



## False sesame (*Ceratotheca sesamoides*) oil - A potential biodiesel source

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### ABSTRACT

Biodiesel is a biodegradable 100% natural energy alternative to petroleum fuel. It can be produced from the vegetable oils. Biodiesel contains no petroleum but it can be blended at any level with the petroleum diesel to create a biodiesel blend. The oil obtained from the seeds of the False sesame is used as a source for biodiesel. False sesame (*Ceratotheca sesamoides*) is a slender erect annual herb belonging to the family Pedaliaceae, which is commonly found in Africa. The False sesame seeds were collected and the oil was extracted by using a hydro-carbon solvent, Petroleum ether. The physico-chemical properties of the oil obtained from the seeds of False sesame have been analyzed for its potential use as a Biodiesel. The physico-chemical properties were analyzed by blending the oil with the conventional diesel at 10% (B10) & 20% (B20) proportions and compared with that of diesel. The physico-chemical properties assessed include specific gravity, density, viscosity, flash point, fire point, cloud point, pour point, smoke point, pH, viscosity, carbon residue, saponification value, acid value, and iodine value. The results were presented and discussed in the present communication.

**Keywords:** Biodiesel, False sesame, Pedaliaceae, Physico-chemical properties, Alternate fuel.

### INTRODUCTION

Biofuel is a nonpolluting, locally available, accessible, sustainable, and reliable fuel obtained from renewable sources. The liquid biofuels are obtained from plant resources like lipids, simple sugars and polysaccharides<sup>[1]</sup>. Biodiesel refers to vegetable oil or animal fat based fuel consisting of alkyl (methyl, propyl, or ethyl) esters obtained by chemical reaction of the lipids (vegetable oil, animal fat) with an alcohol<sup>[2] [3]</sup>. Biodiesel is a clean burning alternative fuel to diesel. It is produced from domestically grown renewable resources<sup>[4]</sup>. Biodiesel consists of esters of long chain fatty acids with short chain alcohols.

False sesame (*Ceratotheca sesamoides*) belongs to the family Pedaliaceae, which has 16 genera and 60 species predominantly found in Africa, Indo-Malayan region, and tropical Australia. False sesame is a slender erect annual herb, usually grown to a height of 60 cm. Most of the parts have glandular hairs. Leaves are variously lanceolate-deltate to ovate-cordate; margins coarsely dentate. Flowers pendent, solitary in the leaf axils, pink, mauve or lilac, lip and throat are cream coloured with dark lines. Fruit a laterally flattened capsule with slender horns. *C. sesamoides* has tender edible shoots, leaves and fruits are eaten whole or in part at raw or cooked. It is a source of protein, vitamins and minerals. The dry seed yielding 40 percent oil whose characteristics are practically identical to those of sesame oil. *C. sesamoides* is used in the treatment of childhood diseases such as measles. The leaves are used to prepare a slimy liquid dropped into the eye to treat conjunctivitis. The mucilage is occasionally used as an emollient and lubricant. The leaf is a good antioxidant, anti-inflammatory and antihypertensive agent. The leaves are used as an abortifacient and emetic as well as for treatment of cutaneous and subcutaneous parasitic infections; diarrhoea and dysentery. *C. sesamoides* has been shown to have antiviral properties and also used as an aphrodisiac. The seed oil is used as an insecticide.

## EXPERIMENTAL SECTION

### Collection, extraction and preparation of *False sesame seedoil*

The *False sesame seed* were collected from the Nagercoil market. The seed were dried and the impurities were removed by hand-picking. The seed were crushed by using a laboratory mortar and pestle. The bulk oil was extracted by using Soxhlet apparatus with Petroleum ether for 24 hours. The diesel used for the experiment was purchased at Indian oil Filling Station, Thuckalay, Tamilnadu, India.

The *False sesame seedoil* was mixed with the conventional diesel in two different proportions namely at B10 (90% diesel and 10% *False sesame seedoil*) and at B20 (80% diesel and 20% *False sesame seedoil*). The physico-chemical studies were carried out for the blended proportions of biodiesel.

### Physico-chemical analysis

The specific gravity and density were determined by using the specific gravity bottle and the values were calculated by using the equations below

$$\text{Specific gravity} = \frac{\text{Mass of Oil}}{\text{Mass of an equal volume of water}}$$

$$\text{Density} = \frac{\text{Mass of Oil}}{\text{Volume of Biodiesel}}$$

The fire point, flash point, smoke point, carbon residue, cloud point, pour point were carried out for the blended biodiesel at different proportion. The fire point was analyzed by using Cleveland open cup apparatus. The flash point was determined by using Pensky-Martens closed cup tester apparatus. The cloud point was obtained by using Deep vision cloud point apparatus. The pour point was analyzed by using Deep Vision pour point apparatus. Carbon residue was determined by using Conradson carbon residue apparatus. The smoke point was observed by using Seta Smoke point apparatus. Viscosity was measured by using calibrated Ostwald Viscometer. The specific gravity was measured by using Borosil glass bottle. The pH was determined by using Elico pH meter.

The econometric and acidimetric chemical properties were analyzed for the *False sesame seed* oil blended with conventional diesel at B10 and B20 proportions. The econometric constant namely the Iodine value was determined by Wijs method. The acidimetric constant namely the acid value and saponification value were measured by the standard AOAC method.

## RESULTS AND DISCUSSION

The oil content of the dried seed of *False sesame seedis* about 40% on dry weight basis. The physical properties like flash point, fire point, smoke point, cloud point, pour point, carbon residue, pH, specific gravity, density and viscosity were analyzed for diesel and the biodiesel blends at 10% and 20% proportions. The results were given in Table 1.

The iodine value, acid value, and saponification value were estimated and presented in the Table 2.

The flash point of these B10 and B20 are almost equal to the petro diesel and the values are within the range specified for petro diesel (Manufacture of Fuels standards comparison table, <http://www.rix.co.uk>). The flash point of biodiesel is higher than that of fossil diesel so it clearly indicated that biodiesel is safer to handle than fossil diesel. Fire point of the blends B10 and B20 are almost equal and the B20 are slightly higher than that the petro diesel, and which falls within the range of the ASTM Standard (American Society for Testing and Materials). This also indicates that the biodiesel is safer to use. The smoke point of the biodiesel blends are less than the petro diesel but within the range of the ASTM standards. The carbon residue is slightly higher than the petro diesel. The high value of carbon residue may be due to the impurities in the biodiesel blends but the values are within the ASTM standard. The Cloud point and Pour point is slightly higher than the petro diesel, because of the fatty acids and the nature of fatty acids present in the biodiesel blends. The pH of the biodiesel blends are slightly less than the petro diesel which also indicates the biodiesel is more acidic than the conventional diesel due to the presence of fatty acid. The density, viscosity and specific gravity are important when considering the spray characteristic of the fuel within the engine. Higher density and viscosity of the liquid fuels affects the flow properties of the fuel, such as spray atomization, subsequent vaporization and air-fuel mixing in the compression chamber. The change in spray can greatly alter the compression properties of the fuel mixture. Specific gravity, viscosity and density of pure vegetable oil is several times higher than that of diesel. By mixing the vegetable oil with the conventional diesel with B10 and

B20 the specific gravity, density and viscosity were found to be slightly higher than that of diesel and it is within the range of the ASTM standard value for the biodiesel.

The chemical properties like the acid value of the blends indicates that the amount of fatty acid present in the sample. The acid value of blends are slightly higher than that of the ASTM standard. The number of double bonds present in a vegetable oil is calculated by treating with iodine. The higher the iodine number is the amount of iodine needed to be saturate or break the double bonds in the fatty acid. From the result the iodine values of biodiesel blends are lesser than the petro diesel and it is within the range of ASTM standard of the biodiesel. The saponification value can indicate the non-fatty acid impurity and the amount of alkali that could be required by the fat for its conversion to soap. In the biodiesel, blends the saponification values are less than that of the petro diesel. However the saponification value is found to be with in the acceptable range of biodiesel.

The present study on *False sesame seed* oil has shown that most of the physical and chemical properties evaluated for the biodiesel blends (B10 and B20) falls within the range of ASTM and EN standard values. The values are nearer to the conventional diesel properties. It could be concluded from the present study that the biodiesel produced from *False sesame seed* oil blend B20 is the most potential source of biodiesel. It can be a replacement for fossil diesel. The production and effective usage of biodiesel blend at B20 will help to reduce the cost effect of the production of energy. It is eco-friendly and protect the environment form the various environment hazards. It grows naturally during the monsoon seasons. As it is a high productive crop, the cost of production of oil is very less when compare to other agricultural cash crops. It could be used as alternative crop cultivation and improve the crop production through biotechnological methods. The production of the *C.sesamoides* biodiesel will boost the economy of the country in many ways . The oil can be used for biodiesel and oil cake can be used as a manure in organic farming.

**Table 1. Physical properties of *Ceratotheca sesamoides* oil B10, B20 and diesel**

Parameters	<i>Ceratotheca sesamoides</i>		Diesel
	B10	B20	
Flash point	38.2°C	45.3°C	47.2°C
Fire point	44.1°C	56.2°C	54.0°C
Smoke point	7mm	4mm	9mm
Carbon residue	0.1g	0.2g	0.2g
Cloud point	7°C	6°C	3 °C
Pour Point	0°C	0°C	0 °C
pH	5.6	5.3	6.8
Specific gravity	0.875	0.896	0.880
Density	0.824g/cm <sup>3</sup>	0.831g/cm <sup>3</sup>	0.804g/cm <sup>3</sup>
Viscosity	4.14	5.30	3.5

**Table 2. Chemical properties of *Ceratotheca sesamoides* oil B10, B20 and diesel**

Parameters	<i>Ceratotheca sesamoides</i>		Diesel
	B10	B20	
Acid value	7.8	12.5	16.31
Iodine Value	4.3	11.5	6.838
Saponification value	92.4	122.5	109.41

### Acknowledgements

The authors are thankful to the Department of Science and Technology Govt. of India (DST/TSG/AF/2012/01 dated 31 December 2012) for financial assistance to carry out this investigation. The authors are indebted to the Chancellor, Vice Chancellor, Noorul Islam University, Kumaracoil for their valuable guidance, constant encouragement and providing basic facilities throughout the study.

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