

# A Review on the Performance, Emission and Combustion in an IC Engine Using Karanja Oil as Bio-Diesel

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**Abstract – A diesel is most significant machine element used normally in many industries and automobile sectors. The key issues on diesel engine are the harmful emissions and pollutants that are liberated in atmosphere. Thus one among the ways to mitigate this drawback is use of bio fuels as appropriate substitute for petroleum product. The biofuels are extracted from agricultural product or renewable sources like biomass. These fuels are often utilized in diesel engines with none major modifications. It reduces the harmful emissions compared to the emissions of diesel. The focus id done to utilize waste biomass product to provide useful bio fuel.**

**Keyword: Emissions, Biomass, Bio Fuels, Diesel Engine**

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## I. INTRODUCTION

It is recognized that the obtainable global oil resource are only to fulfill the demand up to 2030. To satisfy the requirements of energy demand, the fossil oil is imported, ends up in the degradation of the atmosphere because of the fuel combustion. Moreover, the combustion product like CO<sub>2</sub>, sulfur dioxide, and oxide causes warming. The environmental issues caused by the indiscriminate use and scarcity of petroleum. Compression ignition engines role is big for transport and power generation as a result of it's a lot of economical than the other device in their size vary. Increasing industrialization of developing countries is reflective in increased demand for diesel worldwide.

Biodiesel is that the name of a clean burning different fuel, created from domestic, renewable resources. Biodiesel contains no petroleum; however it is mixed at any level with crude oil diesel to form a biodiesel mix. It is utilized in compression-ignition (diesel) engines with very little or no modifications. Biodiesel is straightforward to use, biodegradable, nontoxic, and primarily free of sulfur and aromatics.

Biodiesel is created through an action referred to as transesterification whereby the glycerin is separated from the fat or oil. the method leaves behind 2 product-methyl esters (the chemical name for biodiesel) and glycerin (a valuable byproduct

typically sold to be utilized in soaps and different products (Varuvel, et. al., 2015)

Biodiesel is healthier for the atmosphere because it's made up of renewable resources and has lower emission compared to crude oil diesel.

The transesterification is achieved with monohydric alcohols like methanol and ethanol within the presence of an alkali catalyst.

Biodiesel and its blends with petroleum-based fuel is utilized in diesel engines with none important modifications to the engines. the benefits of biodiesel are that it displaces petroleum thereby reducing warming gas emissions, tail pipe particulate matter, hydrocarbons, carbon monoxide, and different air toxics. Biodiesel improves lubricity and reduces premature carrying of fuel pumps.

## II. LITERATURE REVIEW

Many researchers have over that biodiesel holds promise as another fuel for diesel engines, since its properties are very on the point of diesel oil. The fuel properties of biodiesel like cetane variety, heat of combustion, gravity, and viscosity influence the combustion then the engine performance and emission characteristics as a result of it's

completely different physical and chemical properties than petroleum based mostly diesel fuel.

Varuvel et al. [1] Compared the performance, combustion and emission characteristics of one cylinder four stroke compression ignition engine fuelled with oil made from waste fat. The brake thermal efficiency of neat bio fuel is 32.4% at 80% load that was very high compared to neat diesel (29.98%). The combustion period and ignition delay were cut with neat bio fuel because of high oxygen content and high cetane number of bio fuel. The most drawbacks with the utilization of neat bio fuel in ICE were high Nox emissions in the least loads. Addition of diesel with bio fuel reduced the Nox emissions considerably from 917 ppm to 889 ppm at 80th load with an optimum mix of B80D20.

Swaminath et al.[2] Studied the performance and emission of single cylinder four stroke diesel using biodiesel(fish oil) at a constant speed 1500 rpm. Fuel was blended with oxygenate and EGR technique was conjointly used to improve the performance. He found there's enhanced in brake thermal efficiency. The share reduction was CO-91%, CO<sub>2</sub>-62%, NOx-92% and CxHy-90% were earned once the engine was run at most load using BFO with 2-ditive with EGR and there was reduction all told the odds once the engine was run in different hundreds conjointly. within the case of Night, there was a rise of this emission by regarding 48% within the most load with BFO compared with diesel, for obvious reasons which was conjointly reduced due to the addition of oxygenates and EGR.

K. Muralidhran et al.[3] studied the performance, emission and combustion of VCR engine using methyl esters of waste oil and its blends with normal diesel during a compression ignition engine. Experiments were dispensed for diesel, B20, B40, B60, B80. most brake thermal efficiency for B40 at full load was found to be 4.1% above diesel. Brake specific fuel consumption of the blends B20, B40 at full load was found to be below diesel. Exhaust temperatures of blends were below diesel. Combustion pressure of B40 was found to be above that of diesel. From the analysis of exhaust emission of the blends, it had been found that the hydrocarbon emissions of varied blends were higher at higher loads except B20. The Nox emission for biodiesel and its blends was above that of normal diesel except B40 at lower loads. The CO emission of the mix B40 was nearer to it of normal diesel and it absolutely was found to be higher for light and medium load.

K.Muralidhran et al.[4] studied the performance, emission and combustion of VCR engine exploitation methyl esters of waste cooking oil and its blends with normal diesel at varied compression ratio and engine loading at a continuing speed. Brake thermal efficiency of mix B40 was beyond that of diesel at higher compression ratio. the particular fuel consumption of B40 was below that of all alternative

blends and diesel. Exhaust gas temperature of blends was found to be below diesel. Combustion pressure of waste cooking oil was found to be beyond diesel. The hydrocarbon emission of varied blends was higher at higher compression ratios. The rise in compression ratio will increase the HC emission for mix B40. The emission of oxides of gas (NOx) from the waste cooking oil mix B40 is beyond that of diesel. The CO emission of the mix B40 is nearer to the quality diesel and it's very higher at compression ratio. The carbon dioxide emission is additionally lesser at a similar condition.

Jindal et al. [5] studied that the results of the engine style parameters viz. compression ratio and fuel injection system pressure on the performance with relevancy parameters like fuel consumption, brake thermal efficiency and emissions of CO, CO<sub>2</sub>, HC(hydrocarbon), Nox and Smoke opacity with *Jatropha methyl group ester* as fuel. It's found that the combined increase of compression ratio and injection pressure will increase the brake thermal efficiency and reduces brake specific fuel consumption whereas having lower emissions.

Saravanan et al. [6] studied that the combustion characteristics of a stationary diesel engine fuelled with a mix of crude rice bran oil methyl ester and diesel. It had been discovered that the delay amount and also the most rate of pressure rise for crude rice bran oil methyl ester mix were below those of diesel. The occurrence of most heat release rate advanced for crude rice bran oil methyl ester mix with lesser magnitude in comparison to diesel. This investigation ensures that the suitability of crude rice bran oil methyl ester mix as fuel for CI engines with higher fuel price.

PremAnand et al. [7] calculated the combustion performance and exhaust emission Characteristics of turpentine oil fuel blended with standard fuel during a diesel engine.

YousefHeik et al. [8] distributed an experimental study to use raw algae oil and its methyl group esters in a very Ricardo E6 variable compression ratio engine. Effects of engine speed, engine load output, injection timing of the algae bio fuel and engine compression ratio on the engine output force, combustion noise (maximum pressure rise rate), most pressure and most heat release rate are studied. However, its use reduced the engine output force slightly and increased the combustion noise. The engine output is increased and also the combustion noise is reduced by controlling the engine style parameters e.g. injection timing and compression ratio.

Kalam et al. [9] evaluated the emission and performance characteristics of a multi-cylinder ICE operational on waste oil like 5-hitter palm oil with 95th normal fuel and 5-hitter oil with 95th normal fuel. B0 was used for comparison functions. The

results shows that there are reductions in brake power of 1.2% and 0.7% and reduction of exhaust emissions like unburned hydrocarbon (HC), smoke, carbon mono-oxide (CO), and N oxides (NOx) is offered by the blended fuels.

Mani et al. [10] studied the impact of using waste plastic oil and diesel blends in compression ignition engine. It's discovered that the engine may operate with 100% waste plastic oil and may be used as fuel in diesel engines. Oxides of N (NOx) was higher by regarding 25% and carbon monoxide (CO) enhanced by 5-hitter for waste plastic oil operation compared to diesel oil operation. Hydrocarbon was higher by regarding 15%. Smoke enhanced by 400% at full load with waste plastic oil compared to diesel. Engine fuelled with waste plastic oil exhibits higher thermal efficiency up to 80% of the complete load and also the exhaust gas temperature was higher in the least loads compared to diesel oil operation.

### III. KARANJA (PONGAMIA) METHYL ESTER AS A DIESEL FUEL

Biodiesel, that is synthesized by transesterification of vegetable oils or animal fats sources, could be a realistic different of diesel oil as a result of it's created from renewable resources and involves lower emissions than crude oil diesel. Additionally, it's biodegradable and contributes a lowest quantity of internet greenhouse gases or sulfur to the atmosphere. The transesterification method combines the oil with an alcohol. The most common sort of biodiesel is created with methanol and vegetable oils within the presence of an acceptable catalyst in addition, the method yields glycerol. It's derived from crushing the karanja seed and by exploitation giant mechanical expellers. It's additionally vital to notice that almost all of the experiments conducted on biodiesel are primarily obtained from refined edible sort oils only. The value of refined oils like sunflower, oil and vegetable oil are high as compared to it of diesel. This will increase the general cost of the biodiesel in addition. Biodiesel production from refined oils wouldn't be viable in addition as economical for the developing countries like India. Hence, it's higher to use the non-edible.

### IV. CONCLUSION

The analysis are carried out on calibrating the performance, burning and emission options of a dual variable compression ration diesel engine having Karanja oil because the bio-diesel and comparison are carried oOut with diesel. The result outcomes shows that temperature of exhaust, BTE, SFC and efficiency additionally with torque of the variable compression engine could be a perform of mix comprising the diesel engine. For constant working conditions, the performance of engine is degraded with the increase within the bio-diesel quantity within the blend. Though by rising the compression ratio,

the performance of the engine is differ and it is compared with diesel.

### V. REFERENCE

1. Varuvel E.G., Mrad N., Tazerout M., Aloui F. (2015). Experimental analysis of bio fuel as an alternative fuel for diesel engines. *Applied Energy* 2015; 94: pp. 224-231.
2. Swaminathan C., Sarangan J. (2015). Performance and exhaust emission characteristics of a CI engine fueled with biodiesel (fish oil) with DEE as additive. *Biomass and bio energy* 2015; 39: pp. 168-174
3. Muralidharan K., Vasudevan D., Sheeba K. N. (2015). Performance, emission and combustion characteristics of biodiesel fuelled variable compression ratio engine. *Energy* 2015; 36: pp. 5385-5393.
4. Muralidharan K., Vasudevan D. (2014). Performance, emission and combustion characteristics of a variable compression ratio engine using methyl esters of waste cooking oil and diesel blends. *Applied Energy* 2014; 88: pp. 3959-3968.
5. Jindal S., Nandwana B.P., Rathore N.S., Vashistha V. (2014). Experimental investigation of the effect of compression ratio and injection pressure in a direct injection diesel engine running on *Jatropha methyl ester*. *Applied Thermal Engineering* 2014; 30: pp. 442-8.
6. Saravanan S., Nagarajan G., Lakshmi Narayana Rao G., Sampath S. (2014). Combustion characteristics of a stationary diesel engine fuelled with a blend of crude rice bran oil methyl ester and diesel. *Energy* 2014; 35: pp. 94-100
7. Prem Anand B., Saravanan C. G., Ananda Srinivasan C. (2014). Performance and exhaust emission of turpentine oil powered direct injection diesel engine. *Renewable Energy* 2014; 35: pp. 1179-84
8. Haik Yousef, Selim Mohamed Y.E., Abdulrehman Tahir (2014). Combustion of algae oil methyl ester in an indirect injection diesel engine. *Energy* 2014; 36: pp. 1827-35.
9. Kalam M.A., Masjuki H.H., Jayed M.H., Liaquat A.M. (2015). Emission and performance characteristics of an indirect

ignition diesel engine fuelled with waste cooking oil. Energy 2015; 36: pp. 397-402.

10. Mani M., Nagarajan G., Sampath S. (2015). Characterisation and effect of using waste plastic oil and diesel fuel blends in compression ignition engine. Energy 2015; 36: pp. 212-9.

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