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Experimental Analysis of Working Characteristics of Cornoil As An Alternate Fuel of Diesel Engine

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Abstract:: **In many applications like Transportation, Power generation, Marine applications etc., diesel Engines are being used as a major source. During last century, the use of fossil resources is increasing due to significant growth of population and change in life style. This causes crises of fossil fuel depletion For the diesel engines there is an urgent need for suitable alternative fuels .In this paper will be examined the use of diesel-corn oil mixtures in diesel four stroke engine.. With diesel and different blends of corn oil, an attempt is made to analyze the performance and emission characteristics of a diesel engine. Based on experimental analysis of the engine brake power specific fuel consumption thermal efficiencies are calculated. Emissions such as carbon monoxide, carbon dioxide are measured.**

Keywords: Alternative fuels, Emissions, Diesel engines, fossil fuel, corn oil.

I. INTRODUCTION

As fossil fuels are limited sources of energy, this increasing demand for energy has led to a search for alternative sources of energy that would be economically efficient, socially equitable and environmentally sound. Biofuels are considered as alternative sources of energy. Speaking in terms of advantages, much heard is they, as an alternative fuel, could solve served is used as the increasing energy prices world wide. By using renewable resources like Vegetable oils [1], Animal fats tallow's etc., biodiesel can be produced. Low content of sulfur, aromatic content and having high cetane number and lubrication properties are seen in biodiesel by many investigations [2]. With the help of biodiesel blends with diesel fuel many investigations are carried out and results showed that there is less in emissions like CO,HC,SO2 [3].

In this paper, would like to highlight upon the usage of different blends (10%, 20%, 30%, 40%)of corn oil for a compression ignition engine and studied the performance and Emission characteristics of this fuel at different loads. A single cylinder CI engine (Kirloskar, 4stroke water cooled with 5HP,1500rpm) coupled with eddy current dynamo meter loading is used for experimental investigation and following results have been recorded.

II. LITERATURE SURVEY

S. Bari (4)., makes a point that viscosity of Crude Palm Oil (CPO) is too high to allow smooth flow in fuel lines and thus needs to be heated to reduce viscosity. However, this heating of CPO offered no advantages in term of performance. In the performance test, it was found that the performance of CPO, as a fuel, was comparable with that of Diesel. Carbon monoxide emissions for CPO. Compared to Diesel, were higher.

Y. He (5)., has done his investigation on cottonseed oi1. This oil is promising as an alternate fuel source of Diesel engine because of its high gross heat content. Optimal combinations of four working parameters under two operating conditions were determined when the mixture of 30% cottonseed oil and 70% Diesel oil were used. The main factor influencing the SFC or thermal efficiency was found to be the fuel delivery angle and its optimum values for two operating conditions was about 22CA that is 3CA to 5CA in advance of that which was appropriate for the engine fuelled by pure Diesel oil.

Murat karabektas et al.,(6) In this study " cottonseed oil methyl ester(COME) is use as fuel in Diesel engine to evaluate the performance and emission parameters. For this purpose single cylinder. four-stroke, direct injection Diesel engine is taken. Before supplied to the engine, COME was preheated to four different temperatures. namely 30.60.90 and 120'C. The results revealed that preheating COME up to 90C leads to favorable effects on the BTE and CO emissions but causes higher NOx emissions. Moreover. the brake power increases slighty with the preheating temperature up to 90° C.

L.kallivroussis (7)., points out that one requirement for an oil seed crop to be considered for Bio-Diesel production is that it provides a positive energy return compared with the energy used to produce the fuel. sunflower seed is a good source of Biomass, and a crop considered for Bio-Diesel production. The energy inputs and outputs were estimated to be 10.49 and47.4 GJ ha-1, respectively, which translates into an energy ratio of 4.5:1. The possibilities to reduce the energy inputs are very limited.

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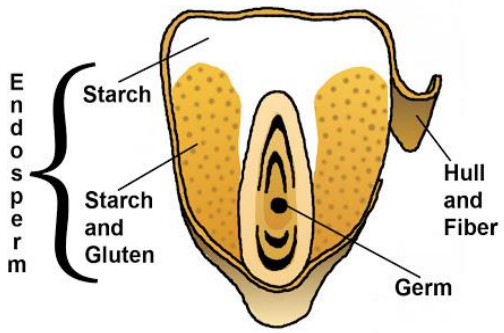
III. CORN OIL

Corn is an important raw material for bioethanol production. The oil is contained in the germ of the grain. Up to 70% of corn is used as an animal feed,20% for food, 5% in industry. Industrial use of corn is expanding By-product of bioethanol production -DDGS(Distillers dried grains with soluble) is used for the production of animal feed. Corn oil can be produced from germ separated in preparation of maize grains for fermentation or for production of starch. corn oil processing starts with corn germ, the first step in corn oil processing is mechanical: corn kernels are dehulled and then crushed with a grooved roller to break down the cell walls. The resultant cake is then "wet milled", steeped in water acidified with sulfur dioxide to separate the components of the seed.

Oil is expelled from the germ using a heated screw press, which can yield as much as 50 percent of the germ oil and remaining oil is stripped from the "press cake" with the solvent hexane, a volatile by-product of gasoline production.(hexane is introduced to the cake bed with an exposure time as brief as possible so that hexane residual in the oil is limited). The corn oil in the hexane solution is heated to vaporize the volatile solvent, which is captured as a condensate and used again. Then the heated expelled and hexane extracted oils are combined as crude oil. The remaining cake is processed for livestock feed.



:corn kernal

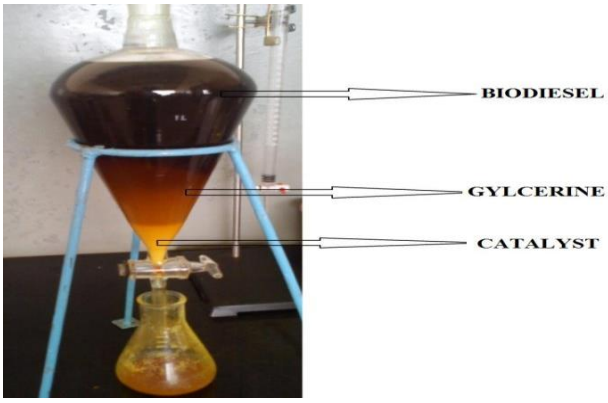
IV. BIODIESEL PRODUCTION PROCESS

Transesterification:

The process of converting bio-oils less viscous and it is a chemical process by which bio-oils are turned into biodiesel by separating glycerin.

***Transesterification process*:**

Corn oil is added into a three neck fitted with condenser, thermometer and methanol dozer. The oil is heated upto 60°C. Mean while prepare sodium hydroxide in appropriate amount of methanol and add this solution to preheated oil and stir it for 1-1.5 hours. Then in a separating funnel the mixture is poured to settle down. Glycerin which is settled at the bottom as thick, cloudy liquid is drained out. The biodiesel remains on top as a translucent liquid.



separating funnel

PROPERTIES OF CORN OIL COMPARISON WITH DIESEL

PROPERTIES	CORNOIL	DIESEL
Density at 15°c (gm/cc)	0.893	0.827
Calorific value(KJ/kg)	36,210	42,682
Kinematic viscosity at 40°c	5.512	5
Flash point(°c)	182	72
Fire point(°c)	196	85

By seeing the properties of corn oil the following conclusions are made:

1.corn oil has high flash point, it means it is safer to transport than diesel.

2.corn oil is non toxic than diesel.

3.corn oil can be used as an alternative fuel because of calorific value which is nearer to diesel.

V. EXPERIMENTAL INVESTIGATION:-

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1.*Engine Specification:*

Engine make : Kirloskar
Type : single cylinder, 4 stroke water cooled
Capacity : 5HP @ 1500 rpm
Bore diameter : 80 mm
Stroke length : 110 mm

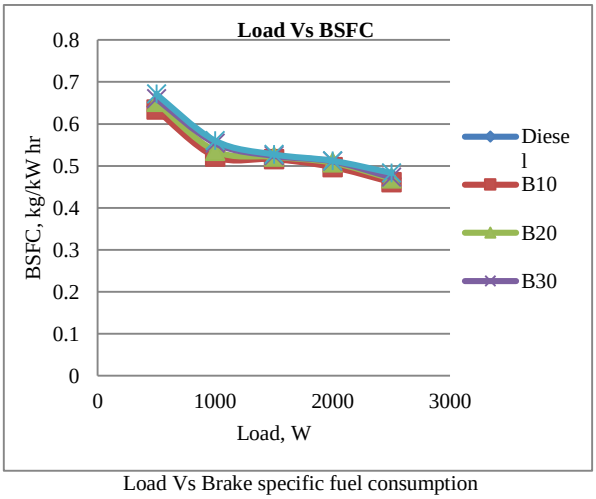
2.Test rig description: Brand new kirloskar make AV1 model diesel engine of 5HP[3.7kW] capacity and water cooled was used. To measure the engine power, eddy current dynamometer was connected. Thermocouples are provided at appropriate positions and are read by digital temperature indicator. Engine speed and load applied at various conditions are determined by digital rpm indicator and energy meter reading. The emission like NOx, HC, CO, O2 and CO2 are measured by employing an exhaust gas analyzer.

3.Procedure: Always engine was started at no load condition by hand cranking using de-compressor lever and allowed to work for at least few minutes to stabilize at rated value. Load the engine by switching on the loading switches..Experiments were carried out with pure diesel and various blends of biodiesel [B10, B20, B30, B40]. At a rated speed, with no load and varying load conditions all blends were tested. The ammeter, voltmeter, time taken for 10cc of fuel consumption parameters which are related to performance of engine were recorded. The emissions from exhaust gas analyzer were recorded. Brake thermal efficiency, brake specific fuel consumption for pure diesel and its blends were calculated.

VI. RESULTS AND DISCUSSION

1. Brake Specific Fuel Consumption

The variation of brake specific fuel consumption with various loads for diesel and various blends of biodiesel is shown in fig.3.It is observed that the brake specific fuel consumption is found to decrease with increase in load. B10 showed lowest brake specific fuel consumption (0.461kg/kWhr). This is due to lower calorific value of the blended fuel as compared with diesel.

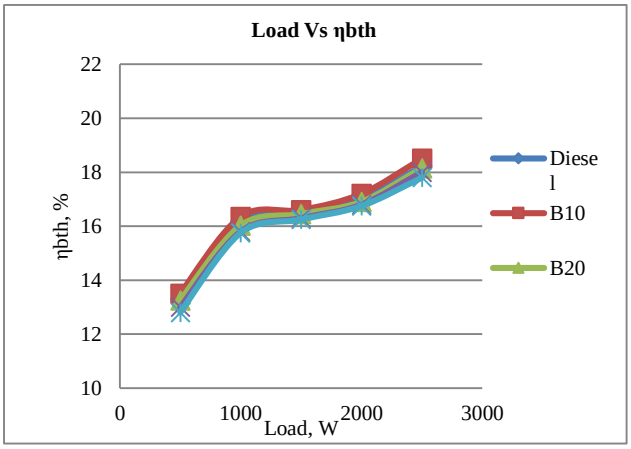


Load Vs Brake specific fuel consumption

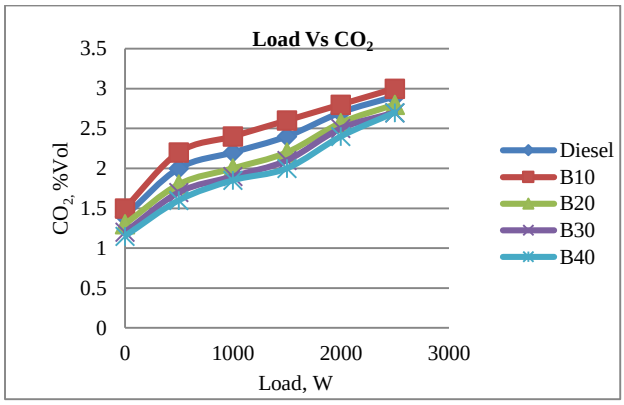
2.Brake Thermal Efficiency

Load Vs Brake Thermal Efficiency

The variation of brake thermal efficiency with respect to various loads of the engine is shown in fig.4...It is observed that the maximum thermal efficiency for B10 (18.5%) was higher than that of diesel (18.23%). This may be due to variation of total power produced by the engine with respect to heat supplied in the form of fuel.



3.Exhaust Gas Emissions of Carbon dioxide:



Load Vs Carbon dioxide

The variation of carbon dioxide emission with respect to various loads of the engine is shown in fig.5. From the results, it is observed that amount of carbon dioxide emission produced while using corn oil blend B10 is higher than diesel at full load condition, this indicates the complete combustion of fuel.

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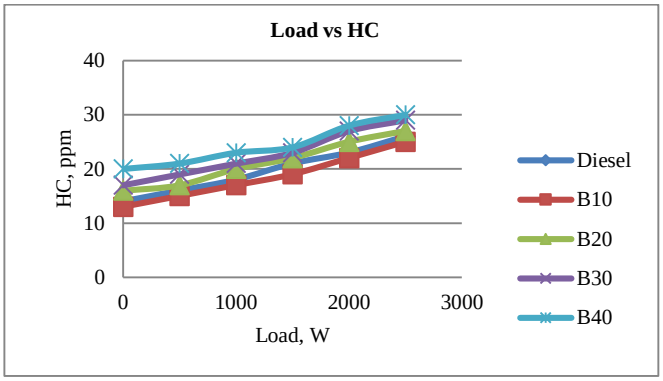
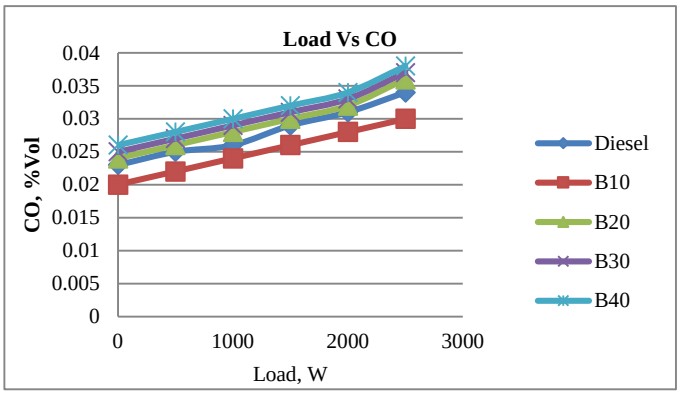
4.Unburnt Hydrocarbons:



Load Vs Hydro carbons

The hydrocarbons variation with brake power for the blends and diesel are shown in fig.6. The hydrocarbons are lower for all blends for all the blends compared to diesel. This is depends on oxygen quantity and fuel viscosity, in turn atomization.

5.Exhaust Gas Emissions of Carbon monoxide:



Load Vs Carbon monoxide

The variation of carbon monoxide emission with respect to various loads of the engine is shown in fig.7.Variation of CO emission against various loads are recorded. These lower CO emissions of biodiesel blend B10 may be due to their more complete oxidation as compared to diesel.

VII.CONCLUSIONS

Following are the conclusions based on the experimental results obtained while operating single cylinder water cooled diesel engine fuelled with corn Oil and its diesel blends.

1. It is observed that the maximum thermal efficiency for B10 (18.5%) was higher than that of diesel (18.23%).
2. B10 showed lowest brake specific fuel consumption (0.461kg/kWhr).
3. It is observed that amount of carbon dioxide emission produced while using corn oil blend B10 is higher than diesel at full load condition.
4. CO emission is reduced for B10 blend fuel compared to diesel
5. HC emission is reduced for B10 blend fuels compared to diesel.

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