REVIEW OF LITRETURE

SaifulIrwanZubairi (2016) In this invention of polyester based on linoleic acid for bio-lubrication base stock-low temperature tribological and rheological properties mentioned that vegetable oil which contain high percentage of linoleic acid 1 are perceived to be a viable alternative to mineral oil for biolubricant applications due to their biodegradability and technical properties. In this study a novel synthetic approach has been chosen for modification of LA for improving the physical and tribological properties.

In this study, trimester derivative 5 was synthesized through a two-step reaction of monoepoxidation and opening of oxirane ring to synthesis the monoester 9,(12)-hydroxy-10,(13)-oleioxyoctadecanoic acid 3. Product 2 results in mixture of two monoepoxides(cis-9, 10-epoxy 12c- 18:1 (2a) and cis- 12, 13 epoxy 9c-18:1(2b) with yield % of 82.14, while the oxirane ring opening in the presence of p-toluene sulfonic acid (PTSA) to prepare 9, (12)-hydroxy-10, (13)-oleioxyoctadecanoic acid with yield % of 84.60.

Barat Ghobadian(2015) The study has shown that with using bio-lubricants how we can reduce the exhaust emission, human dieses such as a respiratory disease, cancer, eye irritation, anemia, poisoning etc. burned oil it gives harmful environment bad effect like acid rain, greenhouse effect, and damages to plant.

In the study results shows that the performance of Jojoba vegetable oil in two–stroke petrol engine was similar to that in commercial engine oil. Results shows that the use of these two engine oil reduced exhaust particle of the scooter engine from 33 to 36 % Singh (2011) produced two stroke engine oil from caster plant oil through the epoxidation method and came to the conclusion that this engine oil reduced smoke by more than 50 percent and also decreased fuel consumption compared to mineral two-stroke engine oil.

GRIGOR B. BANTCHEV (2012) Researcher given information about the film forming properties of blends PAG & HOSUO (50/50 wt.%). Researcher obtains the data viscosity VS pressure by the analysis to calculate the PVC using the Barus and Bair et al. models. If Polyunsaturated fatty acids is more >50% and/or saturated fatty acid (SFA, >10%) PUFAs contribute to poor oxidation stability while contribute to poor cold flow properties of VO. If oleic acid is more mean that oil is good favorite candidate for use in bio-based lubricant formulation.PAGs are synthetic oils obtained by the polymerization
of epoxide monomers. The solubility of PAG is depends on the molecular weight and structure of the monomer used in the synthesis.

- Low toxicity, less environmental damage during spillage
- Advantage is PAG is that its oxidation does not generate solid deposit thus avoiding the problem of varnish generation, which is serious problem in petroleum-based product. Reduce varnish generation such blend can be used in hydraulic & turbine fluid formation. The closeness of the results between PVC from film thickness measurements and those calculated from the theoretical model can be regarded as a validation of both experimental modeling result more needed to make a firm claim about the theoretical calculations.

Mohammed ModuAji (2015) Done study on Jathropha oil, Neem oil & mineral lubricants (energy 20W/50) by Mohammed modu. Given procedure for extraction of oil from seed but not given procedure for esterification mention modification procedure in the lab of Maiduguns University But actual procedure not mention. After that researcher did study on both oil & compared the result. But in the testing parameter researcher mentioned KV @ 40°C & 100°C viscosity & VI also calculated VI from centipoise (CP) value which is wrong. SAE 20W50 value is showing centistoke & Neem oil & Jathropha oil viscosity is in Cp and VI also calculated from that viscosity. Normally VI is considering from centistoke value not Cp value- acid value & TBN value not stated correctly. TAN & TBN is differently characteristics.

Prerna Singh Chauhan (2013) In this paper properties of vegetable oils, fatty esters, chemically modified esters and synthetic esters relevant for performance as lubricants in various industrial applications.

In this study researcher not given exact amount of chemical composition. There are several ways and procedures to covert vegetable oil into biodegradable lubricants. The chemical modification included acylation, epoxidation, partial hydrogenation and trans-esterification. The vegetable oils were transesterified by reacting with ethyl hexanol, which has been treated earlier with sodium. The vegetable oils & its esters are well known to be biodegradable. Study shown that its possible to formulate the automotive and industrial lube oil from vegetable oil esters for application such as engine oil, two strokes oils, compressor oil, Aviation oil, metal working fluids, insulating oil, gear oil, hydraulic oil etc. Biodegradability is the ability of substance to be decomposed by micro-organism- CEC-L-33-A-94 (Time – 21) loss of hydrocarbon infrared bands at 2930cm^{-1} > 70% to ≥ 90
The vegetable oil as such as is glycerides of fatty acid C_{16} to C_{24}. The most abundant fatty acid being Oleic acid, linoleic acid, Palmitic acid, Stearic acid with certain exceptions such as coconut oil large amount of lauric acid, Castor oil has 12 hydroxy oleic acid and karanja oil has oleic acid as major fatty acid constituents.

Rogerio Matheus Vargas (1997) The best model for transesterification reaction was chosen based on it accuracy fitting the experimental data obtained at different operating condition. Transesterification is the general term used to describe the important class of organic reaction where an ester is transformed into another through interchange of the alkoxy moiety. When the ester is reacted with an alcohol, the transesterification is an equilibrium reaction and transformation occurs essentially by mixing the reactant. However the presence of a catalyst (strong acid or Base) accelerates considerably the adjustment of the equilibrium. In order to achieve a high yield of the ester, the alcohol has to be used in excess.

\[
\text{RCOOR'} + \text{R''OH} \leftrightarrow \text{RCOOR''} + \text{R'OHN}
\]  

(General equation for a transesterification reaction)

There are several method which are using for transesterification like- Acid- Catalyzed Processes, Base – Catalyzed process, Lipase- Catalyzed Processes, Non- Ionic Base- Catalyzed Processes, Heterogeneously catalyzed processes are used as per depends on the chemical composition of vegetable oil.

Amit Kumar Jain (2012) Researcher gives very good information about the chemical composition of Non-edible vegetable oils. Oil contains fats which can be divided into three broad categories viz. saturated, monounsaturated and polyunsaturated. Saturated fats are not counted amongst the healthy fats, so its better to consume this in limited quantity. Unsaturated fats are actually considered to be healthy fats, as these help in strengthening the immune system. Using unsaturated types fats in our diet would also help in controlling the cholesterol level. Unsaturated fats are found mostly in fish, nuts, seeds and non-edible vegetable oils.

In this study 55% of product was successfully synthesized using fatty acid of Jathropha curcas oil with trimethylolpropane in the presence of sulfuric acid as catalyst. The result obtain suggest that the following reaction time:3 hours, temperature:150°C, Molar ratio of FA:TMP is 4:1 and catalyst concentration: 2% W/W are sufficient for the esterification of ester TMP as biolubricant base stocks. All the physical and chemical properties of seed oils are dependent on their FA distributions, composition and additional functional group in the chain structure.
Prerna Singh Chauhan (2015) As per collected data (Girish et.al. 2008) who is given in the paper is that India stands first in neem production and about 5,40,000 tons of seeds are produced annually yielding 1,07,000 tons of neem oil and 4,25,000 tons of neem cake (Anonymous, 1195). The amount of need available is estimated to be about 1600 tons per annum, providing enormous amount of raw material for different industries have major role to play in harnessing the potential.

The neem seed initially has to extracted by soxhlet extraction method is the best regarding higher percentage yield 320ml of n-hexane is added & after extraction solvent has to removed by rotator evaporator at 50°C. The transesterificationoil has to be converted into partially hydrogenated oil and both were compared for analysis. Oil is further trans esterified with 75gm of ethyl hexanol 1.4gm of sodium was added until clean solution was obtained. 100gm of refined oil was added to the above solution and refluxed at 180°C for a period of 30 hrs.

After that 100gm for trans esterified ethyl hexyl ester of neem oil, 100gm of hexane and 1.6gm of raney nickel catalyst was suspended in a reactor. In reactor hydrogen was passed at 200psi at 120°C FOR 45 minutes to obtain partially hydrogenated products.

Bashar Mudhaffar, Jumat Salimon, (2015) Production hyperbranched trimethylolpropane was successfully synthesized by esterification with oleic acid with high yield percentage in shortest reaction time. Double bonds are especially reactive and react immediately with the air oxygen while the hydrogen β atom is easily eliminated from the molecular structure. This particular weak point is produce olefins and acid due to the breakage of ester. Normally weak point of ester also is its trend to undergo hydrolysis in the presence of water. From the chemical modification can reduce this weakness through reduction of microbial metabolisms or degradability.

The opening of the oxirane ring has been done by several researchers by chemical modification. The ring opening was done through the reaction with water to obtain a vicinal diol, which is further reacted with an acid anhydride in pyridine.

Biniyam T. Amdebrhan (2015) Given very good interpretation about tropical benefit of the country where castor plant has been cultivated in large quantities in Ethiopia. According to the international energy report, Feb 2015, Ethiopia is exporting the castor seed to abroad countries and importing back the different product. The average production of castor is 505,734.00 barrels per day of petroleum product is imported from different countries.
After experimental procedure purification of crude castor oil, the result of extracted oil is very satisfied, viscosity is around 218.8 mm²/s at 40°C, moisture content is around 0.262%, acid value is approx. 2, composition free fatty acid (%wt.) 1 and yield 23.87%. Bio lubricant is produce using methanol alcohol and potassium hydroxide catalyst at constant reaction time for 1 hour at atmospheric pressure. Esterification reaction done at temperature 65°C, 1.0%(w/w) KOH catalyst amount & for 7:1 molar ratio of alcohol to oil.

**Mathew Menkiti** This invention is related to bio-lubricant from fluted pumpkin seed oil (FPSO), which is good potential for the synthesis of TMP esters. It is rich in unsaturated fatty acids, comprising up to 80.26% of its fatty acid composition (Bello et.al; 2011)

The best kinetic model for the transesterification reaction was chosen based on its accuracy of fitting the experimental data obtained at different operating condition. In the results of kinetic study researcher found that the regression value for the second order kinetic plot was found to be higher than those of the first order for all considered temperatures. Therefore. Second order kinetic model was chosen as the best kinetic model for the transesterification of FPME with TMP. From the transesterification reaction consist of several components, which includes monoester, diester, trimester & unconsumed FPME. Initially the reaction would be a stepwise process whereby monoester and diester would be formed before the final product tri-ester, which will produce finally (Gunam Resul et.al. 2012). For good bio-lubricants high composition of triester is required for good lubricants properties. From the investigation researcher found that within the given range, the highest triester yield of 81.42% was achieved at a temperature of 160°C reaction time of 6 hours and FPME: TMP mole ratio of 6:1.

**Hamizah Ammarah Mahmud** Lauric acid is a medium chain (C12) saturated fatty acid while the linear packed structure. It did not have any double bond chains, which make it in saturated acid groups. The main source of lauric acid is from coconut & palm kernel oil.

-Non-toxic, anti microbeagent safe to handle & also cheap. high oxidative stability. Bad in cold condition as it tend to form macro-crystal which prevent the lubrication in low temperature. Due to the presence of hydrogen in the structure of glycerol-β of the lauric acid that is causing the oil has low thermal & oxidative stability. Lauric acid will be reacted with polyol such as Pentaerytritol(PE) to produce PE ester. PE polyol is selected because it do not have any β hydrogen and has a low melting point. Polyol esters are excellent substitute for mineral oils because of their low volatility. The composition
after esterification Lauric acid = 53.0%, Mono ester = 1.7, Di ester = 3.3, Tri ester = 37.6, Tetra ester = 4.4

Silva M.S. (2015) The epoxidation process improved the oxidative stability and acid value of both pure vegetable oil. Presence of epoxidized oils improved the solubilisation of the additives increasing the fluid performance. The aim of this study is to develop an additives package for hydraulic biolubricant using passion fruit seed and moringa seed oils epoxidized with formic acid, employing a 2\(^3\) factorial design with center points, where the response surface methodology will be used to obtain the optimal condition. Epoxidation reaction was used to introduce oxirane rings at the double bond in the fatty acid chemical structures. These conversions can improve heat and oxidative stabilities.

Yan Zhou, et. al. (2015) Researcher is given information about effect of molecular structure of carbon-based molecules on boilerculation. Synovial joints present extremely low friction coefficients (0.003) with lifespan for more than 70 years. According to the American Academy of Orthopedic Surgeons, there are 543,000 total knee replacement performed per year in US alone. The life expectancy of current prosthetic implant is limited to 10-15 years. Hyaluronan has been used as an intra-articular injection agent in order to relieve pain in patients with osteoarthritis, but beneficial effects are debated that is probably due to the bio-degradation of Hyaluronan and the lack of continuous supplying method. Carbon-based lubricant molecules have been studied and applied in lubrication, such as carbon nanotube, graphene, Graphene oxide (GO), graphite, fullerene and diamondoid. Graphene and G0 have been applied as single- or multi-layer coating on sliding surfaces in order to reduce wear & friction.

D.I. Ahmed, S. Kasolang (2014) In this article researcher explained about formulation of bio lubricants and its testing parameter differentiate. He has taken formulation VG68, soya oil-52.7, mineral oil- 40.55, Hyd. Oil additives- 6.75
After formulation set this formula conformed for VG 68 and results are Pour point: -20°C, Flash point:256°C, VI: 111 (from: 115)
All parameters are reduced because researcher taken soya oil without esterification. If researcher taken esterified oil then parameter of pour point could be lesser than 20°C-flash point may be approx. same & VI defiantly it will be more.

JitendraChandrakar, AmitSuhane (2014) Disposing of this huge amount of MWF’s diminishing the environmental friendliness and impacting an adverse effect on the environmental. Estimation shows that in the USA alone about 700,000 to one million workers are exposed to MWF’s as cutting fluids are complex in their composition; they
may cause irritation or allergy. Water soluble cutting oil, which are harmful to the operators. Researcher given the information about source of biolubricants & there physic-chemical properties. One of the observations is that vegetable oil is tested mainly for ferrous material and there is a gap for nonferrous and super alloys. Using vegetable oil cutting oil the medium performance with reported increase of 117% in tool life and 7% reduction in thrust force.

**Francis Uchenna Ozioko (2014)** Researcher is extracted oil from moringa seed & did some degumming treatment after that he added the oil from 10 to 40% in mineral base oil and tested on pin & disc for wear test. Researcher did study on SAE grade 30 & SAE 40 & found some differences in viscosity @ 100°C & 40°C In this test researcher mention that moringa oil 10 to 20% is ok for SAE 30 & 40 grade but 30 & 40% did not meet the requirement. The wear rate of all blend samples increased with applied load with MOL 10 biolubricant film having maximum ability to protect metal-to-metal contact. There all test done without esterification.

**Pradeep L. Menezes, Carlton J. Reeves (2013)** A new class of greener biolubricant knows as room temperature ionic liquid (ILs). These compound, which are molten salts, consist of combination of a cation and an appropriate anion that remain stable and separated within the fluid. Ionic fluids exhibit a number of unique and useful properties such as their broad liquid range.-Low melting point and high boiling point, negligible vapour pressure non-flammability, non-combustibility, superior thermal stability, variable viscosity miscibility, solubility, lamellar like liquid crystal structure thick monolayer formation and non-volatility.

**Synara Lucien De Lima (2013)** In this paper researcher explain the extracted palm oil from seed scientist name: Carnauba CoperniciaCerifera. He is focusing on some test like PH, acid number, copper corrosion. This test are very important if PH is low the acidity will be more and it will affect on metallic part, rust & corrosion will be more. In the test of TAN researcher mention in the procedure 50ml distilled water has to add in the oil. But as per my knowledge we cannot put water in oil because it will not dissolve, it has to be use TAN solution as per the ASTM test method. From their test researcher want to explain that PH value of the oil carnauba measured by different methods - 6.02/6. According the test TAN in carnauba oil is 0.025mg/KOH/g. and copper corrosion has mentioned slightly tarnished 1b.

**Amit Kumar Jain (2013)** Researcher mentions the uses of biolubricant in Industrial & maintenance application. Given information about major benefits from biolube.
Reduction of friction and wear, reduction of operating noise, improvement in heat transfer, broaching, internal 

Application of biolubricants on a common machining process. Given good information on effect of Biolubricant on Industries and Environment

Bilas S. (2013) Global transportation energy use is expected to increase by an average of 1.8% per year from 2005 to 2025. The International Energy Agency (IEA) report (2007) and Shahid and Jamal (2011) have also indicated that the world will need 50% more energy in 2030 than now, of which 45% will be accounted for by China & India. Jatropha crude oil considers non-edible oil due to the presence of toxic esters (Shah et al., 2004). This plant can grow in tropical and subtropical climates. It grows rapidly and requires minimal water and nutrients. Researchers are given information about advantages and disadvantages of biolubricants. The esterification results show that the decrease in FFA with time (1-5 hrs.) 14.6 to 0.44. High saponification value may lead to foam formation. FFA reduction by esterification VI of Jatropha biolubricant is 195 and it is comparable to other plant based biolubricants. Pour point is improved from 5 to -7°C Recommendations are P.P additives required to improve the pour point. Freshly extracted Jatropha oil should be used for production of Biolubricants.

Pallavi K.G. (2015) In the invention of biolubricants from the Jatropha curcas seed & Simarouba seed oil has brought attention towards the biolubricants, an alternative sources to the conventional petroleum oil based lubricants. One of the advantages of biolubricants being the absence of Sulphur, which is environmentally friendly since it emits zero Sulphur, based greenhouse gases. In the discussion of result various factors affecting the reaction was checked and few of them was taken for optimization. Initial acid value of Jatropha oil and simorouba oil are 26-8% and 39.22% respectively. 63-65°C was selected as optimum temperature for acid esterification reaction of jatropha oil. Catalyst concentration was 2% w/w sulphuric acid to sample, temperature maintained at 63°C and methanol to oil ratio of 6:1 by volume were maintained. The optimum reaction time has chosen 40 minutes, which is very less time for saving production. The free fatty acid (FFA) was found to be decreased from an initial value of 9.8% to 0.44% in 40 minutes. The acid value measured at 40°C was 0.19% and later increased to 0.65% to 65°C. The experiment result indicates temperature higher than 40°C had negative impact on methanolysis of oil to ester. At high temperature changes of loss of methanol may also lead to negative impact on the reaction, hence the temperature selected 40°C. In his study researcher given overall information that two-
step method offers an avenue for reduction in cost of material and energy in biofuel production.

**Krassimira Kardjilova (2013)** In this article researcher presents the result of measuring the calorific value and the rheological characteristics of Plantohyd biolubricant. The main advantage of this oil is excellent composing 90% for just oil 14 days; very-good resistance to aging and oxidation good viscosity. In the specific enthalpy the amount of energy generated when a unit mass of fuel is burned completely is known as the calorific value of the fuel. The value of enthalpy and it change depend on the initial and final state of the thermodynamic (TD) system

Specific enthalpy is the enthalpy per unit mass. \[ h = \frac{kJ}{kg} \]

The change of specific enthalpy determines the heat released from the system at a fixed process. The enthalpy of combustion is defined as the difference between the enthalpy of the product and the enthalpy of reagent when complete combustion occurs at a given temperature and pressure.

**Anjana Srivastava (2013)** In this topic researcher mention that vegetable oil consist primarily of long chain of carbon and hydrogen with terminal ends containing oxygen, hydrogen and carbon. The fact that vegetable oils make very good alternatives to petroleum hydrocarbons as the more saturated carbon behaves more like petroleum. Most of the vegetable oil contains 18 carbon chains. The popular theory has long been that the longer the chain, better performance of lubricants, but in some cases it is not true. Longer the chain acid like erucic acid (22-carbons) from rapseed and crambe are not as good lubricating oil as canola (18-carbon). Palm oil required pour point additives for winter climate condition. After modification of renewable base stock with chemical gives great potential for development of biolubricants. Main modification relate to the carboxyl group of fatty acid, e.g. esterification and fatty acid chain. There are many challenges for researcher in the field of biolubricant will be to improve certain characteristics test parameter of vegetable oil without impairing their excellent tribological & environmentally relevant properties.

**H. M. Mobarak (2013)** In the first part of this paper given information about the source, properties, as well as advantages and disadvantages of the biolubricant. Into the second part the study describes the potential of vegetable oil-based biolubricant as alternative lubricants for automotive applications. I like the final part, which is given the information about the world biolubricant market and its future prospects. Other information is similar to other researcher what they mention in the papers. Life cycle of
bio-lubricant structure has to give more information where I feel researcher has to give more chemical structure reaction. Researcher has not given chemical modification procedure and reaction. The present study can support the establishment of biolubricant, as well as encourage and support research on using renewable natural sources as alternatives.

**Grigor B. Bantcher (2012)** In the present work it is observed & characterized the boundary and fractionation layer formed from binary blends of soya bean base oil and oleic estolide ester (EST) with PAO under elastohydrodynamic conditions. In this study it is shown the film thickness measurement procedure. The elastohydrodynamic (EHD) film thickness of soya bean (SBO)-polylphaolefin (PAO) blend was fitted well with the Hamrock- Dowson equation (H-D) down to 1-2 nm film thickness. After the contact surface had been wetted with SBO or SBO- PAO2 blend for an extended time, a boundary layer was observed. The boundary layer was detected more than the oils wet 15 min. after the contact. The SBO- PAO40 blend at 100°C showed a fractionation behavior which was most pronounced 15min. after the contact was wetted by the blend.

**K. Belafi-Bako (2004)** In the present study on biolubricants from fusel oil by enzymatic esterification in solvent. The researcher given information about fusel oil, fusel oil is a by-product of distilleries; its average composition is 10% ethanol, 13% n-propanol, 15% i-butanol, 51% i-amyl-alcohol, 11% miscellaneous alcohols and water. Now a day’s fusel oil is usually burned to complete the energy demand of the distilleries. Researches have been carried out to utilize it as an additive to improve octane number gasoline or for production of natural flavors and lubricants.

From the investigation it has proven that an ester type biolubricant could be prepared from fusel oil and oleic acid by lipase enzyme in solvent free system. Compared to the product obtained by acid catalysis, in the biolubricant there was no trace of oleic acid since complete conversion was achieved by continuous water removal by pervaporation.

**MitraDebarati (2012)** In this study of synthesis from waste cooking oil (WCO) via enzymatic hydrolysis required more precaution has taken because of continuous burning of the oil color factor also a big factor. This work helps to recycle & convert waste cooking oil in biolubricants by the process of esterification using enzymatic catalyst.

From the study WCO can be successfully hydrolyzed with Candida Rugosa lipase to get free fatty acid at an enzyme concentration of 1.0g L⁻¹ for 30 hrs. The resulting FFA can be esterification with higher alcohol (octanol) using Amberlyst 15H to produce environment friendly biolubricant. Temperature, catalyst amount, reactant molar ratio
(a/c: FFA) were found significant effect on the reaction rate. There are high conversion can be achieved in less time with the use of an appropriate desiccant to remove the water produced during the esterification reaction.

**Mohamed E. S. Mirghani (2012)** In this study of Nahar seed oil for biolubricants, Nahar (MesuaFerrea L.) is from the Clusiaceae family. Nahar is one of Indian highly regarded and sacred trees. Nahar oil from the seeds are used for the topical treatment of various skin problems and also commonly used in Buddhist temples. The fresh blossom of Nahar are said to aid digestion and cough while dried flowers helped in relieving bleeding hemorrhoids, while the root is an antidote for snake poisons. This has encouraged the search for environmentally finally lubricants. During the initial research specification of feedstock is very important.

**Nadia Salih (2011)** Vegetable oils with high oleic content are considered potential candidates to substitute conventional mineral oil-based lubricants oils and synthetic esters (Adhvaryu rt.al.2005). low volatility due to the higher molecular weight of the triglycerol molecules and anarrow range of viscosity changes with temperature. Vegetable oil are classified as a non-flammable liquids because of high flash point over 300°C, pour oxidation stability because of the presence of bisallylic proton,and they are highly susceptible to free radical attack and subsequently undergo oxidative degradation to form polar oxy compound

**Muhammad Faiz M** Jatropha curcas has great potential as feedstock, the optimum rate of conversion and kinetic were attained at temperature of 150°C with the overall second order reaction rate constant of $1.49 \times 10^{-1}$ (% wt./wt.min.°C) The activation energy was estimated about 3.94 kJ/mol and the reaction followed a second order rate law. the pour point achieved for jatropha biolubricant was at -3°C for all tested temperature and VI ranged from 178 to 183.

**United State Patent, Zhou et al. (2013)** In the present invention provides for methods of making diester-based lubricant compositions, Wherein such diester-based lubricant compositions generally comprise vicinal diester speciespre pared by reacting vicinal dial species With monooester(s) of one or more fatty acidstypically in the presence of a catalyst. In some embodiments, such methods formaking suchdiester-basedlubricants utilize one or more biomass precursor species (e.g., monoesters of fatty acids derived from crop oils and/or other sources of triglyceride species). In some or other such embodiments, such diester-based lubricants are derived from Fischer-Tropsch (FT) olefins,
Siti Zubaidah Sulaiman (2002) From the batch process for the transesterification of palm oil methyl ester (POME) with trimethylolpropane (TMP) to TMP ester was investigated in a mini pilot reactor. The process was equipped with a high vacuum pump. The experimental studies explored effects of vacuum pressure, Temperature molar ratio, catalyst amount and agitator speed on the overall conversion. The high catalyst amount resulted in higher conversion of TE (W/W %) but increased in solid content of the product.

T.BAN YAI (2011) From the investigation have proven that an ester type biolubricant could be prepared from isoamyl-alcohol and oleic acid by lipase enzyme in ionic liquid two phase system. Compared to the product obtained in solvent free system. Higher conversion in shorter time was achieved. Despite the lack of water removed from the biolubricant there was no trace of oleic acid since complete conversion was achieved. Determining the optimal reaction mixture composition high amount of ionic liquid and enzyme, large excess of alcohol was closest to the optimal.

Bashar Mudhaffar Abdullah (2011) In this study of the process describes a systematic approach to modify HYOOA to yield biolubricant base stock 9(12)-Hydroxy-10(13)-oleioxy-12(9)-octadecanoate (OLHYOOT). From study based on the results obtained under some condition, hydroxy ester produce obtain high yield% of OLHYOOT were predicted at ratio of OL/HYOOA of 1:1 g/g, catalyst SA of0.2:1 g/g, reaction temperature 110°C and 4.5 h of reaction time.