

“PERFORMANCE STUDY OF NEEM-KARANJA PETROL BLEND IN THREE CYLINDER FOUR STROKE SI ENGINE TEST RIG”

Aman Ahmed Khan¹, Prof. Deenoo Pawar²

M.Tech Scholar¹, Department Of Mechanical Engineering LNCT, Bhopal,
Asst. Professor², Department Of Mechanical Engineering LNCT, Bhopal.

Abstract : Bio oils such as Neem and Karanja oil derived from plants can be used directly in their pure forms or as blends with petrol in internal combustion engines. This study discusses the performance parameter of a test (3 cylinders, 4 strokes Maruti 800 model) fueled with low content bio-oils (Neem and Karanja oil) blends and pure petrol.

Performance of 4 strokes S.I. engine by studying their performance parameters like volumetric efficiency, brake power, brake specific fuel consumption, and brake thermal efficiency has been analyzed. The results thus obtained show that a 10% blend of Neem and Karanja oil with Petrol maintains the standard of pure petrol usage with S.I. engine and thus can be utilized for commercial usage.

1. Introduction

The world is currently facing multiple crises of environmental deterioration and fossil fuel depletion. Continuous extraction and uncontrolled consumption of fossil fuels have led to a reduction in underground-based carbon resources.

Alternative fuels that can promise a balanced co-relation with environmental preservation, energy conservation efficiency and sustainable development have become very necessary in the present as well as future context.

The biofuels and their blends with conventional fossil fuels can provide a feasible solution to this problem.

Researchers in the past few years are focussing on S.I. engines with an aim of reducing harmful emissions without affecting fuel economy and performance of the engine.

Due to the rapid depletion of fossil fuels, efforts of replacing them with non-conventional fuels are being made.

Bio oils such as Neem and Karanja oils can prove to be suitable alternatives for petroleum fuels as they are more environment-friendly and renewable fuels. Their attractive properties are similar to that of gasoline and make them one of the best alternatives available. They can be used as alternative fuels for I.C. engines. Neem and Karanj oils have clean-burning properties as they don't produce carbon dioxide, carbon monoxide, and unburnt hydrocarbons.

A lot of studies have already been conducted on the use of the Bio-oil - petrol blend as a fuel in the S.I. engine and the results show that there are improvements in thermal and volumetric efficiencies, brake power, torque, and fuel consumption. The 10 % Neem and Karanja oil in fuel blend gave the best results for all measured at all engine speed.

2. STATEMENT OF THE PROBLEM

As the world is developing, the consumption of fossil fuel with it is also rapidly increasing causing pollution and depletion of fossil fuels. In order to overcome this problem an alternative fuel that is feasible as well as compatible with conventional fossil fuels is required.

3. OBJECTIVE

The objective of this research is to analyze the performance of 4 stroke, 3 cylinder engine test setup using different blends of Neem and Karanja oil - petrol blends in order to use it to overcome the above-mentioned difficulties.

4. SCOPE OF STUDY

The results obtained in this study assured that further development in the usage of Neem oil and Karanja oil with petrol is possible. The addition of these oils with pure petrol would reduce the consumption of petrol as a lesser quantity of petrol would be consumed to achieve the same performance as obtained by pure petrol.

5. EXPERIMENTAL SETUP AND PROCEDURE

The engine test setup included four-stroke, three-cylinder, petrol (MPFI) engine connected to a hydraulic type dynamometer. Necessary instruments for crank angle and combustion pressure measurement. Combustion pressure signals and Crank angle signals are interfaced with a computer for p-v diagrams through the engine in an indicator. Provisions for fuel flow, load measurement, temperature, and interfacing airflow are also made. A fuel tank manometer, fuel measuring unit, air box, stand-alone panel box, process indicator, load indicator, engine indicator and transmitters for air and fuel flow measurement are also available in the set. For calorimeter water flow measurement and cooling water, rotameters are provided. Study of Volumetric Efficiency, Brake Thermal Efficiency, Brake power, and Brake Specific Fuel Consumption is viable through this setup. To evaluate the engine performance an Engine software is provided in the setup.



Fig.1 Engine Setup

A software named “Engine Soft” is installed in the setup. This software helps in analyzing the performance of the engine and through which evaluation can be done.

Product	Engine test setup 3 cylinders, 4 strokes, Petrol(computerized)
Engine	Make Maruti, Model Maruti 800, Type 3 Cylinder, 4 strokes, Petrol (MPFI), water-cooled
Product code	230H
Bore dia.	72mm
B.P.	27.6 kW
Cubic Capacity	796cc
Max. Speed	5000rpm
Software	“Engine soft” Engine performance analysis software

Table 1:Engine Specification

At first, the engine was started at zero load condition by adjusting the fuel feed control which enabled the engine to achieve the rated speed of 1500 rpm. The engine was then allowed to run until it reached the steady-state and during this process time elapsed for the consumption of 10cc, 20cc and 30cc fuel were measured and averaged with the help of stopwatch and fuel measuring unit.

Power output, exhaust temperature, rpm, and fuel consumption were also measured during this process. By keeping the speed of the engine in the permissible range it was loaded gradually. Short term performance test is carried out on the engine and readings of each parameter are noted to generate the baseline data. Afterward, Neem and Karanja oil-petrol blends were used to check its suitability as fuel with every reading, the leftover fuel is taken out from the engine by drain pipe and it is then recharged with a new blend to take the next readings.

6. EXPERIMENTAL DATA

Engine Speed (RPM)	Load(kg)	Fuel flow sec/100 ml	Mano.defle (mm)	Vol.eff. (%)	Brake Thermal Efficiency	Brake Specific Fuel Consumption	Brake Power
1500	0.5	33.4	34	22.9	7.69	0.91	0.51
1880	0.8	31.6	42	24.5	8.18	0.87	0.68
2410	1.4	28.7	58	26.7	13.87	0.81	0.77
2890	2.5	24.2	74	28.1	11.98	0.95	0.89

Table:-1. Readings for Pure petrol

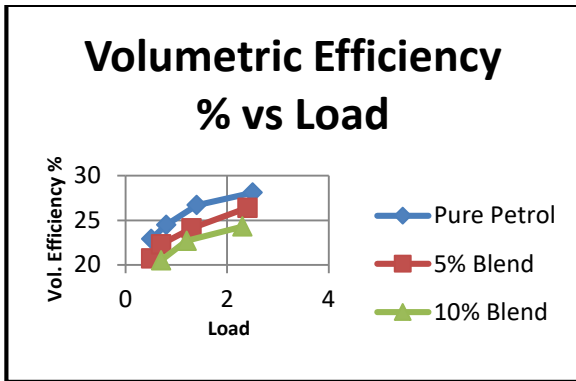
Engine Speed (RPM)	Load(kg)	Fuel flow sec/100 ml	Mano.defle (mm)	Vol.eff. (%)	Brake Thermal Efficiency	Brake Specific Fuel Consumption	Brake Power
1525	0.5	32.3	33	20.7	7.59	0.92	0.53
1876	0.7	30.3	44	22.3	8.21	0.86	0.69
2385	1.3	27.9	58	24.1	13.92	0.79	0.79
2871	2.4	23.1	72	26.4	11.96	0.94	0.87

Table:-2 Readings for 5% Blend

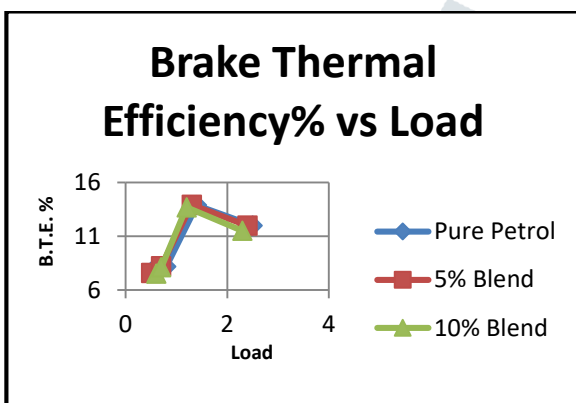
Engine Speed (RPM)_	Load(kg)	Fuel flow sec/100ml	Mano.defle (mm)	Vol.eff. (%)	Brake Thermal Efficiency	Brake Specific Fuel Consumption	Brake Power
1510	0.6	30.1	32	18.3	7.51	0.87	0.51
1865	0.7	28.6	44	20.5	8.11	0.79	0.61
2380	1.2	25.8	56	22.7	13.67	0.71	0.69
2865	2.3	22.5	73	24.3	11.49	0.81	0.81

Table:-3 Readings for 10% Blend

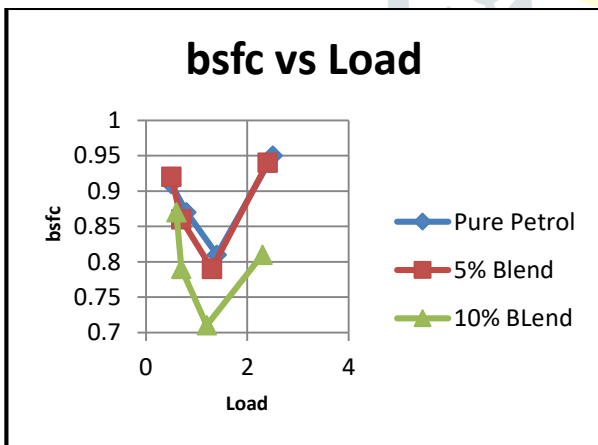
7.COMPARISON OF RESULTS



Graph for Volumetric Efficiency % vs Load

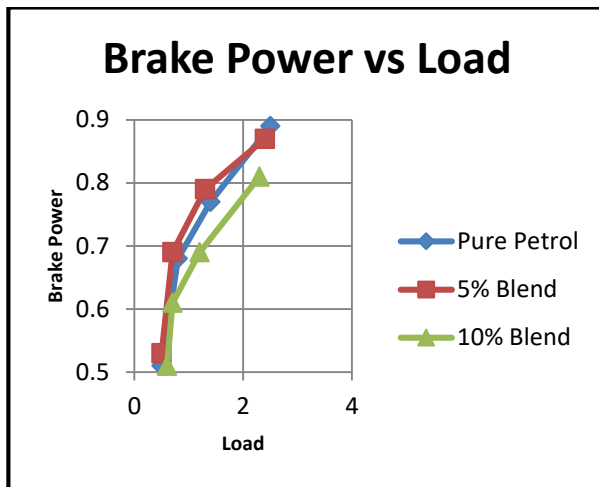


Graph for Brake Thermal Efficiency % VS Load



Graph for BSFC VS Load





Graph for Brake Power VS Load

8.RESULTS AND DISCUSSION

The performance of engine with the addition of Neem and Karanja oil in gasoline was studied in this experiment. The Neem and Karanja oil mixture was blended in the ratio of 0%, 5% and 10% by volume and the performance of the engine studied at different loads with maximum RPM of 3000 in a 4 stroke, 3 cylinder S.I. engine. The parameters considered to study the engine performance were volumetric efficiency percentage, Brake thermal efficiency, Brake specific fuel consumption and Brake power. The engine was run using blends of Neem and Karanja oil mixture with petrol in the ratio of 0%, 5% and 10% and performance of the engine was studied.

The obtained results showed that brake power and brake thermal efficiency showed very little deviation as that obtained using pure petrol. As the load and speed of the engine increased the brake thermal efficiency improved up to a certain limit and then showed a decline in the later stages.

As the blending ratio was increased the value of specific fuel consumption decreased and showed higher values for pure petrol. The Neem oil and Karanja oil additives show lower values of specific fuel consumption when compared to that of pure petrol. With the increase in Brake thermal efficiency and load the values of specific fuel consumption decreased.

The value of volumetric efficiency decreased with the increase in blend percentage. The deviation in the volumetric efficiency for the blends of 5% and 10 % was very little and was comparable to that of pure petrol.

It was observed that the overall performance of the engine with 5% and 10% blends of Neem and karanja oil was acceptable and it was feasible to use these oils with pure petrol.

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