Proceedings of International Conference on Research and Development
Volume 1, Number 21, November 25-28 2008, Institute of African Studies, University of Ghana, Accra, Ghana

NEEM OIL BIODIESEL: A POTENTIAL DOMESTIC FUEL IN PRESSURIZED KEROSENE STOVE

Ajakaye[1] O.N and Olugbenga[2] A.G
[1]Department of Chemical Engineering Federal Polytechnic Bida, Niger State, Nigeria.
[2]Department of Chemical Engineering Federal University of Technology, Minna Niger State, Nigeria.

ABSTRACT

Biodiesel can be made from a wide range of easily renewable plant oil sources and animal fats even waste oils thrown away by most restaurants and homes. Exploring new energy resources, such as Biodiesel fuel, is of growing importance in recent year. Biodiesel derived from vegetable oil or animal fats, is recommended for use as a suitable alternative for petroleum –based diesel mainly because biodiesel is renewable, domestic resource with environmentally friendly emission profile and is readily biodegradable. Neem oil is not used for cooking purposes, but in India and Bangladesh, it is used for preparing cosmetics soaps, hair products and hand creams. Fuel based lighting provides little in return, the problem is most acute in sub-Saharan Africa where over 500million people presently lack modern energy. This paper investigated the suitability of Neem oil Biodiesel as source of domestic fuel. Neem oil was mechanically extracted using hydraulic press and the oil was used as feed –stock for Need oil Biodiesel production. The Biodiesel produced has cloud point of 12°C, Flash point of 102°C and Specific gravity was 0.893.Thereafter, 15 blends of Neem oil Biodiesel /Kerosene blends were made.B90 to B50 were combustible in the pressurized kerosene stove. While B98 to B92 are not combustible. The specific gravity decreased from 0.890 -0.843 as the volume kerosene to biodiesel increases .Also, the theoretical Energy value increases from 2.813KJ to 117.600KJ as volume of kerosene increased .Neem oil Biodiesel/ Kerosene blend can reduce the use of fire wood and charcoal in the country there by saving our forest from depletion.

Keywords: Biodiesel, Pressurized stove, Blends, Renewable, Biodegradable, renewable, Specific gravity, Cloud point, Combustible, Flash point, Cetane number, and Pressurized stove.

INTRODUCTION

The source of Kerosene for Kerosene stove has been from petroleum which is a very expensive commodity. Besides, there are times of scarcity of this product which forced many household that could not get it to go back to fire wood and charcoal stove. Therefore, there is need to find an alternative, renewable, source of fuel that is environmentally friendly ,because most rural household aspires to have a cooking technology and fuel that gives a blue Flame and user's friendly .(Ani, 2003) Worldwide, energy is becoming a hot topic in government and society. Nearly every country in the world depends on imports of various forms of fossil fuel energy, including oil, coal and natural gas .Without a steady supply of affordable energy a county's economy grinds to halt , with no fuel for transportation, energy to run power plant and factories or heat homes .Biodiesel can increase energy security wherever it is produced in several ways .When crops used to produced Biodiesel are grown in the country in which the fuel is consumed , each gallon of Biodiesel replaces a gallon of imported crude oil and its fractions reducing a country's dependence on foreign energy supply. Also, if Biodiesel is produced in dedicated refineries which added to overall domestic refining capacity , eliminating the need to import expensive finished products from other counties, However, when Biodiesel is produced and distributed locally in a community based model it present a more difficult target for potential terrorist attack than large central facilities like oil refineries, or pipe line used in petroleum industries (http://.llen.wikipedia.org) Most rural household in Nigeria and other developing countries cook food on inefficient smoky biomass cook stoves. Besides, creating and environmental pollution., the stoves create health problems for house wives .These cooking systems are based on biomass which are not easily accessible and tedious to collect .(Waldir, et al 2004) Southern Africa has not been spared from the effect of global warming responsible for draught that has cause food shortage .The effect of climate change come on the top of high oil prices on the word market and widespread of poverty in that region. It is therefore time for developing countries to implement integrated programmes aimed at cushion the effect of impact of climate change, reducing the dependency on imported fuels and improving the living standards of the

Scanned with CamScanner

people. One such approach is underway in central Zambia, where Marli investment Ltd, a private company, has so far engaged farmers to grow jatropha, a seed crop that can produce biodiesel and many other products. The Zambian company is planning to construct a US$30 million biodiesel processing plant in Kabwe, about 130km north of the capital Lusaka, where it will produced biodiesel from jatropha oil. Farmers will benefit from this project by selling their seed to Marli investment (African Review of Business and technology, may 2006) Presently, Nigeria has not started public awareness and to encourage the private sector to invest on biodiesel production NNPC has put in place the machinery to start importation of Ethanol for the seedling programme of using Ethanol blend as sources of gasoline. In the same vain an inter-ministerial steering committee has been inaugurated by the Hon Minister for petroleum resource to address the legislative and fiscal policies needed to ensure the success of the programme (Downstream Monitor PPRA, June, 2006). The chemist and the Chemical engineers interest in vegetable oil is limited to Oleo Chemicals. Oleo- Chemicals Are chemical obtained directly from conversion of vegetable oils. Word and research interest in oleo chemicals are ever increasing and at a more higher rate than in petrochemical l(Omalara and Ibiyemi,2001) However, making biodiesel on a large scale is a task of chemical engineers. i is relatively simple process, but require purification and washing to make a commercial fuel, especially i you used waste vegetable oil. If you try the reaction in your kitchen, you can use recipe for a simpl demonstration using common household chemicals (www.woodgas.com) Biodeisel has a lot o environmental beneficial properties. The main benefit of biodiesel is that it can be described as "Carbo neutral " this means the fuel produced no net output of carbon in form of carbon dioxide (CO_2) .This effec occurs because when the oil crops grows it absorbed the same amount of CO_2 as it is release when the fuel i combusted. Infact, this is not completely accurate as $CO_2$is release during the production of fertilizer required to fertilize the field in which the oil crops are grown .Fertilizer is not the only source of pollution i the production of Biodiesel, other source include etherification process, the solvent extraction of oil refining drying and transportations. All these processes required an energy input either in for of electricity or fro fuels both of which use to lead to release of green house gases. To properly assess the impact of thes sources requires the use of technique call life circle analysis. Biodiesel is rapidly biodegradable ar completely non-toxic, meaning spillage represent far less of a risk than fossil diesel spillages. Biodiesel h a higher flash point than fossil diesel and so is safer in the event of a crash (www.essu.strath.ac.uk)

MATERIALS AND METHODS

Neem seed were gathered from Federal Polytechnic Bida and Sodium Hydroxide and Methanol of analytic grade were bought from Nashom Chemical Minna. Kerosene was also bought from Total filling station Bi while pressurized stove was bought from Bida main market..

Materials

The Neem seed oil was extracted mechanically using mechanical extraction. Then 500mls of 0.1M Sodium Methoxide was mixed with 1000mls of Neem oil in a suitable local reactor, and the mixture v stirred continuously for 2-4 minutes to get a homogenous mix. The product of reaction was later transfer into a separating funnel for phase separation .After 6-8 hours two layers of liquid has settled in separating funnel , the Biodiesel at the top and Glycerin at the bottom .The glycerin was selectively run and the biodiesel left in the separating funnel was washed with 50% by volume of warm water. The wash was done for about 3-4 times then it was transferred into the sand bath to be dried at a temperature of 11 115°C for 2hours .After the biodiesel was well dried it was allowed to cooled for the physico-chem properties of the biodiesel to be determined, this type of biodiesel is called B100. Also, the Neem Biodiesel /Kerosene blends were prepared i.e B100 was the Neem Biodiesel without Kerosene while B B50 were prepare by following a simple ratio B98 K2 means for 100mls of Neem Biodiesel/Keros blends, Neem Biodiesel is 98% while Kerosene is 2%.This simple ratio was followed to make B98-B5 Liters each of the blends were made and poured in turns into the pressurized kerosene stove that is when blends has been properly homogenized .The physical property like specific gravity was determined. T after the 2 liters of Neem Biodiesel/Kerosene blends to be tested in pressurized kerosene stove was po and the pressurized stove was operated according to the manufacture's manual. While the flame was o 10minutes the colour of the flame was observed and the time for the 200ml of water to boil was also not

Scanned with CamScanner

Results

Table 1 Physico-chemical properties of Neem oil Biodiesel

Fuel properties	Neem oil Biodiesel
Cloud point	12°C
Flash point	102 °C
Refractive index	1.457
Boling point	84 °C
Specific gravity	0.893
Density	893 Kg/m^3

Source: Experimental, 2008

Table 2 Comparison of result of Neem oil Biodiesel with ASTM(American Society of Testing and Materials) Biodiesel standards.

Fuel properties	Neem oil Biodiesel	ASTM Biodiesel	ASTM Petro-Diesel
Cloud point	12°C	-3 to 12	-15 to 5
Flash point	102 °C	100-170	60-80
Refractive index	1.457	-	-
Boling point	84 °C	182-338	188-343
Specific gravity	0.893	0.880	0.850
Density	893Kg/m^3	880Kg/m^3	850Kg/m^3

Source: Experimental, 2008 and wwwen.wikipedia.org/Biodiesel

Table 3.0 Specification of the stove.

Weight of stove	No of burner and type	Dimension of stove	fuel tank	fuel consumption	Thermal Efficiency
300kg	Simple burner	490mm*225mm *200mm (LWH)	3Litres maximum	250gms/hr	55%

Source : Manufacturer's manual ,2007

Table 4: Physical properties of Neem oil Biodiesel/Kerosene blends

Biodiesel Blends	Biodiesel Percentage (%) Biodiesel	Kerosene	Ignition potential	Specific gravity	Time for 200ml to boil (min)	Theoretical Energy
B98 /K2	98	2	Not combustible	0.890	ND	ND
B96 /K4	96	4	Not combustible	0.887	ND	ND
B94 /K6	94	6	Not combustible	0.885	ND	ND
B92 /K8	92	8	Not Combustible	0.883	ND	ND
B90 /K10	90	10	Combustible	0.880	45	2.813
B83 /K17	83	17	Combustible	0.875	40	6.400
B77 /K23	77	23	Combustible	0.871	38	9.500
B71 /K29	71	29	Combustible	0.865	35	22.400
B67 /K33	67	33	Combustible	0.860	30	30.000
B63 /K38	63	38	Combustible	0.855	27	45.630
B59 /K41	59	41	Combustible	0.852	23	74.520
B56 /K44	56	44	Combustible	0.850	20	96.800
B53 /K47	53	47	Combustible	0.845	17	97.920
B50 /K50	50	50	Combustible	0.843	15	117.600

Source: Experimental, 2008

Scanned with CamScanner

DISCUSSION OF RESULT

As shown in table 1 the Neem oil Biodiesel has a Cloud point 12.°C, Flash point 102 °C, Boiling point 84 °C and specific gravity 0.893 while table 2 show the comparism of Neem oil biodiesel with American Standard of Testing and Materials (ASTM). Table 4 shows the physical properties of Neem oil Biodiesel blends with kerosene B98 to B92 are not Combustible in pressurize kerosene stove.B90 to B50 are combustible. The theoretical Energy value of the blends increased from 2.813KJ for B90 to 117.600KJ for B50.However, specific gravity decreases progressively from 0.890for B98 to 0.843 for B50. The time it takes to boil 200mls of water also reduces as the volume of kerosene increases.

CONCLUSION

Neem oil Biodiesel blends with just 10% of kerosene makes the Neem oil Biodiesel to be combustible in pressurized kerosene stove. Although the Theoretical Energy value which is a measure of energy content is positively affected as the volume of kerosene in the blends. Also, the percentage of kerosene affects the specific gravity of the blends. Neem oil is potential non edible oil for biodiesel production thereby reducing the phobia on food scarcity.

RECOMMENDATION

Farmers in the part of the county that their soil support Neem tree plantation should be encouraged. Also, private sectors can be encouraged to invest in Neem seed farming and non edible seed oil like jathropa .There should be private public partnership for Biodiesel and Bio-energy research. Institution can be in collaboration with relevant agencies to source for non-edible Biodiesel feed-stocks.

REFERENCES

Ajakaye ,O.N ;James, B; Egwin E.C and Popoola. A (2007). Ethanol: An Alternative source of fuels in pressurized Kerosene stove.Chem Class journal.Vol.4 pp 165-169.

Ani .K (2003) R and J strategy for lighting and cooking for rural household current science vol.85 No 2as fuels. St Joseph , Mich. ASAE.pp400

ASAE,(1982) vegetable oil fuels. Proceeding of International Conference on plant and Vegetable oil

ASTM.(2006).Stand d Specification for Diesel Fuel Oils West Conshohocken,penn:ASTM International

Boocock,D.G.B., Konar.S.K., Mao.V. and Sidi (1994) .Biodiesel: Transesterification of vegetable oils

Boocock,D.G.B., Konar.S.K., Mao.V. and Sidi (1996) , Fast one –phase oil rich processes for the Bradshaw G.B. and W.C Meuly,(1942) .Process of making pure soaps .US.Patent 2,271,619.

Bradshaw, G.B.(1994) New soap process.Soap 18 (May) pp23-24, 69-70

Bureau of Transportation Statistics .(2004).National Transportation.

Downstream Monitor, 20 ethanol fuel Questions and answers quarterly publication of Petroleum Products Pricing Regulatory agency (PPPRA) Environment, Agriculture and Industry, proceeding 8th European Biomass Conference pp 1192-1197

Omolara O.Akinyemi and S.A.Ibiyemi (2001) Chemical Magazine 1No2 September

preparation of vegetable oil methyl esters.Biomass and Energy 11 (1) :pp 43-50.

revisited: A method for increasing base –catalysed methanolysis rates in Biomass for Energy , Statistics 2003.US.Department of Tranportation. http://www.bts.gov/publication/national

Waldire ,A ;Bizzo etal (2004) .Safety issues for clean Liquid and Gaseous for cooking in the stove of sustaining development energy for sustainable Development vol. 111 No.3

Scanned with CamScanner

www.aboutmyplanent.com/environment/virginat Retrieved 12/10/ 2008

www.americanfuels.blogspot.com Retrieved 12/10/ 2008

www.biodeselGear.com Retrieved 12/10/ 2008

www.biodiesel.org Retrieved 12 /09/ 2008

www.cogeneration.net/coconut-biodiesel Retrieved 12/10/ 2008

www.ebb-eu.org Retrieved 10/10/ 2008

www.en.wikipedia.org/wiki/coconut Retrieved 12 /09/ 2008

www.epoxy dow.com/epoxy Retrieved 12/09/ 2008

www.essu.strath.ac.uk Retrieved 12/09/ 2008

www.greenfuel.org/biodiesel Retrieved 12/09/ 2008

www.tropicatraditions.com/what is virgin coconut. Retrieved 7 /8 2008

www.ucsusa.org Retrieved 12 /09/ 2008

www.woodgas.com Retrieved 7 /8 2008

www.ucsusa.org Retrieved 12 /09/ 2008

Zhang .X; Peterson C.L; Reece D;Moller .G and Haws .R (1995) .Biodegradability of biodiesel in the aquatic environment .ASAE paper No 956742 ASAE, st Joseph, M, 49085-9659.

Scanned with CamScanner