Non-Edible Vegetable Oil's Methyl Ester (Biodiesel) As Fuel For Automotives.

Palaniswamy E[1], Manjula P[2], Manoharan N[3]
[1,2] Research Scholar, Sathyabama University, Chennai-600 119.
[3] Dean (PG Studies & Research) Sathyabama University, Chennai-600 119.
E-Mail: eps_mech@yahoo.com

Abstract

The increasing industrialization and motorization of the world led to a steep rise in the demand of petroleum products. Petroleum based fuels are stored fuels in the earth and are irreplaceable. Apart from the problem of fast vanishing reserve and irreplaceable nature of petroleum fuels, another important aspect of their use is the extent and the nature of environmental pollution caused by their combustion in the vehicular engines. Petroleum fueled vehicles discharge significant amount of pollutants like CO, HC, NOx, soot, lead compounds and aldehydes. In view of these problems, attempts must be made to develop the technology of alternative clean burning synthetic fuels.Biodiesel is a renewable fuel comprised of mono-alkyl esters of long chain fatty acids manufactured from vegetable oils, animal fats & recycled cooking oils. It is one of the several alternative fuels that can play important role in development of energy policy. Biodiesel contains no petrochemical products. Pure Biodiesel is bio degradable, non toxic & essentially free from sulphur and aromatic compounds. Thus it is a clean burning fuel, therefore helpful in reducing emission levels and ultimately preventing global warming Biodiesel can be blended easily with petroleum diesel in various proportions to create a Biodiesel blends. B-20 (20 % Biodiesel & 80% diesel fuel) is widely used blend because it balances the property difference with conventional diesel, performance, emission benefits and cost. B-20 can be used in automotive engines with no major modifications. The present paper will outline the manufacturing main aspects of methyl esters (Biodiesel) and the various blends of itwith fossil diesel as a fuel for automotive engine.

Key words: Biodiesel, emissions, global warming and blends.

I. INTRODUCTION

Our country being a developing country the increase in demand in our country for oil for use in the transportation sector will grow at a much higher rate. All countries including India are grappling with the problem of meeting the ever-increasing demand of transport fuel within the constraints of international commitments, legal requirements, environmental concerns and limited resources. In this connection transport fuels of biological origin have drawn a great deal of attention during the last two decades. Hence a program for the development of energy from raw material, which grows in the rural areas, will go a long way in providing energy security to the rural people. Known crude oil reserves are stimulated to be depleted in less than 50 years at the present rate of consumption (1). The demand of crude oil has increased dramatically and country's cost for import (2) of crude oil has increased substantially. Diesel engines have been widely as a power of engineering machinery, automobile, and shipping equipment for its excellent drivability and thermal efficiency(3). Diesel fuels, in India are used in heavy trucks city transport buses, locomotives, electric generators, farm equipment, underground mine equipment, etc (4). The consumption of diesel fuels in India in 2003-2004 was 36,625 million tons, which is roughly five times that of gasoline.(5). Diesel particles mainly consist of carbonaceous material, soluble organic fraction (SOF), sulfates and traces of metals. Some constituents of SOF (PAHs and nitro-PAHs) are mutagenic and/or carcinogenic (6). Biodiesel derived from vegetable oil (Vos) attracts attention as a promising one to be substituted for conventional diesel fuels (7). Vegetable oil viscosity can be lowered by dilution of oil with a suitable solvent, emulsification, pyrolysis, and transesterification.(8). India attained an all-time record of Jatropha oil seed production of 25 million ton in 1996-97.(9).Imports represents around 55 percent of India's edible oil consumption and about half the value of its total agriculture imports. Jatropha curcus is a drought resistant species which is widely cultivated in the tropics as a living fence (10). The only bibliographical reference currently available dates back to 1985 when Du Plessis. De Villiers and Van der Walt published a study on the oxidative stability of methyl and ethyl esters produced from sunflower oil. They observed storage behavior under various experimental conditions for a period of 90 days.

A.Bio-Diesel

Bio-diesel in ethyl or methyl ester of fatty acids made from virgin or used vegetable oils (both edible & non-edible) and animal fats through trans-esterification. The main commodity sources for bio-diesel in India can be non-edible oils obtained from plant species such as Jatropha Curcas (Ratanjyot), Pongamia Pinnata (Karanj), Calophyllum inophyllum (Nagchampa), Hevca brasiliensis (Rubber) etc. Bio-diesel contains no petroleum, but it can be blended at any level with petroleum diesel to create a biodiesel blend or can be used in its pure form. Just like petroleum diesel, bio-diesel operates in compression ignition engine: which essentially require very little or no engine modifications upto 20% and minor modification for higher percentage blends because biodiesel has properties similar to petroleum diesel fuels.Bio-diesel can be blended in any ratio with petroleum diesel fuel.

II. EXPERIMENTAL PROCEDURES

Materials: The tests were carried out with a sample of Jatropha biodiesel. The product previously analyzed (Table 1) corresponded to the specifications supplied by the producer for use as diesel fuel.

Working methods: To study the hydrolytic phenomenon, samples of biodiesel were placed in 20-ml vials, and enough distilled water was added to bring the total moisture level to 0.1, 0.3, 0.7, and 1.0% respectively. Results shown are the average values of two determinations. A sufficient number of containers were prepared to carry out the analysis in the time allotted. Some of them were kept in the dark in a room thermostated at 20°C and the rest in an oven maintained at 40°C. In the same way, the samples intended for study of oxidative degradation were made up in 2.5L dark glass containers, filled to 2/3 and secured with screw tops to simulate the presence of air above the mass of stored product. Strips of iron material were added to those containers intended to simulate metallic vessels. The maintenance conditions were identical to those reported above. The sample containers were opened at fixed times and the samples were removed to guarantee an occasional turnover in the overhead air.

III. RESULTS AND DISCUSSION

The acidity values at different times for each of the working conditions are reported in Table 2. Despite adding varying amounts of water, there was no significant change in acidity with storage at 20°C, ever over a long period of time. The last issue to evaluate was the effect of aging on the performance of the product, which, we must not forget, is to be used as diesel fuel. For this purpose, the samples that had been aged at 40° C, stored in glass or iron tanks, were completely characterized as fuels. Table 4 provides the results given by the tests and the characteristics of the fresh samples. From the reported data, no major differences can be seen. The only difference consists of the presence of particulate matter, which can certainly be due to release from the container.

Table 1. Analytical Characterization Of Biodiesel Used In The Tests

Methyl esters	(% w/w)	98.1
Monoglycerides	(% w/w)	0.7
Diglycerides	(% w/w)	0.1
Triglycerides	(mg KOH/g)	<0.1
Acid value	(% w/w)	0.32
Free glycerol	(% w/w)	0.03
Methanol	(% w/w)	0.18
Soaps	(ppm)	15
Moisture	(ppm)	350

TABLE 2. Storage Test in Presence of Different Quantities of Water[A]

	T= 20°C					
Moisture(% w/w)	Time (days)					
	0	15	32	48	60	90
0.1	0.32	0.33	0.32	0.34	0.33	0.34
0.3	0.32	0.33	0.33	0.34	0.33	0.34
0.7	0.32	0.34	0.33	0.34	0.34	0.33
1	0.32	0.33	0.33	0.33	0.32	0.32
	T= 40°C					
Moisture(% w/w)		Time (days)				
	0	15	32	48	60	90
0.1	0.32	0.34	0.32	0.32	0.32	0.33
0.3	0.32	0.34	0.35	0.35	0.36	0.37
0.7	0.32	0.35	0.36	0.35	0.36	0.37
1	0.32	0.34	0.34	0.35	0.34	0.36

[A]results expressed as acid value mg KOH/g

IV. CONCLUSION

It can be stated that this study has allowed evaluation of the behavior of Jatropha oil methyl ester fuel during medium-term storage at conditions similar to those realistically expected. The possibility of influence of the oxidation kinetics by the containing material has also been demonstrated. However, it also has been highlighted that some products with a completely different pattern of oxidation do not perform differently. Despite this, it also seems that, to obtain effects on the increase in acidity (which could be noxious to the product), it is necessary that the three negative issues mentioned above act contemporaneously. The presence of free organic acidity is one of the factors that promote the corrosion of materials, and it is therefore important to keep this parameter under control so that utilization of this diesel fuel substitute can be favorably considered. Clearly, these considerations are valid for samples produced with the appropriate technology, which allows minimizing the presence of those molecules that could facilitate emulsification with water that may be present. Those materials include monoglycerides diglycerides, free glycerol. Phospholipids, and in the case of production processes that include alkaline catalysis, soaps

REFERENCES

[1] Sheehan J, Cambreco V, Duffield J, Garboski M & Shapouri H, An overiew of Biodiesel and petroleum diesel life ccles, A Report by US department of Agriculture and Energy, 199, 1-35

[2] Subamanian KA, Singhal S K, Saxena M & Sinhal S, Utilization of liquid biofuels in automotive diesel engine: An Indian perspectives Biomass & Bioenergy, 29, 65-72,2005.

[3] Xing-Cai L, Jian Guang Y, Wu-Gao Z & Zhen H, Effect of cetane number improver on heat rlease rate and emissions of high speed diesel engine fueled with ethanol-diesel blend fuel, *Fuel*, 83, 2013-2020,2004

[4] Srivastava A & Prasad R, Triglycerides based diesel fuels, *Reneable & Sustainable Energy Rev. 4*, 111-133,2000.

[5] TEDDY 2003-04 (TERI Publiation, habitat Center, New Delh) 2004

[6] Baldassarri L T, Battistelli C L, Conti L, Crebelli R, Beradis B D, Iamieli A L, Gambin M & Iannaccone S, Emission comparson of urban bus engine fueled with diesel oil and "biodiesel" b end, *Sci Tpta; Environ*, 327, 147-162,2004.

[7] Kang B-S, Kim M-J , Park Y M, Kim K, Lee J-S & Lee K-Y, Transesterification of vegetable oil to biodiesel using heterogeneous base catalyst, *catalysis Today*, 93-95, 315-320,2004.

[8] Dmtryshyn L, Dalai A K, Chaudhari S T, Mishra H K & Reaney M J, Synthesis and characterization of vegetable oil derived esters: Evaluation for their diesel additive properties Biores Technol: 92 ,55-64,2000.

[9] Du W, Xu Y Liu D & Xeng J, Comparitive study lipase catalyzed

[10] transformation of soybean oil for biodiesel prodution with different acyl acceptors, *Mole Catalysis B; Enzymatic*, 30, 125-129,2004.

[11] Dahiya S B, Why do depend on imported oilseeds (The Tribune, Chandigarh) 13, August 2001