ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 9, Issue 1, 2016

ISSN - 0974-2441

Research Article

STUDIES ON SUNFLOWER OIL (*HELIANTHUS ANNUUS* LINN) FOR ITS POTENTIAL USE AS BIODIESEL

ARIHARAN VN[1]*, MEENA DEVI VN[2], PARAMESWARAN NK[1], NAGENDRA PRASAD P[1]

[1]Department of Biomedical Engineering, Noorul Islam Centre for Higher Education, Noorul Islam University, Kumaracoil, Thuckalay - 629 180, Tamil Nadu, India. [2]Department of Physics, Noorul Islam Centre for Higher Education, Noorul Islam University, Kumaracoil, Thuckalay - 629 180, Tamil Nadu, India. Email: kabilvn@gmail.com

Received: 24 November 2015, Revised and Accepted: 3 December 2015

ABSTRACT

Biodiesel is gaining more and more importance as an attractive fuel due to the depleting fossil fuel resources. The sunflower is valuable from an economic, as well as an ornamental plant. It is one of the important oilseed crop, cultivated for the production of oil in the world especially from western countries. Sunflower seed oil is a triglyceride derived from the seeds of the sunflower. It belongs to the family Asteraceae. The oil can be used for cooking and the seeds also food for birds. In this study, the seeds were collected from the local market, and oil was obtained by using chemical extraction. Sunflower oil was subjected to various physical and chemical studies such as pH, specific gravity density and viscosity. The fire points, flashpoint, cloud point, pour point, carbon residue. The chemical properties like Acid value, Iodine value, and saponification value were assessed. The Physico - Chemical Properties of the sunflower oil biodiesel blends 10% (B10), and 20% (B20) were analyzed. The values were compared with the ASTMT standards of biodiesel. The blend B20 is found to be within the ASTM standard, and it could be used as an alternative energy source as biodiesel.

Keywords: Sunflower, Triglyceride, Biodiesel, Fire point, Cloud point.

INTRODUCTION

Sunflower is an annual herb, with a rough, hairy stem, grows to a height of 3-12 feet. Sunflower is also used to refer to all plants of the genus Helianthus. Sunflower exhibits heliotropism. Its uniqueness is that the flowers are facing toward the east at the dawn of sunrise. Over the course of the day, they move toward the track of the sun from east to west. While at night they return to the east word orientation [1]. This motion is performed by motor cells in the pulvinus, a flexible segment of the stem just below the bud. As the bud stage ends, the stem stiffness and the blooming stage is reached. Because of this phenomenon the plant is called sunflower [2]. The oil extracted from the seeds of this plant is called sunflower oil. The oil is slightly yellowish, limpid, of a sweetish taste and odorless [3]. The plant is native to the Western United States, and it is distributed in The North countries especially in India and China [4]. The botanical name of the sunflower is *Helianthus annuus* Linn. The common name is a sunflower. The name Helianthus, being derived from Helios (the sun) and anthos (flower), has the same meaning as the English name sunflower, Tamil name is Soorya kanthi. Surya mukhi in Sanskrit. Sunflower seeds are the best whole source of vitamin E [5].

It provides an ideal heart - healthy profile, is high in protein, and naturally low in carbohydrate. Almost 90% of the fat in sunflower seeds is good, unsaturated fat. The seeds have diuretic and expectorant properties [6]. It is used in the treatment of bronchial, laryngeal, pulmonary affections, coughs, colds, and in whooping cough. Sunflower seeds contain folate, pantothenic acid, vitamin B6, thiamine and niacin [7]. Sunflower is used as a Bioenergy source, and it has great attention among the futurist and the world policy makers. The seeds contain more than 50% oil on dry weight basis [8]. It is used for an alternative fuel for conventional petroleum-based diesel chiefly because it is a renewable, domestic resource with an environmentally friendly [9]. The biodiesel source from sunflower is biodegradable, and better quality of exhaust gas emission [10]. In this study, the direct blending of sunflower oil with petro diesel at two different proportions of 10% and 20% (B10, B20) were analyzed for its phyico chemical properties of biodiesel to ascertain the alternative source of energy from natural resources.

METHODS

Collection

The sunflower seeds were purchased from an Ayurvedic Medical store in Marthandam, Kanyakumari District in Tamil Nadu, India.

Extraction

The seeds were dried, and the impurities were removed by dehulled and hand picking. The seed was crushed by using a laboratory mixer grinder. The oil was extracted by using Soxhlet apparatus with the solvent, Petroleum ether for 48 hrs.

The diesel used for the experiment was purchased at Bharat Petroleum, Thuckaly, Tamil Nadu India. The blends were made on a volume basis and stored in glass bottles at room temperature. A blend of 20% biodiesel with 80% conventional petroleum diesel, by volume, is termed "B20" and a blend of 10% biodiesel with 90% conventional petroleum diesel, by volume, is termed "B10." The Physico Chemical studies were carried out for the blends of biodiesel.

Physico - chemical analysis

Sunflower oil blends (B10 and B20) were analyzed for various physical chemical properties. The physical parameters studied were pH, specific gravity, viscosity, density, and significant biodiesel properties such as fire point, flash point, smoke point, cloud point, and carbon residue. The general physical parameters include conductivity, salinity, total dissolved solid, and total dissolved oxygen. The acidimetric constant chemical properties such as the Acid value, Iodine value, and Saponification value were analyzed. The pH was determined by using Elico pH meter. The specific gravity and density were measured by using Brosil glass bottle method. Viscosity was measured by using calibrated Ostwald viscometer. 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. The smoke point was observed by using Seta Smoke point apparatus. Carbon residue was determined by using Conrad son carbon residue apparatus.

The econometric constant namely the Iodine value was determined by Wijs method. The acidimetric namely acid value and saponification value were measured by the standard AOAC method.

RESULTS

The oil content of the dried seed of sunflower is about 65% on dry weight basis. The General physical properties of the biodiesel blends (10% and 20%) such as pH, specific gravity, density, viscosity, fire point, flash point, cloud point, pour point, smoke point, carbon residue were measured. The results were given in the Table 1. The chemical properties such as acid value. Iodine value and saponification value were recorded for the biodiesel blends and given in Table 2.

DISCUSSION

The pH of biodiesel blends is higher than the petro diesel which also indicates the biodiesel is more acidic than the conventional diesel due to the presence of fatty acid. The specific gravity is 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 automation, subsequent vaporization and air-fuel mixing in the compression chamber. The change in a spray can greatly alter the compression properties of the fuel mixture. The specific gravity, density, and viscosity of vegetable oil are several times higher than that of diesel. By mixing the vegetable oil with the conventional diesel with 10% and 20% the Specific gravity, Density and Viscosity were found to slightly higher than that of diesel and it is within the range of the ASTM standard value of the biodiesel. The fire point of the blends B20 is slightly less and B10 is higher than that of petro diesel, and which falls within the range of ASTM standard. The flash point of these B10 is higher, and B20 is slightly less than that of petro diesel and the values are within the range specified for petro diesel. Hence, it clearly indicated that biodiesel is safer to handle than fossil fuel. 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 Smoke points of the biodiesel blend are higher than the petro diesel but within the ASTM standard value. The carbon residue is slightly less than the petro diesel. The high value of carbon residue may be due to the impurities present in the biodiesel blends.

Table 1: General physical properties of sun flower oil blends B10, B20 and diesel

Parameters	Sun flower oil blends		Diesel
	B10	B20	
pH	8.1	8.3	6.8
Specific gravity	0.83	0.84	0.880
Density (g/ml)	1.020	1.076	0.804 g/cm^3
Viscosity (Nm-2s)	5.04	8.41	3.5
Fire point	53.6°C	48.4°C	54.0°C
Flash point	50.4°C	44.7°C	47.2°C
Cloud point	5°C	7°C	3°C
Pour point	3°C	3°C	0°C
Smoke point	11 mm	13 mm	9 mm
Carbon residue	0.12 g	0.16 g	0.2 g

Table 2: Chemical properties of sun flower oil blends B10, B20 and diesel

Parameters	Sun flower oil blends		Diesel
	B10	B20	
Acid value (mg KOH/g)	19.3	20.9	16.31
Iodine value	8.184	14.151	6.84
Saponification value	187.96	145.88	180.41

The acid value of blends indicates that the amount of fatty acid present in the sample. The Acid value is slightly higher than that of ASTM standard because of the presence of the long chain unsaturated fatty acid in the blends. The number of double bonds present in the 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. Here, 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 value of B10 is higher and B20 is lesser than that of the petro diesel. However, the Saponification value is found to be within the acceptable range of biodiesel.

CONCLUSION

The sunflower is valuable from an economic point of view as well an ornamental plant. Furthermore, sunflower oil could become a renewable, eco-friendly energy source. It can be used as a major source for the production of biodiesel. The present study on sunflower seed oil has revealed 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 this study the sunflower oil blend B20 is the most suitable source for biodiesel. It can be a replacement for fossil fuel. The production and effective usage of biodiesel blend at B20 will help to reduce the cost effect in the production of energy. It is eco-friendly biodegradable and protects the environment from the various environmental hazards.

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 and the Management, Noorul Islam University Kumaracoil for their valuable guidance, constant encouragement and providing basic facilities throughout the study.

REFERENCES

1. Meena Devi VN, Vijayalakshmi GS, Nagendra Prasad P. A Hand Book of Bioenergy Crops. India: Agro Bios; 2008. p. 226-9.
2. Kachapur MD, Hasimani AS, Sastry KS. Influence of presowing seed hardening on early growth of Niger (*Guizotiz abyssinica* Cass). Curr Res 1978;7(5):86-7.
3. Antolín G, Tinaut FV, Briceño Y, Castaño V, Pérez C, Ramírez AI. Optimisation of biodiesel production by sunflower oil transesterification. Bioresour Technol 2002;83(2):111-4.
4. Shahidi F, Wanasundara PK. Phenolic antioxidants. Crit Rev Food Sci Nutr 1992;32(1):67-103.
5. Schumacher LG, Borgelt SC, Fosseen D, Geotz W, Hires WG. Heavy duty engine exhaust emission tests using methyl ester soybean oil/ diesel fuel blends. Bioresour Technol 1996;57(1):1372-8.
6. Pereyra-Irujoa GA, Izquierdoa NG, Covib M, Nolascoc SM, Quiroza F, Aguirreza Bala LA. Variability in sunflower oil quality for biodiesel production: A simulation study. Biomass Bioenergy 2009;33:459-68.
7. Ma F, Hanna MA. Biodiesel production: A review. Bioresour Technol 1999;70:1-15.
8. Rashida U, Anwara F, Moserb BR, Ashrafa S. Production of sunflower oil methyl esters by optimized alkali-catalyzed methanolysis. Biomass Bioenergy 2008;32:1202-5.
9. Ahmad M, Ahmed S, Hassan FU, Arshad M, Khan MA. Base catalysed transesterification of sunflower oil biodiesel. Afr J Biotechnol 2010;9(50):8630-5.
10. Zhang Y, Dube MA, Mclean DD, Kates M. Biodiesel production from waste cooking oil. Process design and technological assessment. Bioresour Technol 2003;89:1-16.