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Experimental investigation of the orange peel oil and cotton seed oil blend with petrol as an alternate fuel for petrol engines

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ABSTRACT : Petrol Engines are widely used for different applications like Transportation, Agriculture etc., Despite its advantage the environmental pollution caused by Petrol Engines become a major concern throughout the world. Usage of fossil fuels like Petrol is polluting the environment due to the emission of Carbon-based gases like carbon monoxide, Carbon dioxide and Hydro carbons and dust which proves harmful to all the living beings. Environmental pollution can be reduced when petrol is blend with some other oil. Several alternate fuels are under study to find a right alternative for petrol either partially or absolutely. Oil extracted from orange peel and cotton seed can be blend with petrol in petrol Engines without any modifications of the engine. By Trans-Esterification method cotton seed oil and orange peel oil is obtained. The experiment is to be conduct when the Engine is fuelled with orange peel oil and cotton seed oil in various proportions like 5%, 10%,15% and 20% by its volume and allow it to blend to occur various emission characteristics of Petrol Engine at different load conditions.

KEYWORDS: Petrol Engine, Orange peel oil, Cotton seed oil, Trans-Esterification.

I. INTRODUCTION

Now coming to the present situation we have absolute scarcity of fuel. Hence we are popularizing the slogans such as **"**Save Oil**"**, introducing new fuel saving vehicles, etc. It is necessary to introduce alternate fuel to replace the existing fossil fuels as it has been predicted by experts that the existing resources of the fossil fuels will be exhausted in another 50 years. As the situation is deteriorating day-by-day especially in developing countries like India, we have to think of introducing alternate fuels. Apart from the scarcity, the cost also is increased at regular intervals. Depending on this, country's economy is also affected. Continuous search for the alternate fuels has lead researchers to several areas. They are alcohols, H_2, LPG, CNG, Biogas, Vegetable oils, etc. Out of these, Vegetable oils are becoming popular worldwide because it is renewable and they can be produced easily as the technology for extraction is well known.

Alternate fuels which are extracted from vegetable oils will positively reduce the usage of fossil fuels. There are various types of vegetable oils that can be used as alternate fuels. The different vegetable oils are: Jatropha oil, Cotton seed oil, Rubber seed oil, Rape seed oil, Rice bran oil, Orange peel oil. Out of these different vegetable oils, Orange peel oil is most important. Because the Calorific value of the orange oil is almost equal to the calorific value of the petrol. As oranges are available in abundance in India, we can easily extract oil from its peel which can be successfully used as an alternate fuel to meet the requirements of fuel at the most economical rate. The oil extracted from orange peel can be blended with cotton seed oil, which can be directly used in petrol engines without any modifications to the engine. Several researchers have taken efforts to adopt suitable methods of using vegetable oils which exhibited improved

performance and reduced emissions.

II. EXPERIMENTS

Our proposed methodology includes the following procedures

1) Extraction Of oil From Orange Peels

- Peel the oranges. Put the peel in a warm dry place to dry.
- Grate the peels with a grater or grind them in a grinder.
- Put the ground peel into a glass jar. Add enough alcohol to cover the peel. Cover the jar tightly with the lid.
- Leave the covered jar in the sunny spot to get more yield. Shake the jar periodically over the course of several days.
- Strain the mixture through a coffee filter or paper towel.
- Leave the strained alcohol in a small covered dish. When the alcohol evaporates, the remaining liquid is the orange peel oil.

2) Extraction of Alternate Fuel From Orange oil By Using Trans-Esterification Process:

There are several methods for reducing the viscosity of oil which are Pre-heating the oil, Trans-Esterification, Blending with another vegetable oil like orange peel oil, Blending with ethers, Blending with alcohols etc., Trans-Esterification is one of the most suitable methods.

Trans-Esterification

Orange oil and cotton seed oil is too thick to flow through modern petrol engines without causing damage, so we can lower its viscosity through a process called trans-esterification. Trans-esterification is the chemical process which replaces one type of alcohol with another in an ester. An ester is made by combining an alcohol with an acid. These reactions are catalyzed by an acid or base or enzyme. Trans-Esterification is of the fuel blend is done from the Lipase enzyme obtained from Bacteria.

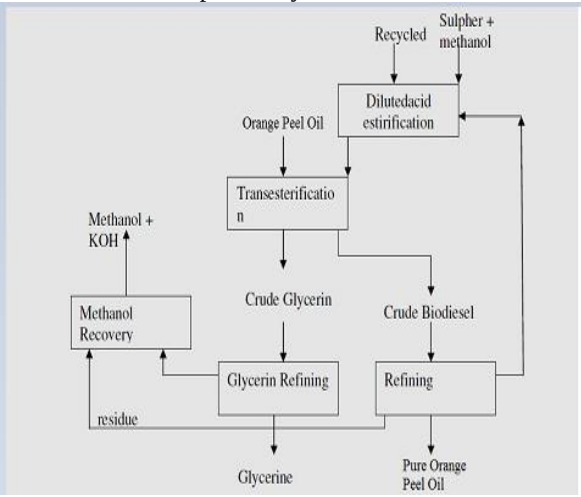

Fig 1 Process of Trans-Esterification

3) Test Procedure:

The following steps are to be conducted

- Mixing has to be done with the orange peel oil and cotton seed oil in the required proportion with petrol.
- The fuel is to be filled in the fuel tank with the required blend.
- The decompression lever should be kept in the open position.
- The engine has to be started at no load condition.
- The readings are to be noted at no load condition and tabulated.
- Load has to be added step by step and corresponding readings are tabulated.
- All the loads from the engine should be removed before stopping.

The following table will show the blending percentage of fuels

Sample no.	Blended fuel (litre)	Cotton Seed Oil (%)	Orange Peel Oil (%)
1	1	5	-
2	1	10	-
3	1	-	5
4	1	-	10
5	1	10	5

Table 1 Blending ratio table

III SMOKE TEST

Smoke test are used to identify the percentage of emission gases present in the exhaust gas.

Fig 2. Smoke meter

Curves will be plotted for

- 10% load of the engine Vs Carbon monoxide emission
- 10% load of the engine Vs Hydro carbon emission
- 10% load of the engine Vs Nitrous oxide emission

This analysis is extended for different fuel blends at the different load conditions such as 20%, 30%, 40% and

50% load in petrol engines.

1) Specification of the engine

The following table will show the specifications of the engine

Ignition system	Spark Ignition
Make and model	Bajaj AV 1
No. of cylinder	Single
Cycle	2 stroke
Bore & stroke	57mm
Rated power	1HP @1500rpm
Cooling medium	Air cooled

Table 2 Specification of the engine

2)Test engine

Test engine will used to calculate the efficiency of the engine

Fig 3 Test engine

IV CALCULATION FOR THE PERFORMANCE CHARACTERESTICS

Total fuel consumption

$$TFC = \frac{10}{t} x \frac{3600}{1000} x\, specific gravity of\ oil \quad \text{Kg/s}$$

Brake power

$$BP = \frac{2\pi NT}{60\ x 1000}\, kw$$

Mechanical efficiency

$$\eta_{mech} = \frac{Brake\,Power}{Indicated\,Power} \times 100\ \%$$

Brake thermal efficiency

$$\eta_{B.th} = \frac{Brake\,Power}{Fuel\,Power} \times 100\ \%$$

Fuel power = $\frac{TFC}{3600} \times$ Calorific value of petrol

(Calorific value of petrol = 42000KJ/Kg)

V GRAPHS

The following graph will use to identify the friction power of the engine

X – Axis Brake Power (kw)
Y – AXIS Total Fuel Consumption(kg/kwhr)

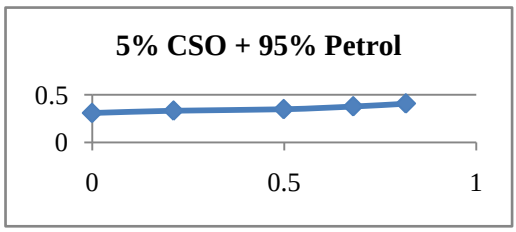

Fig 4 Friction power with 5%CSO+95%Petrol blending

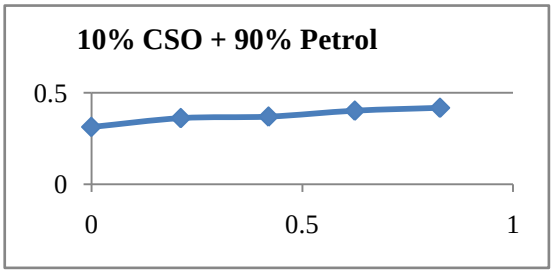

Fig 5 Friction power with 10%CSO+90%Petrol blending

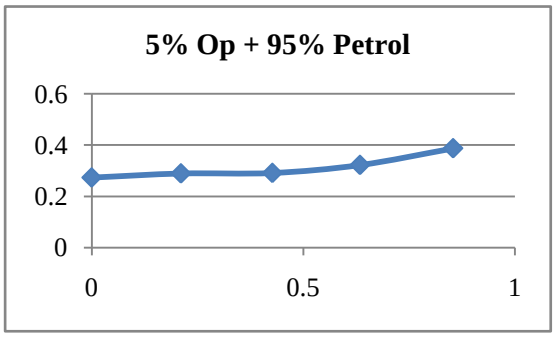

Fig 6 Friction power with 5%OP+95%Petrol blending

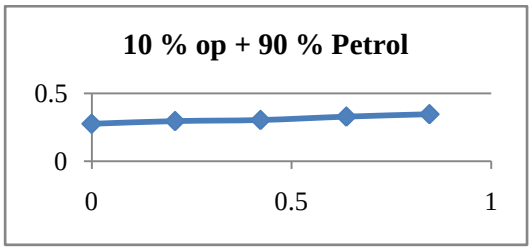

Fig7 Friction power with 10%OP+90%Petrol blending

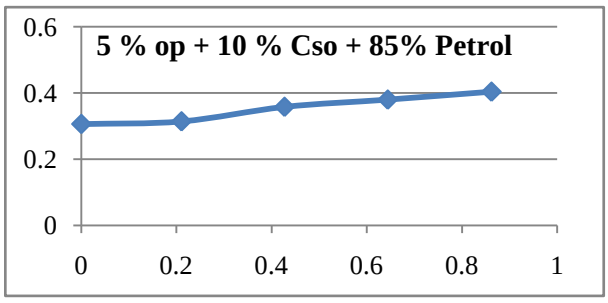

Fig8 Friction power with 5%OP+10%CSO+85%Petrol blending

1) Load vs Mechanical efficiency

The following graph shown the Mechanical efficiency of the engine

X – Axis Load (kg)
Y – Axis Mechanical efficiency (%)

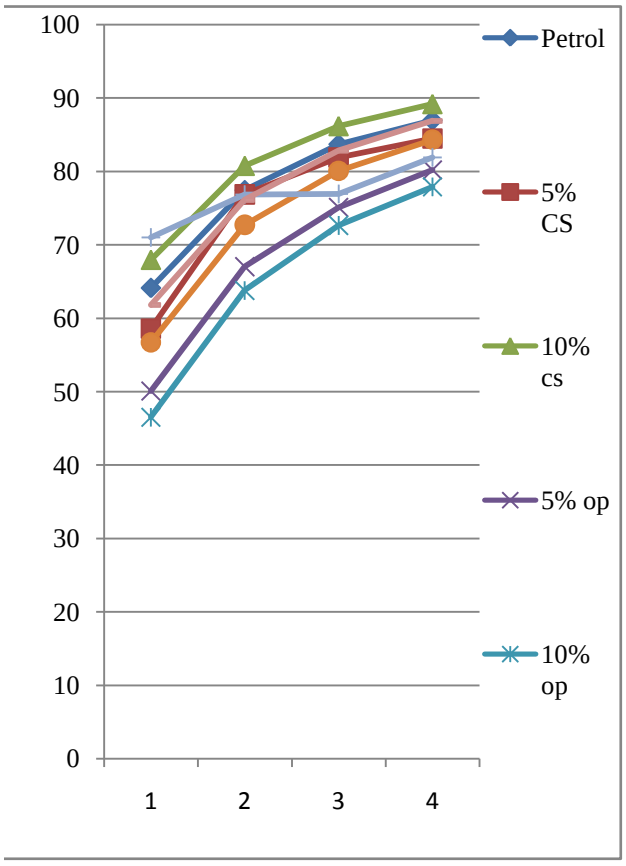

Fig 9 Load Vs Mechanical efficiency

2) Load vs Specific Fuel consumption

The following graph shown the Mechanical efficiency of the engine

x – axis load (kg)
y – axis Specific fuel consumption(kg/hr)

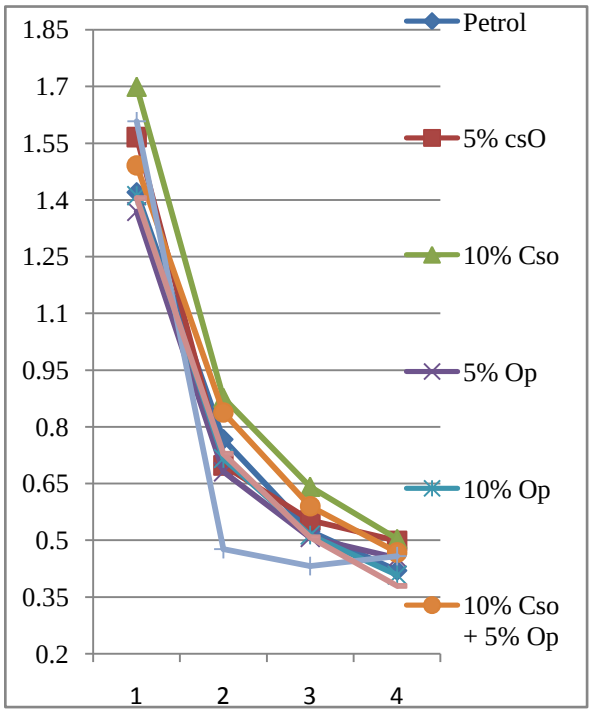

Fig 10 Load Vs Specific fuel consumption

3) Load vs Brake Thermal Efficiency

The following graph shown the Brake thermal efficiency of the engine. Improvement of brake thermal efficiency is achieved by increasing the blending ratio of the fuels.

X – Axis Load (kg)
Y – Axis Brake Thermal efficiency (%)

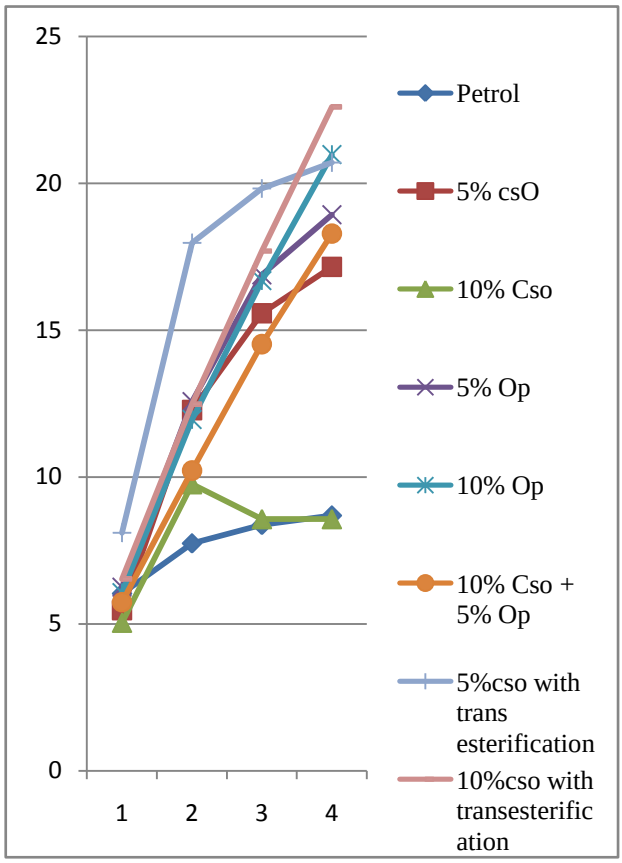

Fig 11 Load Vs Brake thermal efficiency

VI RESULTS

The following comparison table will shown the results of our Experiments.

Table 3 Results

Blending %	Before Trans-Esterification		After Trans-Esterification	
	η_{mech} %	ηbth %	η_{mech} %	ηbth %
5%CSO+ 95% PETROL	60.36	13.73	61.25	14.11
10%CSO+ 90% PETROL	60.83	6.08	61.54	11.85

VII CONCLUSION

The optimum blends of after Trans –Esterification of orange peel oil and cotton seed oil with petrol affects the mechanical efficiency of the engine only by 0.91%.

The Brake thermal efficiency is found to be increased with the blends when compared to petrol by 5.69%. Good reduction of hydrocarbons and CO emissions will be note for proportions of orange peel oil blends with cotton seed oil. Thus the fuel blend of orange peel oil and cotton seed oil is an efficient alternate for petrol, which enhancing a promising future.

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