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EXPERIMENTAL COMPARISON OF THE PERFORMANCE AND EMISSIONS OF DIFFERENT BIO-DIESEL BLENDS USING CI ENGINE

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Abstract: - In the present years, population of vehicles increased enormously which increases the demand of fossil fuel, The availability of conservative fuels decreased continuously, these reasons makes to find the alternative fuels especially biofuels . The use of biodiesel considerably reduced emission and increase the performance of the engine. Now a days researchers have reported the possibility for the production of biodiesel from non edible oil jatropha curcus , pongamia pinnata etc. There is a best source of raw material that is calophyllum inophyllum oil for biodiesel production. In present study calophyllum inophyllum is used as fuel in C.I engine.Blends such as CIME10, CIME20, CIME30, CIME100 are taken for the experiment From this blends CIME20 gives good results and for this blend Isobutanol is added as fuel additive with concentration of 10%,15%. The Performance was improved and emissions were reduced by using Isobutanol with CIME20.

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I INTRODUCTION

DIESEL ENGINE: Developed in the 1890s by inventor Rudolph diesel, the diesel engine has become the engine of choice for power, reliability, and high fuel economy, worldwide. Early experiments vegetable oil fuels included the French government and Dr.Diesel himself, who envisioned that pure vegetable oils could power early diesel engines for agriculture in remote areas of the world, where petroleum was not available at the time. Modern biodiesel fuel, which is made by converting vegetable oils into compounds called fatty acid methyl esters, has its roots in research conducted in the 1930s in Belgium, but today's biodiesel industry was not established in Europe until the late 1980s.

1.1EARLY WORK:

The early diesel engines had complex injection systems and were designed to run on many different fuels, from kerosene to coal dust. It was only a matter of time before someone recognized that, because of their high energy content, vegetable oils would make excellent fuel. The first public demonstration of vegetable oil based diesel fuel was at the 1990 world's fair, when the French government was interested in vegetable oils as a domestic fuel for their African colonies. Rudolph diesel later did extensive work on vegetable oil fuels and became a leading proponent of such a concept, believing that farmers could benefit from providing their own fuel. However, it would take almost a century before such an idea became a widespread reality. Shortly after Dr.Diesel death in 1913 petroleum become widely available in a variety of forms, including the class of fuels we know today as "diesel fuel".

1.2NEED FOR BIO-DIESEL IN INDIA.

It is observed from the trend of energy use of developing countries that the energy needs are growing exponentially because of rapid increase in population, economic growth and individual energy consumption. The ever-increasing expenditure on the fuel oil imports is causing economic imbalance, price hike and hardships for the people. At the same time, emissions produced from the use of fossil fuels are contributing a lot for the irreparable damage of the environment and ecosystem. Even if the stringent set norms for energy conservation and emissions have not been able to bring

the situation in the right track. Hence other viable options need to be explored. In this context alternative energy technologies offer a promising solution.

1.3 SOME OF THE REASONS NEED BIO-DIESEL IN INDIA:

1. Lack of crude oil (conventional) resources.
2. For reducing pollutant products to fulfil the aim of
3. SWACHH BHARAT.
4. Utilizing the sources available in forest areas.
5. To reduce the amount of imported fuels from other countries.
6. By introducing the bio diesel into the agricultural sector can become a great revolution for reducing diesel usage in locomotive engines.

1.4 ADVANTAGES:

- High energy return and displace petroleum based fuels.
- Reduces life-cycle Greenhouse emission.
- Reduces pollution.
- Improves air quality and positive impact on human health.
- Utilizing bio diesel where the conventional fuels are not available.

1.5 DISADVANTAGES:

- Conversion of raw oil into bio-diesel is difficult
- Time taken process.
- NOx from the emission of bio-diesel is high when compared conventional fuels.
- Some bio-diesels requires engine modifications.
- Bio-diesel having low calorific value & high viscosity.

1.6 OBJECTIVES OF PRESENT WORK:

In the present project work the following objectives are met.

- Collection of calophyllum inophyllum seeds from different sources and extracting oil.
- Collecting requirements for the present work based on standard journals.
- Converting raw oil into bio-diesel.
- Make ready the computerized MFVCR engine.
- Conducting base line test using diesel.
- Checking the properties of bio-diesel and compare with the base line values.
- Checking the performance. Combustion and emission analysis of the calophyllum inophyllum bio-diesel with additives

II LITERATURE REVIEW

The main purpose of this literature review is to provide background information on the issues to be considered in this work and to emphasize the relevance of the present study. An intensive literature survey has been carried out from bio- diesel and its blends in diesel engine.

The chapter contains the information we have got from different papers

2.1 BIO-DIESEL:

In the present years non edible oils are easily obtained because of the availability. In the paper stated that potential calophyllum inophyllum as a most promising feed stock for biodiesel production In this paper, several aspects such as physical and chemical properties of crude Calophyllum inophyllum oil and methyl ester, fatty acid composition, Transesterification blending and engine performance and emissions of Calophyllum inophyllum methyl ester were studied. Overall, Calophyllum inophyllum appears to be an acceptable feedstock for future biodiesel production.

T.M.M. Marso et al. studied the production of biodiesel from calophyllum inophyllum seeds. In this biodiesel production raw oil is prepared and then the viscosity of the oil is reduced by the transesterification process.

Sahid at el studied the use of biodiesel in CI engine by using edible oils such as soybean oil, sunflower oil, cotton seed oil. It can reduce the emission reduced in the engine but it has one limitation for the use edible oil as biodiesel i.e. edible oils are used as the food crops in daily life due to its unavailability non edible oils are used as biodiesel.

Soo-young No studied the scope non edible oils in the present generation. Due to the unavailability of edible

oils non edible oils are preferred. Non edible oil such as jatropha, Karanja, linseed, rubber are used as fuels. In this jatropha is used as biodiesel in CI engine and the results were obtained concluded that NOx emissions increased by the use of bio diesel and reduced CO and HC emissions compared to diesel.

B.AshokK.Nanda gopal, D.shakthi Vignesh stated Calophyllum inophyllum is a source of bio-diesel in India. The calophyllum trees in India can reduce the dependency on petroleum products. In present study different types of blends such as B100,B30,B60 are used for engine testing and comparing this results with conventional fuel. The results obtained by the engine shows performance characteristics increased by using calophyllum inophyllum bio-diesel with out any modification.

2.2 BIODIESEL ADDITIVES

B.Ashok,k.Nanda gopal in the present study anti oxidant additives are used in calophyllum inophyllum bio-diesel to improve the performance of the engine. Anti oxidant additives such as Ethanox and Butylated hydroxytoluene are added to the calophyllum inophyllum biodiesel in different concentrations. Experimentation conducted then results are compared. Ethanox has better performance compared to the Butylated hydroxytoluene.

In this paper Effect of leaf extract from pongamia pinnataon the oxidation stability, performance and emission characteristics of calophyllum biodiesel from this paper oxidation stability of calophyllum inophyllum biodiesel can improved by adding leaf extract additive to the CIME20.due to the additive concentration emission OF CO and HC slightly increased compared to the diesel .

Al-Hasan studied the effect of Isobutanol addition to the diesel engine and the results are concluded that decrease brake thermal efficiency and increase thespecific fuel consumption with the addition of Isobutanol compared to diesel engine.

The knowledge we have got from the studying the above papers

III PREPARATION OF BIO-DIESEL.

Preparation of bio diesel involves following process.

1. Collection of seeds from the sources and converting into raw oil.
2. Pre-treatment
3. Acid-test
4. Esterification.
5. Transesterification.
6. Settling & separation
7. Water washing.
8. Post-treatment.

3.1 COMPARING THE PROPERTIES OF BIO-DIESEL WITH BASE LINE VALUES:

SL NO	PROPERTY	CALOPHYLLUM INOPHYLLUM BIO-DIESEL	Isobutanol	DIESEL
1	CALORIFIC VALUE kJ/kg	38500	33100	41888
2	FLASH POINT(°c)	146	35	93
3	FIRE POINT(°c)	152	-	62-106
4	CLOUD POINT(°c)	7.5	-	-12
5	POUR POINT(°c)	-	-	-20
6	ACID VALUE mgKOH	-	-	0.36 mgKOH
7	DENSITY kg/m^3	878	825	849
8	KINETIC VISCOSITY mm^2/s	4.18	2.63	2.6
9	CETANE NUMBER	51.2	25	54.6

Tab 1 properties of prepared bio-diesel & comparing with base line value

3.2 DETAILS OF TEST RIG AND ITS SPECIFICATIONS:

The MFVCR engine test rig is a computer based analysis engine by using different sensors and thermocouples. The sensors are used in the present test rig that are used to find the speed, torque, fuel consumption etc., k-type thermocouples are used in the test rig to measure the temperature at various points.
Engine specifications:

Engine: 4 stroke computerized variable compression ratio multi fuel direct injection water cooled engine Make: TECH-ED
Basic engine: Kirloskar
Rated power: 5 HP (DIESEL)
Rated power: Up to 3 HP (PETROL)

Bore diameter: 80mm
Stroke length: 110mm
Connecting rod length: 234mm
Swept volume: 551cc
Compression ratio: 5:1 to 20:1 Rated
speed: 1500 rpm

Initially the baseline test was conducted using diesel at various loads from no load to full load condition in five intervals(0%,25%,50%,75%,100%) . the performance and combustion are observed using engine test software which are loaded in the computer through interface The emission analysis is carried out Airval automation emission analyser and AVL smoke meter The six gas smoke analyser gives the percentage of CO (carbon monoxide) ,NOx (nitrogen oxide), SOx (sulphur oxide), oxygen (O2), carbon dioxide (CO2), HC(hydro carbons) and smoke meter will gives the amount of smoke coming from the engine.

IV RESULTS & DISCUSSIONS

4.1 PERFORMANCEANALSIS

BP v/s LOAD:

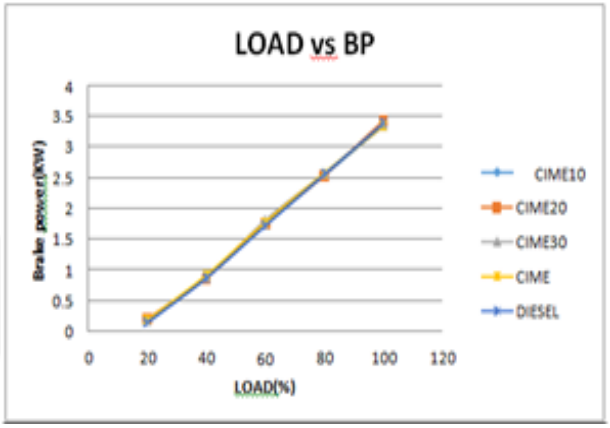


FIG 1.LOAD v/s BP diagram

BP vs SFC:

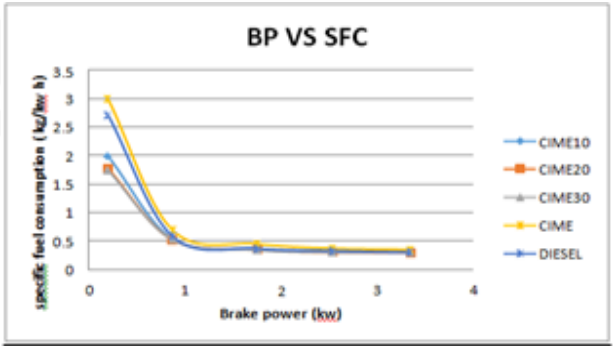


FIG 2. BP v/s SFC diagram

BP v/s Hb

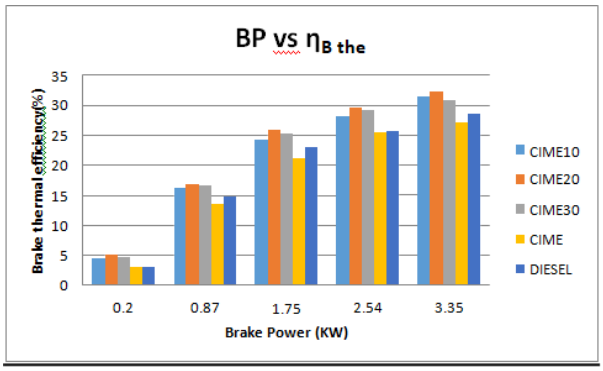


FIG. 3 BP v/s ηB the diagram

OBSERVATIONS

By observing the graph all the fuel combinations are varying linearly with small deviations. The diesel and CIME20 are producing highest BMEP, then both are having highest BP. At full load condition the CIME20 will produce maximum BMEP, so it will produce maximum output. It is recommendable for higher loads.

BP vs Mech

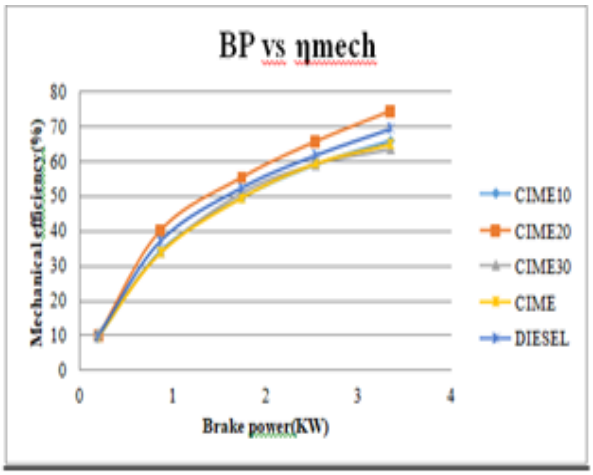


FIG4:BP v/sMech diagram

BP vs Vol

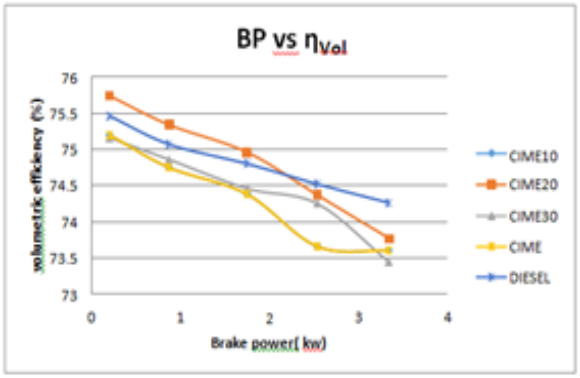


FIG5. BP vs Vol

Observations:

Volumetric efficiency for different blends were observed. The plot of volumetric efficiency against BP Comparison of different blends with the diesel. Diesel has the highest volumetric efficiency compared to the blends. From the blends CIME20 has better volumetric efficiency at highest BP.

EMISSION ANALYSIS:

Load v/s CO:

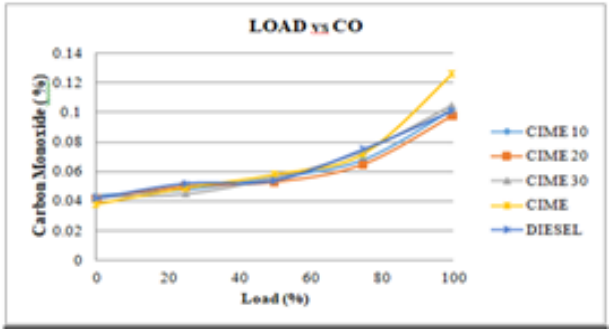


Fig 6 Load vs CO diagram

Load v/s HC:

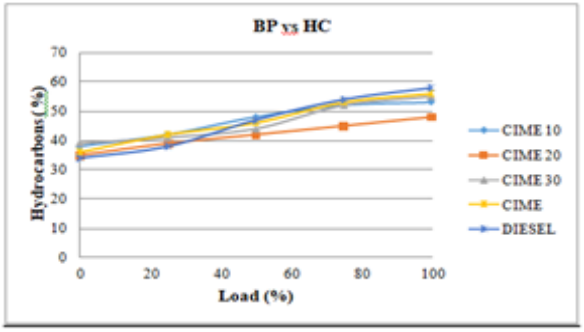
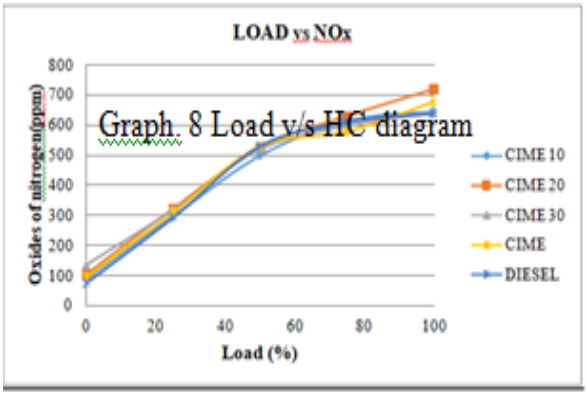


Fig 7 Load v/s HC diagram

Load v/s NOx:



Graph 8 Load v/s HC diagram

Fig 8 Load v/s NOx diagram

V CONCLUSION

The main objective of the present study was to use the non-edible calophyllum inophyllum oil as biodiesel in CI engine. To reduce the viscosity of neat calophyllum inophyllum, transesterification was done to bring it close to that of conventional diesel. In order to obtain a basis for comparison, Various blends are used such as (B10,B20,B30,B100) from this blends B20 shows best results compared to the diesel. To improve the performance characteristics Isobutanol additive added in the B20 in the concentration of 10% and 15%.

OBSERVATIONS:

CIME20 gives the good performance and emission results in single cylinder operation

In CIME20 has low emission parameters except NOX compared to diesel engine operation.The performance of CIME20 is further increased by adding Isobutanol additive.Finally we conclude that by observing performance, combustion and emission analysis the combination of CIME20+ISO15 gives better results compared to conventional diesel fuel. At full load condition the CIME20+ISO15 will produce maximum B.P. so, this combination is recommendable for the stationary engine.

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