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Performance Analysis of Biodiesel Blends using C.I Engine

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Abstract:
The aim of the study is to investigate the effect of vegetable oil blends on the performance of single cylinder compression ignition engine. The two types of vegetable oil appear to affect the engine performance in a similar way and compare well with diesel fuel. This project includes preparation of two sample fuels with six tests. This include (75% olive oil-25%diesel blends) (50% olive oil-50%diesel blends) (25% olive oil-75%diesel blends), (75% corn oil-25% diesel blends) (50% cornoil-50% diesel blends) (25% corn oil-75% diesel blends). By comparing the characteristics like flash point, fire point, cloud point & viscosity of corn and olive oil with sunflower oil. The proposed fuel blends to be tested & analysed critically by using CI engine.

Keywords: Performance, Blends, Vegetable oil, Alternative fuels, Compression ignition engine.

1.INTRODUCTION

Bio-diesel is an alternative to petroleum-based fuels derived from vegetable oils, animal fats, and used cooking oil including triglycerides. Vegetable oils are widely available from various sources, and the glycerides present in the oils can be considered as a viable alternative for diesel fuel. They have good heating power and provide exhaust gas with almost no sulphur and aromatic polycyclic compounds. Vegetable oils are produced from plants, their burning leads to a complete recyclable carbon dioxide (CO2). CO2 associated with solar energy falling on earth gets converted in to the feedstock through photosynthesis. Vegetable oils available through this feedstock can be use to produce biodiesel. 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 meet requirements of biodiesel production. However, there is a considerable potential to further enhance the oilseeds production in the world to meet the increasing demand for food and biodiesel

2. ALTERNATIVE FUELS:

2.1 METHANOL

Methyl alcohol - wood alcohol - may be obtained organically by the distillation of hardwoods at high pressure and a temperature of around 350°C itself a high energy consuming process. With a far higher cumulative toxicirating than ethanol, the energy content is around 3.7 kWh per litre (about one third that of petrol), making it a less attractive alternative transport fuel. Trying to mix methanol with petrol brings problems - they are not entirely compatible, and the slightest amount of water absorbed by the fuel causes the alcohol to separate out in the bottom of the tank. Additives are commercially available, but this adds to the fuel cost.

2.2 ETHANOL:

Ethanol is a clear, colourless liquidwith a characteristic, agreeable odour. In dilute aqueous solution, it has a somewhat sweet flavour, but in more concentrated solutions it has a burning taste. Ethanol has been made since ancient times by the fermentation of sugars. All beverages- ethanol and more than half of industrial ethanol is still made by this process. It can be made from raw materials such as sugarcane, sorghum, corn, barley, cassava, sugar beets etc using already improved and demonstrated technologies. Ethanol is used as an automotive fuel by itself and can be mixed with gasoline to form what has been called "gasohol" or can be mixed with diesel to form diesohol or E-diesel. Because the ethanol molecule contains oxygen, it allows the engine to more completely combust the fuel, resulting in fewer emissions.

2.3BIODIESEL

Biodiesel is an alternative fuel formulated exclusively for diesel engines. It is made from vegetable oil or animal fats or it is the name for a variety of ester- based fuels generally defined as the mono alkyl esters made from vegetable oils through simple transesterification process. Use of biodiesel in CI engine:

- It is recommended for use as a substitute for petroleum-based diesel mainly because biodiesel is a renewable, domestic resource with an environmentally friendly emission profile and is readily biodegradable. Biodiesel is nontoxic, biodegradable. It reduces the emission of harmful pollutants from
- Diesel engines (80% less CO2 emissions, 100% less sulphur) but emissions of nitrogen oxides are increased. Biodiesel has a high cetane number. The high cetane numbers of biodiesel contribute to easy cold starting and low idle

3. LITERATURE SURVEY

In 2003, Khaled R. Asfar and etal [1] has an experimental study of using fuel blends, composed of diesel oil with olive oil and isobutanol alcohol as additives in various percentages in compression ignition engines is presented.
The engine used is a single- cylinder, four-stroke, water-cooled, variable compression ratio engine. The effect of various blends on the brake specific fuel consumption, exhaust soot mass concentration is investigated. They study shows, for blends of diesel and iso-butanol, a considerable drop in soot is obtained for a 5% and 10% pure iso-butanol with diesel . The brake specific fuel consumption increases with alcohol addiction. Adding 5% to 10% iso-butanol to 10% olive oil- diesel mixtures as compared to pure diesel.

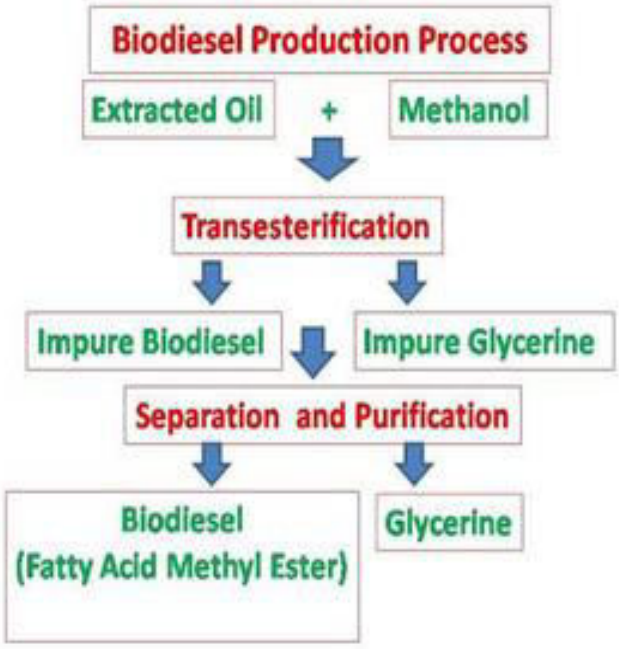
In 2003 M. Canakci and etal[2] expressed in their paper comparison of engine performance and emissions for petroleum diesel fuel, yellow grease biodiesel, and soybean oil biodiesel .
The experiments were carried out on a single cylinder direct injection diesel engine by fuelling Five kinds of pure Fatty acid Methyl ester (FAME) are methyl laurate, methyl myristate, methyl palmitate, methyl separate and methyl oleate, the performance and emissions of diesel engine with the above fatty acids are studied. The conclusions of this study . Both of the methyl esters and their blends gave nearly identical thermal efficiencies with diesel fuel. The *bsfc* for the esters were higher than for diesel fuel . The higher *bsfc* for the net esters may be attributed to their lower heating values. The heating values of the methyl esters are about 12% less than for diesel fuel.

In 2008,P. Pavi. Kumar and etal[3] studied performance of C.I. engine using blends of methyl esters of palm oil with diesel the study on the single cylinder 4- stroke naturally aspirated compression ignition engine using alternating fuel like methyl esters of palm oil .
The compression of properties like viscosity , density , flash point , could point etc. of different mixture of diesel and methyl esters of palm oil etc . are been examined in the study. briefly the suitability of alternating fuels to diesel engine, the vegetable oil, methyl esters of palm oil is chosen as alternative to diesel, which is due to its agricultural origin is able to reduce net carbon dioxide emissions. the biggest hindrance to the easily adaptation of these vegetable oils is high viscosity and low volatility. In the performance analysis, the acquiredata will useful to predict the thermal efficiency, brake specific fuel consumption, carbon dioxide, carbon dioxide and hydrocarbon.

In 2009,Rehman, A.1, Pandey and etal[4] expressed in their paper. performance and emission evaluation of diesel engine fueled with vegetable oil.
To ascertain the possibility of use of modified karanja oil as fuel for compression ignition engine the performance test were conducted. The comparison of the test fuels made with diesel fuel. Test fuels' performance analyzed for esters of karanja oil, blends of karanja oil, and the diesel oil as baseline at varying loads performed at governor controlled speed. The variations in the injection parameters were analyzed to observe its influence on the engine performance with different fuels. results show that diesel engine gives poor performance at lower Injection Pressure than, esterified karanja oil and its blends with diesel. Specific energy consumption is a more reliable parameter for comparison. A comparison of physical and fuel properties of vegetable oils with those of diesel fuel indicates that the vegetable oil are quite similar in nature to diesel fuel. However, vegetable oils have exceptionally high viscosity.After esterification of karanja oil, the specific gravity reduced to 0.895 at 280^0C and for diesel at the same temperature was 0.84. The calorific value of esterified karanja oil found to be 36.76 MJ/kg, which is 17.95% lower than that of diesel. The specific Energy consumption is higher for pure karanja methyl ester as well as for its blends with diesel.

4.METHDOLOGY

The corn, olive oil was purchased in Erode. The commercial diesel fuel was purchased from petrol pump from Tiruchengode petrol pump. All chemicals (Methanol, KOH Catalyst) were burrowed from bio technology department. Magnetic separator used for Transesterification of Corn oil, olive oil was provided by KSR College of Technology. The fuel properties have been determined by using equipment such as Redwood viscometer, open cup flash and fire apparatus.



The above flow chart is describes about the extraction process.

5.FORMULA USED

1. Density of oil, ρr= ρr-0.000063(T-Tr) gm/cc.
2. Kinematic viscosity, ϒ=At-B/t centistoke.
3. Absolute viscosity, μ= ϒx ρ_t centistoke.
   ρr=density of oil at room temperature(gm/cc)
   Up 100 sec A=0.260 & B=171.5
   Above 100 secA=0.247 & B=65
   ρτ= density of oil at room temperature (gm/cc)
   T= test temperature (℃)
   Tr=room temperature (℃) t
   = redwood seconds
   A and B are redwood constants

Table.1. Reading and Calculations

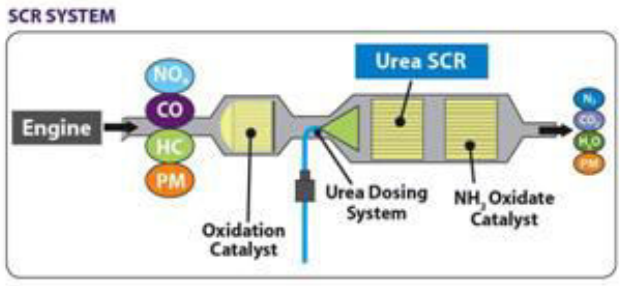
Test name	Corn oil	Olive oil
Flash point	167c	180c
Fire point	173c	186c
Density	161.02	164.67
Kinematic viscosity	6.67	8.57
Absolute viscosity	$107.87*10^{3}$	$1.405*10^{3}$

6.EMISSION TEST

Emissions of many air pollutants have been shown to have variety of negative effects on public health and the natural environment. Emissions that are principal pollutants of concern include:

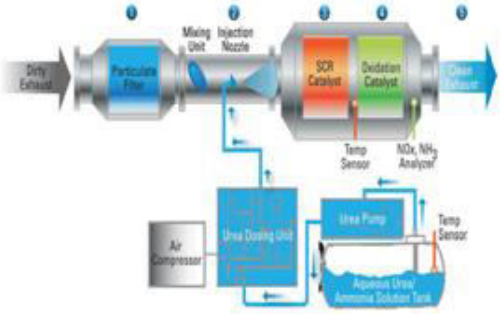
- Hydrocarbons (HC) - A class of burned or partially burned fuel, hydrocarbons are toxins. Hydrocarbons are a major contributor to smog, which can be a major problem in urban areas. Prolonged exposure to hydrocarbons contributes to asthma, liver disease, lung disease, and cancer. Regulations governing hydrocarbons vary according to type of engine and jurisdiction; in some cases, "non-methane hydrocarbons" are regulated, while in other cases, "total hydrocarbons" are regulated. Technology for one application (to meet a non-methane hydrocarbon standard) may not be suitable for use in an application that has to meet a total hydrocarbon standard. Methane is not directly toxic but is more difficult to break down in fuel vent lines and a charcoal canister is meant to collect and contain fuel vapours and route them either back to the fuel tank or, after the engine is started and warmed up, into the air intake to be burned in the engine.
- Carbon monoxide (CO) - A product of incomplete combustion, inhaled carbon monoxide reduces the blood's ability to carry oxygen; overexposure (carbon monoxide poisoning) may be fatal. (Carbon monoxide persistently binds to haemoglobin, the oxygen-carrying chemical in red blood cells, where oxygen (O_2) would temporarily bind; the bonding of CO excludes O_2 and also reduces the ability of the haemoglobin to release already-bound oxygen, on both counts rendering the red blood cells ineffective.

7.CATALYTIC CONVERTER



The catalytic converter is a device placed in the exhaust pipe, which converts hydrocarbons, carbon monoxide, and NO_x into less harmful gases by using a combination of platinum, palladium and rhodium as catalysts.

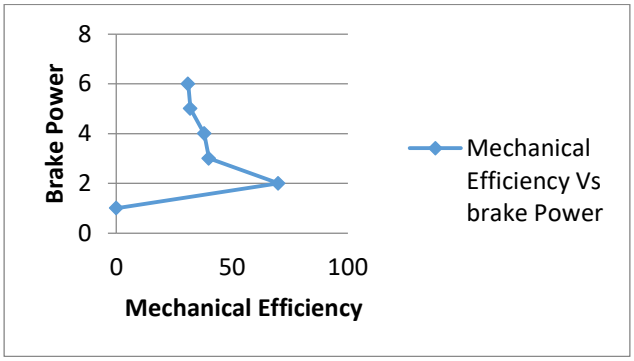
8.METHODS FOR EMISSION TEST



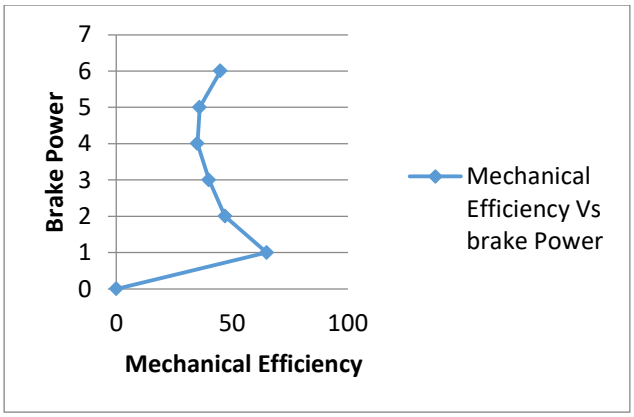
Biodiesel fulfils strategic needs of energy of a country like India, which has large dependence on the imported crude. Biodiesel is a tested and proven low emission fuel, which is accepted world over by engine manufacturers, is safer to handle and requires no separate infrastructure for its distribution and marketing. The biodiesel is the alternate to petroleum diesel and has been successfully introduced in several countries in the world. Therefore, biodiesel is an eco-friendly fuel made from the local resources. India is not ready to invest heavily in biofuels because the political and physical infrastructure necessary to support the industry currently does not exist. Biodiesel distribution channels are virtually non-existent as most of the biofuel produced is used either by the producing companies for self-use or by certain transport companies on a trial basis. Further, the cost of biodiesel depends substantially on the cost of seeds and the economy of scale at which the processing plant is operating. The lack of assured supplies of feedstock supply has hampered efforts by the private sector to set up biodiesel plants in India. In the absence of seed collection and oil extraction infrastructure, it becomes difficult to persuade entrepreneurs to install trans-esterification plants.

9. RESULT

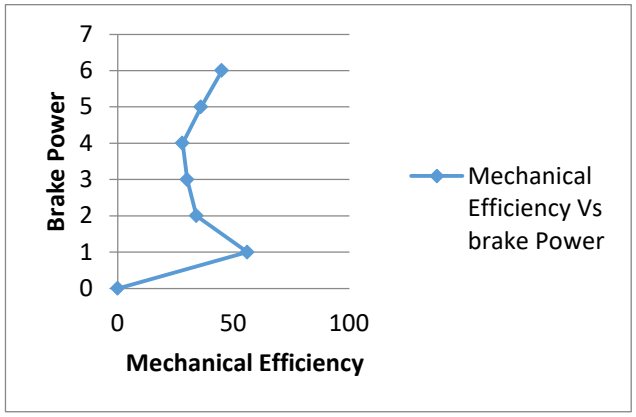
Corn oil for the blend B25:



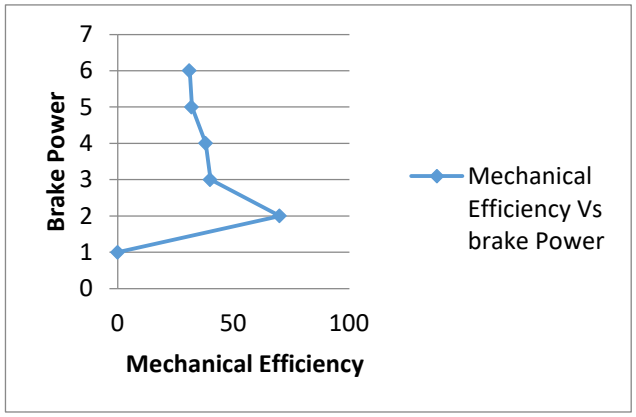
Corn oil blend for B50:



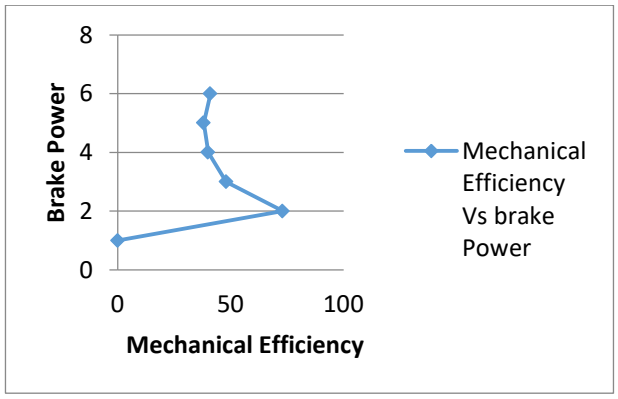
Corn oil for the blend B75:



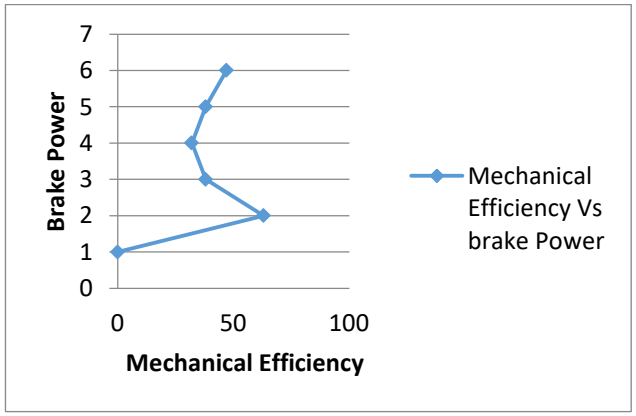
Olive oil for the blend B25:



Olive oil for the blend B50:



Olive oil for the blend B75:



Hence from the above experimental it is concluded that the biodiesel is showing effective result.

9. CONCLUSION

The productions of biodiesel from these oils provide a valuable local, regional and national benefit. To develop biodiesel into an economically important option in India. The oil extracts exhibited good physical chemical properties and could be used as a biodiesel feedstock and industrial application. This source of diesel is attracted considerable attention during the past decade as a renewable, biodegradable, eco friendly and non-toxic fuel. Considering the increasing prices and environmental aspects of fossil fuels especially diesel fuel, interests have been revived around the world to find renewable substitute for fossil fuels. Biodiesel obtained from vegetable oils is considered the most suitable alternative to diesel around the world. The USA, Germany, Brazil, Argentina, and France are the world's top biodiesel producer countries where the USA has increased the biodiesel production mainly from soybeans by 159% to nearly 3.2 billion liters in 2011.However, Indonesia, Malaysia, Thailand, the Philippines, and India are the largest biofuel producing countries in Asia.

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