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RESEARCH ARTICLE

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EXTRACTION AND PERFORMANCE ANALYSIS OF BIODIESEL FROM SOYA OIL

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ABSTRACT
During the past decades worldwide petroleum consumption has permanently increased due to the growth of human population and industrialization, which has caused depleting fossil fuel reserves and increasing petroleum price. On the other hand, combustion of fossil fuels contributes most to emissions of greenhouse gases, which lead to atmospheric pollution and global warming. Growing concern regarding energy resources and the environment has increased interest in the study of alternative sources of energy. To meet increasing energy requirements, there has been growing interest in alternative fuels like biodiesel to provide a suitable diesel oil substitute for internal combustion engines. Biodiesel offer a very promising alternative to diesel, since they are renewable and have similar properties. This paper is regarding the extraction of biodiesel from soya oil. Soya oil is abundantly available and economical. The biodiesel is extracted from soya oil through transesterification. The extracted biodiesel is blended with diesel at B10 and B20 ratios. The properties of these blends are found and compared with normal diesel. Load test and smoke test is done on single cylinder diesel engine with B10 blend .The results are comparable with normal diesel.

I. INTRODUCTION

Biofuels is the name of a clean burning alternative fuel, produced from domestic, renewable resources. Biodiesel contains no petroleum, but it can be blended at any level with petroleum diesel to create a biodiesel blend. It can be used in compression-ignition (diesel) engines with little or no modifications. Biodiesel is made through a chemical process called transesterification whereby the glycerine is separated from the fat or vegetable oil. Bio fuels are being used the world over as admixtures with conventional fuels at levels that do not require modifications of internal combustion engines. The oil extracted from plants such as Rubber, Jatropha, Soybean, Mustard, Cotton seed etc., can be processed into bio fuel.

A.K. Goswami et al[1] carried out an investigation focused on alternative fuel for diesel in the form of soybean oil methyl ester and their different blends with petroleum diesel. The soybean oil is important oil from economic point of view for the biodiesel production and in the country like India this oil is mainly used for edible purpose. The Transesterification process was used to produce the methyl ester from soybean oil. A. Bulent Kocet. Al[2] studied about conventional biodiesel production from soybeans uses separate processes for oil extraction and biodiesel conversion. Oil extraction

from soybeans is accomplished by using mechanical presses, solvent extraction, supercritical fluid extraction and microwave- and ultrasound-assisted solvent extractions. The extracted oil is degummed and converted to biodiesel via transesterification. Transesterification is a chemical reaction process during which the oil is combined with alcohol, usually ethanol or methanol, in the presence of a catalyst to form fatty esters and glycerol.

Shashi Kumar Jain et.al [3] reviews the technical sustainability of biodiesel and its blends with diesel in C.I. engines. Besides exploring historical background of biodiesel production from vegetable oils, it also provides insight of different methodologies evolved for the conversion of vegetable oil in biodiesel. AlemayehuGashawet.al[4] studied about the environmental problems caused by the use fossil fuels, considerable attention has been made to biodiesel production as an alternative to petro diesel. Biodiesel is an ecofriendly, alternative diesel fuel prepared from domestic renewable resources i.e. produced from vegetable oils and animal fats. It is a renewable source of energy seems to be an ideal solution for global energy demands including Ethiopia as well. The general method to produce biodiesel is transesterification of non-edible oil with methanol in the presence of either base or strong acid catalysts. Ivana B. Bankovicet. al[5] investigated worldwide petroleum consumption has permanently increased due to the growth of human population and industrialization, which has caused depleting fossil fuel reserves and increasing petroleum price. On the other hand, combustion of fossil fuels contributes most to emissions of greenhouse gases, which lead to atmospheric pollution and global warming. The transport section is almost utterly dependent on petroleum derived fuels. The increase of the number of transport vehicles, as predicted, could affect the stability of environment and climate on the whole planet.

II. METHODOLGY

Trans-esterification involves reaction of the triglycerides of the oil with ethyl alcohol in the presence of a catalyst Potassium Hydroxide (KOH) to produce glycerol andfatty acid ester. For this process, a Specified amount of 250mL ethanol and 3.75gr Potassium Hydroxide (KOH) was mixed in a round bottom flask. The alcohol/catalyst mix is then charged into a closed reaction vessel and 1000mL soya oil is added. Excess alcohol is normally used to ensure total conversion of the fat or oil to its esters. Once the reaction is complete, two major products exist: glycerine and biodiesel. The quantity of produced glycerine varies according the oil used and the amount of excess alcohol used. Both the glycerine and biodiesel products have a substantial amount of the excess alcohol that was used in the reaction. The ethanol can be removed by vaporization and this ethanol will usually be dry enough to directly recycle back to the previous reaction.

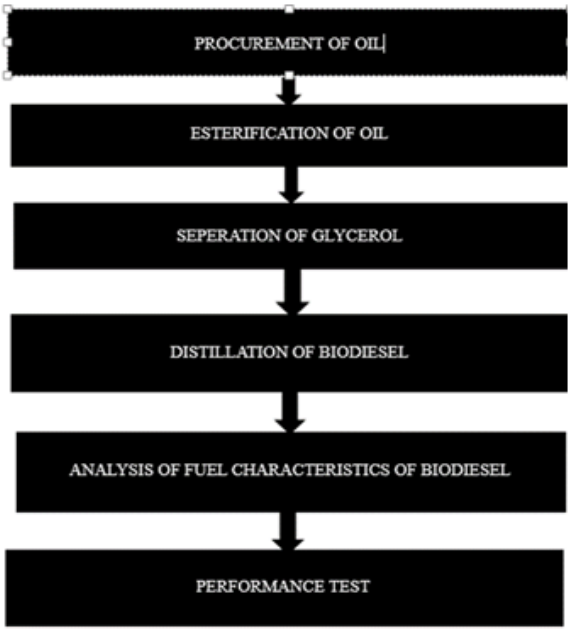

Fig.1: Preparation of biodiesel

III. RESULTS

In order to understand the effect of the biodiesel that we prepared from soya oil on engine efficiency, the brake specific fuel consumption (BSFC) and thermal efficiency of the engine were measured at half full load, no load at an engine speed of 1500 rpm. The engine load and speed were kept constant for all of the test fuels. From our test reports we understood that properties, efficiency and emission characteristics of blend B10 of soya oil biodiesel showed a value that is closer to properties

of normal diesel. The tables and graphs are given below.

Sl No	FUEL	DENSITY (Kg/m³)	CALORIFIC VALUE (KJ/Kg)	KINEMATIC VISCOSITY (cp) at 40°C	FLASH POINT (°C)	FIRE POINT (°C)
1	DIESEL	850	44000	2.62	52	60
2	SOYBEAN OIL BIODIESEL	821.9	39439	2.02	200	207
3	SOYBEAN OIL BIODIESEL B10	789.66	38980	1.89	70	76
4	SOYBEAN OIL BIODIESEL B20	792.82	39260	1.99	81	87

Table 1: Properties of soya Oil Biodiesel

When analysing the above table we understood that density and the calorific value of soybean oil biodiesel are less than the standard values of diesel. When we consider the flash and fire point soybean oil biodiesel blend B10 showed better compared to B20.

Sl No	Fuel	Load	s1 (kg)	s2 (kg)	Time for 5cc (sec)	Brake Power (KW)	TFC (Kg/hr)	SFC (Kg/KWhr)	BTE
1	DIESEL	NO LOAD	0	0	45	0	0.328		0
		HALF FULL LOAD	5	0.4	30.9	1.458	0.4776	0.3275	26.25
		FULL LOAD	9.5	1.2	23	2.63193	0.6417	0.2438	35.27
2	SOYBEAN OIL BIODIESEL B10	NO LOAD	0	0	43	0	0.333	0	0
		HALF FULL LOAD	5	0.2	31	1.22	0.457	0.375	24.6

Table 2: Load Test on Soya Oil Biodiesel Blend B10

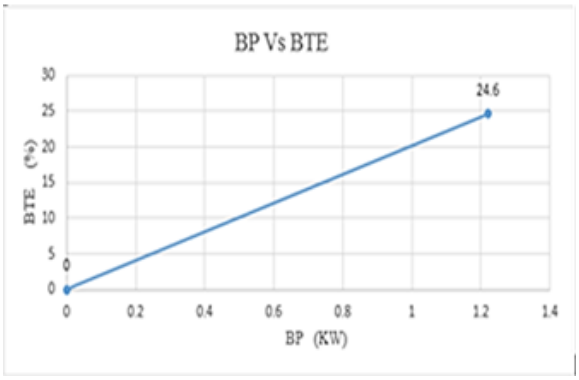

Fig. 2: BP Vs BTE

We conducted load test for diesel at no load, half full load and full load conditions and obtained the standard values. Then we conducted load test on soybean oil biodiesel blend B10 at no load, half full load conditions and found out the brake power, specific fuel consumption and brake thermal efficiency. The value of brake thermal efficiency obtained is slightly less than the standard value at half full load condition

Table 3: Emission Test on soya oil Biodiesel Blend B10

Sl no	Fuel	Load	S1 (kg)	S2 (kg)	Time For 5cc (sec)	CO (% volume)	HC (ppm Volume hex)	CO_2 (Volume)	NO (ppm volume)
1	DIESEL	NO LOAD	0	0	45	0.04	14	1.7	85
		HALF FULL LOAD	5	0.4	30.9	0.04	15	2.8	200
		FULL LOAD	9.5	1.2	23	0.05	17	4.1	410
2	SOYBEAN OIL BIODIESEL B10	NO LOAD	0	0	43	0.029	14	1.4	100
		HALF FULL LOAD	5	0.2	31	0.031	14	2.1	230

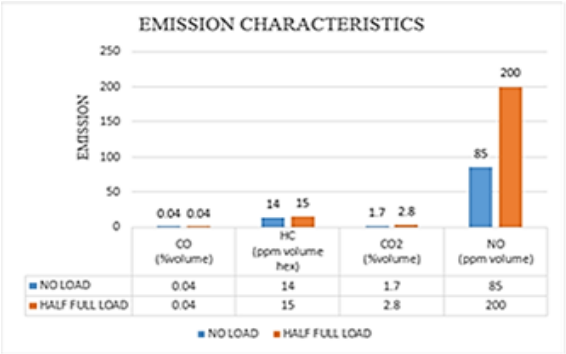

Fig 3:Emission characteristics of Standard Diesel

The above table shows emission characteristics of standard diesel and soybean oil biodiesel blend B10. We compared the emission results and plotted the graph. In the graph 1 represents % CO, 2 represents HC in ppm volume, 3 represents % CO2 and 4 represents NO in ppm volume. From this we understood that percentage emission of CO, HC and CO2 are less than the standard value of diesel and NO emission for blend B10 of Soybean oil biodiesel is slightly higher than the standard value

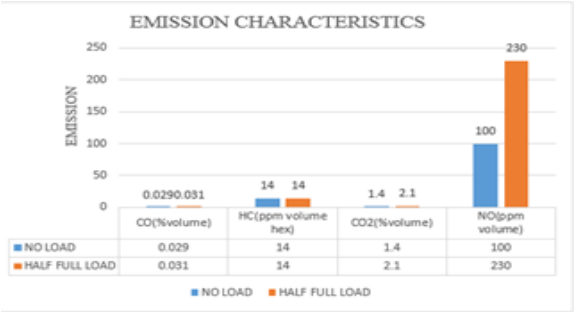

Fig. 4: Emission Characteristics Soya oil

IV. CONCLUSIONS

The various properties of biodiesel such as viscosity, density, calorific value, flash point, fire point were determined. When analyzing the values we understood that density and the calorific value of B20 blend of soya oil biodiesel is very closer to the standard values of diesel. When we considered the flash and fire point B10 and B20 blend of soya oil biodiesel showed better compared to other biodiesel.

Load test and emission test were also conducted on the B10 blends soya oil biodiesel. We found out the brake power, specific fuel consumption and brake thermal efficiency. The value of brake thermal efficiency obtained B10 blend of soya oil biodiesel is more close to the standard value of diesel at half full load condition. CO, HC and CO2 emission of soya oil biodiesel is lesser than the diesel emission. But NO emission of soya oil biodiesel is greater than the normal diesel emission. The performance characteristics are improved and NO emissions can be controlled by adding nano particles like cerium oxide.

REFERENCES

[1]. A.K. Goswami , G. A. Usmani "Characterization of Biodiesel Obtained From Pure Soybean Oil and Its Various Blends with Petro-Diesel", International Journal of Innovative Research in Science, Engineering and Technology Vol. 3, Issue 9, September 2014

[2]. Bulent Koc, Mudhafer Abdullah and Mohammad Fereidouni, "Soybeans Processing for Biodiesel Production", Soybean - Applications and Technology, ISBN 978-953-307-207-4

[3]. Shashi Kumar Jain, Sunil Kumar and AlokChaube, "Technical Sustainability of Biodiesel and Its Blends with Diesel in C.I. Engines: A Review", International Journal of Chemical Engineering and Applications, Vol. 2, No. 2, April 2011

[4]. AlemayehuGashaw and AmanuLakachew "Production Of Biodiesel from Non-edible oils",International Journal of Science, Environment and Technology, 2014, Issue No 4 Vol. 3, pp. 1544 – 1562

[5]. Ivana B. Bankovic, "Renewable and Sustainable Energy Reviews" 2012,Issue No 16, pp. 3621– 3647

[6]. Monisha J, Harish A, Sushma R, Krishna Murthy T P, Blessy B Mathew, Ananda S ,"Biodiesel: A Review", International Journal of Engineering Research and Applications, Nov-Dec 2013, ISSN : 2248-9622, Issue 6, Vol. 3, pp. 902-912

[7]. Ebtisam K. Heikal, Salah A. Khalil, and Ismaeil K. Abdou "Jatropha Bio-Diesel Production Technologies", International Journal of Bioscience, Biochemistry and Bioinformatics, May 2013, Issue No. 3, Vol. 3

[8]. Lalit Sharma, Sunil Kumar and AlokChaube "Comparison of Engine Performance of Mixed Jatropha and Cottonseed Derived Biodiesel Blends with Conventional Diesel" ,International Journal on Emerging Technologies, 2012,Issue No 3, Vol. 1, pp. 29-32

[9]. Bhojraj N. Kale, Dr.S.V.Prayagi, "Performance Analysis of Cottonseed Oil K.M. Shereena, T.Thangaraj, "Biodiesel: an Alternative fuel Produced From Vegetable Oils by Transesterification", Electronic Journal of Biology, 2009,Issue no 3 Vol.5, pp. 67-74

[10]. Methyl Ester for Compression Ignition Engines",International Journal of Emerging Technology and Advanced Engineering, August 2012,Issue 8, Volume 2, ISSN 2250-2459

[11]. KhandelwalShikha and Chauhan. Y. Rita, "Biodiesel production from nonedible-oils : A Review", Journal of Chemical and Pharmaceutical Research, 2012 Issue No 4, Vol. 9, pp. 4219-4230