International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

"Analysis of biodiesel blend at Baramati"

Rohit Thoke[1], Shivam Singh[2], Sohan Sharma[3], Deepak Nishad[4], Prof. Reetika Sharan[5]

[1,2,3,4]Student of Final Year B.E. Dilkap Research Institute of Engineering and Management Studies, Neral, Maharashtra, INDIA

[5]Prof. Dilkap Research Institute of Engineering and Management Studies, Neral, Maharashtra, INDIA

Abstract - *Fuel produced by waste cooking oil is reviewed as a Biodiesel promising fuel source. An experiment investigation has been conducted by using waste vegetable cooking oil. renewable This oil is been tested in the bio diesel engine without any modification in a present engine. A double step best transesterification process of this waste vegetable cooking oil to obtain the biodiesel fuel was studied in order to find reaction time, fire point, Cloud point Catalyst which effect the product yield during transesterification process. Throughout the process the temperature is being constant and the molar ratio is been changed in every batch. we compare the conventional method over ultrasound method and the reaction time is been found rapid in ultrasound method. the different properties biodiesel is been studied and compared. the test result indicates that factor responsible for the yield of biodiesel is reaction time, molar ratio and catalyst. the test indicate that B20 blend of biodiesel can act as an alternative fuel.*

Key Words: Waste oil, Transesterification, Flash point, Fire point, Acid value, Emission.

1. INTRODUCTION

It is quite common nowadays to learn that every country is in the race to find suitable and affordable alternative fuel option for diesel engine as the present-day fuel reserve in depleting fast [1]. "Fuel derived from renewable biological resources for use in diesel engine are known as bio-diesel'' [2]. Among the alternative fuel for the petroleum fuel, seed oil has gained suitability for their use in compression ignition engine. Bio-diesel is consider as one of the most versatile alternative fuel options for petroleum diesel in direct injection diesel engine application because it has sustained prospect as a long-term replacement for diesel fuel. The flow and combustion properties of bio diesel are similar to petroleum-based diesel and thus can be used as a substitute for diesel fuel or more commonly in fuel blend [3].

The emission produced from biodiesel are cleaner compared to petroleum-based diesel fuel [4].

Ultrasound is defined by its intensity (Watt/cm2) as well as by its frequency (kHz) [5]. A higher frequency causes the ultrasound probe to vibrate faster, resulting in a larger surface area for mixing the alcohol, triglycerides and a smaller cavitation bubble [6]. Factors influencing the progress of reaction such as the pretreatment conditions, reaction time, reaction temperature, molar ratio of the two reactants and its loading were varied to establish the effect on the progress of reaction [7].

1.1 Current Scenario

Rising fuel cost and impending emission have sharpened the automotive industry focus on efficiency. However, the cost of the biodiesel is high. This is because of the high cost of vegetable oil. However, blend oil is used as the biodiesel the efficiency is reduced to 30% as that of biodiesel also when this biodiesel is stored for few days it was observed that the fatty acid content increases and also the fatty acid goes on increasing which leads to the failure in the diesel engine as acid value increases the corrosion will take place in the engine.

1.2 Objectives of the study

- To study different type of available biodiesel.
- To select alternative fuel from different sources.
- To compare the selected biodiesel sources.
- To compare and find the best biodiesel.

2. LITERATURE REVIEW

S.Savariraj. (2013): stated that biodiesel derived from soya bean, rapeseed, sunflower, palm, coconut oil has been found suitable and feasible for use in biodiesel engine. He used fish oil as an alternative source in replacement of petroleum. In order to study the performance, combustion, and emission characteristic of the fish oil biodiesel engine he set up one experiment in which he found that the engine was operated initially with base reference fuel, diesel for about 30 min to attain a normal working condition. In which he found that the break specific fuel consumption and break thermal efficiency were respectively 10.54% and 1.5% higher for fish oil biodiesel fuel than that of diesel at full load condition in conclusion he mention that for B100 in the test engine at full produced 34.95%,1.65%,14.65% and 1.8% higher smoke and he found that NO,CO, and HC emission respectively when compared with diesel fuel.

Mayank Chhabra (Used soya bean cooking oil as a bio-diesel) 2014: according to him fuels derived from

biodiesel engines are known as bio-diesel. He used soya bean cooking oil as an alternative source in replacement of petroleum. In order to study the performance, combustion, and emission characteristic of soya bean oil biodiesel engine he has set up one experiment. he said that soya bean oil it is superior fuel than diesel because of lower Sulphur content, high flash point and lower aromatic content. In is experiment he has done transesterification process is used to produce biodiesel from vegetable/animal fat. While performing the experiment transesterification reaction was carried out in a water bath and 250 gm of waste cooking oil was taken in a conical flask and it was preheated to the temperature of 60 degree C for 30 minutes. He observed that brake power increases when the load was increased for all operations of diesel and WCO bio-diesel blends. He has concluded that the flash and fire point of biodiesel was higher than that of diesel. His result also reveals that the cloud and pour point waste cooking oil methyl ester were found to be lower than those of diesel.

He found that use of 15 % blends of waste cooking oil methyl ester as partial diesel substitution can go a long way in conservation measure, boosting economy, reducing uncertainly of fuel availability and making more self-reliant.

Bharatkumar Z. Dholakiya (Super Phosphoric Acid Catalyzed Biodiesel Production from Low Cost Feed Stock) 2012: He defined biodiesel fuel that consists of alkyl esters derived from either the transesterification of triglycerides (TGs) or the esterification of free fatty acids (FFAs) with alcohols. In this process the Triglyceride reacts with alcohol to give biodiesel and glycerol in the presence of catalyst which increases the rate of reaction. The intension of this method is to improve the process by using super phosphoric acid (SPA) catalyst to produce the biodiesel from low cost feed stocks (crude degummed cotton seed oil).

He observed that the main advantage that with the help of catalyst is to produce biodiesel from low cost feed stocks. In short cost-effective biodiesel can be produced from low cost feed stock by using SPA catalyzed process with minimum separation cost and without soap formation with remarkable improvement in gross percentage of yield.

3. METHODOLOGY

Experimental set-up

The basic setup consists of a 1.5 L reactor in which the ultrasound probe is immersed [7]. The reactor has an inlet for the feed and an outlet for the product. The probe having a frequency of 20 kHz is connected to the transducer which in turn is controlled by the ultrasound generator. A thermocouple is inserted into the reactor to measure the inside temperature which is displayed on the generator.

An overhead condenser is provided to the reactor to condense back methanol vapors formed, if any. All the parameters like reaction time, temperature, pulse rate, amplitude can be set on the generator. The whole setup is kept inside a wooden box that acts as a sound shield. Figures 1 represent the schematic and actual experiment setup for biodiesel production.

Fig 1: Pictorial representation of the experimental set up for the Ultrasound assisted synthesis of biodiesel.

Esterification

The first step for the production of biodiesel is esterification process. In esterification the acid value of the waste oil is reduced. The acid value is reduced in order to prevent from corrosion. Esterification process is most economical process to reduce acid value. In esterification process waste oil is mixed with the alcohol and the catalyst used is concentrated H_2SO_4 in order to speed up the reaction.

The blend is heated at the temperature of 65°C for 45 minutes. Letter the oil is kept for settling.

$$waste\ oil + methanol \xrightarrow{conc.H2SO4} biodiesel + glycerine$$

Transesterification

It is one of the most and the important method for the production of biodiesel. It is the cheapest method and the most beneficial method as compared to other. Transesterification is the process in which the waste oil is converted into the biodiesel. The oil obtained from the esterification process is used for the transesterification process. A known amount of catalyst KOH based on weight per cent of oil is mixed in excess mole per cent of methanol.

The mixture of potassium hydroxide (KOH) in methanol is added to the oil in round bottom flask. Required temperature is maintained by controlling the electrical heating till the reaction is completed. The transesterification reaction temperature was maintained at 65°C for 2 hours keeping the molar ratio of methanol to potassium hydroxide of 0.5 weight percentage of oil and 13% of methanol.

$$oil\ obtained + methanol \xrightarrow{base\ catalyst(KOH)} biodiesel + glycerine$$

Fig 2: Blend preparation using magnetic stirrer

Settling and separation

The oil obtained for the transesterification process is kept for 4hr for the settling. Later the two layer is formed. Upper portion consists of pure biodiesel and the lower portion is of glycerin.

Blend preparation

The final stage is the blending in which the diesel oil is heated at 40°C for 20 min and we get the pure form of diesel.

4. RESULT AND DISCUSSION

In the present work a comparison is made between the conventional method and ultrasound method and it is found that the ultrasound method is more rapid over conventional method. The reaction time for ultrasound method is half of conventional method. The physical properties like fire point, flash point, cloud point and viscosity have been compared and presented in table no 2. The theoretical values are in well agreement with their experimental values indicating that if the composition of vegetable oil is known we can find out their properties by theoretical equation within aggregable error.

The effect of different oil to methanol molar ratio on biodiesel yield

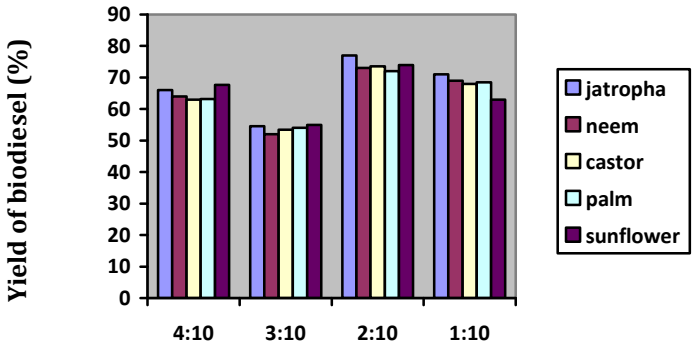

Chart 1: The effect of oil to methanol molar ratio on biodiesel production

within 1:1, 3:1, 4:1 oil to methanol molar ratio. Oil to methanol molar ratio of 3:1 gave lowest yield of biodiesel. The basic concept of increasing the methanol to oil molar ratio, means alcohol amount were elevated from the result it can be seen that 2:1 oil to methanol molar ratio gives higher ester yield compared and yield increased.

The effect of different alcohol types of biodiesel production

From the result obtained, methanol gave best fatty ester yield, followed by butanol and least was ethanol. The main reason is methanol gave the best fatty ester yield, because methanol is simpler in terms of chemical structure, thus transesterification is more likely to occur.

Secondly the base catalyzed formation of ethyl ester is difficult when compared with methyl ester. In case of methanol, formation of emulsion quickly and its breakdown easily to form lower glycerol rich layer. In case of ethanolysis these emulsions are stable and it get complicated for separation and purification of ester.

Analysis of biodiesel viscosity

From the result obtained viscosity were higher than ASTM standard. the average viscosity was 4mm^2 /s at 45°C however ASTM D675 standard limit is 2 -6mm^2 at 45°C. the viscosity is slightly higher due to the long storage time.
Few researchers found that the longer the storage time of biodiesel the higher the viscosity value. it was reported that the kinetic viscosity of biodiesel from waste cooking oil was 4.5 mm^2/s at 313K in commercial biodiesel fuel.

5. CONCLUSION

In this project various type of blend from waste oil are made and their performance is tested on the engine. It is found that the jatropha oil can be used as a source of biodiesel. Flash and fire point of this oil is slightly higher than that of diesel and the viscosity is found to be 4.5 mm^2 /s at 45°C.

The comparison is made between the conventional method and ultrasonic method and it is found that the ultrasound method is more effective with 50% less reaction time than conventional method. Different oil to molar ratio has been tried and it is found that 2:1 gives higher yield of biodiesel with conversion rate of 93.42% and 3:1 gives lowest yield of biodiesel.

Table 1: Percentage Yield and Percentage Conversion for Each Run.

Sample no	Field parameter			Experimental parameters					Yield (%)	Conv (%)
	Oil (ml)	KOH (%v/v)	Methanol (ml)	Reaction time (min)	Temp (°C)	Pulse rate		Amplitude (µm)		
						ON(s)	OFF(s)			
1	250	5	32.5	45	65	7	3	50	80.72	93.42
2	400	8	52	45	65	4	5	25	83.57	89.16
3	500	10	65	45	65	4	4	50	79.34	90.76
4	550	11	71.5	45	65	6	7	35	84.6	86.7
5	600	12	78	45	65	7	4	25	97.3	90.2

Table 2: Properties of Biodiesel Obtained from Ultrasound Process.

Sample no	properties				
	Flash point (°C)	Cloud point (°C)	Pour point (°C)	Density (g/cc)	Viscosity (cp)
1	152	-1	-2	0.81	4.543
2	156	2	1	0.82	4.535
3	154	1	0	0.862	4.5
4	155	2	-1	0.861	4.43
5	151	2	-2	0.821	4.33

Sample no:

1. Jatropha
2. Neem
3. Castor
4. Palm
5. Sunflower

6. REFERENCES

[1] S. Savariraj, T. G. (2013). Performance, emission and combustion characteristics of fish-oil biodiesel engine . *European Journal of Applied Engineering and Scientific Research*, 26-32.

[2] Chhabra, M. (2014). Performance characteristics of automotive diesel engine fueled with diesel and blends of biodiesel produced from waste soybean

[3] cooking oil . *Archives of Applied Science Research*, 163-171.

[4] Deepak Verma, J. R. (2016). A critical review on production of biodiesel from various feedstocks . *Journal of Scientific and Innovative Research* , 51-58.

[5] Dholakiya, B. Z. (2012). Super Phosphoric Acid Catalyzed Biodiesel Production from Low Cost Feed Stock . *Archives of Applied Science Research*, 551-561.

[6] Ejikeme PM, A. I. (2010). Catalysis in biodiesel production by transesterification processes-An insight. *Journal of Chemistry*, 1120-32.

[7] Gogate PR, R. V. (2010). Synthesis of biodiesel from waste cooking oil using sonochemical reactors. . *Ultrasonics Sonochemistry*, 827-32.

[8] more, S. b. (2018). Improved synthesis of medium chain triacylglycerol catalyzed by lipase based on use of supercritical carbon dioxide pretreatment. *Chemical engineering journal*, 1977-1987.