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Performance Analysis of Ci Engine with the Mixture of Diesel and Bio Diesel Blend

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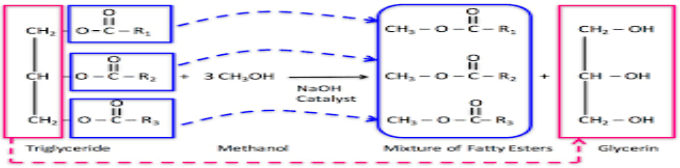
Abstract:
With the advancement of technology and increasing population the demand of the petroleum products are increasing day by day. So we need to look for alternative options to bridge this gap of increased consumption of fuel. Therefore, in this paper, we analyse the performance of biodiesel as an automobile fuel. As we know so far petroleum based fuels are giving higher efficiency as compared with alternative fuels so to reduce the fuel consumption strict measures to be adopted to control the consumption and also alternative fuels to be developed to mix with the petroleum fuels so that petroleum product reserves will go for longer period and it will meet with increased demand. The aim of the present investigation is to study the performance characteristics of single cylinder four stroke direct injection diesel engine using Castor seed oil as an alternate fuel. Here castor seed oil is used in the form of blends at various proportions with diesel.

Keywords: BioDiesel, Brake specific energy consumption, Brake Power, Thermal Efficiency

I. INTRODUCTION

World energy future in present trend countries, the world in the next 50 years will be more crowded than that of today. The world population may reach 10 billions. The conventional sources of energy are depleting and may be exhausted by the end of the century or at the beginning of the next century. Biodiesel is an oxygenated diesel engine fuel that can be obtained from vegetable oils or animal fats by conversion of the triglycerides to esters via transesterification. It has similar properties to those of fossil diesel. Therefore, research on biodiesel derived from vegetable oils and animal fats lead to the study of alternative to petroleum based diesel fuels. It has been reported by the results of many studies that biodiesel can be used in diesel engines with little or no modifications, and with almost the same performance. The results vary according to the base vegetable oil or animal fats, the process of biodiesel production as well as biodiesel fuel properties. Therefore different blends of biodiesels and neat diesel were tested in diesel engines at different engine loads On the other hand, biodiesel has high viscosity, high density, lower calorific value and poor non-volatility, which leads in pumping problem, atomization problem and poor combustion inside the combustion chamber of a diesel engine.Due to regular use of biodiesel oils in diesel engines, piston ring stick and infectivity of lubricating oils are hurdle to occur. In this major problems is that the vegetable oil is highly viscous . Hence, it is necessary to reduce the viscosity of vegetable oil to a more approximate value of diesel. Transesterfication is the process of exchanging the organic group R″ of an ester with the organic group R′ of an alcohol. These reactions are often catalyzed by the addition of an acid or base catalyst. In this process we use various alcoholic compound ie, methanol, ethanol or butanol in presence of a catalyst, such as sodium hydroxide (NaOH) or potassium hydroxide (KOH), which chemically breaks the molecule of raw renewable oil into methyl or ethyl esters of the renewable oil with glycerol as a byproduct, reducing the viscosity of the oil. As the properties this oil are very much similar to that if petroleum diesel it is known as 'Biodiesel'



II. CONVERSION PROCESS

Solution to the viscosity problem has approached in at least two ways:

1. by dilution
2. by preparation of methyl esters transesterification

A. DILUTION

Dilution or blending of vegetable oil with neat diesel fuel, to improve fuel property of vegetable oil, is one of the well known methods. Dilution of sunflower oil with diesel fuel (1.3v/v) provides a fuel with a viscosity of 4.88 at 40 c, which is higher than the specified ASTM value of 4.0 at 40c. The viscosity is moderately less than that of neat sunflower oil..

B. METHYL ESTER TRANS ESTERFICATION

Fatty acid methyl esters (FAME) are a type of fatty acid ester that are derived by transesterification of fats with methanol. The molecules in biodiesel are primarily FAMEs, usually obtained from vegetable oils by transesterification. They are used to produce detergents and biodiesel. FAMES are typically produced by an alkali-catalyzed reaction between fats and methanol in the presence of base such as sodium hydroxide, sodium methoxide or potassium hydroxide. One of

the reasons for FAME use in biodiesel instead of free fatty acids is to nullify any corrosion that free fatty acids would cause to the metals of engines, production facilities and so forth. Free fatty acids are only mildly acidic, but in time can cause cumulative corrosion unlike their esters. As an improved quality, FAMEs also usually have about 12-15 units higher cetane number than their unesterified. A mixture of anhydrous alcohol and reagent (NaOH) in proper proportions is combined with moisture free vegetable oil. The materials are maintained at 65 to 75 c and allowed to settle by gravity for 24 hours. Alkali catalyzed transesterification is known to proceed much fatter than acid catalyzed transesterification. Fatty acid methyl esters are considered as a possible substitute for a conventional automotive diesel engine.

VEGETABLE OIL+ ALCOHOL= GLYCERIN + ESTERS

III. CASTOR SEED OIL: Castor oil is a vegetable oil obtained by pressing the seeds of the castor oil plant (Ricinus communis).[] The common name "castor oil", from which the plant gets its name, probably comes from its use as a replacement for castoreum, a perfume base made from the dried perineal glands of the beaver (castor in Latin). Castor oil is a colorless to very pale yellow liquid with a distinct taste and odor. Its boiling point is 313 °C (595 °F) and its density is 961 kg/m^3.[3] It is a triglyceride in which approximately 90 percent of fatty acid chains are ricinoleates. Oleate and linoleates are the other significant components. Castor oil and its derivatives are used in the manufacturing of soaps, lubricantshy draulicand brake fluids, paints, dyes, coatings, inks, coldresistant plastics, waxes and polishes, nylon, pharmaceuticals and perfumes It is also used for traditional and medical treatment purposes (Debiprasad Behera et). The castor oil is produced by transestersification process. It contain between 35% and 65% oil that is rich in triglycerides, mainly ricinolein.

Table.1. Properties of blend

S.NO	PROPERTIES	DIESEL	B10	B20	B30	B40
1	DENSITY(KG/MM^3)	835.2	828.4	851	892.6	915.2
2	FLASH POINT(^{O}C)	68	86	124	151	176
3	POUR POINT(^{O}C)	-6	-15	-27	-31	-35
4	KINEMATIC VISCOSITY(MM^2/S)	3.51	4.82	7.85	13.7	16.5
5	HEATING VALUE(KJ/KG)	43456	40123	39125	38546	37985

IV. EXPERIMENTAL SETUP

This experimental work is to investigate the performance of single cylinder 4-stroke diesel engine connected to eddy current dynamometer fuelled with castor oil (10%, 20%) as bio-diesel blends with diesel fuel under different load conditions and constant engine running speed. The performance parameters consists of BP, TE, BSFC etc. there are several ways of producing bio diesels from bio fuels (edible and non edible oils ,animal fats)

PERFORMANCE VALUE OF PURE DIESEL AND VARIOUS BLENDS

DIESEL

Load (Kgf)	Engine Speed (rpm)	Fuel Consumption (Kg/hr.)	Brake Power (Kw)	Brake sp. Fuel Consumption (Kg/Kw hr.)	Thermal Efficiency (%)
5	1500	1.31	1.24	0.72	9.39
10	1500	1.43	2.67	0.42	14.7
15	1500	1.55	4.24	0.39	21.4
20	1500	1.86	5.59	0.36	23.8

10% BLENDING

Load (Kgf)	Engine Speed (rpm)	Fuel Consumption (Kg/hr.)	Brake Power (Kw)	Brake sp. Fuel Consumption (Kg/Kw hr.)	Thermal Efficiency (%)
5	1500	1.52	1.47	0.8314	10.34
10	1500	1.36	2.69	0.519	15.32
15	1500	1.9	4.94	0.398	20.40
20	1500	1.89	5.38	0.35	24.15

20%BLENDING

Load (Kgf)	Engine Speed (rpm)	Fuel Consumption (Kg/hr.)	Brake Power (Kw)	Brake sp. Fuel Consumption (Kg/Kw hr.)	Thermal Efficiency (%)
5	1500	1.13	1.37	0.95	9.76
10	1500	1.38	2.65	0.54	15.6
15	1500	1.71	4.05	0.43	19.4
20	1500	2.09	5.40	0.38	20.7

V. CONCLUSION

The overall characteristics of castor oil biodiesel and diesel are similar. These plants do not require more water and can be grown on barren land. A large part of barren Government land can be leased to the unemployed youth and the yield can be sold at lower price to produce a large quantity of biodiesel. This will make country self sufficient and less dependent of imported fuel apart from savings in valuable foreign exchange. Use of castor biodiesel will increase the use of waste land and will generate rural employment. The Local production of biodiesel will save a huge amount of foreign exchange. This capital when invested in country will improve its financial structure.

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