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Spray pattern analysis of PAMO oil

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Abstract--- The main objective of this project is to study the fuel spray pattern of bio-diesel for different blends at different temperatures and pressures, then compare these spray patterns with the spray pattern of diesel fuel. The performance of engine running on bio-diesel for different blends at different temperatures, then compare those results with the performance of conventional diesel and also to investigate the properties of fuel such as specific gravity, density, viscosity etc of diesel and biodiesel fuel. The Test fuels used were a conventional diesel and 20%, 30%, 40%, blends of Transesterified PAMO oil with diesel. In order to analyze the performance of engine the above mentioned biodiesel blends were used to run the engine at room temperature and also at elevated temperatures and the parameters like brake power, brake thermal efficiencies and Mechanical efficiencies were tabulated and compared with that of conventional diesel fuel. And in order to analyze the fuel spray pattern the above mentioned biodiesel blends were sprayed through fuel injectors of three different nozzle pressures which are 180 bar, 200 bar and 220 bar at room temperature and also elevated temperatures and the resulting spray patterns of the biodiesel blends were compared with the spray patterns of diesel fuel.

Key Wards: Bio-diesel, PAMO Oil, Blends, Spray pattern, nozzle pressure.

I. Introduction

After the depletion of in the mid-1970s, all countries have tried to find a new energy which can substitute petroleum by using their district energy; such as vegetable oil, the most promising alternative fuels. Vegetable oils cannot be used in diesel engines because of the problem associated with it of the using pure vegetable oils as fuels in diesel engines. There are more than 350 oil bearing crops available in nature, among which only sunflower, soybean, cottonseed, rapeseed and peanut oils are the most potential alternative fuels for diesel engines. The most prominent properties of these oils are their high viscosity, low volatility**,** poor atomization and auto-oxidation.

Recently attention in developing countries such as Malaysia, Indonesia also Thailand need been provided for of the preparation about biofuels starting with domestic, renewable assets. Biofuels are at present being a great substitute clinched alongside Different approaches i.e. depleting fossil fuels, resources, natural health, vitality security Also Agricola economy. The two mossy cup oak basic sorts about biofuels would ethanol Also biodiesel.

Research on the utilization of vegetable oils concerning illustration fuel substitutes to diesel engines have been carried on numerous nations. Subside et al. (1982) utilized Degummed soybean blended with petroleum diesel at the proportion about 2:1 similarly as a fuel clinched alongside an diesel motor. After 600 hours about running it might have been found that that motor execution didn't change. Other specialists found that 95% vegetable oil mixing with 5% petroleum diesel to a diesel motor offered no issues of carbon store on the motor parts or in the fuel injector. Adam et al. (1983) tried an Agricola machine with mixed oil (soybean oil and petroleum diesel) What's more found that toward utilizing soybean mixed for petroleum diesel in the proportion for 2:1, those motor functioned great. Kevin et al. (1999) inferred that by utilizing semi-refined rapeseed oil (SRO) On An regulate infusion diesel engine, those energy yield diminished Toward 0.06% to each 1% expansion On SRO consideration rate and the brake particular fuel utilization expanded by 0.14% for every 1% increment On SRO Incorporation rate. Chiyuki Furthermore Jun-chi (1998) closed that de-acidified rapeseed oil Might be utilized within An single barrel Yanmar IDI diesel motor At degummed Furthermore rough rapeseed oil were unsatisfactory for utilization Likewise fuel because of those large amount about incombustible materials in the oil. Suporn (1987) found that utilizing 100% refined palm oil for a Kubota diesel motor model KND 5B brought about those best energy yield Also best emanation same time utilizing 70% refined palm oil mixed with 25% diesel brought about the best particular fuel utilization.

To vehicles powered with diesel engines, an elective substitute of diesel fuel need been produced namely, biodiesel. It will be handled from that concoction holding of liquor with oils, fats, greases or synthetically known alkyl esters. These esters bring comparable properties Likewise that mineral diesel fuel furthermore actually finer As far as its cetane amount. On addition, biodiesel will be superior to diesel fuel As far as sulfur content, blaze point and fragrant content. Concerning illustration a fluid fuel, biodiesel may be straightforward to utilize Furthermore cam wood be utilized within layering ignition loop (diesel) engines without adjustments. It likewise could be mixed during any level for petroleum diesel on make a biodiesel mix. In regards these qualities about vegetable oils, Malaysia need

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submitted to explore the utilization of biodiesel for blends about palm oil as an elective fuel for diesel engines. This paper displays palm also olive biodiesel as an elective green renewable biofuels for diesel engines

II. Literature Survey

Based on various literature reviews it is seen that the best combination that produces high efficiency to be Palm ad Olive oil combination

JawabNagi conducted experiment on performance of diesel engine using Palm biofuel as an substitute for diesel. They have come across that, palm biodiesel gives lower execution on diesel motors for torque and warm effectiveness, contrasted with petroleum diesel. This is created by the lower warmth estimation of palm biodiesel to that of petroleum diesel, which delivers a lower work to achieve a higher torque. At the point when the motor upheavals continue expanding the torque created from palm biodiesel tends to diminish. At lower motor unrests, palm biodiesel produces a nearby torque contrasted with petroleum diesel, while at higher motor upheavals the torque came about for palm biodiesel drops strongly than petroleum diesel. This is brought about because of the thickness of palm biodiesel, as it is higher than petroleum diesel. Since palm biodiesel is smoldered incompletely, it has a quick infusion in the burning chamber, which diminishes the torque created. Notwithstanding, then again, from the most reduced motor transformation to the most astounding motor upset, palm biodiesel has lower fuel utilization than that of petroleum diesel. This shows the utilization of palm biodiesel in diesel motors gives more fuel sparing than petroleum diesel. The lower fuel utilization of palm biodiesel is brought about by its higher blaze point and thickness than the petroleum diesel. The higher the glimmer purpose of palm biodiesel, the better atomization procedure will be performed which will minimize the bead size of palm biodiesel and abatement its pre-ignition time, with the goal that it will smolder at the time the chamber goes at its top dead center. The powerful warm productivity of palm biodiesel was likewise seen to be lower than the petroleum diesel, which is brought about because of the lower calorific estimation of palm biodiesel.

Syed Ahmed conducted experiment for exhaust gases of Palm biodiesel. They watched that palm biodiesel mixes created lower CO emanations than petroleum diesel for the whole motor burden range. The palm biodiesel mixes tended to lessen CO_2 outflows contrasted with petroleum diesel. The diminishment of CO_2 discharges is intelligent in view of the oxygenated way of palm oil and the lower measure of carbon in the palm biodiesel mixes ,All mixes of palm biodiesel delivered lower emanations of unburned hydrocarbons (HC), .However, palm biodiesel mixes expanded the grouping of NOx outflows particularly at the higher motor burdens . The added substance oxygen content in palm biodiesel is the reason for this, as more oxygen amid ignition will raise the burning mass temperature. Higher NOx emanations of palm biodiesel are additionally come about because of its different properties or by cooperation with the fuel infusion procedure and ignition chamber progress. Moreover, the biodiesel fills delivered lower grouping of dark smoke than petroleum diesel under comparable motor working conditions. This is on account of palm oil contains natural oxygen which oxidizes the quantity of vaporous by-items.

VenkateswaraRao conducted an **Experimental Investigation of Palm, Jatropha and Neem Methyl Esters as Biodiesel on C.I. Engine.** From the investigation it was found that "Palm, Jatropha and Neem based methyl esters (biodiesel) can be straightforwardly utilized as a part of diesel motors with no motor changes. Brake warm productivity of B10, B20 and B40 mixes are superior to anything B100 yet at the same time sub-par compared to diesel. Properties of distinctive mixes of biodiesel are near the diesel and B20 is giving great results. It is not fitting to utilize B100 in CI motors unless its properties are similar with diesel fuel. Smoke, HC, CO outflows at diverse burdens were observed to be higher for diesel, contrasted with B10, B20, B40 mixes With properties near diesel fuel, bio-diesel from Jatropha, neem and palm seed oil can give a helpful substitute to diesel consequently advancing our economy.

Thomas McGuir conducted a simulation study on **Alternative Fuel Spray Length Characterization: Comparing Diesel and Biodiesel Fuels.** From the reproduction study he found that "the little increment in thickness and consistency of biodiesel versus petroleum diesel brought about a noteworthy change in speed and infiltration of the fuel splash in the chamber".

PrabhakarRao directed an Experimental Investigation of Methyl Esters of Oils as Biodiesel on C.I. Motor. From the examination it was found that "Great blend development and lower smoke discharge are the key variables for good CI motor execution. These components are very affected by thickness, thickness, and unpredictability of the fuel. For bio-diesels, these variables are fundamentally chosen by the viability of the transesterification process. With properties near diesel fuel, bio-diesel from Jatropha, Palm and Neem seed oil can give a helpful substitute to diesel in this manner advancing our economy".

S. Chinkolkar directed a study on Biodiesel as an Alternative Fuel for Pollution Control in Diesel Engine. From the study they found that "Biodiesel is renewable vitality source; can be utilized without change as a part of existing motor. Biodiesel lessens the fumes outflow, in this way helps in diminishing contamination. Biodiesel increments country salary; give business and leads towards financial development of India".

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III. Blend preparation

The fuel selected for testing in the engine to find the performance of the engine is pamooil.The blends of Pamo oil and diesel are prepared on volume basis as follows:

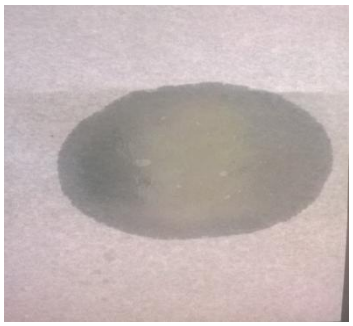
- B10: 10% Pamo oil (75%Palm+25%olive) and 90% Diesel,
- B20: 20% Pamo oil (75%Palm+25%olive) and 80% Diesel,
- B30: 30% Pamo oil (75%Palm+25%olive) and70% Diesel

VI. Experimental Setup for Spray Pattern Analysis

The nozzle tester was mounted on a bench and was clamped to it using two C-Clamps. The pressure pipe was fixed to the tester. Three different single nozzle fuel injectors having pressures 180 bar, 200 bar and 220 bar were used for the experiment. The nozzles were placed at a height of 25cm from the flat surface on which the OHP sheets were placed.

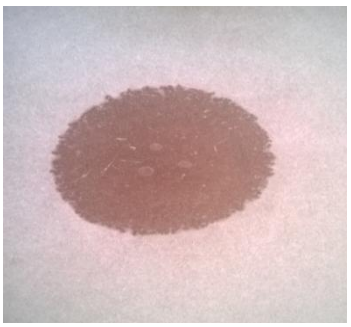
Fig 4.1: Experimental Setup

Procedure: Initially diesel was poured into the test-oil container. Now, fuel injector of 180 bar pressure was fixed to the pressure pipe and using the hand lever the diesel was sprayed onto an OHP sheet to obtain its spray pattern. Then, the same procedure was followed for injectors of 200 bar and 220 bar pressures and their respective spray patterns were obtained. These spray patterns are shown below.



220 bar

200 bar



180 bar

Fig 4.2: Spray Pattern of Diesel for Different Nozzle Pressures at 40^0

Now B20 blend of biodiesel was poured into the test-oil container. Then fuel injector of 180 bar pressure was fixed to the pressure pipe and using the hand lever the diesel was sprayed onto an OHP sheet to obtain its spray pattern. The same procedure was followed for injectors of 200 bar and 220 bar pressures and their respective spray patterns were obtained. These spray patterns are

220 bar

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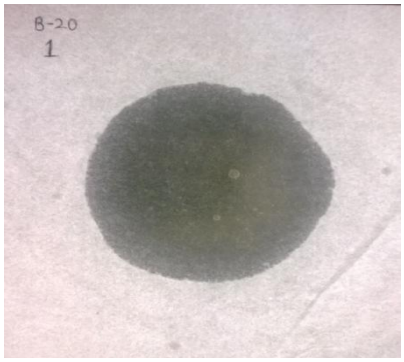
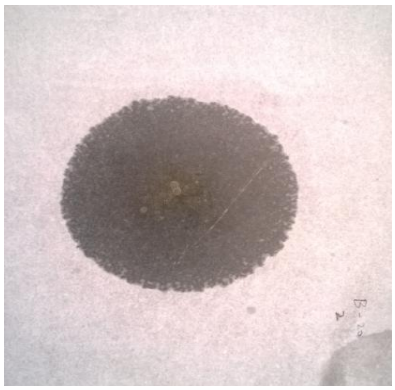


200 bar



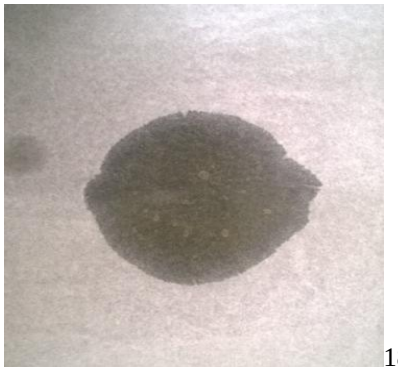
180 bar

Fig 4.3: Spray Pattern of B20 Biodiesel for Different Nozzle Pressures

Now B30 blend of biodiesel was poured into the test-oil container. Then fuel injector of 180 bar pressure was fixed to the pressure pipe and using the hand lever the diesel was sprayed onto an OHP sheet to obtain its spray pattern. The same procedure was followed for injectors of 200 bar and 220 bar pressures and their respective spray patterns were obtained. These spray patterns are shown below.

220 bar

200 bar



180 bar

Fig 4.4: Spray Pattern of B30 Biodiesel for Different Nozzle Pressures

V. Conclusion

- The spray diameter of diesel and B20 blend of biodiesel containing transesterifiedPamo oil decreases with increase in nozzle pressure. Hence the B20 blend may be used as fuel in CI engines having fuel injectors of nozzle pressures 180, 200 & 220 bar.
- The spray diameter of B20 and B30 blends of biodiesel containing Pamo is almost similar to the spray diameter of diesel at a nozzle pressure of 220 bar. Due to similar spray patterns proper combustion takes place resulting in higher efficiency. Hence instead of diesel, these blends may be used as fuel in CI engines having single nozzle fuel injectors of 220 bar nozzle pressure
- When the B30 blend of biodiesel containing Pamo is preheated to a temperature of 40^{O}C, its spray diameter decreases with increase in pressure. Hence as diesel also exhibits a similar property, B30 blend of biodiesel could be used as fuel in CI engines having single nozzle fuel injectors of nozzle pressure 180, 200 and 220 bar.
- The viscosities of the various blends of the biodiesel decreases with increase in temperature of the fuel.
- As Pamo oil has good lubricating property, less viscosity and has no hydrocarbon they will also help in effective lubrication of cylinder walls, piston, piston head etc. when used along with diesel as fuel.

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