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Comparison of some performance test results of diesel with alternate oil with Mahua oil on Variable Compression Ratio Engine Investigation on alternative to exhausting natural fuels.

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ABSTRACT

Comparison Tests to investigate an alternate fuel with natural available bio products. Results got with satisfactory values of performance graphs. An alternate can be thought from present days to meet the exhausting fuels from the earths crust. Mahua is a flower from large trees that gives pungent smells to the pedestrians causing a lot of alcoholic effect. This flower having good fueling properties can mimizes the alcololics thereby an alternate fuel.

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INTRODUCTION

The use of vegetable oil for energy purposes is not new. It has been used world over as a source of energy for lighting and heating since time immemorial. As early as in 1900, a diesel-cycle engine was demonstrated to run wholly on groundnut oil at the Paris exposition. Even the technology of conversion of vegetable oil into biodiesel is not new and is well established. However the unprecedented rise in fuel prices recently has made it economically attractive. The present availability of vegetable oils in the world is more than enough to meet the edible oil requirements, and surplus quantity available can partially me t requirements of biodiesel production. However, there is a considerable potential to further enhance the oil seeds production in the world to me t the increasing demand for food and biodiesel.

Need for Biodiesel:

Due to the increase in price of petroleum and environmental concern about pollution coming from automobile emission, biodiesel is an emerging as a developing area of high concern. The world is confronted with the twin crises of fossil fuel depletion and environmental degradation. Alternative fuels, promise to harmonize sustainable development, energy conversion, management efficiency and environmental preservation. Vegetable oil is a promising alternative to petroleum products. The economic feasibility of biodiesel depends on the price of crude petroleum and the cost of transporting diesel over long distances to remote areas.

It is a fact that the cost of diesel will increase in future owing to increase in its demand and limited supply. A great deal of research and development on internal combustion engines has taken place not only in the design area but also in finding an appropriate fuel. Many researchers have concluded that biodiesel holds promise as an alternative fuel for diesel engines, since its properties are very close to diesel fuel. The fuel properties of biodiesel such as cetane number, heat of combustion, gravity, and viscosity influence the combustion and so the engine performance and emission characteristics because it has different physical and chemical properties than petroleum-based diesel fuel. The consumption of diesel oil is several times higher than that of petrol. Due to the shortage of petroleum products and its increasing cost, efforts are on to develop alternative fuel especially for diesel oil for its partial replacement. It has be n found that the vegetable oils are promising fuels because their properties are similar to that of diesel and are produced easily and renewably from the crops. Vegetable oils have comparable energy density, cetane number, heat of vaporization and stiochiometric air-fuel ratio with that of the diesel fuel. Vegetable oils are non-toxic,

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renewable sources of energy, which do not contribute to the global CO_2 build up. In terms of the economic benefits, vegetable fuels could be used as an emergency energy source in the event of another petroleum fuel shortage.

Vegetable oil from crops such as soybean, peanut, sunflower, rape, coconut, cotton, mustard, linseed and castor have been tried in many parts of the world, which lack of petroleum reserves as fuels for CI engines. The long chain hydrocarbon structure, vegetable oils have god ignition characteristics, however they cause serious problems such as carbon deposits build up, poor durability, high density, high viscosity, lower calorific value, more molecular weight and poor combustion. These problems lead to por thermal efficiency, while using vegetable oil in the diesel engine. These problems can be rectified by different methods which are used to reduce the FFA value and viscosity of vegetable oils. These methods are: trans esterification method, dilution method and cracking method. 1.3 Why can vegetables oils be used as diesel fuels. The vegetable oils, animal fats, and their derivatives such as alkyl esters are suitable as diesel fuel because there must be some similarity to petro diesel fuel or at least to some of its components. The fuel property that best shows this suitability is called the cetane number. In addition to ignition quality as expressed by the cetane scale, several other properties are important for determining the suitability of biodiesel as a fuel. Heat of combustion, pour point, cloud point, (kinematic) viscosity, is among the most important of these properties.

Development of Biodiesel in India:

Biodiesel is a relatively new product in India. The use of vegetable oils for engine fuels may seem insignificant today. But such oil may in the course of time become as important as petroleum and the coal tar products of present time. Scientists discovered that the viscosity of vegetable oil could be reduced in a simple chemical process in 1970 and that it could work well as diesel fuel in modern engine. The fuel is called Biodiesel. It is alternative fuel that can be used in diesel engines and provides power similar to conventional diesel fuel. It reduces the countries dependence on foreign oil imports. As per its end use it is classified with petroleum products industry more particularly with diesel. Cost of petroleum products is directly proportional to the living cost of common man. Although biodiesel is new product, it is going to replace product of petroleum industry i.e. diesel in future. The southern railway adopted a three pronged strategy of large scale processing of oil into biodiesel and making use of it for its large fle t of road vehicles and locomotives. Awareness in India is only now giving shape to projects. In Andhra Pradesh four companies viz. Southern Online Biotechnology (SBT), Sri Sainath Enterprises, Sanathnagar, Hyderabad, Sri Sainath Enterprises, Saifabad, Hyderabad, Sri Sainath Enterprises, Himayatnagar, Hyderabad, Universal Bio fuels, Punjagutta, Hyderabad

In India Bio Diesels are produced in large quantity by the manufacturing companies like CHANDRA OIL COMPANY, Rajasthan, R. K. OIL PRODUCTS, Madhya Pradesh, Advanced Biofuel Center, Vidhyadhar Nagar, Jaipur.

Vegetable Oil acts as a C .I. Engine Fuel:

Vegetable oil can be produced from plant sources, which are viable to produce on a mass scale or in local rural areas on many land conditions. The various edible vegetable oils like sunflower, soybean, peanut, cotton seed etc have been tested successfully in the diesel engine.

Research in this direction with edible oils yielded encouraging results. Diesel is produced from crude oil, biodiesel is produced from vegetable oils and either edible or non edible oils can be used depending on their properties, using diesel derived from vegetable oils is not a new idea. When Rudolf Diesel invented the diesel engine he used peanut vegetable oil fuel in Paris as an alternative to diesel. Using straight vegetable oils as a fuel substitute an option but only with many modifications to be performed on the engine itself for continued satisfactory engine performance. In future more advanced engines may be designed to cope with these crude oils. However at the current time and for a transition period to a cleaner fuel system biodiesel is a viable option. To allow the use of vegetable oils as a fuel without modification of the engine, the fuel needs to be modified for compatibility with the engine. As the diesel engines are designed for diesel fuel any substitute needs to have similar properties for the engine to operate satisfactorily. Biodiesel is a viable opportunity that will not incur large costs for a new infrastructure as the storage and distribution will be the same as the diesel infrastructure.

Alternative Fuels:

The term alternative fuels or unconventional fuels are the substances that can be used as fuels other than the conventional fuels. Generally the conventional fuels are the fuels derived from the fossils. They include petroleum, coal and natural gas. The alternative fuels are the fuels include bio fuel such as alcohol, energy derived from hydrogenics. The present work undertaken however focuses on the production of biodiesel and its workability by performing various test procedures.

Today in the world, particularly in India the Diesel engines dominate the fields of commercial transportation and agricultural machinery on account of its superior fuel efficiency. Another important field of diesel consumption is in Diesel power plants.

The tremendous growth of vehicular pollution and industrialization of the world has led to step rise

in the demand for petroleum products. This has given rise to frequent disturbance and uncertainties and uncertainties in the supply of petroleum and its prices. This situation is likely in the long run a lead to diesel scarcity and ultimately its depletion. The diesel fuels with their combustion produces pollute the air to great extent.

The high consumption of diesel fuels and limited Sources of the others are reasons for an enormous rise in prices of petroleum fuels. The above facts have led to a search for alternative fuels based on renewable Sources as land resources are more plentifully available and more uniformly distributed than diesel products. It has been found that biodiesel hold special promise in this regard, since it can be produced from plants like palmolein trees Jatropha, Mahua, Neam, Cotton seed, Rape seed, , Karanja etc.

Any substance that can be used as fuel other than conventional fuel is called alternate fuel. These are some of the alternative fuels that can be used for IC engines. Methanol, Ethanol, Hydrogen, Natural gas, Liquefied petroleum gas, Biogas, Producer gas, Blast furnace gas, Coke oven gas, Benzol, Biodiesel.

Need For Alternate Fuel:

Mankind has depended upon nature from time immemorial for all its needs. But the most important need lately has been that of energy. The energy requirement these days has grown exponentially resulting in indiscriminate extraction of fossil fuels that have been serving the need of humans. but of late the utilization of these resources has resulted in several problems and difficulties. While the major problem that is being forecasted is the substantially of these fuels in the future as they have reached a stage where their exhaustion seems quite inevitable also the after effect of using these fuels has generated quite a noticeable amount of harm to the environment. So in order to overcome these difficulties the search for the alternative fuels has fast gained momentum.

There has been quite a lot of research activity going on in order to replace fuels such as diesel and other petroleum products with other fuels .The importance of this research is reflected in the words of Rudolf Diesel (1858-1914), creator of the diesel cycle engines, who used peanut vegetable oil to demonstrate his invention in Paris in 1900. In 1912, Diesel said, the use of vegetable oil as engine fuel may seem negligible today. Nevertheless, such oils may become in the passing years as important as oil and coal tar presently.

The present work thus is a step in the direction of developing an alternative fuel for the diesel engines. It has ben found through research that the oil extracted from vegetable has the potential to replicate the results obtained from diesel. So the vegetable oil and properties are studied below.

The vegetable oils are obtained predominantly from grains of different plant species. In order to extract the oil two methods can be employed. The first one could be the physical process in which the grains are crushed using mechanical pres. The other method could be using solvent extraction process. Through the later is found to fare better in terms of yield, the former is generally preferred owing to its simple operation. However the choice of method is decided considering the quality and yield required.

Mahua (Madhuca Indica) Oil:

The two major species of genus Madhuca found in India are Madhuca Indica (Latifolia) and Madhuca Longifolia (Longifolia). Mahua is widely accepted as local name, for both these species. This plant is common in deciduous forests. The seed potential of this tree in India is 500,000 tons and oil potential is180,000 tons.

Madhuca Latifolia is a medium sized to large deciduous trees, distributed in Andhra, Gujarat, Madhya Pradesh, Orissa, Bihar and Uttar Pradesh.

Madhuca Longifoia, a large evergreen tree found in South India, and evergreen forests of the Western Ghats from Konkan Southwards. The tree is planted in most part of India, propagating either by itself or sown seeds.

Critical quality parameters in the process are:

- Complete reaction
- Removal of glycerol
- Removal of catalyst
- Removal of alcohol
- Absence of free fatty acids
- Low sulphur content

Methanol is used as the alcohol for producing biodiesel because it is the least expensive alcohol, although other alcohols such as ethanol may yield a biodiesel fuel with bet er fuel properties but it is expensive. Often the resulting products are also called fatty acid methyl esters (FAME) instead of biodiesel. The amount of alcohol used can be reduced by conducting the reaction in steps, where part of the alcohol and catalyst are added at the start of each step, and the glycerol is removed at the end of each step. Fre faty acids in the oils or fats can be converted to alkyl esters with an acid catalyst also. This can be followed by a standard alkali-catalyzed transesterification to convert the triglycerides. Acid catalysts can be used for the transesterification of oils to alkyl esters, but they are much slower than alkali catalysts.

Engine Details:

Internal Combustion engine set up under test is having the below details.

Power 3.50 kw @ 1500 rpm which is 1 cylinder, four stroke , constant speed, water cooled, diesel engine, with Cylinder bore 87.50(mm), stroke length 110.00(mm), connecting rod length 234.00(mm), Compression Ratio 18.00, Swept volume 661.45 (cc)

Combustion Parameters : Specific Gas Const (kJ/kgK) : 1.00, Air Density (kg/m^3) : 1.17, Adiabatic Index : 1.41, Polytrophic Index : 1.19, Number Of Cycles : 10, Cylinder Pressure Referance : 5, Smoothing 2, TDC Reference : 0

Performance Parameters : Orifice Diameter (mm) : 20.00, Orifice Coeff. Of Discharge : 0.60, Dynamometer Arm Legnth (mm) : 185, Fuel Pipe dia (mm) : 12.40, Ambient Temp. (Deg C) : 27, Pulses Per revolution : 360, Fuel Type : Diesel, Fuel Density (Kg/m^3) : 835, Calorific Value Of Fuel (kJ/kg) : 42500

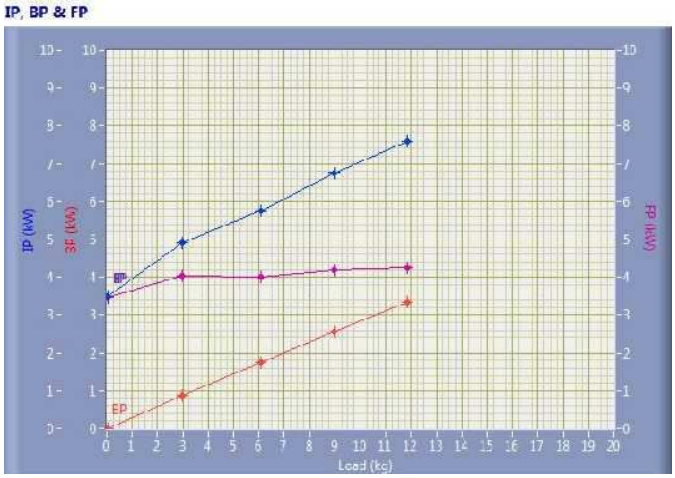

Fig. 1: Showing the Variable Compression Engine test results of I.P, B.P. and F.P. for diesel.

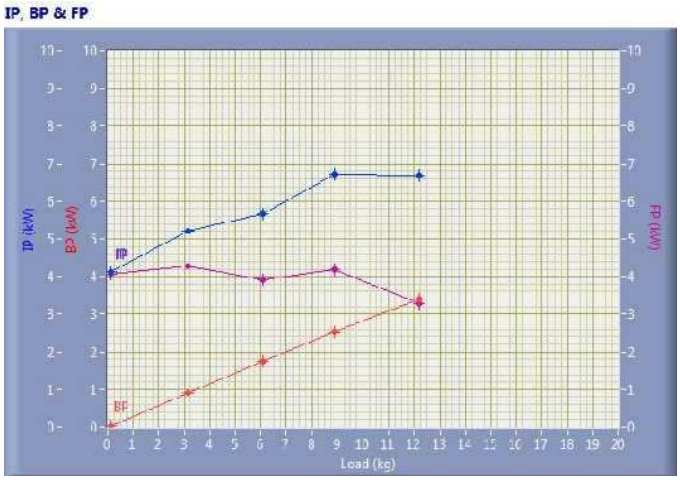

Fig. 2: Showing the Variable Compression Engine test results of I.P, B.P. and F.P. for Alternate Fuel made of Mahua

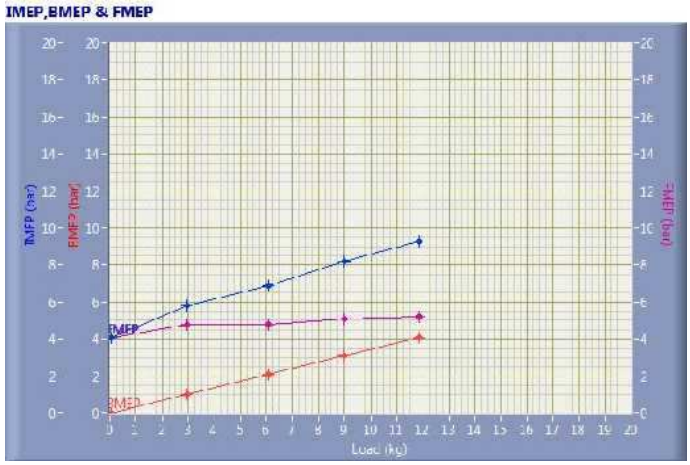

Fig. 3: Showing the Variable Compression Engine test results of I.M.E.P, B.M.E.P.AND F.M.E.P. for diesel.

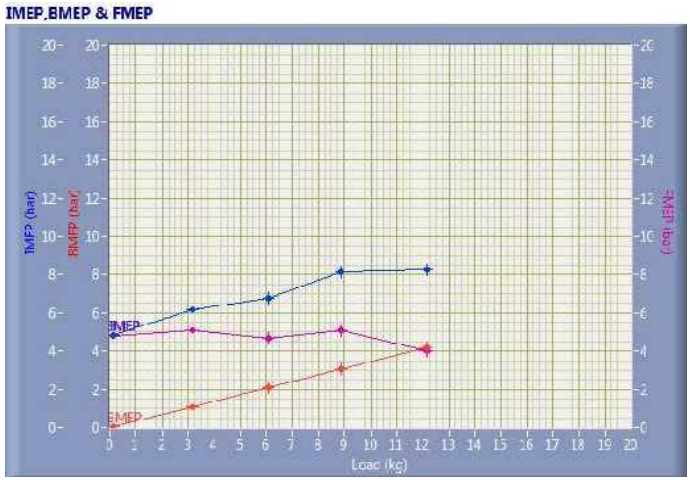

Fig. 4: Showing the Variable Compression Engine test results of I.M.E.P, B.M.E.P.AND F.M.E.P. for alternate fuel with Mahuo

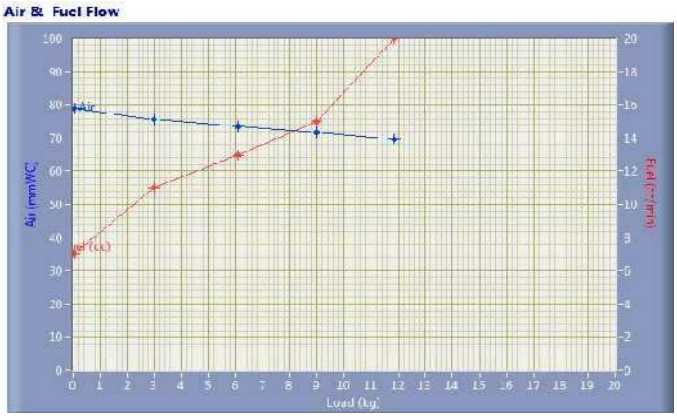

Fig. 5: Showing the Variable Compression Engine test results of Air and Fuel flow for diesel.

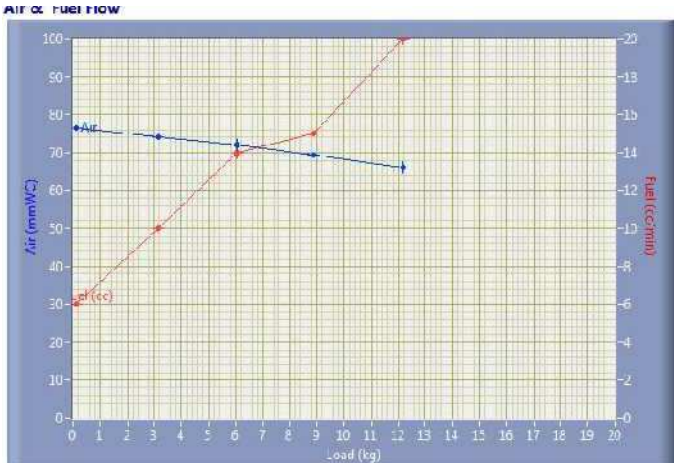

Fig. 6: Showing the Variable Compression Engine test results of Air and Fuel Flow for alternate fuel with Mahua.

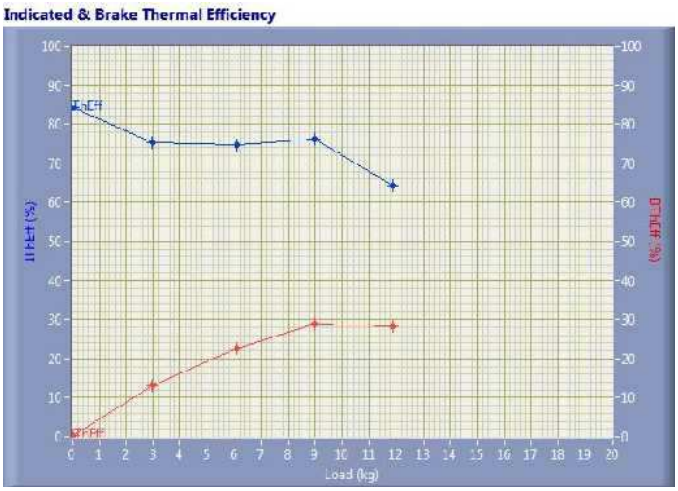

Fig. 7: Showing the Variable Compression Engine test results of Indicated and Brake Thermal Efficiency for diesel.

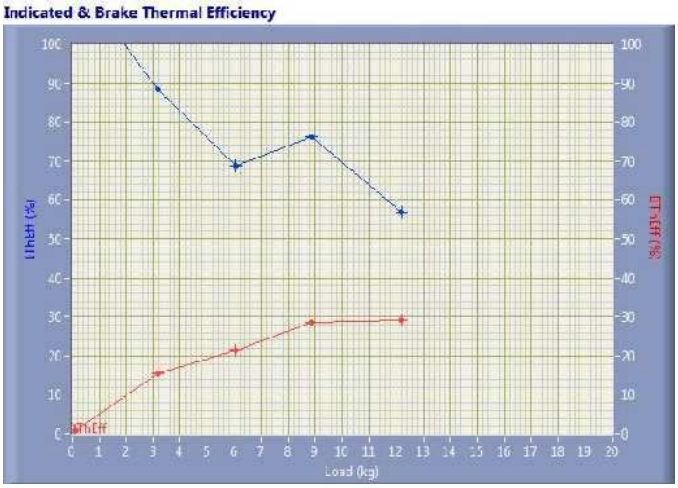

Fig. 8: Showing the Variable Compression Engine test results of Indicated and Brake Thermal Efficiency for Mahua.

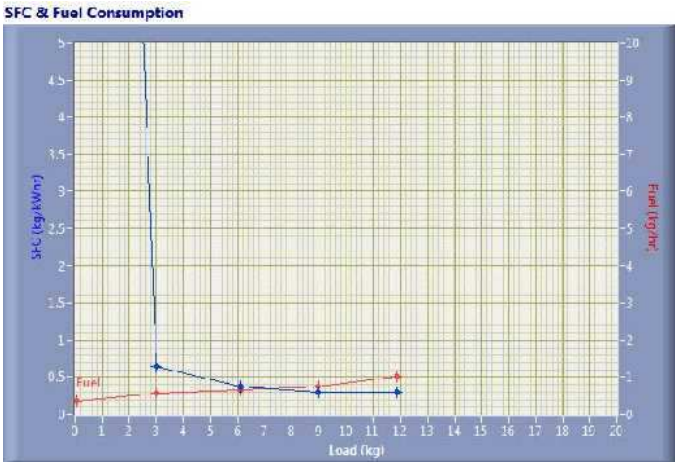

Fig. 9: Showing the Variable Compression Engine test results of SFC & Fuel Consumption for diesel.

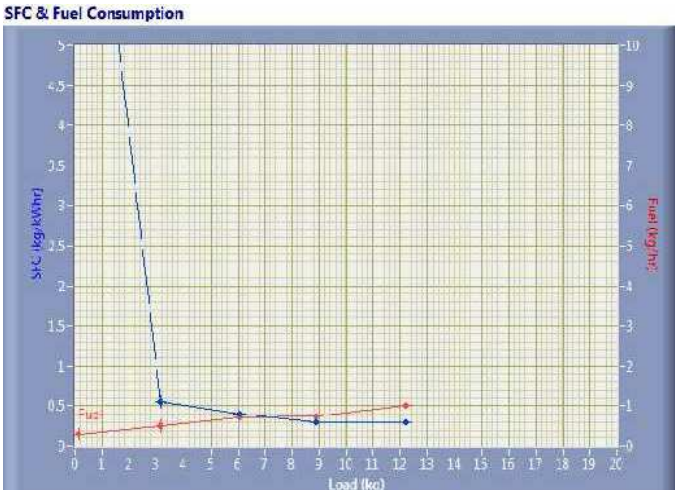

Fig. 10: Showing the Variable Compression Engine test results of SFC & Fuel Consumption for Alternative diesel with Mahua

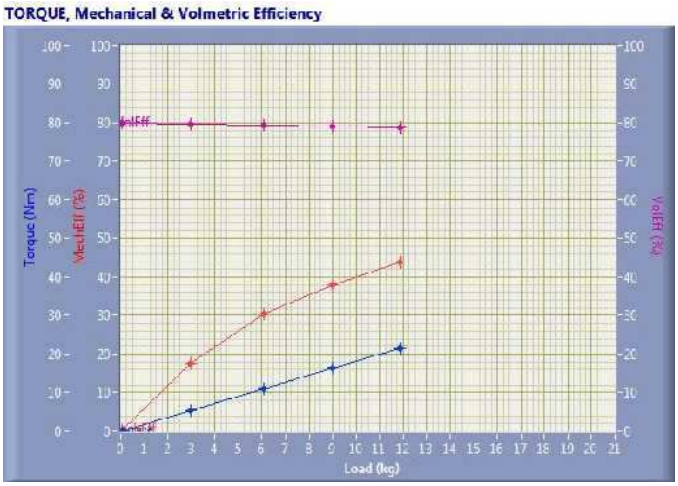

Fig. 11: Showing the Variable Compression Engine Test results of Torque, Mechanical Efficiency and Volumetric Efficiency of Diesel.

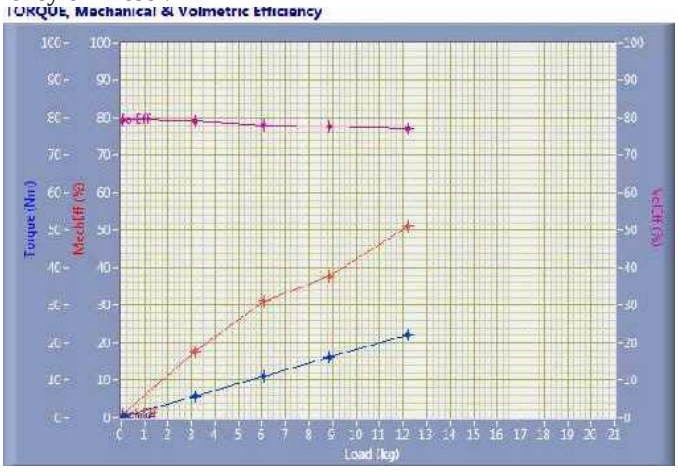

Fig. 12: Showing the Variable Compression Engine Test results of Torque, Mechanical and Volumetric Efficiency of Alternate Fuel with Mahua.

Conclusion:

The performance, of a V C R engine fuelled with Mahua oil

Biodiesel have been analyzed, and compared to the diesel fuel.

The results of present work are summarized as follows:

- The ignition delay of MO and its blends is found to be lesser as compared to that of diesel. The peak pressure of MO-diesel is higher than that of diesel.
- The engine develops maximum rate of pressure rise and maximum heat release rate for diesel compared to MO and its blends.
- With increase in percentage of MO in the blend, the maximum rate of pressure rise and maximum heat release rate decrease.
- The specific fuel consumption increases with increase in

Percentage of MO in the blend due to the lower calorific value of MO.

- The brake thermal efficiency decreases with increase in percentage of MO in the fuel.
- Increase in oxygen content in the UCME-diesel blends as

Compared with diesel results in better combustion and increase in the combustion chamber temperature. This leads to increase in NO_X. UCME recorded higher values of NO_X compared to diesel at rated load.

- Emissions of CO and HC decrease with increase in percentage of MO in the blend.
- It is also observed that there is a significant reduction in smoke intensity especially at higher loads even with 20%MO.
- The used cooking oil as feedstock for transesterification reduces the production cost of biodiesel.
- Mahua oil biodiesel satisfies the important fuel properties as per ASTM specification of biodiesel and improves the performance and emission Characteristics of engine significantly.

Scope For Future Work:

- Investigations are to be carried out on different blends of esters with diesel to determine better performing blends.
- Investigations have to be carried out on combustion characteristics.
- Investigations are to be carried out on emission characteristics.
- These investigations have to be carried out in high speed automobile Multi cylinder engines.
- Endurance tests like 500 hours or more running are to be carried out.

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