine. Pugazhivadivu M. et al.[3] Test conducted on single cylinder four stroke diesel engine and diethyl ether (DEE) as additive to prepare blend of B25, B50 and B75 with 10% to 20% blending of DEE and different charts for NOx recorded. The blends shown the significant reduction in smoke emission though thermal efficiency found to be less. DEE addition upto 15-20% is suggested to reduce NOx. Altin R et al.[4] Paper discusses the properties of various vegetable oil fuels and used two thermostatically controlled electrical heaters to heat vegetable oil upto 800C to reduce the viscosity at fuel pump and injector level to minimize the resistance of flow. Engine torque at 1300 rpm and 1700 rpm is graphed with 9 different vegetable oils and diesel. Exhaust emission is and sfc also recorded at 1300 rpm and suggests need of modification of diesel engine before use of raw vegetable oils. Venkanna B.K et al.[5] Paper discusses the use of honge oil in blends with diesel and finds best result with 20% honge oil and 80% diesel by volume performs near to diesel if the direct injection opening pressure is increased. Engine was tested

from 0 to 100% load range of 5hp engine working at 1600rpm. Different graphical representation of observations is mentioned to % of blend of honge oil in the blend. Crank angle v/s cylinder pressure and net heat release rate is mentioned. Performance at 30% blending found to be effective when injection pressure increased from 200 bar to 225 bar. Sarada S N et al.[6] Paper conclude the experiment using single cylinder diesel engine using cotton seed oil and notice quieter operation with injection pressure of 210 bar. This noticed that the brake thermal efficiency have marginal gain of 3% by increasing injection pressure from 180 bar to 210 bar. It also record the reduction of HC emission from 1720 ppm to 1480 ppm. Paper further suggest working blending to reduce viscosity of the non-edible vegetable oil.

#### Experiment setup:



#### Methodology:

Experiment will be conducted on single cylinder, four stroke, water cooled with bore 114 mm and stroke of 139.7 mm. Rated output 8hp at 950 rpm. Engine have compression ratio of 16.5:1 and injection pressure of 13.5 MPa.

Waste vegetable oil with oxygenating additives of different proportion ranging from 1 to 5% in the blend with governing the following three parameters

1. Compression ratios
2. Injection pressure
3. Injection timing for ignition will be conducted on Psycho-chemical tested fuels.

After due observations the suitable method (taguchi method) will be applied to find the optimization values.

#### Engine specification:

Type of engine	Vertical, totally enclosed, compression ignition, four stroke cycle, water cooled
Number of cylinder	1
Bore	114.3mm
Stroke	139.7mm
Cubic capacity	1432cc
Compression ratio	16.5:1
Type of engine	950 rpm
Rated output	8 hp
Fuel used	High speed diesel
Specific fuel consumption	264g/kw
Lubrication	Forced lubricated & partly by splash
Cooling	Through water supply cooling
Rotation	Clockwise looking at flywheel

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