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EXPERIMENTAL STUDY AND MODELING OF DIESEL ENGINE FUELED WITH RUBBER SEED OIL

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ABSTRACT

The huge expand in number of vehicles as of late has brought about extraordinary interest for petroleum items. With unrefined petroleum stores assessed to last just for few decades. Numerous nations import more unrefined petroleum causes colossal remote trade out-go from one viewpoint and expanding fumes emanation on the other. Hence there has been a dynamic quest for interchange fills like biodiesel to give a suitable diesel substitute to inside ignition motors.The rubber seed oil based bio-diesel offer an extremely swearing up and down to alternative to diesel. The acid value for rubberseed oil is high. Two stage esterification i.e. acid catalyzed transesterification took after by basic/base catalyzed trans-esterification is created to prepare biodiesel from high FFA rubberseed oil. The motor energized with diesel and mixes of rubber seed oil based bio-diesel. The destination of the present study is examining the utilization of mixes of rubber seed oil based bio-diesel on execution and outflow qualities of a diesel motor contrasted with that of diesel. Motor execution with biodiesel does not contrast significantly from that of diesel fuel. The trial outcomes demonstrated that the utilization of rubber seed oil based biodiesel is suitable elective to diesel. The lack of the fossil fuel, ecological contamination and sustenance emergency are the world's significant issues in mongrel-rent period. Biodiesel is an elective to diesel fuel, environment agreeable and biodegradable and is prepared from either eatable or non-consumable oils. In this study, non-edible rubber seed oil (RSO) with high free fatty acid (FFA) substance of 45% was utilized for the generation of biodiesel. The procedure includes two steps. The principal step is the acid esterification to lessen the FFA worth and the second step is the base trans-esterification. The reaction surface system (RSM) was utilized for parametric enhancement of the two stage forms i.e. acid esterification and base trans-esterification. The yield of biodiesel was dissected utilizing gas chromatography. The FTIR (Fourier Transform Infra-Red) range was likewise discourage-mined to affirm the transformation of fatty acid to methyl esters.

I. INTRODUCTION

Lately, much analysis and exploration has been completed to discover suitable alternative fuel to diesel and other petroleum items. The utilization of renewable fuels like ethanol, biogas and biodiesel in diesel engines is noteworthy in this connection. The properties of these sources rely on upon the kind of the vegetable oil utilized for the trans-esterification process. Exploratory dissection of the engine with different biodiesel and its blends obliges much exertion and time. Thus, a hypothetical model is created to investigate the execution qualities of the packing ignition engine fueled by biodiesel and its blends. In the present examination, biodiesel is handled utilizing grungy elastic seed oil. A two-stage trans-esterification methodology is produced for the creation of methyl-esters of elastic seed oil. The properties of this biodiesel are nearly matched with those of diesel fuel. The execution tests are completed on a diesel engine utilizing biodiesel and its blends with diesel as fuel. The impacts of relative air-fuel degree and pressure proportion on the engine execution for diverse fuels are likewise broke down utilizing this model. The correlations of hypothetical and exploratory outcomes are introduced.The regularly expanding vitality requests coupled with the restricted accessibility of fossil fuels and the unfavorable natural impacts coming about because of their utilization, has guided exploration to looking for elective fuels to steadily substitute ordinary ones. Around these, biofuels have gained expanding consideration because of their alluring characteristics of being renewable in nature and lessening the net CO_2 emanations. Biofuels have been utilized as a part of accepted diesel and fuel engines either as slick fuels or as supplements.

II. PROPERTIES OF RUBBER SEED OIL

In the present investigation rubber seed oil, a non-edible type of vegetable oil, has been considered as a potential alternative fuel for compression ignition (CI) engines. The rubber seed production potential in India is about 150 kg/ha per annum. The estimated availability of rubber seed is about 30,000 MT/year. Rubber seed kernels (50–60% of seed) contain 40–50% of pale yellow oil. At present, rubber seed oil has not found any major application and hence the natural production of seeds remains underutilized. The fatty acid composition and properties of rubber seed oil in comparison with diesel is given in Table 1 and Table 2, respectively. The purpose of present study is to analyze the suitability of rubber seed oil as fuel for diesel engine and comparison of experimental results with simulation results obtained by Matlab software.

Fig 1-Rubber Seeds

Table 1. Fatty acid composition of rubber seed oil

Fatty Acid	Composition (%)

(Saturated)	
$C_{16:0}$ palmitic acid	**10.2**
$C_{18:0}$ stearic acid	**8.7**
(Unsaturated)	
$C_{18:1}$ oleic acid	**24.6**
$C_{18:2}$ linoleic acid	**39.6**
$C_{18:3}$ linoleic acid	**16.3**
Others	**0.6**

2.1 Specific Gravity

Biodiesel is slightly heavier than conventional diesel fuel (specific gravity 0.88 compared to 0.84 for diesel fuel). This allows the use of splash blending by adding biodiesel on top of diesel fuel for making blends.

2.2 Cetane Number

Cetane number is indicative of its ignition characteristics. The higher is the cetane number affects a number of engine performance parameters like combustions, stability, drive ability, white smoke, noise and emission of CO and HC. Rubber seed oil has a higher cetane number than conventional diesel fuel. This results in higher combustion efficiency and smoother combustion.

2.3 Viscosity

In addition to lubrication of fuel injection system components, fuel viscosity controls the characteristics of the injection from the diesel injector (droplet size, spray characteristics, etc.). The viscosity of biodiesel can reach very high levels, and hence, it is important to control it within an acceptable level to avoid negative impact on the performance of the fuel injection system.

2.4 Flash Point

The flash point of a fuel is defined as the temperature at which it will ignite when exposed to a flame or spark. The flash point of biodiesel is higher than the petroleum-based diesel fuel

2.5 Iodine Number

A high content of unsaturated fatty acids in the ester (indicated by high iodine number) increases the danger of polymerization in the engine oil. Oil dilution decreases the oil viscosity. A sudden increase in oil viscosity is attributed to oxidation and polymerization of unsaturated fuel parts entering into oil through dilution. The tendency of the fuel to be unstable can be predicted by iodine number.

2.6 Acid Number

The acid number reflects the presence of free fatty acids used in manufacture of biodiesel. It also reflects the degradation of biodiesel due to thermal effects.

Table 2.Properties of Rubber Seed oil in Comparison with Diesel

Property	Rubber Seed Oil	Diesel
Specific Gravity	0.91	0.835
Viscosity (mm^2/s)	76.4	7.50
Flash point (°C)	198	50
Calorific value (kJ/kg)	37,500	42,250
Saponification value	206	-
Iodine value	135.3	38.3
Acid Value	53.0	0.062

2.7 Effect of Dilution And Heating on Viscosity of Blends

It can be seen that the viscosity of rubber seed oil has decreased due to the dilution with diesel. The viscosity reduction increases with the increase in diesel content of the blend. The blends were stirred well so that the mixture was in a stable condition for a longer time. It has been shown that the blends containing 80% of diesel have viscosity and specific gravity close to that of diesel. Heating could reduce the viscosity of oils. Viscosity of blends decreased with increase in temperature and became close to that of diesel at temperature values above 60 °C.

III. CONCLUSION

The aim of the present investigation was to analyze the suitability of rubber seed oil as an alternative for the diesel fuel in CI engine. Simulation and modeling has been done to determine various parameters affecting its performance as an alternative fuel.

REFERENCE

[1] Pramanik K. Properties and use of Jatrophacurcas oil and diesel fuel blends in compression ignition engine. Renewable energy 2003;28(2):239-48.

[2] Ramadhas AS, Jayaraj S, Muraleedharan C. Use of vegetables oil as I.C engine fuels-a review. Renewable energy 2004;29(5):721-42.

[3] Lyn WT, Valdamanis. Effects of physical factors on ignition delay, SAE 680102, 1968

[4] Wong CL., Steere DE. The effects of diesel fuel properties and engine operating conditions on ignition delay.SAE 821231, 1982.

[5] Hadenberg HO, Hase FW. An empirical formula for computing the pressure rise delay on a fuel from its cetane number and from the relevant parameters of direct injection diesel engines. SAE 790493, 1979

[6] Dent JC, Pramod SM. Phenomenological combustion model for a quiescent chamber diesel engine. SAE 811235, 1981.

[7] Ottikutti P. Multizone modeling of a fumigated diesel engine. SAE 910076, 1991.

[8] Gosman AD, Harvey PD. Computer analysis of fuel-air mixing and combustion in an axisymmetric D I diesel. SAE 820036, 1982.

[9] Nishida K, Hiroyasu H. Simplified three-dimensional modeling mixture formation and combustion in DI diesel engines. SAE 890269, 1989.

[10] Kashiwaya M, Kasyge T, Nakagawa KK. The effect of atomization of fuel injected on engine performance.SAE 900261, 1990.