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KERO-SESAME BIODIESEL: A FUTURE FUEL FOR RUNING ABUJA METROPOLITANT LIGHT RAIL

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ABSTRACT

The existing source of energy such as Coal, Oil, Uranium etc. may not be adequate to meet the ever increasing energy demands. These convectional sources of energy are also depleting. Consequently, sincere and untiring efforts have to be made by engineers and scientists in exploring the possibilities of harnessing energy from several convectional and non convectional energy sources for power generation. Biodiesel is one of the most thoroughly tested alternative fuels on the market .A number of independent studies have been completed with the result showing biodiesel perform similar to petroleum diesel while benefiting the environment and human health compared to diesel. This paper discus the experimental trials of using Kero –Sesame Biodiesel blends to run diesel generator which can be adopted for running the future Abuja Metropolitan light rail. All the Blends from B90 to B10and also, B100 all burn well in the diesel generating set with little carbon monoxide emission. The specific gravity decreased progressively from 0.896 to 0.825.This decrease in specific gravity showed that in Kerosene/ Sesame blend, Kerosene has effect on the density of Sesame biodiesel and this was confirmed by the way Kerosene reduced the density of B100 from 896kg/m^3 to 825kg/m^{3}for B10.In conclusion Kero- Sesame Biodiesel can be adopted in running the future Abuja Metropolitan light rail

INTRODUCTION

Biodiesel can be used in pure form (B100) or may be blended with petroleum diesel at any concentration in most injection pump engines. Blends of biodiesel and convectional hydrocarbon-based are products most commonly distributed for use in the retail diesel fuel marketing place. Much of the world uses a system known as the B factor to state the amount of Biodiesel in any fuel mix. Fuel containing 20% biodiesel is label B20 , while pure biodiesel is referred to as B100 (www.nationalbiodiesel board) .It is common in the USA to see B99.9 because a federal tax credit is awarded to the first entity which blends petroleum diesel with pure biodiesel. Blends of 20 percent biodiesel with 80 percent petroleum diesel (B20) can generally be used in unmodified diesel engines. Since the passage of the energy policy Act of 2005 biodiesel use has been increasing in the United State (www.enwikipedia-org/wiki/Biodiesel The royal train on 15th September, 2007 completed its first ever journey to run on 100% biodiesel fuel supplied by green fuel Ltd. His royal Highness, the prince of Wales, and Green fuels managing director, James Hygate, were the first passengers on a train fueled entirely by biodiesel fuel. Since 2007 the Royal Train has operated successfully on B100 that is 100% biodiesel (www.ews-railways.co.uk) Also, in 2007 Disreyland began running the park train on B98 biodiesel blends (98%biodiesel).The programe was discontinued in 2008 due to storage issues, but in January 2009 it was announced that the park would then be running all trains on biodiesel manufactured from its own used cooking oils, this is a change from running the train on soy-biodiesel (www.upi.com) The low emission of biodiesel make it an ideal fuel for use in marine areas, national parks and forests, and heavily polluted cities .Biodiesel has many advantages as a transport fuel. For example, biodiesel can be produced from domestically grown oil seed plants such as Canola. Producing biodiesel from domestic crops reduces the Australia's dependence on foreign petroleum, increase agricultural revenue and creates jobs (www.biodiesel.org) Sesame is among the most important oil seeds of mankind, and there are very different kinds of sesame oils available. Sesame is otherwise known as Beni-seed. Basically, nearly all the seeds contain some kind of stored energy used as fuel by young plant in the first phase of life (www.uni.gazat/katzer/eng/sesa.ind/html) The following states are major producer of Sesame (Beni Seed) in Nigeria: Adamawa, Taraba, Yobe , Benue, Kaduna ,Kogi, Jigawa, Crossrever, Nassarawa and Niger. (www.rawmaterialsanddevelopmentcouncil)

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Benue, Kaduna ,Kogi, Jigawa, Crossrever, Nassarawa and Niger. (www.rawmaterialsanddevelopmentcouncil) Nigeria Minister of Science and Technology Dr. Alhassan Zaku challenged the research Experts on the best way to explore the potentials of these biodiesel plants for job and wealth creation through cultivation of the plants for biodiesel production (Science and Technology Digest, 2009)

MATERIALS AND METHODS

MATERIALS

The Sesame seed was bought from Okene market in Kogi State and Sodium Hydroxide and Methanol of analytical grade were bought from Panlac Chemical store in Minna and Kerosene was bought from Agip filling station Bida , while pressurized stove was bought from Bida main market..

METHODS

The Sesame (Beni- seed) oil was extracted mechanically using hydraulic press at NCRI (National Cereal Research Institute Badegi). Then 500mls of 0.1M of Sodium Methoxide was mixed with 1000mls of Sesame oil in a suitable local reactor, and the mixture was stirred continuously for 2-4 minutes to get a homogenous mix. The product of reaction was later transferred into a separating funnel for phase separation .After 6-8 hours two layers of liquid has settled in the separating funnel , the Biodiesel at the top and Glycerin at the bottom .The glycerin was selectively run off and the biodiesel left in the separating funnel was washed with 50% by volume of warm water. The washing was done for about 3-4 times then it was transferred into the sand bath to be dried at a temperature of 110 to 115°C for 2hours .After the biodiesel was well dried it was allowed to cooled for the Physico-Chemical properties of the biodiesel to be determined.. Also, the Kerosene /Sesame oil Biodiesel blends were prepared i.e B100 was the Sesame Biodiesel without Kerosene while B90-B10 were prepare by following a simple ratio B90 K10 means for 100mls of Kerosene /Sesame Biodiesel blends. Kerosene is 10% while Sesame Biodiesel is 90%.This simple ratio was followed to make B90-B10 .2 Liters each of the blends were made and poured in turns into the diesel generating set, this after the blends has been properly homogenized. And The physical properties like specific gravity , viscosity refractive index and others have been determined. Thereafter the diesel generating set was operated according to the manufacture's manual. And the current generated was used for electrical bulbs lightening and for some other electrical appliances.

RESULTS

Table 1: Shows Physico- Chemical Properties of Sesame Ethyl Ester Biodiesel

Fuel properties	Sesame oil Biodiesel	ASTM Biodiesel Specification
Specific Gravity	0.896	0.880
Density Kg/m^3	0.896	0.880
Viscosity (cp)	2.17	*
Refractive Index	1.4324	*
Flash Point (°C)	84	100-170(°C)
Cloud Point (°C)	-3.5	-3 to 12 (°C)
Cetane Number	47	48-65
Boiling Point (°C)	215	182-338 (°C)

Source: Experimental, 2010

Note (*) means not indicated

Table 2: Shows the Physical properties of Kero- Sesame Biodiesel blends.

SesameBiodiesel/ Kerosene Blends	Volume in 1000ml		Specific Gravity	Density (Kg/m^3
	Sesamebiodiesel	Kerosene		
B100	1000	0	0.896	896
B90	900	100	0.888	888
B80	800	200	0.885	885
B70	700	300	0.875	875
B60	600	400	0.865	865
B50	500	500	0.855	855
B40	400	600	0.843	843
B30	300	700	0.835	835

B20	200	800	0.830	830
B10	100	900	0.825	825
K100	0	1000	0.810	810

Source: Experimental, 2010
Note B is for Biodiesel
While K is for Kerosene.

Table 3 Technical details of the Diesel generating set used

Description	Specifications
Type	R175A
Rated power	4.4kw/2600r/min
Max Power	4.85kw/2600r/min
N.w	65Kg
Factory Number	No 14949
Manufacturer	Mingbo tri-circle power Machnic Co.LTD

Source: Manufactures details on the machine, 2010

Table 4 Technical details of the Alternator used

Manufacturer		Viking Exclusive joncod	
Type ST	3	COS Q	1.0
3	KW	EXCUIT	42 V
230	V	EXCUIT CURR	2A
13	A	IUSCL	B
50	HZ	RAT	S1
1500	r/min	I	Phase
Standard	Q /MDL 001	-1998	
Machine No		04120399	

Source: Manufactures details on the machine, 2010

DISCUSSION OF RESULT

Table 1 showed the Pysico-Chemical Properties of the Sesame Biodiesel in which the Sesame biodiesel specific gravity differ with a difference of 0.008 while the flash point, Cloud Point, Boiling Point and Cetane Number for fuel is within the ASTM standard for biodiesel fuels. Also, as Shown in table 2.0, all the blends of Sesame Biodiesel, B90, B80 , B70, , B60, B50, B40 , B30, B20, and B10, were all combustible with little carbon monoxide emission at the exhaust .Besides, also, in table 2 it was observed that as the volume of Kerosene increased from 100ml to 900mls, the specific gravity decreased from 0.896 to 0.825. While, similarly, Density Decrease from 896 Kg/m^3 – 825Kg/m^3 for B100 to B10. Table 3 showed the mechanical specification of the diesel generating set used and this was obtained from manufacturer's template on the generator. Table 4 showed the electrical mechanical specification of the alternator used and this was obtained from manufacturer's template on the alternator.

CONCLUSION

A blend of B90 to B10 perform well in the diesel generation with little observable carbon monoxide at the exhaust .It should also be noted that B100 which is 100% Sesame Biodiesel burn well in diesel generator, hence this type of alternative fuels can be adopted in the future Abuja Light Rail. And lastly, Kerosene has effect on the specific gravity in Kerosene/Sesame Biodiesel blends.

RECOMMENDATION

Government should invest more in renewable energy sector .There should be legislative support to include certain percentage of Biodiesel and Biodiesel blends in the dispensed petro –diesel in Nigeria, this can be done by reducing the tax paid by filling stations that sell Petro-diesel and Kerosene blended with Biodiesel. Also, research should be done on effect of different Kero-Biodiesel blends on the compression ignition

engine. Finally, Micro-finance banks should be willing to give loan to investors, farmers that are ready to invest in Bio-energy feed stocks. Nigeria should take a lead through Energy Commission in setting up Nigeria Biodiesel Board to draw a road map on Biodiesel , research ,Biodiesel Processing Quality Control, Via Nigeria Biodiesel Standards and Marketing Distribution in the country.

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