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Effect of Maize Oil Based Biodiesel on the Performance of a Vertical Diesel Engine

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ABSTRACT: Accessibility of energy sources and climate change are the two biggest challenges that mankind facing in this century. The fast-growing population and the increasing prosperity have led to rapid rise in the energy demand. Human civilization predominantly depends on the utilization of energy, it plays a big role in socio-economic development by improving the standard of living. Energy is vital for the economic development of every country. Every sector of the economy such as agriculture, industry, transport, commercial and domestic sectors require energy. The high energy demand in the industrialized world as well as in the domestic sector had caused environmental pollution problems due to their widespread use of fossil fuels. The concerns about environmental impacts have increased and triggered the examination of alternative energy sources. Biodiesel is a substitute to diesel fuel derived from the triglycerides of vegetable oils or animal fats. In this study, a analysis on the effect of maize oil- BIO DIESEL on performance and of a diesel engine is performed. The purpose of this study is to determine various effects of using waste cooking oil which has been converted into biodiesel, on the performance of a diesel engine and to identify a suitable composition of fuel to achieve optimal engine performance. Engine performance tests will be performed on a diesel engine at various loads to determine performance of a diesel engine using maize oil as biodiesel as fuel and the performance curves for the following will be plotted.

KEYWORDS: Mazie Oil, Bio-diesel, Blending ratios, Performance of Engine.

I. INTRODUCTION

Decomposing plants and other organisms, buried beneath layers of sediment and rock, have taken millennia to become the carbon-rich deposits we now call fossil fuels. These non- renewable fuels, which include coal, oil, and natural gas, supply about 80 percent of the world's energy. They provide electricity, heat, and transportation, while also feeding the processes that make a huge range of products, from steel to plastics.

When fossil fuels are burned, they release carbon dioxide and other greenhouse gases, which in turn trap heat in our atmosphere, making them the primary contributors to global warming and climate change.

Fossil fuels come in three main forms: petroleum, or crude oil, coal; and natural gas. All have many uses, but each serves one main purpose. In 2011, fossil fuels accounted for approximately 82 percent of world's primary energy use but this is expected to fall to 78 percent by 2040, meaning that the use of fossil fuel sis expected to be on a decline due to use of alternative fuels. Yet fossil fuels are finite resources and they can also irreparably harm the environment. According to Environmental Protection Agency, the burning of fossil fuels was responsible for 79 percent of U.S. greenhouse gas emissions in 2010. Oil is the world's primary fuel source for transportation. Most oil is pumped out of underground reservoirs, but it can also be found imbedded in shale and tar sands. Once extracted, crude oil is processed in oil refineries to create fuel oil, gasoline, liquefied petroleum gas, and other non-fuelproducts such as pesticides, fertilizers, pharmaceuticals and plastics.



Alternative Fuels:

Alternative fuels include gaseous fuels such as hydrogen, natural gas, and propane; alcohols such as ethanol, methanol, and butanol; vegetable and waste-derived oils; and electricity. These fuels may be used in a dedicated system that burns a single fuel, or in a mixed system with other fuels including traditional gasoline or diesel, such as in hybrid-electric or flexible fuel vehicles.

Alcohol-based *Ethanol* derived from fermenting and distilling crops is already being blended with gasoline in India to increase octane levels and improve emission quality. Though it is renewable in nature, subsidies attached to it have a negative impact on food prices. *Natural Gas* is already being used in homes and fertilizer plants successfully because of its lower emissions compared with gasoline or diesel. However, the methane created is far worse for global warming than carbon di-oxide.

Liquefied Petroleum Gas (LPG) or *Propane*, a by-product of natural gas processing has already entered our kitchens on commercial basis and is popular in the transportation sector primarily because of its lower emission properties. But its production, storage and distribution hamper its rapid acceptance as an alternative fuel.

Biodiesel, based on vegetable oils and animal fats is an alternate fuel which is considered safe and biodegradable. It is, however, yet to be fully exploited commercially. Alternative fuels have both advantages and disadvantages relating to their impact on the environment and society in general. But the time has come to increase the utilization of alternative fuels to help create a better and cleaner world for everyone.

Biodiesel is a form of diesel fuel derived from plants or animals and consisting of long-chain fatty acid esters. It is typically made by chemically reacting lipids such as animal fat (tallow), soybean oil, or some other vegetable oil with an alcohol, producing a methyl, ethyl or propyl ester.

Unlike the vegetable and waste oils used to fuel converted diesel engines, biodiesel is a drop-in biofuel, meaning it is compatible with existing diesel engines and distribution infrastructure. Biodiesel can be used alone or blended with Petro diesel in any proportions. Biodiesel blends can also be used as heating oil.

inpainting is a method for repairing damaged pictures or removing unnecessary elements from pictures. It recovers the missing or corrupted parts of an image so that the reconstructed image looks natural. In real world, many people need a system to recover damaged photographs, designs, drawings, artworks etc. damage may be due to various reasons like scratches, overlaid text or graphics etc.

This system could enhance and return a good-looking photograph using a technique called image inpainting. Image inpainting modify and fill the missing area in an image in an undetectable way, by an observer not familiar with the original image. The technique can be used to reconstruct image damage due to dirt, scratches, overlaid text etc. Some images contain mixed text-picture-graphic regions in which text characters are printed in an image. Detecting and recognizing these characters can be very important, and removing these is important in the context of removing indirect advertisements, and for aesthetic reasons. There are many applications of image inpainting ranging from restoration of photographs, films, removal of occlusions such as text, subtitle, logos, stamps, scratches, red eye removal etc.

Maize oil, edible oil obtainable from the seeds (kernels) of maize (maize), valued for its bland flavour and light colour. The oil constitutes about half of the germ (embryo) of the maize kernel, which is separated from the rest of the kernel during the operation of milling to produce meal, animal feed, hominy, breakfast foods, or other edible solids. The maize germ is dried in a kiln, and the oil is extracted by either a hydraulic or a screw press; the pressed cake is further treated by washing it with a solvent, ordinarily hexane, and the dissolved oil is recovered by evaporating the solvent. The oil cake remaining after solvent extraction is ground and used as an animal fodder known as hominy feed.

Maize oil is used primarily for food. It is favoured as a salad oil and frying oil because it contains little cholesterol; large quantities of it are converted into margarine by hydrogenation, a process in which the oil is combined with hydrogen at high temperature and pressure in the presence of a catalyst.

II. LITERATURE REVIEW

V. Gopinath and P. Suresh [1], In this paper an attempt has been made to investigate four types of fuels are considered 100% Diesel, 90% Diesel+10% Methyl Ester, 80% Diesel+20% Methyl Ester, 70% Diesel+30% edible oil Methyl Ester and 60% Diesel+40% edible oil Methyl Ester. The various performance parameters like, brake thermal

efficiency, Mechanical efficiency and brake specific fuel consumption were measured and analyzed. In this experiment it is found, that the biodiesel blends gives comparable performance to diesel.

YedilfanaSetargeMekonnen [2], investigated the production of biodiesel from three mixtures of vegetable oil and used cooking oil by alkali catalysed transesterification. Three kinds of vegetable oils, including jatropha, roselle and coconut oils were tested. The effect of used cooking oil content in oil feedstock (used cooking oil/vegetable oil ratios of 0.03-0.2 v/v) on methyl ester formation was investigated and optimized. The methyl ester content from each reaction condition was determined by gas chromatography (GC). The optimum used cooking oil/vegetable oil ratio was 0.03 v/v for all three kinds of oil feedstock.

Chatpalliwarl et al. [3], described the brief overview of the Biodiesel production plant. Various issues- sources, opportunities, challenges, plant design, and evaluation etc, are discussed related to the Biodiesel production. The contribution of the work is that it discusses the important issues concerned with the Biodiesel production plant design, the fundamental details required for the formulation of Biodiesel plant and also it presents possible approach for the mathematical model to evaluate the Biodiesel plant design. Olivera S. Stamenkovića [4], This paper deals with biodiesel production from maize oil as a feedstock via the transesterification and esterification reactions. Here, after brief discussion of the issues related to maize botany, cultivation, and use, as well as the maize germ and oil composition, properties and use, the methods of maize processing for germ and DDGS recovery are presented. In addition, the mechanical and solvent extraction techniques for oil recovery from whole ground maize kernels, germs, and DDGS are considered. [5] Furthermore, biodiesel production from maize oil, waste frying maize oil, and CDO is critically analyzed. It is expected that further investigation will be directed toward developing simpler, more effective and energy-saving technologies for biodiesel production from maize oil- based feedstocks, especially from CDO.

Recep Altin, Selim Centinkaya [6], the author presents a potential of using vegetable oil fuels as fuel for diesel engines. The effects of vegetable oil fuels and their methyl esters (raw sunflower oil, raw cottonseed oil, raw soybean oil and their methyl esters, refined maize oil, distilled opium poppy oil and refined rapeseed oil) on a direct injected, four stroke, single cylinder diesel engine performance and exhaust emissions was investigated. Avinash Kumar Agarwal [7], reported the technical feasibility of using straight vegetable oils (Jatropha oil), into a constant speed direct injection compression ignition engine. Vegetable oils have very high viscosity, which make their direct usability in engines questionable. In this investigation, SVO's were preheated by using waste heat from engine exhaust, in order to reduce their viscosity. The effect of using these oils on typical engine problems such as injector coking, piston ring sticking, lube oil dilution etc. was investigated in detail.

III. METHODOLOGY

They burn less fuel than a petrol engine performing the same work, due to the engine's higher temperature of combustion and greater expansion ratio. Gasoline engines are typically 30% efficient while diesel engines can convert over 45% of the fuel energy into mechanical energy. [8] They have no high voltage electrical ignition system, resulting in high reliability and easy adaptation to damp environments. The absence of coils, spark plug wires, etc., also eliminates a source of radio frequency emissions which can interfere with navigation and communication equipment, which is especially important in marine and aircraft applications.

The life of a diesel engine is generally about twice as long as that of petrol engine due to the increased strength of parts used. Diesel fuel has better lubrication properties than petrol as well. Diesel fuel is distilled directly from petroleum. Distillation yields some gasoline, but the yield would be inadequate without catalytic reforming, which is a more costly process. [9] Diesel fuel is considered safer than petrol in many applications. Although diesel fuel will burn in open air using a wick, it will not explode and does not release a large amount of flammable vapour. The low vapour pressure of diesel is especially advantageous in marine applications, where the accumulation of explosive fuel-air mixtures is a particular hazard. For the same reason, diesel engines are immune to vapour lock.

Diesel engines can accept super- or turbo-charging pressure without any natural limit, constrained only by the strength of engine components. This is unlike petrol engines, which inevitably suffer detonation at higher pressure.

The carbon monoxide content of the exhaust is minimum; therefore diesel engines are used in underground mines. Biodiesel is easily synthesized, non-petroleum-based fuel (through transesterification) which can run directly in many diesel engines, while gasoline engines either need adaptation to run synthetic fuels or else use them as an additive to gasoline (e.g., ethanol added to gasohol).



The prepared fuel blends are used in Kirloskar made Four stroke, single cylinder diesel engine- test rig in the laboratory and load test is held with additional attachment of muffler to the exhaust smoke pipe. By the load test, the performance characteristics and from smoke analysis, combustion analysis of fuel is obtained.

The given I.C engine is a vertical, single cylinder, 4-stroke, and water-cooled constant speed diesel engine. It is fitted with a flywheel sufficient enough to give momentum to absorb energy when in power stroke and release during the other three strokes to get a uniform speed. Provision is made to measure the exhaust heat with the help of a calorimeter and thermocouples fixed at salient points. This engine is provided with a crank handle for starting. The engine is mounted with an absorption thermometer of brake drum type. The engine set up is also provided with burette, graduations duly marked and a three way to measure the fuel flow rate.

Blending:

It is the main process involved for making biodiesels. It is nothing but mixing of transesterified oil in certain proportions to obtain the required properties. This process involves:

Taking proportions of the transesterified oil.

Mixing of biodiesel and diesel in the mixture up to the foam arises.

Blending of oil:

In this process, the conventional diesel fuel is mixed with transesterified Maize oil and Methanol in required proportions to obtain the required blends.

Following are the blends obtained in this process:

D100 –DIESEL 100%

D90 - MAIZE OIL BIODIESEL 10 %, DIESEL 90%

D80 - MAIZE OIL BIODIESEL 20%, DIESEL 80%

D85 - MAIZE OIL BIODIESEL 10%, DIESEL 85%, METHANOL 5%

D75 - MAIZE OIL BIODIESEL 20%, DIESEL 75%, METHANOL 5%

D70 - MAIZE OIL BIODIESEL 30%, DIESEL 70%

When biodiesel is blended with petroleum diesel, the cloud point of the diesel fuel and bio fuel are the two most important properties. The blended fuel must still need the seasonal temperature for cloud point for the region the fuel is being used. If blending is done into seasonal diesel, it must be done such that the seasonal cloud point temperatures are maintained. Therefore, the cloud point of biodiesel and petroleum diesel must be known. In some cases, this may govern the blend level of the biodiesel blend. Operators that blend even low percentages of biodiesel with seasonal diesel in the winter or shoulder seasons, risk having operational issues due to the raised cloud point. Therefore, it is important to know the cloud point of diesel used for blending, the biodiesel intended for blending and regional seasonal cloud point for the biodiesel blend. Blending of biodiesel blends without knowing the cloud points of the fuels being blended is not recommended.

Engine performance is an indication of the degree of success with which it is doing its assigned job, i.e., the conversion of the chemical energy contained in the fuel into the useful mechanical work.

Calculations:

Fuel consumption (F.C) = $(10 \times \text{SP. Gravity} \times 3600) / (t \times 1000)$

Brake power (B.P) = $(2\pi N(W-S) \times 9.81 \times r) / 60000$

Friction power (F.P) = (from graph)

Indicated power (I.P) = B.P. + F.P

Specific fuel consumption (S.F, C) = F.C / B. P

Brake thermal efficiency (η_{Bth}) = $(B.P \times 3600) / (F.C \times C. V)$

Indicated thermal efficiency (η_{Ith}) = $(I.P \times 3600) / (F.C \times C. V)$

Mechanical efficiency (η_{mech}) = B.P / I.P

Brake mean effective pressure (B.M.E.P) = $(B.P \times 60000) / (L \times (\pi/4) d^2 \times (N/2))$

Indicated mean effective pressure (I.M.E.P) = $(I.P \times 60000) / (L \times (\pi/4) d^2 \times (N/2))$

IV. EXPERIMENTAL RESULTS

Performance test is been conducted on the vertical diesel engine with all the six compositions. The below graphs compares the output values with all the compositions.

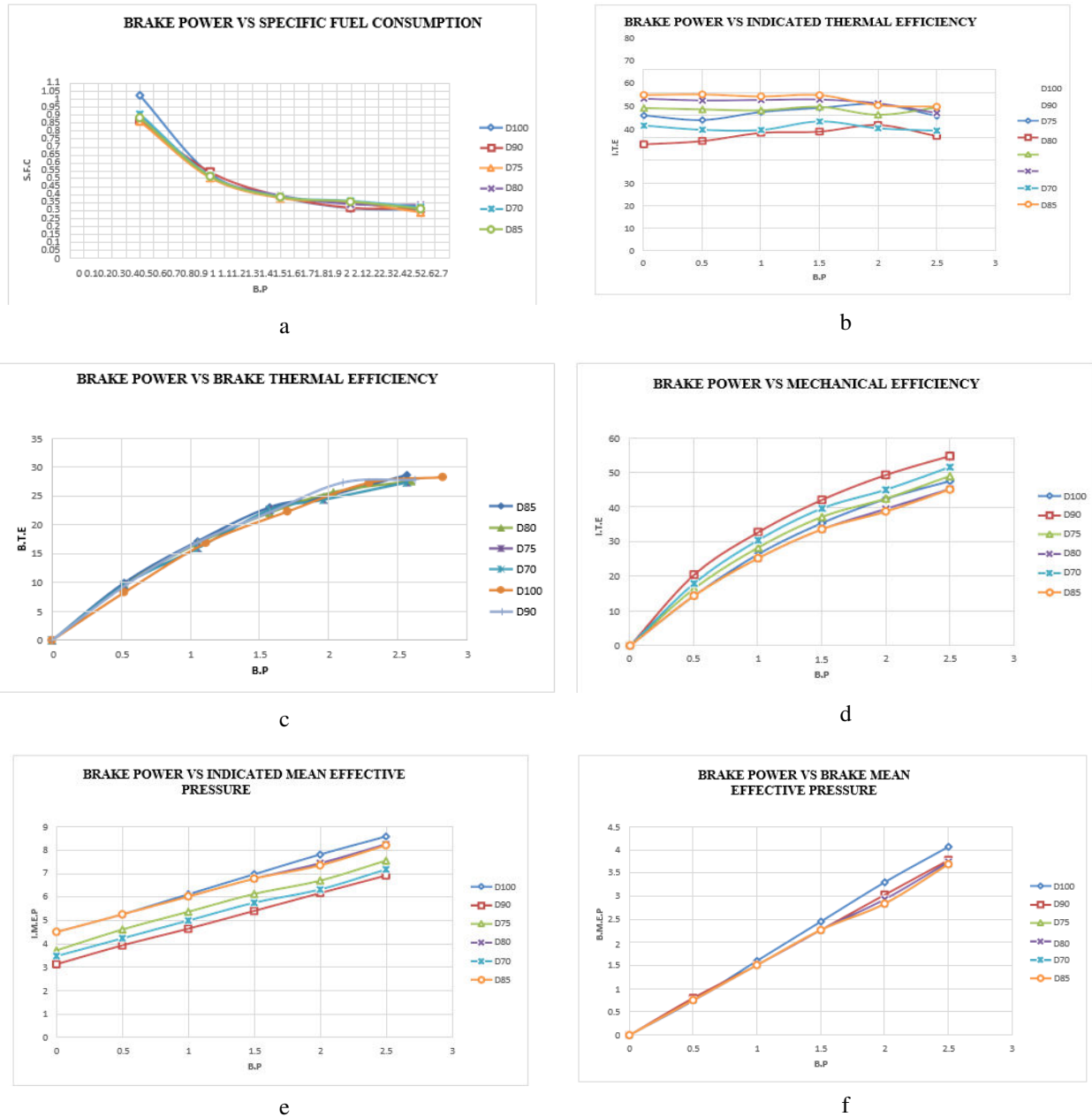


Fig.1 (a-f) Shows the performance of biodiesel samples.

A comparative analysis of diesel with different blends of diesel and transesterified maize oil with reference to the performance of the engine and cost of the fuel was taken up for experimental study and analysis. It has been observed that a right blend of two oils only gives best performance but is not economically viable. The following observations were made from graphs plotted:

- It is found that frictional power which is generally function of speed of engine is also found to be variable which changes with composition. From experimentation, it is inferred that D90 blend has minimum losses in terms of mechanical power and power consumed by auxiliaries, which put together generally known as Frictional Power. Therefore D90 blend offers the best mechanical efficiency.
- The specific fuel consumption varies directly with respect to fuel consumption. It is observed that at no loads, specific fuel consumption is less for D75 blend and also at higher loads D75 is found to be the best.



- iii. Indicated thermal efficiency of diesel engine varies inversely with fuel consumption rate. The lesser the fuel consumption, higher is the indicated thermal efficiency and vice versa. It is observed that at higher loads D85 offers higher indicated thermal efficiency.
- iv. All the blended samples are higher in cost when compared to the cost of conventional diesel fuel.

V. CONCLUSION

The experimental study is conducted to evaluate and compare the blends of Maize oil biodiesel to conventional diesel fuel in single cylinder naturally aspirated vertical diesel engine.

The series of tests are conducted using each of fuels with the engine working at a constant speed of 1500 rpm and at different loads starting from no load. In each test fuel consumption, specific fuel consumption, thermal efficiency, mechanical efficiency and mean effective pressure are computed from measured flow rate and calorific value.

From the performance characteristics it is observed that when mechanical efficiency values are considered it is better to use D90 blend. But conventional diesel fuel still remains a economically viable option as price being lesser than the other blends. When specific fuel consumption is considered it is found that D75 has low specific fuel consumption than other blends. When indicated thermal efficiency is considered D85 is more preferable than other blends.

REFERENCES

- [1] V. Gopinath, P Suresh; Performance Evaluation of Diesel Engine Runs on Biodiesel Blending, Applied Mechanics and Materials 592-594:1719-1722, May 2014.
- [2] YedilfanaSetargeMekonnenAnbessieDegfieTadios, TesfayeTadiosTefaye, Optimized Biodiesel Production from Waste Cooking Oil (WCO) using Calcium Oxide (CaO) Nano-catalyst, Sci Rep, 2019.
- [3] Chatpalliwarl et al., Modelling of Biodiesel Plant Design: Data estimation and generation based on suppositions and interpolation, IJMIE, Vol. 2, Iss. 2 (2012).
- [4] VladaB.VeljkovićaMilanO.BiberdžićIvanaB.Banković-IlićaIvicaG.DjalovićMarijaB.TasićaZvonkoB.NježićOliveraS.Stamenkovića, Biodiesel production from maize oil: A review, June 2018.
- [5] MertGülüm, AtillaBilgin, Density, flash point and heating value variations of maize oil biodiesel–diesel fuel blends, Fuel Processing Technology, Volume 134, June 2015, Pages 456-464
- [6] RecpAltin, SelimCentinkaya, The potential of using vegetable oil fuels as fuel for diesel engines, 2001 Energy Conversion and Management 42(5):529-538
- [7] Deepak Agarwal and Avinash Kumar Agarwal, "Performance and emission characteristics of Jatropha oil (preheated and blends) in a direct injection compression ignition engine", Elsevier, Applied Thermal Engineering 27, 2007, pp.2314-2323.
- [8] [8]M Dantas, Marta Conceicao, V. Fernandes Jr, Nataly Santos, R. Rosenhaim, Aldalea Marques, Ieda Santos and A. Souza, Thermal and kinetic study of maize biodiesel obtained by the methanol and ethanol routes, march 2007.
- [9] N. El Boulifi,1 A. Bouaid,1 M. Martinez,1 and J. Aracil, Process Optimization for Biodiesel Production from Maize Oil and Its Oxidative Stability, May 2010.



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