Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 6, Issue, 7, pp.5172-5174, July, 2015

International Journal of Recent Scientific Research

ISSN: 0976-3031

RESEARCH ARTICLE

PHYSICAL AND CHEMICAL PROPERTIES OF JATROPHA BODIESEL

Afaf Ghais Abadi and Salwa Malik Omer

ARTICLE INFO

Article History:

Received 14th, June, 2015
Received in revised form 23rd, June, 2015
Accepted 13th, July, 2015
Published online 28th, July, 2015

Key words:

Jatropha ; Blended biodiesel ;physic and chemical properties.

ABSTRACT

Biodiesel is becoming prominent among the alternatives to conventional petro-diesel due to economic, environmental and social factors. The physical and chemical properties of pure jatropha biodiesel (B100) and blended jatripha (B50) were assessed for their potential in biodiesel. The properties of B100 and B50 were compared with petrodiesel and B 20. ASTM Standards (ASTM6751) showed that the kinematic viscosity of B100 is high and cannot be use for engine .B50 is within the standards range in spite that its kinematic viscosity is at the upper limit of working conditions.

INTRODUCTION

Vegetable oils are among the different sources of energy fuels being considered as alternatives to fossil fuels. Soybean, sunflower, and coconut oils have been the main raw materials for biodiesel production. However, these oils are required in refined forms to obtain quality biodiesel, in addition to their are food needs. This makes the production of biodiesel from these sources uneconomic [1].

Non-edible plant oils such as jatropha curcas and castor beans may provide better alternatives. Foidla *.et.al* studied the production of methyl esters bio diesel from jatropha oil ,[2] .Bio fuels could be used directly in diesel engines or blended with petro diesel. However, their high viscosity lead to problems in the engine [3,4]. Kinematic viscosity is one of the parameters specified in biodiesel and petro-diesel standards that require compliance especially for jatropha raw oil which reaches to 39 cSt at 40^{o}C. [5]. Reducing viscosity is therefore the major reason for processing plant oils to make them suitable for use as biodiesel.

Methods of reducing viscosity besides transesterification include blending, microemulsion, pyrolysis and catalytic cracking [6,7,8,9]. Tint Kywe *.et.al* produced the jatropha biodiesel from transesterification reaction of raw oil with methanol,he used optimum sodium hydroxide catalyst of 1% at 65^{o}C ,for one hour reaction time and the methanol to oil is 6:1. The properties of produced biodiesel which is a fatty acid methyl ester were within ASTM specification for engine use.[10]

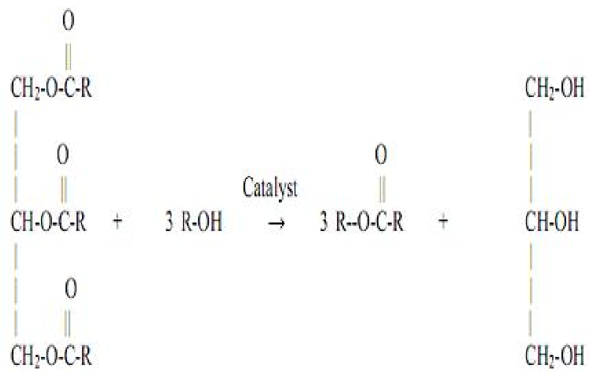

Figure1 Transesterification Reaction

For fuel quality attributes jatropha biodiesel properties to be studied were kinematic viscosity, density, specific gravity, flash point, cloud point, and Cetane number [11] .Flash point is specified to serve as a restriction of alcohol amount in biodiesel for safety measure in transportation and storage. Flash point can be adjusted through blending biodiesel with petro diesel in appropriate proportions, e.g Blends (B20) of 20% biodiesel to80% petro diesel.[9,12,13].

Cloud point indicates the lowest temperature at which a fuel is usable, especially in cold countries. Its value is 1^{0}C as specified in the ASTM D2500 [14]. Density is specified to exclude unrelated materials from being used as biodiesel feedstock [15]. It is also used in determination of the viscosity of biodiesel.The American Society for Testing and Materials

*Corresponding author: **Afaf Ghais Abadi***

(ASTM) standards controls the physical and chemical properties of diesel and biodiesel (B100) .ASTM D975 for diesel fuel and ASTM D6751 for biodiesel B100 were used,[16]. Jatropha biodiesel viscosity is very high comparing with other plants oil, the blend with petro diesel reduced the viscosity to the permittivity limits .New ASTM D7467 was published for B6 to B20 of 6vol% to 20vol %,[14]Table 1.

Table 1 Physicochemical Properties of Diesel and Biodiesel, [14] [16]

Physicochemical Property	Diesel ASTM D 975	Biodiesel(B100) ASTM D6751	Biodiesel (B6-B20) ASTM D6467
Specific gravity	0.85	0.87-0.89	0.87-0.89
Density 15 ^{0}C , g.cm^{3}	0.82-0.87	0.88	0.88
Kinematic Viscosity (40^{o}C) cSt	1.3-4.1	1.9-6.0	1.9-6.0
Flash Point(^{o}C)	60-80	130 (min)	52(min)
Cloud Point (^{o}C)	-15 to5	-3 to12	-3 to12
Carbon Residue (10% distillation)	0.15	0.3 (max)	0.35 (max)
Cetane No.	40-55	47 (min)	40 (min)

Increasing the ratio of jatropha biodiesel in diesel blend is one of the economic choices ,which reduced the dependency on fossil fuels and represent and alternative energy clean source The research studied the production of jatropha biodiesel through transesterification reaction ,the physical and chemical properties of Jatropha B100 , and 50 % diesel and 50% jatropha (B50)compared to the ASTM standard .

MATERIALS AND METHOD

Materials

Jatropha curcas oil used in this study was supplied by African Technology City-Sudan. Methanol and sodium hydroxide from the chemical engineering department laboratory. Commercial diesel was purchased from a nearby petroleum station. Biodiesel produced in the Unit operation Laboratory, Faculty of Engineering, while the sample analysis was held in Central Petroleum Laboratories-Khartoum.

Experiments

0.5 gm of NaOH was mixed with 25ml of methanol, stirred tightly for soda dissolve and sodium methoxide preparation .100 ml of jatropha oil was preheated to 65 ^{o}C then added to the sodium methoxid mixture. The reaction for 1hr under 65^{0}C was held in a stirred tank reactor. For the transesterification reaction completion excess methanol added .The ratio 6:1 methanol to oil converted jatropa oil it to esters.

Two major products produced biodiesel and glycerol. Glycerol separated by gravity for 24hr in separatory funnels .Repeated wash of the biodiesel product with warm distilled water allow to separate unit the wash water pH is 7 to assure that the product is free from glycerol. Excess methanol removed by distillation.

The biodiesel and biodiesel blend (B50) were characterized for kinematic viscosity at 40 ^{0}C using ASTM D445 , density, specific gravity ,flash point ASTM D93, cloud point ASTM D2500, carbon residue ASTM D4530 and Cetane number.

RESULTS AND DISCUSSION

The physical and chemical properties of jatropha biodiesel (B100) and blended biodiesel with petro diesel (B50) were analyzed using ASTM standards tests and the results were compared with petro diesel and B20 which is well practiced in automobile engines ,Table 2.

Table 2 Physical and chemical properties of B100 and B50

Physicochemical Property	B100	B50	B20	Diesel
Specific gravity	0.865	0.841	0.87-0.89	0.85
Density 15 ^{0}C , g.cm^{3}	0.881	0.863	0.88	0.82-0.87
Kinematic Viscosity (40^{o}C) cSt	4.51	4.04	1.9-6.0	1.3-4.1
Flash Point(^{o}C)	172	87	52(min)	60-80
Cloud Point (^{o}C)	1	2	-3 to12	-15 to5
Carbon Residue (10% distillation)	0.3%	0.1%	0.35 (max)	15%
Cetane No.	49.5	49.5	40 (min)	40-55

Density and specific gravity of B100 are higher than that of B50 ,but the two of them are within the higher limit of petro diesel and B20.Kinamatic viscosity which is the major problem of jatropha oil applied in biodiesel production is high for both B100and B50. The kinematic viscosity of B100 is above the working limit of petro diesel. Pure jatropha biodiesel cannot be used for engine without blend with diesel.

Safe transportation and storage of the jatropha biodiesel is indicated from high flash point of B100 and B50, and the cloud point is within the working range.

The carbon residue gives a measure of the tendency of a fuel to produce carbon deposits. High carbon residue results can be indicative of excessive amounts of glycerol in the biodiesel sample.B50 lowest carbon residue between B100,B20 and petro diesels, expected that low carbon can be deposits when using B50 in a working engine. Cetane number is a rating of fuels burn ability, the higher the cetane number the better and efficient fuel will burn.

CONCLUSION

Biodiesel blend derived from jatropha oil is suited for use in diesel engines given that its kinematic viscosity, flash point, cloud point, and cetane number conform to the recommended international standards. Pure jatropha biodiesel cannot be used for engine ,due to its higher kinematic viscosity. Blending of diesel with ratio up to 50% jatropha can be applicably used.

Acknowledgement

Researcher want to thanks African Technology City, Central Petroleum Laboratories and the chemical engineering department for their great support and help.

References

1. Afaf Ghais ,Salwa Malik." Biodisel Production from Jatropha Oil",Faculty of Engineering, 2012.
2. Canakci M., and Gerpen J., Van. “Biodiesel Production from Oils and Fats with High Free Fatty Acids.

American Society of Agricultural Engineers, vol. 44, No. 6, pp.1429-1436, 2001.

3. Canoira Laureano, Galean Juan Garcia, Alacantara Ramon, Lapuerta Magin and Garcia Contereras Reyes, "Fatty Acid Methyl Esters (FAMES) from Castor oil:
4. Demirbas Ayan, “Biodiesel production from vegetable oils via catalytic and non-catalytic supercritical methanol transesterification methods”, Progress in Energy and Combustion Science, vol.31, pp.466-487, 2005.
5. Demirbas Ayhan, “Biodiesel Production via non-catalytic SCF method and biodiesel fuel characteristics”. Energy Conservation and Management, vol. 47, pp. 2271-2282 ,2006.
6. Gemma Vicente, Mercedes Martinez and Jose Arcil, Integrated Biodiesel Production: A comparison of different homogeneous catalysts systems. Bioresource Technology, vol. 92, pp. 297-305, 2004.
7. Hirata Shizuko and Berchmans Hanny Johanes, “Biodiesel Production from crude Jatropha Curcas L. seed oil with high content of free fatty acids”. Bioresource Technology, vol. 99, pp. 1716-1721, 2007.
8. http://www.astm.org/Standards," ASTM Standard Test Method for Cloud Point of Petroleum Products",23.Feb.2015, 8.00pm.
9. Knothe Gerhard and Steidley R., Kevin. “Kinematic Viscosity of Biodiesel Fuel components and related compounds. Influence of compound structure and comparison to petro-diesel fuel Components”. Fuel, vol. 84, pp. 1059-1065, 2005.
10. Knothe Gerhard, “Analysing Biodiesel: Standards and other methods”. JAOCS, vol. 83, pp. 823-833, 2006.
11. Knothe Gerhard, “Dependence of Biodiesel Fuel Properties on the Structure of Fatty Acid Alkyl Ester”. Fuel Processing Technology, vol. 86, pp.1059-1070, 2005.
12. Ma Fangrui and Hanna Milford A. “Biodiesel Production: a review”. Bioresource Technology, vol. 70, pp. 1-15, 1999.
13. N.Foidla,G.Foildla,M.Sancheza,M.Mittelbachb and S.Hackelb, " Jatropha Curcas as a sourse for production of biofuel in Nicaragua” ,Elsvier,1996.
14. Pramanik K, “Properties and use of jatropha curcas oil and diesel fuel blends in compression ignition engine”. Renewable Energy, vol. 28, pp. 239-248, 2003.
15. Production Process Assessment and Synergistic effects in its properties”. Renewable Energy, pp. 1-10, 2009.
16. Tint Kywe,Mya Oo,"Production of Biodisel from Jatropha Oil in Pilot Plant",World Academy of Science, Engineering and Technology, 2009.
17. Wouter Achten,"Sustinability Evaluation of Biodiesel from Jatropha Curcas L", 2010.

How to cite this article:

Afaf Ghais Abadi and Salwa Malik Omer., Physical And Chemical Propertied Of Jatropha Biodiesel. *International Journal of Recent Scientific Research Vol. 6, Issue, 7, pp.5172-5174, July, 2015*

****