A Mini Review on Production of Biodiesel from Waste Products

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ABSTRACT

There has been a progression in the production, use and supply of the conventional fossil fuels, from the time when they came into existence. Their undesirable and harmful after effects have been damaging the environment and the ecosystem largely. Therefore, keeping this in mind, there's an additional better solution to this problem i.e., generation of a sustainable and environment friendly source of energy, which has gained much significance in these current years. Accordingly, Biodiesel is one of the best replacements over these fuels because of its exceptional properties such as lower toxicity, higher flash and fire points, no sulphur emissions, no greenhouse gases emissions, no particulate matter pollutants and biodegradability. Also, they are less flammable hence safer to handle. This is a review paper, which evaluates the diverse materials used in the production of biodiesel, a variety of methods of production, physical and chemical properties of biodiesel and its scope in future.

Keywords: *Biodiesel, Biodegradability, Toxicity.*

INTRODUCTION

With the increase in the population, there has been a drastic rise in the requirement of fuel demand. Henceforth, problems like energy sustainability, environmental problems and fuel prices go hand in hand [1]. The fuels, mainly signifies the fossil fuels, which are in limited amount may dwindle and cannot meet the rising future demand. Moreover, further research has proved that these fuel resources will exhaust in coming 70–75 years, tentatively. Thus, there is an utter need to search for an alternative fuel which is also environment friendly and also does not harm the ecosystem much. Biodiesel, on other side is one such alternative fuel which can be used instead of petrol and diesel [2]. Also, it has several better properties as compared to the other fuels *viz*., no hazardous gases emissions, higher flash point, lower toxicity, higher lubricity, better biodegradability, *etc*. And if cost of the biodiesel is an issue, then it can be reduced by replacing certain materials. This paper majorly focuses on materials, methods and the collective analysis of the biodiesel in all [3-6].

HISTORY OF BIODIESEL

In the modernization diesel engine plays an important role from 1893. The German researcher Dr. R. Diesel invented and published his research work in "The theory and construction of a rational heat engine". Dr. R. Diesel focused over the use of vegetable oil and developed diesel engine which was exhibited in Paris [7]. Also, nowadays people are majorly focusing on the use of waste products like plastic and other non-biodegradable waste for the production of biodiesel. The transterification of frying oil (waste) analyzed reaction kinetics (acid-catalyzed) by Zheng S. During the experimentation he found m to o (methanol/oil) molar ratio, 250:1 at a temperature of 70 ^{0}C at a rate of 400 rpm. In the research (Trans esterify) of waste cooking oil the researcher Issariyakul Titipong *et al.* used 2 step processes [8-9]. In this process the catalyst was sulphuric acid with the mixtures of ethanol and menthol. In this process the researcher observed ester more than 90 percent with

the comparison of 50 percent ester yield of first stage. The research work on transesterification reaction of rapeseed oil with methanol also carried out by Georgogianni K.G. *et al.* In another work Issariyakul Titipong along with the Dalai K. Ajay [10] concentrates on transesterification process by using of canola oil and greenseed canola oil. In this research work the agitation 600 rpm for a time period of 90 minutes on 60°C were used [11-13].

METHODS FOR ANALYSIS

Since, we used waste frying oil and plastic for the production of biodiesel, there are different methods of its production *viz*.

For Plastic
Pyrolysis

For Waste Frying Oil
Transesterification

These two methods have been explained below:

Pyrolysis Process

The pyrolysis is the process used for the production of biodiesel from waste plastic by heating at high temperature for an about 300°C. In this process the polythene chain breaks into hydrocarbon chain of petroleum product. Take a jar (preferably steel) which is capable of sustaining fire at high temperature about 300°C. Put the plastic and tyre pieces inside this jar. Fix a small steel pipe in the hole. Take another jar (plastic one) for making a temporary condenser. Using the copper coil, bend it into condenser by twisting it into a coil like structure.

Make sure a small portion of the coil inside the plastic jar comes out of a hole made in front of the jar. Place a glass or plastic beaker by the side of this plastic jar, making sure that the diesel coming from the coil will be stored in it. Now, this mechanism is ready to be placed on fire, burn the material inside the hearth and let this system be undisturbed for 20-30 minutes. After 30 minutes, the diesel coming out of the coil will be observed [14].

Transesterification

The Transesterification process is used for the production of biodiesel from waste cooking oil with the help of catalyst KOH or NaOH in the presence of alcohol. In this process the waste cooking oil (WCO) is first filtrated by using filter paper or cotton cloth so that the larger particles get removed from oil. Then the filtered WCO is preheated at a temperature of 50°C for about 15 to 20 minutes so that the moisture contained in the oil is evaporated. The preheating is depends upon the oil is fresh or used. The titration of WCO is to be done to find how much amount of KOH is required for the reaction as well as amount of KOH required to neutralize the FFA_s. For 1lit of oil sample, mix calculated amount of KOH by titration with 200 ml of methanol and stir it till KOH is completely mix with methanol. Now add the mixture of KOH to the filtrated oil sample and stir it at least for 20 min, the temperature of oil rises. Now close the container and leave it for 20 to 24 hours so that biodiesel separates from glycerol. The upper layer is biodiesel and lower layer is glycerol separate the biodiesel from

glycerol. After this process of separation wash the biodiesel with water so that un-reacted alcohol gets removed from biodiesel hence obtained the pure form of biodiesel [15-17].

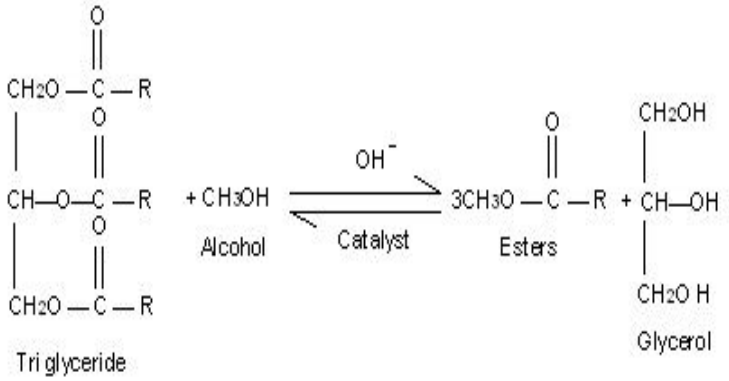

Fig.1. The of Transesterification Reaction.

DISCUSSION

The oil and plastic used in the processes above have few fuel related properties.

Table. 1. Properties of Oil

	Units	Jatropha oil	Palm oil	Soyabean oil	Waste frying oil
Kinematic viscosity at 38 ° C	Mm^2/sec	49.93	39.6	32.6	36.4
Cetane no.	X	40-45	42.0	37.9	49.0
Heating value	Mg/kg	-	-	39.6	-
Flash point	X	240	267	254	485
Cloud point	X	-	31.0	-	-
Density	Kg/ml	0.9186	0.9180	0.9138	0.8830
Carbon residue	Wt%	0.10	0.25	0.25	0.46

Table 2. Properties of Plastic

Plastic No.	Plastic	Thermal Properties
		T_m°C
1.	PET (Polyethylene terephthalate	245 +265
2.	HDPE (High density polyethylene)	130 137
3.	PVC (Lolyvinyl chloride)	
4.	LDPE (Low density polyethylene)	98 115
5.	PP (Polypropylene)	168 175
6.	PS (Polystyrene)	

Table: 3. Strength Properties

Strength Properties	
Tensile (Pa)	**Compressive (Pa)**
48263301 72394951.5	75842330.2 103421359.3
22063223.3 31026407.8	18615844.6 24821126.2
40679068 51710679.6	55158058.3 89631844.8
8273708.7 31371145.6	9652660.2
31026407.8 41368543.7	37921165.1 55158058.3
35852737.9 51710679.6	82737087.5 89631844.8

PROPERTIES OF FUEL [18]

1. **Density**
   This property of fuel liquid affects the system of fuel injection and very important property in this research work which is measured generally at 15^0 C. The densities of bio diesel 0.860g/cm3 and 0.897g/cm^3 at a mentioned temperature which shows the high value than petroleum diesel.
2. **Viscosity**
   It is a property of fuel diesel which is used as a measure of liquid resistance to flow. This property affects the system of fuel injection at less temperature.
3. **Flash and Fire points**
   It is an important property parameter of research which shows from the literature studied with the comparison of petroleum diesel the biodiesel's have higher flash and fire points. This observation indicates that it has safe to handle due to its less flammable property.
4. **Cetane Number**
   This property of fuel shows the ignition quality. The higher cetane number indicates better the quality of ignition. Cetane number shows the ignition quality of biodiesel and from the various researches it shows can be better than the petroleum diesel.

Table: 4. Biodiesel Standards

Property	Unit	JPT	SB	PLM
Density at 20°c	Kg/m^3	880	885	880
Viscosity at 40°c	Mn^2/s	2.37	4.5	5.7
Cloud point	C°	-	1	13
Flash point	C°	135	178	164
Pour point	C°	2	-7	12
Water	%	0.025	-	-
Sulphur	PPM	-	-	-
Carbon residue	Wt%	0.20	-	-

Cetane number	-	61	45	62
Calorific value	Mj/kg	39.2	33.5	33.5
Read: JTP-Jatropa, SB- Soyabean, PLM- Palm				

Table: 5. Biodiesel Standards

WCO	Biodiesel standards	
	ASTM D 6751-02	**DIN EN 14214**
884	870-900	875-900
4.5	1.9-6.0	3.5-5.0
1	-	-
180	130	120
-5.00	-15 to10	-15 to10
0.4	0.03	0.05
-	50	50
0.3	-	0.3
57.2	48-60	49
32.9	-	-

CONCLUSION

From this research review study it has conclude that the demand of conventional diesel is increasing day by day and hence the bio-diesel is an optional effective alternative choice which can be used in a diesel engine.

The review study also concluded that the bio-diesel has many positive sides for the application such as

1) The cost is less as compare to conventional diesel.
2) It has a non-sulfur emissions
3) It is obtained from renewable source
4) It has a capacity to reduction in green house gas emissions
5) It has a non-particulate matter pollutants and low toxicity
6) It has high biodegradability
7) It has a excellent lubrication property

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