ORGANIC KEROSENE PRODUCTION FROM A MIXTURE OF CASSAVA (MANIHOTESCULENTIA), MAIZE (ZEAMAYS) AND AKINTOLA LEAVES (CHROLLAENAODORATA)

UHUEGBU, C. C[1]
ONUORAH, L. O[1]
AYARA, W. A[2]
UGONABO, O[3]

[1]Dept. of Physical and Geosciences Godfrey Okoye University Enugu, Nigeria
[2]Dept. of Physics, Covenant University Ota, Nigeria
[3]Dept. of Physics and Astronomy University of Nigeria Nsukka, Ningeria, Nigeria

ABSTRACT

Organic kerosene was produced using cassava, maize and Akintola leaves in a liquid mixture. The specific gravity, viscosity and Boiling point were determined using ASTM (D 4052, D 445 and D 86), respectively. The specific gravity ranged from 1.003 to 1.005 compared to the standard value of 0.78 – 0.81, viscosity range from 3.535 to 3.585 compared with standard value of 2.16 and boiling point of 101 – 102^0 C compared to standard value of 150 – 290^0 C.

KEYWORDS: Organic kerosene, Renewable energy, cassava, maize and Akintolaleaves.

INTRODUCTION

Fossil fuel has been generally used for both domestic and industrial purposes over the years. The effects of the use have led to damaging of man and ecosystem such as depletion of ozone layer, causing global warming. Hence, the interest on alternative energy is to reduce this negative impact. Renewable energy is derived from natural sources such as sunlight, geothermal, wind, water and bio fuels derived from feedstock and life stocks. The intention of this research is to produce organic kerosene from a mixture of cassava, maize and Akintola leaves. Kerosene is a thin clear liquid comprising of hydrocarbons with density range of 0.78 to 0.81 g/m^3. It can be gotten as a by product of fractional distillation of petroleum at temperature between 150^0 C and 275^0 C giving rise to carbon chains that is made up of 6 to 16 carbon atoms per molecules. The flash point is between 37^0 C and 65^0 C (100^0 F and 150^0 F with auto ignition temperature of 220^0 C (428^0 F). The heat of combustion is similar to that of diesel, the lower and higher heating values are 43.1 MJ/kg and 46.2 MJ/kg, respectively. It is immiscible in water but miscible in petroleum solvents.

Biokerosene is an alternative fuel to petroleum kerosene which is renewable in nature and has no fossil content. It is a clean source of energy produced from many crops and plants such as

Jasthropha, cassava, maize, sorghum and other starch producing, crops through processes such as gasifying biomass liquefied by the Fischer – Tropsch. Kerosene production may either involve using clay as an absorbent or using ammonium chloride (Sal ammoniac). The repetition of the distillation will give a final product which is clear and safe to light since the volatile hydrocarbon fraction had been removed. This product can be gotten from oil shale and bitumen by heating the rock. Apart from its use in kerosene lamps and lanterns, it is used as jet engines fuel. Another form of kerosene RP -1 is burned with liquid oxygen as rocket fuel.

Cassava is a perennial woody shrub with an edible root grown in tropical and subtropical areas of the world. It is rich in calcium, vitamins B, C and essential minerals. Its nutrient composition differs according to variety, age, soil condition, climate and other environmental factors during cultivation. Cassava roots can be harvested between 6 months and 3 years. Many varieties contain a substance called cyanide which makes it toxic if inadequately processed but this effect can be reduced by grating, sun drying and fermenting. Cassava processing produces large amounts of waste (FAO, 1979, 2001) and fresh by-products which can cause environmental problems (Aro, et. al., 2010). In Nigeria, cassava waste are left to rot away or burnt off emitting carbon dioxide with strong offensive smell (Adebayo, 2008). High amounts of cyanogenicglucosides and pomace (high amounts of biodegradable organic matter) may cause surface water pollution (Pandey, et. al., 2000, Cereda, et. al., 1996, Barana, et. al., 2000). More than 60% of the rural populations are engaged in cassava-based cottage industries.

Three groups of bacteria; fermenting bacteria that perform hydrolysis and acid genesis Volatile Fatty Acids (VFA). Some carbon dioxide and hydrogen are formed by the actions of exo-enzymes to hydrolysepolymeric matter like fats, carbohydrates and proteins into smaller units which then enter the cells to undergo an oxidation – reduction process. (i) The fermenting bacteria are called acidifying or acid genic population. (ii) Acetogenic bacteria break down the product of acidification step forming acetate, hydrogen and carbon oxide and (iii) conversion of acetate or carbon dioxide and hydrogen into methane involving methanogenic bacteria.

In most anaerobic digestion processes other possible methanogenic substrates likeformate, methanol, carbon monoxide and methylamines are of minor importance. Feedstock for biogas production includes water lettuce, water hyacinth, dung, cassava, agricultural residues and sewage (Okagbue, 1988, Ubalua, 2008). It was estimated that Nigeria produces about

227,500 tons of fresh animal waste daily. Since 1 kg of fresh animal waste produces about 0.03m^{3}of biogas, certainly Nigeria can produce about 6.8 million cubic metres of biogas everyday from animal waste. Igoni, et. al., 2008 provides the key issues and analyses concerning the design of a high performance anaerobic digester.

Biogas production has been carried out by several researchers (Aldo, 2009, Lawal, et. al., 1995, Audra, et. al., 2010, Ojolo, et. al., 2007, Odeyemi, 1983, Kozo, et. al., 1996, Krammer, 2008, Rungrawee, 2007, Ogwueleka, 2009).

Maize is cultivated around the world and used for its nutritional value. It thrives best in a warm climate (high summer temperature rather than on high mean temperature. It gets matured in short hot summer and withstands extreme heat). The average maturing period is short and grows at fairly high latitudes. Botanically, it belongs to the kingdom plantae. There are over fifty species available but most abundant in sub-Saharan Africa is Zeamays. 70% of the kernel is starch (from the endosperm), 10% protein (gluten), 4% is oil (extracted from the germ and 2% is fibre (from the hull).

Materials and Method

The materials used for this research include the following: cassava (manihotesculentia), maize (zeamays), Akintola leaves (Chrollaenaodorata), water, Hot plates, thermometer, conical flask, Beakers, measuring cyclinder, funnel, filter paper, and magnetic stirrer. The cassava tubers were washed and peeled cut into small chips and soaked for four days. It was then grinded and sieved. The liquid obtained was stored as shown in fig. 1. The maize seed was removed from the cob soaked between 12 to 72 hours and was wet grinded and sieved using a Mushin cloth. The filtrate was collected into a container as shown in fig. 2.

Fig. 1: Cassava extract

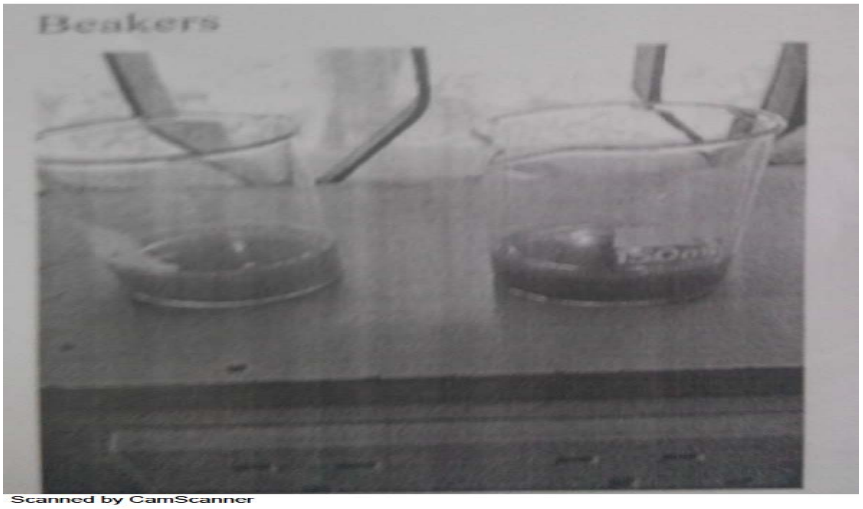

Fig. 2: Maize extract.

The Akintola leaves were washed and squeezed to extract the liquid and stored in a bottle as shown in fig. 3. 500 m of cassava liquid and maize extracts were put, each in a petridish and placed in hot oven at temperature of 80^0 C for 2 hours. Some were put in a beaker and heated for 12 hours with the magnetic stirrer to ensure even temperature during the heating process as shown in fig. 4. After this period, the slurry or cure is allowed to cool to 60^0 C. Thereafter 4 mls of Akintola leave extracts is added to the slurry of both cassava and maize and allowed to cool down completely in the oven. Pale coloured slurry was obtained as seen in fig. 5. It was observed that the ratio of cassava and maize extracts to Akintola leave extracts are the great determination of the results obtained. The cured solution was tested for kerosene properties (physical, chemical, viscosity, flash point). The results obtained were compared with the characteristics of kerosene from petroleum.

Fig. 3: Akintola leave extract.

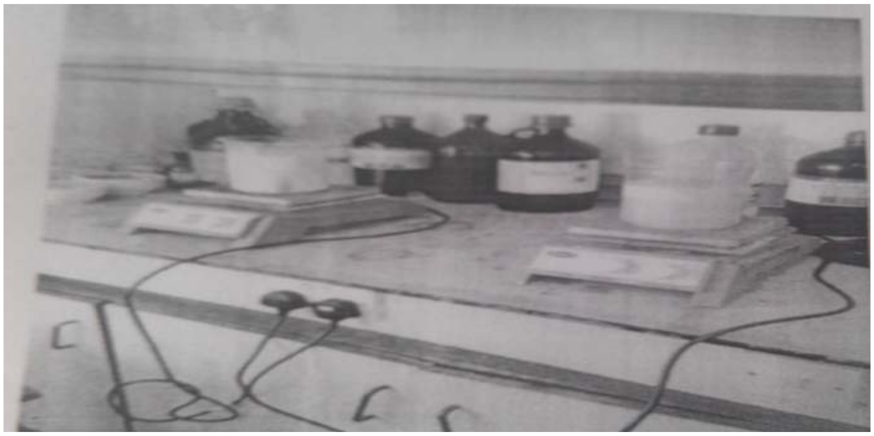

Fig. 4: Heating extracts to 80^0 C

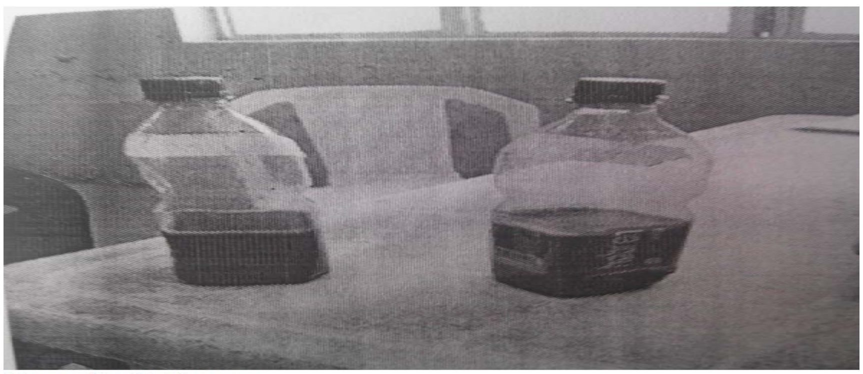

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Fig. 5. Mixture of maize and cassava in equal proportion or in the ratio 2:1 in any order would also be tested for properties of kerosene.

Result/Discussion

The results obtained compared with the standard results are presented in table

S/N	properties	values	standard	unit	methods
1	Specific gravity	1.005	0.78 – 0.81	_	ASTM D4052
2	Viscosity	3.585	2.16	mPa.S	ASTM D445
3	1 Bpt	102	150 - 290	^{0}C	ASTM D86

Table 1: Sample 1 result compared with the standard.

S/N	properties	values	standard	unit	methods
1	Specific gravity	1.003	0.78 – 0.81	_	ASTM D4052
2	Viscosity	3.535	2.16	mPa.S	ASTM D445
3	1 Bpt	101	150 - 290	^{0}C	ASTM D86

Table 1: Sample 2 result compared with the standard.

It is observed that the specific gravity for both samples differ from the standard by 0.195 and 0.193, viscosity by 1.425 and 1.375 and Boiling point- 188.

Conclusion

We have been able to produce organic kerosene which was able to burn, though the difference in properties maybe as a result of mixture ratio and the concentration of the constituents.

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