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EXTRACTION AND CHARACTERIZATION OF BIODIESEL AND GLYCEROL FROM WASTE VEGETABLE OILS

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Abstract: This research highlights the viability of hybrid biofuel based on Microemulsion of waste cooking oil (WCO) as an alternative to Petro Diesel. In this study, microemulsification A producer biofuel has been shown as an alternative to Intensive and economically viable energy. Liquid biofuels production route. Hybrid Biofuels system based on the microemulsion formulated. The use of ethanol as scattered. The phase exhibited fuel properties that satisfy the ASTM D6751 rules for biodiesel. This study also highlights the preparation of the simple biodiesel system by microemulsification. Without using any externally added surfactant. These simple fuel systems formulated. Only by using Butan-2-OL, since the cosurfactant showed excellent physical stability with THW Training of transparent Winsor IV systems. The presence of droplets of nanomass in the formulations confirmed the formation of the miceller microemulsion system inverse. Upon the other cold side, the flow properties of the systems were much higher than those of Biodiesel the present investigation suggests that biofuel based on microemulsion. Systems formulated by OMA can be an attractive candidate for the biofuels industry inner future.

KEYWORDS: Microemulsion, Waste of kitchen oil, Biofuel, Biodiesel, Surfactant, Co surfactant, NMR spectroscopy

1. INTRODUCTION

The continual depletion of oil sources, combined with rising environmental concerns, has limited human beings' ability to seek out sustainable, impartial, and ecological alternatives. Fuels can be obtained for regular oil. With both appear and grow economics, research profit has increased, boosting technological analysis forward for the manufacture and evolution of Biodiesel as a crude oil fuel replacement. From the development of the diesel engine, vegetable oils have been identified as a potential feedstock for the production of biofuels. The capacity to easily extract pip from many plant strains, high power content, low fickleness, high flash point, clean burning bearing with 0% life cycle carbon dioxide emissions There have been some describe about the perpetration of microemulsion combustible from vegetable oils during 1980-1990s using active exterior representative such as Butenol, n- octanol, alpha- Linoleic acid etc. With all outlines hire purified vegetable oils. This talk to require a soft mix of unionized oil stage with polar solvents such as water or ethanol in the presence of surfactants and co surfactants. Although the water it has been the most used arctic solvent in this regard, current investigation also point up. The use of ethanol as arctic solvent the greatest gross fatty value of ethanol. That water can be another superiority of include it into the technique. These fuel technique they contain a thermodynamically steady colloidal scattering of isotropous optical liquid. With Microstructure measurement of the drop 1-150nm. The arctic ethanol is dispersed in the continual oil phase in these systems with system origination close to type Water In Oil microemulsion.

The constant depletion of oil sources, combined with rising environmental concerns, has limited humanity's ability to seek for sustainable, impartial, and environmentally friendly alternatives. Obtain fuels for regular oil. With both appear and expand economics, the profit of research has increased, propelling technological analysis forward for the production and evolution of Biodiesel as a crude oil fuel replacement. From the development of the diesel engine, vegetable oils have been discovered as a potential feed for the production of biofuels. The capacity to easily obtain pip from many plant strains, high power content, low fickleness, high flash point, and clean burning bearing with zero life cycle carbon dioxide The emissions stability of microemulsion fuel systems based on formulated vegetable oil that are structurally comparable to W/O systems. Another more difficult task of preparationmicroemulsion-basedThe choice of appropriate and sufficient surfactant-surfactant determines the emissionsstability of microemulsion fuel systems based on fuel systems. The use of biological non-ionized water that is good to the environment.

Due to environmental concerns, the use of surfactants and cosurfactants that do not accommodate n and s is becoming more common. Possibilities for chemical reaction participation are included in the insertion. For systems including non-ion only form of surface active agent, articulation and fuel supplication are insignificant. The current study looks at the fuel standard for the microemulsion system, which is made from waste kitchen oil. Butan-2-ol as a co surfactant improves the fuel characteristics of the systems.

2. LITERATURE REVIEW

2.1 Production of Biodiesel

For synthesis biodiesel different type of process can be applied.

2.1.1 Direct use and blending

This process is not favorable to produce biodiesel from waste kitchen oil. This process is problematic for biodiesel because it has many inherent failing. In this process also required some chemical notification before can be used into the engine. It was discovered that the utilisation of unmixed vegetable oils is similar to that of biodiesel.

2.1.2. Microemulsion process

Solvents such as methanol, ethanol, and 1-butanol are very useful to decrease high viscosity in lower viscosity. Diesel fuel, vegetable oil, alcohol, and surfactant, co surfactant, and cetane improver are components in suitable proportional. Methanol and ethanol properties are to viscosity lowering additives. Alcohol is used as surfactant. Alkyl nitrates as cetane improvers. Spray properties improve by microemulsion by explosion of vaporization of lower boiling constituents in miceller.

2.1.3 Thermal cracking (Pyrolysis)

In this process air or oxygen is absence when heating. In this process when reaction is occurring in chemical bond cleavage is done to yield small molecule. During thermal cracking process with the removal of oxygen also removes any atmospheric benefits of using an oxygenated fuel. Pyrolyzed materials name are methyl ester of fatty acid, natural fatty acid, animal fats, vegetable oils.

2..1..4 Transesterification

Transesterification process is chemical reaction used for conversion of triglycerides (fats) contained in oils into useful biodiesel. The help of this process decrease viscosity of biodiesel making it capable of replacing petro diesel into diesel engines. In this process Glyceride reacts with an alcohol (methanol or ethanol) in presence of catalyst forming saturated fatty acid alkyl esters and an alcohol. H_2SO_4, sulfonic acid and HCL use as catalyst in acid-catalyzed process. The acid catalyzed reaction is slower than alkali-catalyzed transesterification of vegetable oil process.

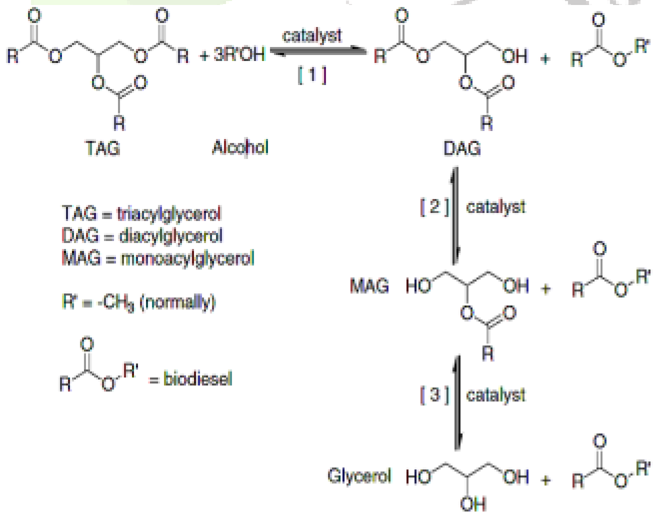


Fig. Transesterification process

2.2 Production method of Methanol and Ethanol

2..2.1 Process of Methanol:

1. Pyrolysis of firewood fluid purification
2. Biomass Pyrolysis Gaseous Products
3. Fluid Filtration from Charcoal Pyrolysis
4. Biomass and coal-based synthetic gas
5. Gas (natural)
6. Natural gas

2.2.2 Process of Ethanol:

1. Fermentation of sugars and starches
2. Enzymatic conversion of synthetic gas
3. Synthesis from petroleum
4. Synthesis from coal
5. Bioconversion of cellulosic biomass
6. Hydration of alkanes

3. EXPERIMENTAL SECTION

3.1 A Material requirements For Method A: Microemulsion

I. Sample collection:

1. Waste cooking oil collected on 19th July 2021 in afternoon (between 12:30 pm to 1:30 pm) from sweet shop.
2. Oil sample taken from shop.
3. Oil was collected in 1 liter sample bottle.
4. This oil stored at room temperature.

A: Materials

- **Apparatus:**

-Conical flask
- 25 ml Beaker
- Filter paper
- Funnel
- Glass rod
- Magnetic stirrer
- Magnetic stirrer niddle
- Amber bottle

- **Chemicals:**

CHEMICAL NAME	COMPANY NAME	MANUFACTURING DATE	PURITY
SODIUM CARBONATE	SIMSONS	APRIL,2021	99.5%
SULPHURIC ACID	SIMSONS	OCTOBER,2019	99%
SODIUM SULPHATE	OXFORD LAB FINE CHEM. LTD.	MAY,2019	99.5%
METHANOL	QUALIGENS (THERMO FISHER PVT. LTD.)	MARCH,2021	99.5%

❖ **A Procedure for method A : Microemulsion**

- **Procedure:**

In theses microemulsion process to produce biofuel from collect waste Cooking oil Filtering WCO using filter Paper at least 72 hours followed by Filtration once again.

After filtration 6 small scoops of Na_2SO_4 is added in 300 ml WCO and stirred in circular motion this will help to absorbing extra water and result in small water crystals will be settled down in form of droplets.

Fig. 1: Na2SO4 crystals and impurities on filter paper

While adding the powder continuous stirring was done so mixture is distributed proportionally. After add and stirred Na_2SO_4 in WCO kept for 10 minutes for settlement of impurities and to absorb water molecules.

Filtration of WCO done by filter paper. After filtration in WCO water molecule and also impurities is remove.

Then Butenol (10 ml), Ethanol (10 ml), Waste cooking oil (10 ml) add one by one in beaker. Mixture of solution stirred using glass rod for continuously 2 min. Kept this solution for 1 day.

After that in the mixture put one magnetic stirrer niddle and it was kept on magnetic stirrer for 10 minutes.

Fig. 2: Mixture

After stirring we observed mixture is in homogeneous form.

Then put this mixture in amber bottle for 1 day at room temperature.

Result of Microemulsion Process

- Change in the state of mixture.
- 2 layers are formed.
- Between two layers one thin sheet can be seen.
- Bottom down settled material is glycerol upper floating layer is diesel.

Fig. 3: Result of Microemulsion

3.2 A Material requirements For Method B : TRANSESTERIFICATION

- **Apparatus:**

- 500 ml three neck RBF
- Magnetic stirrer
- Magnetic stirrer niddle
- Beaker
- Reflux condenser
- Thermometer
- Oil bath
- Separating fannel

❖ A Procedure for method B : TRANSESTERIFICATION

1. A 500 ml three neck round bottom flask was cargoed with 150 ml warm up oil and 300 ml Methanol with 2 ml A 500 ml three neck round bottom flask carrying 300 ml Methanol with 2 ml H2SO4 and magnetic stirring was cargoed with 150 ml warm up oil. (350rpm).

Fig. 4: Beaker put on magnetic stirrer

Fig. 5: After stirred result

2. Reflux condenser and a thermometer on an oil bath maintained at 60 degree C For 2 hour. Observe separate 2 layers.

Fig. 6: Reflux condenser setup

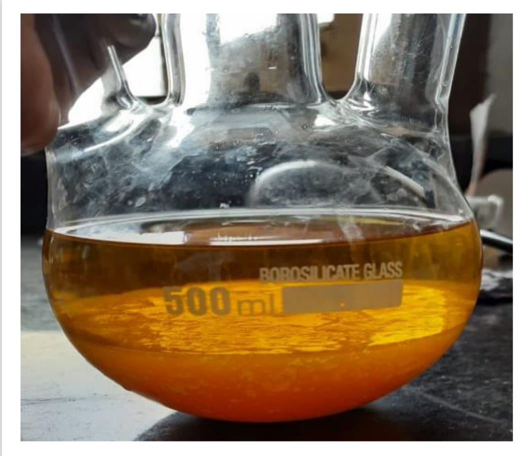


Fig. 7: After Reflux the mixture

3. Then shake the mixture and transfer the mixture in separating funnel.

Fig. 8: Mixture in separating funnel

4. Then put aside separating funnel to separate this mixture in to 2 layers.
5. Then open the cock of fannel and take a bottom down layer in to one beaker and upper layer other beaker.

Result of Transesterification Process

A successful reaction produces two liquid phases: crude glycerol and ester Entire mixture then settles and glycerol is left on the bottom and biodiesel (methyl ester) is left on top.

Fig. 9: Result of Transesterification process

4. CHARACTERIZATION

4.1. NMR SPECTROSCOPY

Microemulsion based biodiesel sample was also comparably inspect by means of Nuclear Magnetic Resonance spectroscopy to determine the structural and chemical transformation in oils due to processing.

4.2 RESOLUTION OF DIFFERENT FUEL PROPERTIES

Standard test methods were pour point, cloud point, acid value, calorific value, density, kinematic density. Viscosity of waste kitchen oil, were determined according to falling ball viscometer. Cloud point and Pour point were determined according to instrument.

5. RESULTS AND DISCUSSION

5.1. PHYSICAL STABILITY

The filled section in the phase diagram represents the expression consisting two separate phases while the vacant portion represents ‘stable’ single phase articulation. Expression contain two separate phases formed with having a separate ethanol phase..

5.2. PROPERTIES OF FUEL MICROEMULSION BASED FUEL SYSTEM

Thickness and kinematic consistence of the microemulsion based biofuels are presented in table 1.

Volume %of components in microemulsion based biofuel system			**Density At 15^{0}C**	**Kinematic viscosity at 40^0 C**
WCO	**Butenol**	**Ethanol**		
30	50 60	20 10	0.854 0.875	2.83 2.97
40	40 50	20 10	0.830 0.896	4.39 3.75
50	40	10	0.843	4.76
60	20 30	20 10	0.860 0.911	6.94 5.61
70	20	10	0.863	11.55

Table1. Density and Kinematic viscosity of microemulsion based biofuel

Unsaturated	67.33
Saturated	32.01
Oleic	29.54
Stearic	20.46
Linoleic	31.85
Polyunsaturated	37.79
Linoleic	5.94
Others	0.66

Table2. Fatty acid composition of WCO

5.3. CLOUD POINT AND POUR POINT

Decreasing WCO fraction in system the cloud point and pour point of system is decreased. The droplets have tendency to agglomerate when temperatures is lower and as a result we can see that the two phases separated. Value of Cloud point and Pour point is in table 3.

Boiling point	314-349
Flash point	100-169
Cloud point	-2 to 14
Pour point	-4 to 11

Table-3 Biodiesel physical characteristics

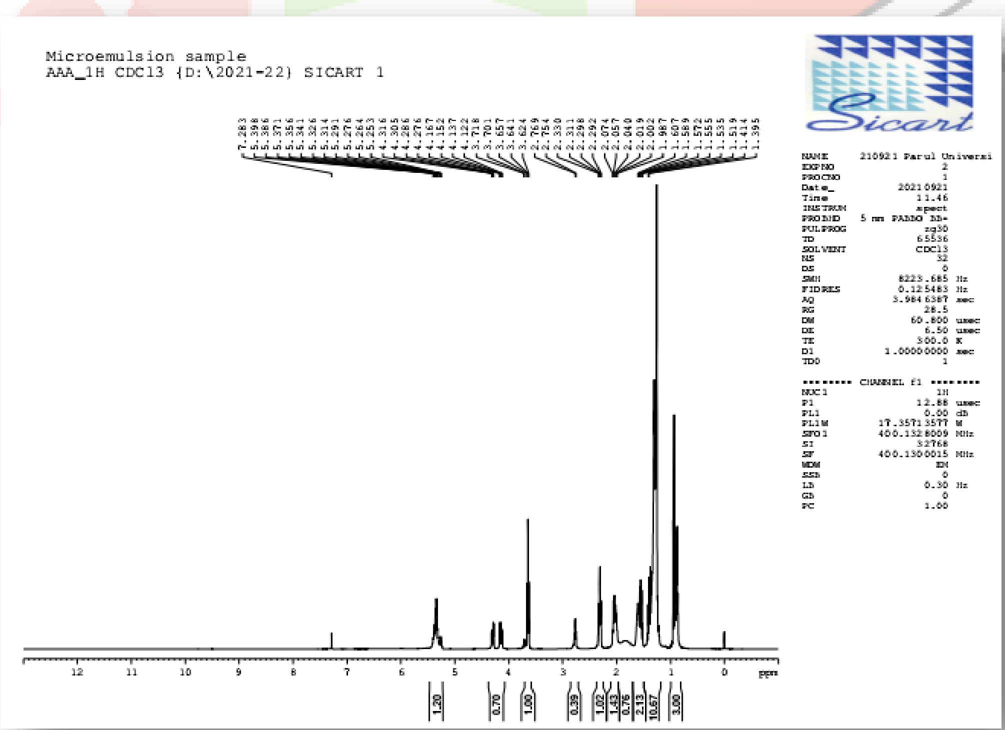
5.4. ACID VALUE

Increase in Alcohol fragment made the systems increasingly acidic which is not advantageous as it may lead to engine erosion. Acid value is given in table no. 3

5.5. ^{1}H NMR SPECTROSCOPY

In biodiesel sample molecular composition have been investigate by a combination of NMR spectroscopic methods. The use of NMR spectroscopic to quntify and identify the moities of the molecule,s, particularly the unsaturated long chain alakyl esters. NMR spectrosopy is detect to quntify methanol in biofuel. NMR spectroscopy full form is Neuclear Magnetic Resonance spectroscopy.

Fig.1 NMR spectra of Microemulsion sample (A) and (B)



A

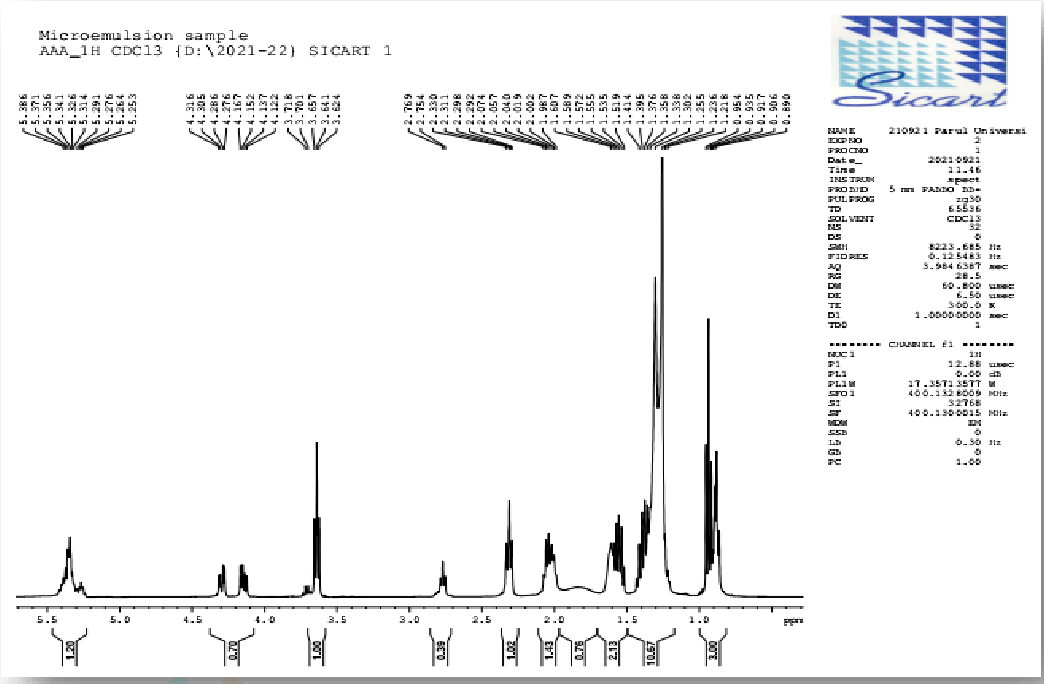


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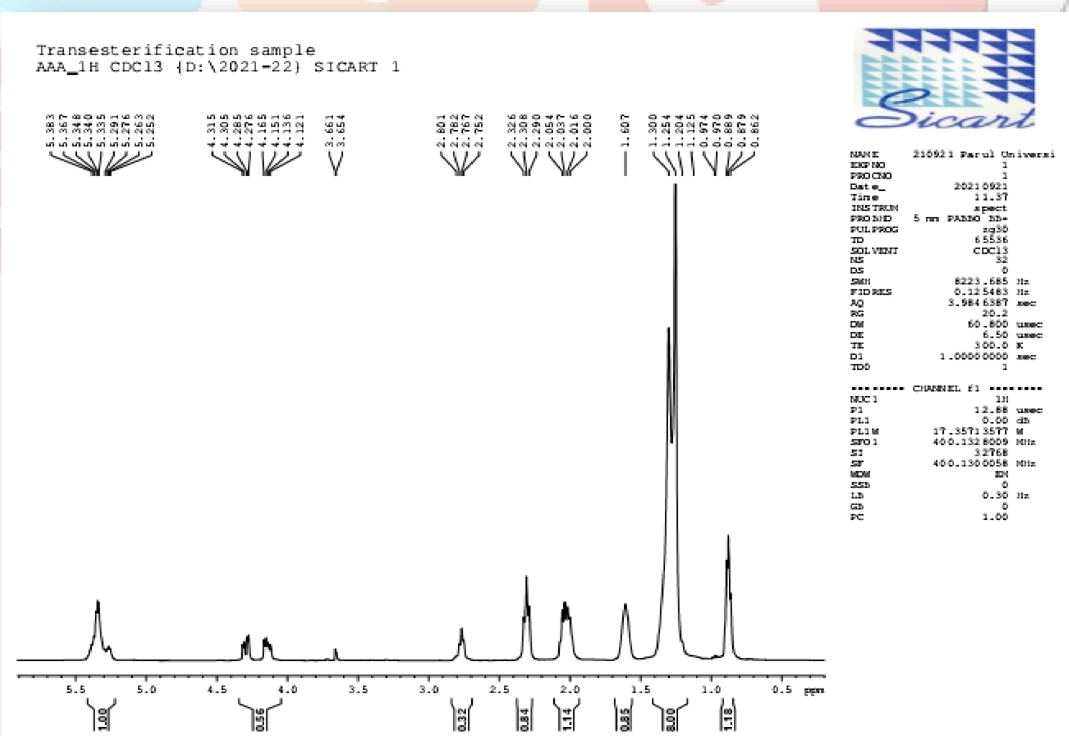
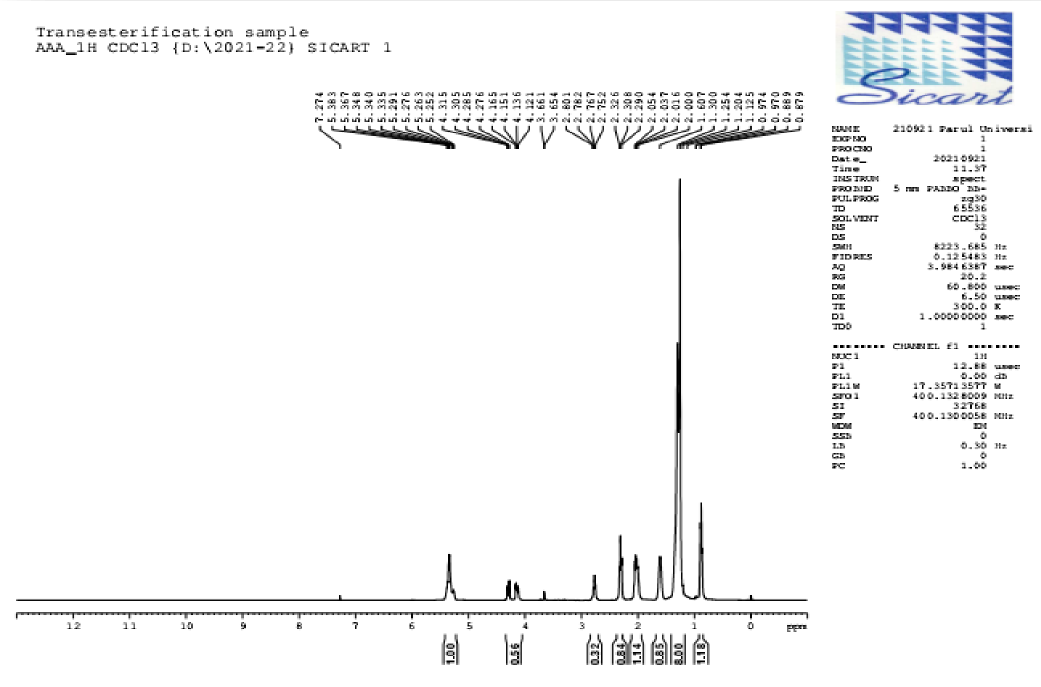
Fig. 2 NMR spectra of Transesterification sample (A) and (B)



A



B

6. CONCLUSION

The microemulsions are optically isotropic and thermodynamically stable liquid solutions of oil, water and anfafifiles. The microemulsion is easily distinguished from normal emulsions by its transparency, low viscosity and more fundamentally its thermodynamic stability. The purpose of transesterification of vegetable oils to its process of methyl esters is to lower the viscosity of the oil. The parameter that affects transesterification is the molar ratio of glyceride to alcohol, the catalyst, the reaction temperature and the pressure, the reaction time. The most important property of Biodiesel is the viscosity.

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