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Cottonseed Oil as an Alternative Fuel for C.I. Engine

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Abstract - In today's era of escalating energy cost, vegetable oils provide a technically as well as economically viable substitute to diesel oils for use in automobile as well as stationary engines. Alternate fuels have the great potential to supplement the growing demands for conventional petroleum fuels. The main alternative fuel of significance in the present and near future may be bio fuels or bio diesel.
Bio-diesel is an efficient, clean 100% natural energy alternative to petroleum fuels. It is a renewable substitute or blending stock, currently being commercialized in United States and Europe.
Bio-diesel operate in C.I. engines similar to diesel fuels. It can be burnt in any standard unmodified diesel engine blended with 25% to 100% bio-diesel with diesel. Cottonseed oil can be converted into bio-diesel fuel as ethyl fuel as ethyl ester by transesterification.
Cottonseed oil methyl ester was prepared which showed density, calorific value, flash point, and pour point close to that of diesel oil. The blends of varying proportions of this bio-diesels and diesel were used to run a single cylinder compression ignition engine and significant improvement in engine performance and emission characteristics were observed.

Key words - CSME, Esterification, Brake thermal efficiency, Smoke density, ester.

I. INTRODUCTION

Demand of petroleum based fuel is increasing day to day due to increasing industrialization. These fuels are of non-renewable type and are stored in earth. With our present known reserves and growing demand these fuels will last no longer. Due to finite resources of petroleum products concentrated in the certain part of world there arises frequent uncertainties in its supply and price. One solution to avoid this problem of environmental pollution and energy shortage will be carefully planned gradual shift to our energy economy from fossil fuels to renewable source of energy.

II. ESTERIFICATION

Bio-diesel is prepared from vegetable oil by Base Catalyzed transesterification of oil with alcohol. An ester is produced when an alcohol reacts with an organic or inorganic acid.

The vegetable oil ester can be produced by mixing with unhydrous methanol. The methanol is mixed in the proportion with the catalyst Sodium Hydroxide (NaOH).

The moisture free vegetable oil is mixed with the mixture of unhydrous methanol and catalyst. The mixture is heated and maintained at 65^0C for one hour, while heating the solution is stirred continuously with stirrer having variable speed. The product of reaction is kept in a separating funnel for four hours. The two distinct layers are formed, the upper layer is the required ester and the lower layer is glycerol.

The lower layer is separated the separated ester contains NaOH which is removed by mixing with hot water and moisture content is removed by using $CaCl_2$. It is observed that 960 ml of cottonseed methyl ester is obtained from 1 liter of cottonseed oil.

III. PROPERTIES

The properties of fuel are needed in design and engineering of engine combustion system, vehicle fuels system and fuel storage. The various characteristics of biodiesel which have been investigated are Specific gravity, Calorific value, Flash point, Viscosity, Pour point, Aniline point and Diesel index.

IV. EXPERIMENTATION

ENGINE TEST SET UP

The performance test using soyabean oil methyl ester was carried out on the compression ignition (C.I.) engine of following specification.

1. Make : Kirloskar, single cylinder, fourstoke compression Ignition Engine.
2. Rated Power Output : 5 HP
3. Speed : 1400 RPM
4. Stroke Length : 110 mm
5. Bore Diameter : 80 mm
6. Type of load on engine : Water resistance type load changing arrangement.
7. Length of Moment arm : 0.2 M
8. Orifice diameter : 250 mm
9. Coefficient of discharge : Cd=0.64

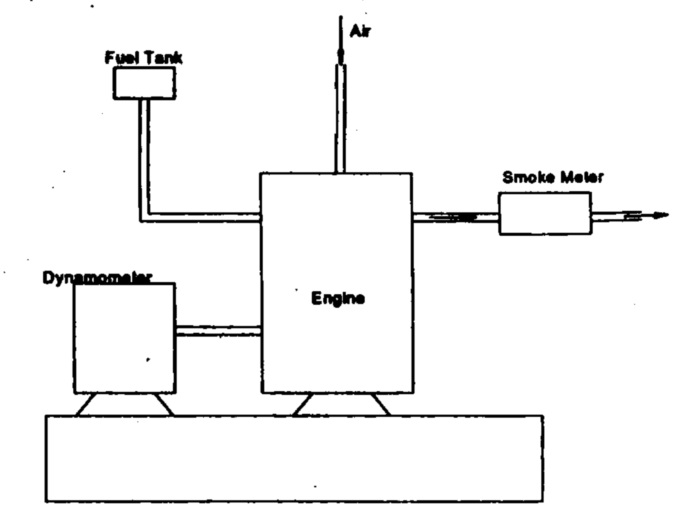

Figure 1. Experimental setup

V. RESULT AND DISCUSSION

Following are the observations after conducting the experiment on the engine setup.

5.1 Variation of Load Vs Smoke Density

The smoke density by using 50% CSME & 50% diesel blend is minimum among all combinations. The deviation in smoke density for different load conditions are shown in Table 1.

Table1. Deviation in Smoke Density

Load	25% CSME	50% CSME	75% CSME	100% CSME
No Load	3.22	3.26	- 6.52	- 28.2
2 kg	13.53	13.53	6.76	- 16.5
4 kg	9.21	6.6	- 17.10	- 32.89
6 kg	- 1056	- 4.97	- 15.52	- 51.55
8 kg	1.63	5.98	- 19.02	- 69.56

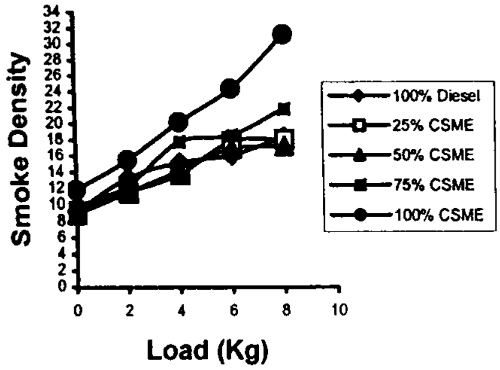

Figure1. Variation of Load Vs Smoke Density

5.2 Variation of Load Vs BSFC

The variation BSFC with load shows no improvement with bio-diesel and blends of bio-diesel when compared with diesel fuel. This is probably because of calorific value of diesel and bio-diesel are in the same range.

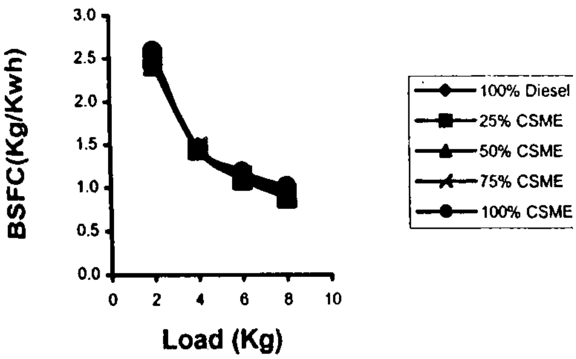

Figure 2. Variation of Load Vs Brake Specific fuel consumption

5.3 Variation of Load Vs Brake Thermal Efficiency.

The brake thermal efficiency is nearly same for ester and diesel. The deviation in brake thermal efficiency for different load conditions is shown in Table 2.

Table 2. Deviation in Brake Thermal efficiency

Load	25% CSME	50% CSME	75% CSME	100% CSME
No Load	--	--	--	--
2 kg	- 0.75	- 2.5	- 2.5	- 2.63
4 kg	- 1.53	- 3.2	- 3.76	- 6.50
6 kg	- 3.25	- 7.14	- 6.54	- 6.55
8 kg	- 3.65	- 7.5	- 5.35	- 3.76

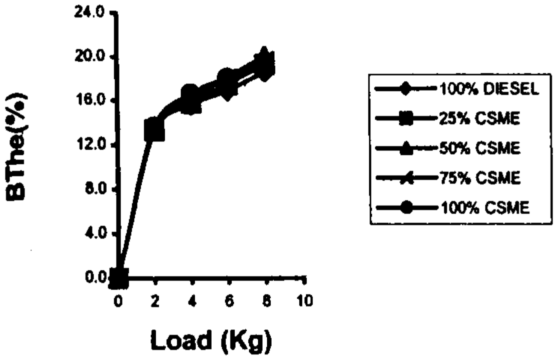

Figure 3. Variation of Load Vs Brake thermal Efficiency

VI. CONCLUSION

The brake thermal efficiency is same for ester and diesel. The viscosity of the ester is higher and by minor modification in the fuel intake system or by using additives the viscosity can be lowered down which will improve the brake thermal efficiency.

The cost of production is on the higher side. The cost can be reduced by better production technique on large scale, better instrumentation. The cost of biproducts and re-use of calcium chloride will reduce the cost.

Hence, it is concluded that in future the existing diesel engines with minor rectification can be run on vegetable oil ester i.e. cottonseed methyl ester.

REFERENCES

[1] Agrawal, A.K., “Vegetable oils versus diesel fuel: development and use of biodiesel in a compression ignition engine” , Centre for Energy Studies, I.I.T. Delhi.
[2] Richard L. Bechtold, “Alternative Fuels Guide Book”, Society of Automotive Engineers, Inc. Warrendable, USA (1997).
[3] J.F. Mcdonald, “Emission Characteristics of Soy Methyl Ester Fuels in an IDI Compression Ignition Engine”, “Alternative fuels for low emission and improved performance in CI and heavy duty engines”, SAE Inc. (1995).
[5] I.L. Finar, “Organic Chemistry, Longman Singapore Publishers (6th Edition, 1986)”.
[6] Poultron M.L., “Alternative Fuels for Road Vehicles”.
[7] Michael S Graboski, Rober L. McChormick, “Combustion of fat and vegetable oil derived fuels in diesel engines”, Progress in energy and combustion science,volume 24, issue 2, 1998.

