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Linseed *(Linum isitatissimum L.)* Oil – An Alternative Fuel Source As Biodiesel.

VN Ariharan[1]*, VN Meena Devi[2], and P Nagendra Prasad[1].

[1]Department of Biomedical Engineering, Noorul Islam Centre for Higher Education, Kumaracoil -629180, India.
[2]Department of Physics, Noorul Islam Centre for Higher Education, Kumaracoil -629180, India.

ABSTRACT

Linseed *(Linumusitatissimum L.)* is an annual herb belonging to the family Linaceae,which is commonly found in Asia. The Linseedwere collected and the oil was extracted by using ahydro-carbon solvent, Petroleum ether. The Physico chemical properties of the oil obtained from theseeds ofLinseedhas been analyzed for its potential use as a Biodiesel. The physico-chemical properties were analyzed by blending the oil with the conventional dieselat 10% (B10) & 20% (B20) proportions and compared with that of diesel. The physico-chemical properties assessed includes, 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, Linseed, Linaceae, Physico-chemical properties, Alternate fuel.

Corresponding author

INTRODUCTION

Biofuel is a nonpolluting, locally available, accessible, sustainable, and reliable fuel obtained from renewable sources[1,2]. The liquid biofuels are obtained from plant resources like lipids, simple sugars and polysaccharides[3]. 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[4,5]. Biodiesel is a clean burning alternative fuel to diesel. It is produced from domestically grown renewable resources[6]. Chemically most biodiesel consist of alkyl esters instead of the alkanes and aromatic hydrocarbons of petroleum derived diesel[7].

Biodiesel is made from vegetable oil, renewable sources that come mostly from non-edible sources such as callophyllum, rubber, cotton seed etc[8]. These raw materials can either be mixed with pure diesel to make various proportions or used alone[9,10]. Despite ones mixture preference biodiesel will release smaller number of pollutants than conventional diesel, because biodiesel burns both clearly and more effective biodiesel is sulphur free[11]. Biodiesel is better for environment because it is made from renewable source and has lower emission of toxic compounds compared to petroleum diesel and biodegradable [12].

Linseed*(LinumusitatissimumL)* belonging to the family Linaceae. It is a cool temperate annual herb with erect and slender stems around 80-120 cm tall. Leaves are alternate, lance-like and greyish-green with 3 veins. Flowers have five, pale blue petals in a cluster. The sepals are lance-like and nearly as long as the petal fruit. The fruit are spherical capsules. The seeds are oval, somewhat flattened, 4-6mm long and are pale to dark brown and shiny. Flax is native to the African region extending from the Eastern Mediterranean to India. It was extensively cultivated in ancient Egypt [13]. The Linseed was called asAlsi in Hindi, Ali Tamil,Madanginja, Ullusuluin Telugu, Atasiin Bengali, Atasi in Sanskrit. Flax is grown both for its seed and for its fibers.Various parts of the plant have been used to make fabric, dye, paper, medicines, fishing nets and soap. It is also grown as an ornamental plant in gardens.The oil is non edible but it is used as medicine for some human ailments[14]. In Ayurveda, Flax is used internally in habitual constipation, functional disorders of the colon resulting from the misuse of laxatives and irritable colon, as a demulcent preparation in gastritis and enteritis. Externally, the powdered seeds or the press-cake are used as an emollient, in poultices for boils, carbuncles and other skin afflictions. Used in Soothing Body Lotion for dry skin[15].

MATERIALS AND METHODS

Collection, extraction and preparation of Linseedoil

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

The Linseedoil was mixed with the conventional diesel in two different proportions namely at BI0 (90% diesel and 10% Linseedoil) and at B20 (80% diesel and 20% Linseedoil). 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

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

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

The fire point, flash point, smoke point, carbon residue, cloud point, pour point were carried out for the blended biodiesel at different proportion.Thefirepoint 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 usingDeep visioncloud 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 calibratedOstwald 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 Linseed 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 Linseedis about 40% on dry weight basis. The physical propertieslike 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.

Table 1: Physical properties of *L.usitatissimum*oil B10, B20 and diesel.

Parameters	*Linumusitatissimum*		Diesel
	B10	B20	
Flash point	37.5°C	44.8°C	47.2ºC
Fire point	46.2°C	53.3°C	54.0ºC
Smoke point	6mm	5mm	9mm
Carbon residue	0.2gm	0.1gm	0.2g
Cloud point	6°C	7°C	3 ºC
Pour Point	0°C	1°C	0 ºC
pH	5.9	5.1	6.8
Specific gravity	0.868	0.882	0.880
Density	0.813g/cm^3	0.835g/cm^3	0.804g/cm^3
Viscosity	4.29	4.56	3.5

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

Table 2: Chemical propertiesof *Linumusitatissimum* oil B10, B20 and diesel

Parameters	*Linumusitatissimum*		Diesel
	B10	B20	
Acid value	8.4	13.2	16.31
Iodine Value	5.6	19.4	6.838
Saponification value	120.4	156.7	109.41

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 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 Linseed 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 Linseed 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 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 weed, the cost of production of oil is very less when compare to other agricultural cash crops. It could be tamed under cultivation and improve the crop production through biotechnological methods. The production of the *L.usitatissimum*biodiesel will boost the economy of the country.

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