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Short Communication

Biofuel characteristics of beniseed (*Sesanum indicum*) oil

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Local method was used to extract oil from beniseed (*Sesanum indicum*). Laboratory experiments were carried out to characterize the oil. Transesterification of beniseed to produced methyl ester which had fuel properties similar to common biofuels, hence beniseed could be utilized as an alternative renewable energy resource.

Key word: *Sesanum indicum*, biofuel, flashpoint, pour point, cloud point, transesterification, methyl ester.

INTRODUCTION

Several investigations on the chemistry and technology as well as use of various seed oil domestically and industrially have been made (Hoffman, 1989). An interestingly tremendous increase in the chemical investigation of a vast number of seed oils has been on for a long time (Ibemesi, 1991). In recent times, there is remarkable utilization of this oil from seeds which goes beyond the food system for this particular commodity (Aigbodion et al., 2004).

More than 70% of the population of people in developing nations lives in rural areas where there are resources for agriculture. The cultivation of fast growing species of plants and tall grasses for fuel could be an economically competitive method for converting solar radiation into useful energy particularly in the areas where there is rising cost of gas and oil (Barminas et al., 2001).

Biomass technology is a cheap energy resource, which could be derived from industrial, municipal waste and cultivated products through chemical and biological process to produce biofuels such as methyl gas, ethanol, or charcoal (Ali and Hanna, 1994). Categories of suitable agricultural product for biofuel production include seeds, nuts, fruits, leaves, stems and roots. In Nigeria, a fast growing crop whose seed can be utilized for biofuel Production is beniseed (*Sesanum indicum*) which is used to serve other purposes rather than as fuel.

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Beniseed is commonly cultivated in Northern Nigeria. The tiny spherical seeds are edible, having milky flowering flavour. The seeds are consumed fresh, dried, fried or when blended with sugar. It is also used as a paste in some local soups. Beniseed has different varieties, the notable ones being white, yellow and black. In this study, experiments were carried out to ascertain the biofuel potentials of beniseed and its methyl derivative.

MATERIALS AND METHODS

Beniseed was purchased from Hong, Adamawa State, Nigeria. The seeds were crushed to form a paste using local grinding machine. Water was heated to 100^{o}C and added to the paste. This was stirred and allowed to stay for 24 h. Oil was found floating on top of the paste and it was decanted. This was repeated until neligible oil is formed. The unsaponifiable matter was determined (Kapseu, 1993), saponification value, iodine value and % FFA (Oleic acid) were determined using methods by David (1994). The Kinematic viscosity was determined by the ASDM D445 method using cannon fenske (model No. N.O. 1057 / N.0. 1063).

The methyl ester was obtained using the method adopted By Foidl et al. (1996). The fuel properties of the raw oil and its methyl ester were determined using the methods of the Institute of Petroleum (London, 1993). The calorific value (Hu) of the raw oil was obtained using Batel et al. (1980) formula:

Hu = 47645 – 4.187I – 38.31S Where I and S are the iodine and saponification values, respectively.

RESULTS AND DISCUSSIONS

The chemical characteristics of oils extracted from two varieties of beniseed are shown in Table 1. The values of

Table 1. Chemical characteristics of beniseed (*Sesanum indium*) oil.

Parameter	Variety	
	White	Black
Unsaponnifiable matter (% of oil)	0.76	0.71
Saponnification value (mg KOH/g)	150.26	158.04
Iodine value (g/100 g)	98.20	106.26
Free fatting acid (% Oleic)	0.78	0.73

Table 2. Fuel properties of black beniseed oil and its methyl derivative compared with other biofuels.

Parameter	Beniseed oil	Soybean oil	Sunflower oil	Methyl ester		
				Beniseed Oil	Crude soybean	Refined soybean
Kinematicviscosity @40°C (mm^2/s)	33.2	32.6	37.1	7.62	5.24	6.24
Flashpoint (°C)	236	254	274	141	70	84.1
Cloudpoint (°C)	2.1	-3.9	7.2	-5.3	-8.4	-.7.3
Pourpoint (°C)	15.2	12.2	15.0	6.4	-11	-12
Calorific value (MJ/kg)	41.1	46.7	46.3	*	*	*
Fuel value MJ/l)	34.9	39.71	39.38	*	*	*

Table 3. Fuel properties of biodiesel.

Parameter	Value
Kinematic viscosity@40°C mm2/s	1.9 to 6.0
Flash point (°C)	100 to 170
Cloud point (°C)	-3 to -12
Pour point (°C)	-15 to -13

Source: http://www.meadbiofuel.com.

unsaponifiable matter were comparable to those obtained by Kapseu (1993) and it showed similar chemical properties. The iodine value shows that beniseed is a non drying oil and as such it is unsaturated thus making it suitable for utilization as fuel as well as raw material in industries for the manufacture of soap and vegetable oil – based ice cream (Ibiyemi et al., 1992).

The fuel properties of raw beniseed oil (extracted from black variety) and it derivatives is shown in Table 2. Raw oil from has a lot of potential as a renewable resource considering its viscosity which is close to those of soybean and sunflower. Its flash point is lower but comparable to values reported for soybean and sunflower oils. The calculated fuel value is also comparable to those of soybean and sunflower oils hence, it has high energy density. The methyl derivative has its cloud point and pour point value close to those of methyl esters of crude and refined soybean. The flash point is within the acceptable range for biodiesel (Table 3). Generally, the tranesterification process afforded biofuel with better fuel quality than the raw oil and these may be used to run direct injection engines without residue formation (Barminas et al., 2001).

Parameters such as cetane number, water and sediment, sulfated ash, total sulphur, copper strip corrosion, free glycerine, total glycerrine and mineral elements like P, Mg and Fe which might block filters and enhance microbiological decomposition (Gerpen et al., 2004) should be determined so as to produce a better biofuel.

Beniseed a fast-growing plant which is cultivated on a small scale by rural farmers could be produced on large scale for consumption and to be used as fuel. The Northern part of Nigeria having sufficient sunlight can produce enough beniseed for industrial application utilization as a biofuel resource material in Nigeria.

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