

# Performance evaluation of CI engine with Rice bran and Pungamia oil-Diesel blends as Alternative fuel.

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**Abstract:** Petroleum products resources are limited and their consumption is increasing very fast with globalization. Diesel consumption is about 45% of the total consumption of petroleum products. Over the last 15 years the demand for petroleum products in India has risen and the situation could be more difficult for diesel engines. Apart from conservation there is a global threat to the environment due to polluting nature of conventional fuels. The solution to these twin problems will be utilizing the vegetable oils. A lot of research is going on the potential use of many vegetable oils. This paper provides detailed information, based on experimental work, on the use of rice bran and pongamia-oil as bio fuel. Various performance tests were carried out by blending rice bran and pongamia-oil as 5%, 10%, 15% with diesel and the results were found to be convincing with all blend ratios. More effective output was obtained with 15% blend these oils and their performance was analyzed along with diesel in various blend ratios such as 5%, 10%, and 15%.

**Keywords:** Alternative fuel, Pungamia oil, Rice bran oil, diesel blends, performance.

## 1. Introduction

In the present industrialized world, the consumption of petroleum products has become an index of country's prosperity. The consumption of petroleum products has started as a few tons/year about 140 years ago has reached over 3000 million metric tons/year. Vehicle population is increasing considerably and according to the Association of Indian Automobile Manufacturer (AIAM), the increased use of petroleum fuels by automobiles in India is not only causing fuel scarcities, price hikes, higher import bills and economic imbalance. Hence, there is a need to substitute conventional petroleum fuels by suitable eco-friendly alternative fuels such as natural gas, bio fuels etc. Rice bran and pungamia oil were found to be effective source of alternative fuels. Biodiesel were extracted from

## 2. Preparation of biodiesel:

### Pungamia oil

Pongamia pinnata is a species of family Leguminosae, native in tropical and temperate Asia including part of India, China, Japan, Malaysia, Australia. Commonly it is called as karanja, pongam (in Gujarat), dalkaramch (in Tamilnadu). The oil can be extracted by mechanical expeller and by soxhlet extraction method [1]. The extraction of oil from karanja seed was done by using different methods, i.e. mechanical expression, solvent extraction and

cold percolation using n-hexane as solvent [3].



Fig 1: Pungamia seed.

Rice bran oil:

Rice bran is the by-product of rice processing, accounted for 5-8% in grain weight. Rice bran oil, extracted from the rice bran, contains the unsaturated fatty acids, accounted for 38-42% oleic acid and 32-35% linoleic acid. Preparation methods of rice bran oil include the mainly mechanical press method, solvent extraction, enzymatic extraction and supercritical CO<sub>2</sub> extraction method [2].

3. Comparison of properties:

Table1: Comparison of properties.

Most of the properties except its viscosity are nearer to diesel properties which makes it so suitable for diesel.

Properties	Pongamia	Diesel
Density (kg /m3)	925	850
Viscosity(CST)	2.0to6	1.2to2
Net Calorific Value(kJ/kg)	37000	42000
Gross Calorific Value(kJ/kg)	40000	44000
Moisture and volatile matter	0.1%	25%
Acid value	2	0.06
Iodine value	105	38.3

4. Engine Specification:

Engine Type	Four stroke, variable speed diesel engine
Bore Diameter	87.50 mm
Stroke Length	110mm
Compression Ratio	17.5:01
Speed	1500rpm
Injection Type	Direct Injection
Cooling	Water
Number of Cylinder	1
Loading	Electrical dynamometer loading
Displacement	661.45 c.c

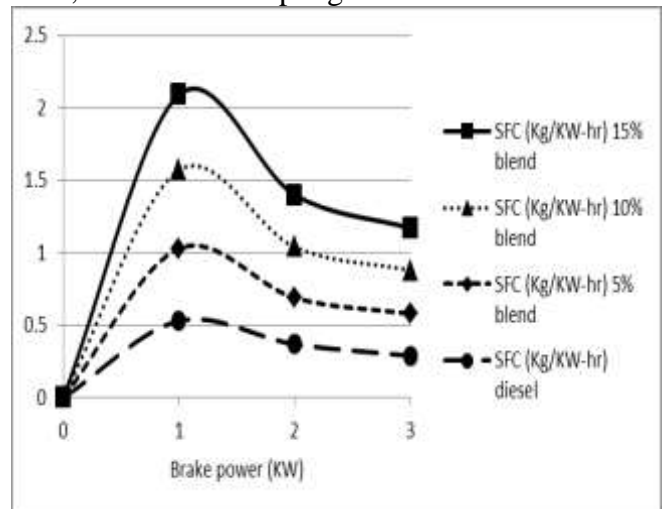
Table2: Engine specifications.

5. Experimental summary

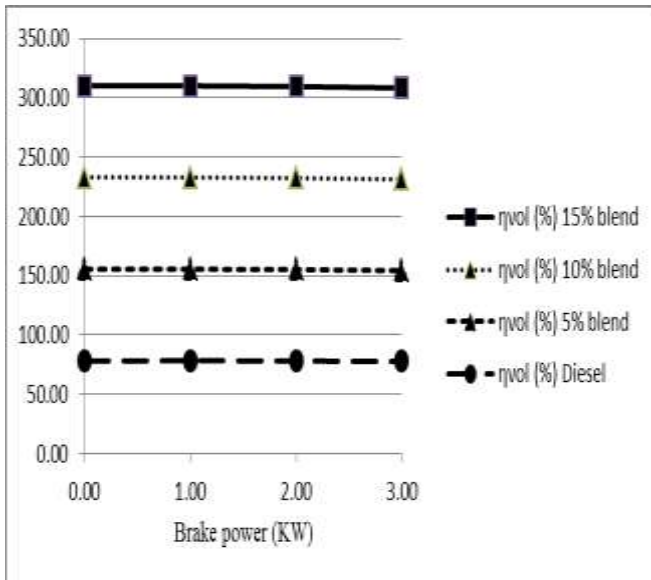
The experiment is carried out in a single cylinder four stroke water cooled diesel engine(make kirloskar) here the engine is mounted on a MS channel frame and is coupled to a AC generator. The electrical loading arrangement is coupled with the AC generator. The engine load is varied by changing the amps with constant voltage.

6. Results and discussions

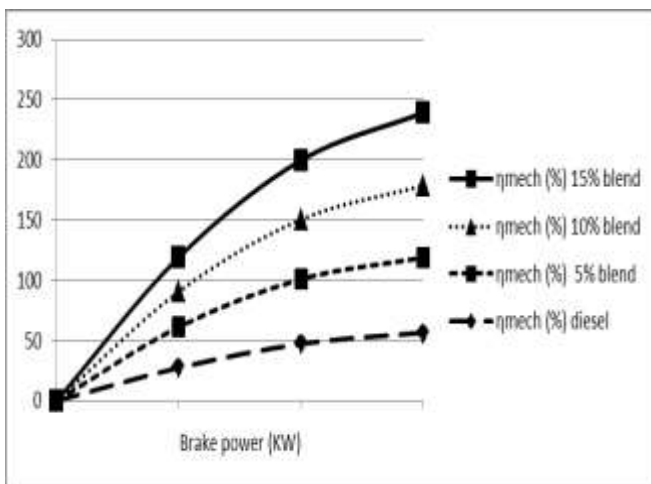
The following graphs shows the variation of SFC, volumetric efficiency, mechanical efficiency and brake thermal efficiency with diesel and blends in varied proportions of 5%, 10%, 15% blends of pungamia and rice bran oil.



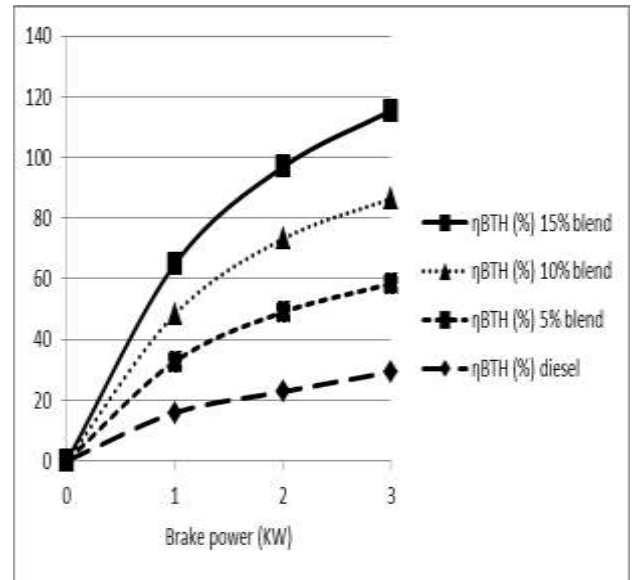
Graph 6.1: BP Vs SFC.

Graph 6.2: BP Vs  $\eta_{vol}$ .

It is observed that the  $\eta_{vol}$  is found to be increasing with increase in BP with 10% blend but SFC is seemed to be likely similar to that of diesel with increase in brake power.

Graph 6.3: BP Vs  $\eta_{mech}$ .

It is clear from the graph that the mechanical efficiency is found to be always higher than that of the diesel at any level of BP (Brake power).

Graph 6.4: BP Vs  $\eta_{BTH}$ .

Also looking into the above graph it is clear that the brake thermal efficiency of the engine is improved at all levels of blend when compared to diesel.

#### 7. Conclusion:

Based on the above inspection it is found that there is no significant power reduction in the engine operation on pongamia and rice bran oil – diesel blends with 15% level of significance.

- The volumetric efficiency is found to be decreased when compared to diesel, at all three levels of blends.
- The brake thermal efficiency is found to be nearly similar as compared to diesel in all levels of blends.
- Similarly, the mechanical efficiency is also found to be in order with that of diesel.

Hence, it can be concluded that the oil derived from pongamia seed and rice bran can be used as a promising alternate fuel for transportation.

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