



## Production of Biodiesel from Non- Edible Oil (WCO)

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### Abstract

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Today world's energy demands are increasing day by day due to increase in population, standard of living, industrialization & urbanization and which are mostly fulfilled by fossil fuels. Fossil fuels are non-renewable so its reserves are getting declined and also it is environmentally unreasonable. This made an interest in the area of alternative fuels. Biodiesel can be good alternative fuel because of its renewability and environmental benefits and apart from this it can be a strategic source of energy for the countries which doesn't have oilfields. Biodiesel can be produced from edible, non-edible, algae and waste cooking oils. There are four essential approaches to make biodiesel, direct use and mixing, miniaturized scale emulsions, warm breaking (pyrolysis) and Transesterification. The most regularly utilized technique is transesterification of vegetable oils and creature fats. This researches the transesterification response of refined vegetable oils by methods for ethanol, utilizing sodium methoxide and sodium hydroxide as impetuses. Especially, the goal of this work was to plan ethyl esters with the two distinctive homogeneous impetuses, while the response had been done in one stage. A short time later, the subsequent items were assessed with respect to the physicochemical properties

#### Key Words

Biodiesel,  
Non-Edible Oil Feed stocks  
Biodiesel Production Processes  
Catalytic Transesterification  
Yield Properties of Biodiesel

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### 1. Introduction

The overall stress over the insurance of condition and the preservation of non-inexhaustible normal assets has offered ascend to exchange advancement of wellsprings of vitality an alternative for customary fossil fuels.[1] The significant piece of all vitality expended overall originates from fossil sources (oil, coal and gaseous petrol). Elective new and sustainable energizes have the potential to understand a significant number of the present social issues and worries, from air contamination and an Earth-wide temperature boost to other ecological enhancements and manageability issues.[2]. Manufacturing of Biodiesel from squander cooking oil which is too a non-edible oil which is beneficial for environment.

### 2. Biodiesel

Biodiesel is an elective fuel like regular or 'fossil' diesel. Biodiesel can be delivered from straight vegetable oil, creature oil/fats, fat, and waste cooking oil. The procedure used to change over these oils to Biodiesel is called Transesterification. In the current work a lot of investigations were completed for delivering ethyl esters under homogeneous impetus with sodium methoxide. Squander cooking oil was deliberately used to maintain a strategic distance from the side response of balance of free unsaturated fats. [3]. All tests were performed with sodium methoxide (CH<sub>3</sub>ONa) as homogeneous impetus. The virtue of biodiesel was surveyed by ester content. The mass yield was resolved as a marker of the sanitization of biodiesel, demonstrating that the less cleansers and emulsions prompted less misfortune. Appraisal of ethyl esters needs further thought in light of the fact that the response framework is touchy to minor

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changes in the test conditions debasing the Notoriety quality.

### 2.1 Role and Importance or characteristics of Biodiesel

The job of Biodiesel industry isn't to supplant oil diesel, however to help make a decent vitality approach with the most advantage .It is one of a few elective powers intended to expand the helpfulness of oil, and the life span and tidiness or diesel motors. A definitive objective is to add to building a more grounded, progressively independent network by method of a network based biodiesel creation model [4]. The incredible preferred position of biodiesel is that it very well may be utilized in existing motors, vehicles and framework with for all intents and purposes no changes. It very well may be siphoned, put away, and consumed simply like oil diesel fuel, can be utilized unadulterated, or in mixes with oil diesel fuel in any extent. This can likewise be utilized as warming fuel in household and business boilers. The force yield of biodiesel relies upon its mix, quality, and burden a condition under the fuel is singed [5].

### 2.2 Waste Cooking Oil

Squander cooking oil utilized for browning are sunflower oil, palm oil, coconut oil and so on. As they are effectively accessible and particularly so of the coconut oil which is bounteously accessible in South India [6]. The waste cooking tests utilized for the reason for existing is of typically palm oil since it is ordinarily utilized oil in the cafés and lodging kitchens in Table 1.[7]

Table 1. Primary properties of WCO

Properties	Units	Value
Density	g/cm <sup>3</sup>	0.91-0.924
Kinematics viscosity	(40 °C) mm <sup>2</sup> /s	36.4-42
Saponification value	mg KOH/g	188.2-207
Acid value	mg KOH/g	1.32-3.6

## 3 Material & Research Methods

### 3.1. Transesterification Process

Transesterification can be characterized as a concoction response wherein liquor responds with triglycerides of greasy acids (vegetable oil), in nearness of impetus. It is a reversible response. It is utilized primarily in the blend of polyesters and in the creation of biodiesel in light of the fact that it has a greater number of points of interest than ester union from carboxylic acids and alcohol[8].

There are for the most part sorts of transesterification process dependent on the utilization of impetus and those are:-

#### 1.Base-Catalyzed Transesterification

#### 2.Acid-Catalyzed Transesterification

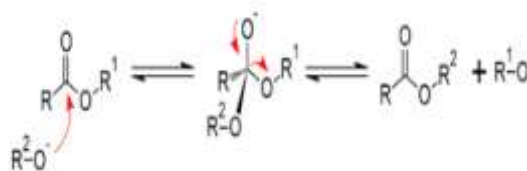


Figure1 Transesterification reaction Mechanism 60min.



Figure 2. Transesterification Process

### 3.2. Production of Biodiesel From Non Edible Oil

Biodiesel is made by a substance procedure called transesterification, where naturally inferred oils (vegetable oils, creature fats and reused café oils) are joined with liquor and synthetically changed to frame greasy esters, for example, methyl ester. The biomass-determined esters can be mixed with regular diesel fuel or utilized as a flawless fuel (100% biodiesel) [9].The procedure brings about two items - methyl esters (biodiesel) and glycerin.

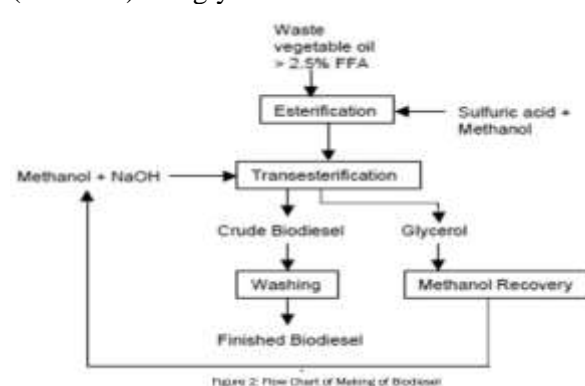


Figure 3. Flow sheet of Biodiesel from non-edible oil[6].

### 3.3 Procedure

The catalyst used was sodium methoxide CH<sub>3</sub>ONa gotten from. Ethanol was of 99.9% virtue (water content: 1000 mg/kg), and it was utilized as the transesterification liquor. Unadulterated glycerol was likewise utilized, so as to quicken the partition of ester-stage and glycerol-stage. The transesterification

response was done in a level bottomed circular reactor, gave mechanical mixing, testing outlet, and fume relaxing framework. The disturbance speed was picked at 300 rpm in order to stay away from the mass exchange confinements, and the response time was delayed for 8-9 hours. Impetus focuses inspected were 0.7% m/m for CH<sub>3</sub>ONa, as an ideal fixation for refined oils and for NaOH at first similar centralization of 0,7% m/m yet a short time later, 0,4% m/m was tried further. Along these lines, the crude response blend was chilled off to lab temperature and afterward, it was moved to an isolating pipe. Glycerol was included some 10% of the response volume into the pipe and it was blended enthusiastically for 3 minutes. From that point, the settlement went on for four hours. After the partition of the two layers by gravity, the co-item glycerol was painstakingly pulled back; the ethyl esters were washed a few times with warm refined water (60 °C), to extricate the buildups of impetus. In the long run, the non-responded liquor and water were evacuated by turning evaporator at decreased weight. For little scope creation of biodiesel 250 ml oil, 63.8 ml methanol and 4.565 is. Sodium meth oxide is taken. [10].

### 3.3.1 Physio- Chemical Properties

- Density
- Flash Point
- Fire Point
- Viscosity
- Cloud Point
- Cetane Number



## 4. Result and Discussion

### 4.1. Reacting Conditions

The analyses were done in consistent natural conditions, at encompassing weight, at 80 °C and in one-phase transesterification process, by ethanol refluxing. The exploratory factors were the impetus CH<sub>3</sub>ONa and the proportion of ethanol to oil, that were in the scope of 6:1 – 15:1. The grouping of CH<sub>3</sub>ONa impetus was steady of 0.7% m/m. The main trial of 0.7% m/m CH<sub>3</sub>ONa in squander oil indicated agreeable transformation at molar proportions of 9:1 - 12:1.

### 4.2. Effects of CH<sub>3</sub>ONa

A lot of examinations were done with CH<sub>3</sub>ONa as ethanolysis catalyst. In difference to hydroxides, the response of CH<sub>3</sub>ONa with ethanol doesn't free water however methanol, in this way, the nonappearance of water keeps from hydrolysis responses in the framework. As confirm, the ester content. The higher molar proportions of ethanol to oil are increasingly gainful for complete change.

CH<sub>3</sub>ONa was expended in a slower rate and in a little degree, adding up to 28%. Stage division after the response, if there should arise an occurrence of methoxides was quick and no sudsy interfaces or emulsions were shaped. The last mass was lower for CH<sub>3</sub>ONa, clarifying the less cleansers and emulsions.

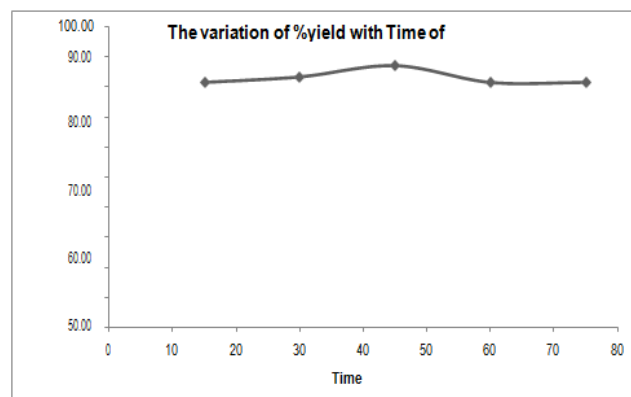


Figure 4 Effect of reaction time on % yield

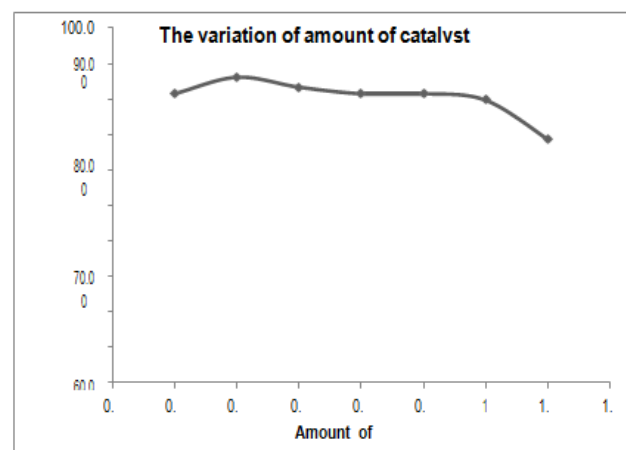


Figure 5. The variation of the amount of KOH with % yield. Reaction conditions: Molar ratio; 1:6, Temperature; 65°C, Time [11].

### 4.3. Ethanol to Oil Molar Proportion

It is a significant parameter analyzed in this work is the molar proportion of ethanol to oil. The outcomes appeared in Figure 1 affirmed the requirement for the ideal molar proportion. It indicated that the best ethanol to oil proportion for Notoriety creation was 12:1. The enhanced molar proportion of ethanol to oil was 12:1.

### 4.4. Mass premise yield

Based on the mass yield results, the transesterification response with CH<sub>3</sub>ONa was better than with NaOH or KOH on a mass premise of recuperated ethyl esters. The mass distinction between the capacity of the impetuses was brought about by the higher measure of cleansers shaped with NaOH. For correlation, a plan of

Table 2. Values for the optimization of the Amount of Catalyst for the transesterification of oil.[12].

Molar ratio	Vol of /ml	Vol of Methanol/m	Amount of Catalyst	Temp	Time	Trial /ml	Tria2 /ml	Tria3 /ml	Tria4 /ml	Average Yield/ml	% Yield
1:6	48	12	0.5	64	60	43.5	43	45	44.5	44	81.48
1:6	48	12	0.6	64	60	46.5	45.5	47.5	46.5	46.5	86.11
1:6	48	12	0.7	64	60	44.5	44	46	45.5	45	83.33
1:6	48	12	0.8	65	60	42	43.5	45	45.5	44	81.48

two-phases process within the sight of 0,7% m/m CH<sub>3</sub>ONa was further tested.[13]. The outcomes uncovered that there was an improvement in ester content, in spite of the fact that its worth is acceptable at 12:1 molar proportions, yet the significant increase of the multistage procedure were: simpler partition and cleansing stages, less emulsions and cleansers development, coming about to higher ethyl esters mass yield on the grounds that the misfortunes were lessened. [14].

## 5. Conclusion

The aftereffects of the current examination demonstrated that, the ideal response conditions for squander cooking oil was accomplished at 1.2% KOH and 0.1% NaOH as impetuses, methanol to oil molar proportion 6:1, response temperature of 60°C, pace of blending 250 rpm – 500rpm and a response time of 7-8 hours, gave the best yield. The response will in general be inadequate with a low pace of blending i.e., at 100 rpm, while blending at high rpm appears to support the opposite response process. In these investigations, we saw that utilizing NaOH impetus was denser than that acquired from KOH impetus. Biodiesel arrangement utilizing NaOH impetus sets aside more effort to finish, while better yield is acquired from KOH impetus. while, KOH impetus is all the more exorbitant than NaOH and from this investigation of impetus we arranged example. It is broke down that the temperature and time of response didn't greatly affect the rate yield of the WCO methyl ester; these were found in the graphical portrayal for the different Response conditions contemplated. All the fuel properties broke down were inside the ASTM standard; the quality boundaries were all inside as far as possible. The cetane number of around 47 is adequate; the properties for natural effect evaluation were additionally inside the cutoff points. These outcomes suggest that it is very conceivable to deliver biodiesel from waste cooking oil which is appropriate for use in diesel motors.

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