

Title

Composition and process of manufacturing biodiesel grease by gelling biodiesel, anti-wear additives, extreme pressure additives, water repellent additives and anti-oxidant additives.

Description

The use of biofuels as alternatives to currently petroleum base oils to produce grease-like lubricants has been an area of considerable research and investigation.

This invention relates to the process of producing grease-like lubricants by gelling biodiesel with organoclay grease gellant or silicone dioxide.

The invention includes the addition of anti-wear, anti-oxidant, corrosion inhibitors and extreme pressure additives.

BACKGROUND OF THE INVENTION

Shrinking crude oil reserves and the escalating cost of crude oil have led to renewed interest in using biodiesel as an alternative to petroleum base oil for the production grease-like lubricants. These lubricant greases are produced from biodiesel derived from methyl and ethyl ester having C-14 to C-18 carbon atoms.

Advantages of said greases include that they are renewable, less environmentally hazardous and safer to human contact unlike the petroleum-based greases.

Grease-like lubricant produced from the above composition exhibits excellent lubricating, non-melt, water repellent and extreme pressure properties over conventional mineral based grease.

They are useful as heavy duty lubricant grease in many applications including the automotive where they are used as wheel bearing grease and lubricant for all the joints and moving parts of the vehicle.

From an economic or commercial perspective, there continues to be a need for greases produced from biodiesel that provide improvements in the above mentioned properties which are economic to manufacture. That is, with the cost of raw materials and manufacturing processes affecting the pocket of the consumer, there continues to be a need for greases produced from biodiesel. In particular, there is a need for greases produced from biodiesel that are manufactured through a simplified and reliable process using readily available, economical and non-hazardous raw materials with simplified equipment and production times.



SUMMARY OF THE INVENTION

Patentee has discovered the composition and a novel process for gelling up biodiesel into grease-like lubricants that have exceptionally high load carrying capabilities using biodiesel of C-14 to C-18 carbon atoms as main composition materials derived from methyl or ethyl ester, organoclay grease gellant or silicone dioxide, chlorine extreme pressure additives, sulfur anti-wear additives, water repellent additives, corrosion inhibitors, and aminic or zinc phosphate anti-oxidant.

In an embodiment of the invention wherein the organoclay grease gellant is used to gel the biodiesel into grease-like lubricants.

In another embodiment of the invention the chlorine extreme pressure additives is used to enhance the load carrying capabilities of the grease-like lubricants.

In yet another embodiment of the invention sulfur or zinc anti-wear additives is used to enhance the anti-wear properties of the grease-like lubricant.

In yet another embodiment of the invention the aminic or zinc phosphate anti-oxidant is used to enhance the anti-oxidant properties of the grease-like lubricants.

In yet another embodiment of the invention sulfonate based corrosion inhibitor or amine based corrosion inhibitor is used to enhance the corrosion inhibition properties of the grease-like lubricant.

DETAILED DESCRIPTION OF THE INVENTION

In accordance with this discovery, it is an object of the invention to provide a method and composition for the manufacturing of grease-like lubricants using biodiesel as main proportion of the composition.

The method and composition are herein described.

In accordance with the invention, grease-like lubricant is produced by gelling of major proportion of biodiesel (either Methyl or Ethyl Ester) of C-14 to C18 carbon chain and a minor proportion of chlorine extreme pressure additives, sulfur or zinc anti-wear additives, water repellency modified montmorillonite bentonite, sulfonated or amine base corrosion inhibitor, aminic anti-oxidant with organo-clay or silicone dioxide in a mixing vessel.

Figure 1 shows biodiesel (either Metyhl or Ethyl Ester) of C-14 to C-18 carbon chain to be gelled into grease-like lubricant is loaded into the mixing vessel at an amber temperature of 25°C to 30°C,

Figure 2 shows extreme pressure additives either chlorine or phosphorus based is added into the mixing vessel and are mixed and agitated for 10 minutes with a mixer.

Figure 3 shows sulfur or zinc anti-wear additives is added into the mixture and mixed for another 10 minutes.

Figure 4 shows the organoclay grease gellant is added slowly into the mixture .

Figure 5 shows a semi-solid grease takes place slowly when the total desired amount of organoclay grease gellant in added into the mixture.

It is preferred that the above composition is prepared with 80 % of biodiesel by weight with the remainder 20 % by weight of extreme pressure additives, anti-wear additives, anti-oxidant, and organoclay or silicone dioxide.

Biodiesel

Biodiesel can be selected from methyl or ethyl ester with C-14 to C-18 carbon chain. The said esters are derived from transforming vegetable or animal fatty acids with methyl or ethyl alcohols.

Extreme Pressure Additives

Extreme pressure additives can be selected from chlorinated alkanes or ZDDP Zinc dialkyl dithio phosphate. A preferred chlorinated alkane is chlorinated paraffin with a chlorine content of 30 wt% to 52 wt%.

The said preferred Chlorinated paraffin is selected because of its excellent extreme pressure characteristics.

Anti-Wear Additives

Anti-wear additives can selected from **Polysulfide compound** or Zinc phosphate.

A preferred Zinc phosphate is ZDP, Zinc Dithiophosphate.

Zinc Dithiophosphate is selected for the said composition because of its excellent oxidation and anti-wear characteristics.

Zinc Phosphate based anti-oxidant/ Aminic anti-oxidant

Zinc phosphate based anti-oxidant can be selected from Zinc dithiophosphate or Zinc dialkyldithiophosphate.

Aminic anti-oxidant additives can be selected selected from one of these; PAN (Phenyl-1-Naphthylamine), ODP (Octylated diphenyl amine), NDPA (Nonylated diphenylamine), ADPA (Alkylated diphenyl amine).

A preferred aminic anti-oxidant is Phenyl-1-Naphthylamine due to its excellent anti-oxidation and higher thermal stability properties

Water Repellent Additives

Water repellent additives can be selected from Bentonite based additives (Alkyl Quaternary Ammonium Bentonite) or Montmorillonite based additives (Alkyl Quaternary Ammonium Montmorillonite).

A preferred water repellent additives is Alkyl Quaternary Ammonium Montmorillonite due to its high polarity characteristics.

Amine /Sulfonate based corrosion inhibitor

Corrosion inhibitor can be selected from amine or sulfonate based inhibitor.

Amine base inhibitor can be selected from amine carboxylate or other amine compounds.

Sulfonate base inhibitor can be selected from Barium, Lithium, Zinc, Magnesium, Sodium, Calcium sulfonate.

A preferred sulfonate is calcium sulfonate due to its excellent compatibility with biodiesel.

Organoclay Grease Gellants

Organoclay grease gellant is selected from silicon dioxide or cristobalite polymorph quartz. A preferred silicon dioxide SiO_2 is used due to its high gelling efficiency for biodiesel.

EXAMPLES

In the process of gelling biodiesel of C-14 to C-18 carbon chain into grease-like lubricant, by way of example and not limitation, the following are illustrative of various embodiments of the foregoing invention.

Example 1

This example illustrates the process of gelling biodiesel of C-14 to C-18 carbon chain into grease-like lubricant at ambient temperature of 25°C to 30°C .

In a typical process, 80 wt % of biodiesel of C-14 to C-18 carbon chain, a 22 wt % mixture of calcium sulfonate, Phenyl-1-Naphthylamine, Alkyl Quaternary Ammonium Montmorillonite, Chlorinated paraffin, Zinc Dithiophosphate were mixed in a stainless steel mixing vessel and with the help of an industrial mixer before 8 wt % of silicon dioxide SiO_2 is added to mixing vessel to gel up biodiesel into grease-like lubricant with a consistency of NGLI 00.

Example 2

This example illustrates the process of gelling biodiesel of C-14 to C-18 carbon chain into grease-like lubricant at ambient temperature of 25°C to 30°C.

In a typical process, 80 wt % of biodiesel of C-14 to C-18 carbon chain, a 22 wt % mixture of calcium sulfonate, Phenyl-1-Naphthylamine, Alkyl Quaternary Ammonium Montmorillonite, Chlorinated paraffin, Zinc Dithiophosphate were mixed in a stainless steel mixing vessel and having the help of an industrial mixer before 10 wt % of silicon dioxide SiO₂ is added to mixing vessel to gel up biodiesel into grease-like lubricant with a consistency of NGLI 0.

Example 3

This example illustrates the process of gelling biodiesel of C-14 to C-18 carbon chain into grease-like lubricant at ambient temperature of 25°C to 30°C.

In a typical process, 80 wt % of biodiesel of C-14 to C-18 carbon chain, a 22 wt % mixture of calcium sulfonate, Phenyl-1-Naphthylamine, Alkyl Quaternary Ammonium Montmorillonite, Chlorinated paraffin, Zinc Dithiophosphate were mixed in a stainless steel mixing vessel and with the help of the industrial mixer before 12 wt % of silicon dioxide SiO₂ is added to mixing vessel to gel up biodiesel into grease-like lubricant with a consistency of NGLI 1.

Example 4

This example illustrates the process of gelling biodiesel of C-14 to C-18 carbon chain into grease-like lubricant at ambient temperature of 25°C to 30°C.

In a typical process, 80 wt % of biodiesel of C-14 to C-18 carbon chain, a 22 wt % mixture of calcium sulfonate, Phenyl-1-Naphthylamine, Alkyl Quaternary Ammonium Montmorillonite, Chlorinated paraffin, Zinc Dithiophosphate were mixed in a stainless steel mixing vessel and having the help of an industrial mixer before 12 wt % of silicon dioxide SiO₂ is added to mixing vessel to gel up biodiesel into grease-like lubricant with a consistency of NGLI 1.

Example 5

This example illustrates the process of gelling biodiesel of C-14 to C-18 carbon chain into grease-like lubricant at ambient temperature of 25°C to 30°C.

In a typical process, 80 wt % of biodiesel of C-14 to C-18 carbon chain, a 22 wt % mixture of calcium sulfonate, Phenyl-1-Naphthylamine, Alkyl Quaternary Ammonium Montmorillonite, Chlorinated paraffin, Zinc Dithiophosphate were mixed in a stainless steel mixing vessel and having the help of an industrial mixer before 12 wt % of silicon dioxide SiO₂ is added to mixing vessel to gel up biodiesel into grease-like lubricant with a consistency of NGLI 2.

Example 6

This example illustrates the process of gelling biodiesel of C-14 to C-18 carbon chain into grease-like lubricant at ambient temperature of 25°C to 30°C.

In a typical process, 80 wt % of biodiesel of C-14 to C-18 carbon chain, a 22 wt % mixture of calcium sulfonate, Phenyl-1-Napthylamine, Alkyl Quaternary Ammonium Montmorillonite, Chlorinated paraffin, Zinc Dithiophosphate were mixed in a stainless steel mixing vessel and with the help of an industrial mixer before 14 wt % of silicon dioxide SiO₂ is added to mixing vessel to gel up biodiesel into grease-like lubricant with a consistency of NGLI 3..

The foregoing embodiments are susceptible to considerable variation in its practice. Accordingly, the embodiments are not intended to be limited to the specific exemplifications set forth hereinabove. Rather, the foregoing embodiments are not within the spirit and scope of the appended claims, including the equivalents thereof available as matter of law.

The patentees do not intend to dedicate any disclosed embodiments to the public, and to the extent any disclosed modifications or alterations may not literally fall within the scope of the claims, they are considered to be part hereof under the doctrine of equivalents.

Claims:

What is claimed is:

- 1) A composition and process of manufacturing biodiesel grease comprising of the steps of:
 - a. Gelling a major proportion of biodiesel and with a minor proportion of organoclay grease gellants, extreme pressure additives, anti-wear additives and anti-oxidant additives to form a grease-like lubricant.
 - b. Adding sulfur or zinc salts of dithio organophosphates anti-wear additives to enhance the boundary lubricant properties of the grease-like lubricant.
 - c. Adding Chlorine or Phosphorous Extreme Pressure additives to enhance the load carrying capabilities of the grease-like lubricant.
 - d. Adding anti-oxidant to enhance the grease-like lubricant anti-oxidant properties.
 - e. Adding water repellent additives to enhance the water repellent properties of the grease-like lubricants.
 - f. Adding organoclay grease gellant or silicone dioxide to gel up the biodiesel to form a grease-like lubricant
- 2) A composition and method of manufacture as in claim 1 wherein the grease-like lubricant has a NLGI Consistency Grades for Grease from 000 to 6.
- 3) A composition and gelling method of manufacture as in claim 1a wherein the biodiesel is derived from methyl or ethyl ester.
 - a. A method as in claim 1a wherein the carbon chain of the biodiesel is C-14 to C-18
 - b. A method as in claim 1a wherein the Cetane Index of the biodiesel is 50-90
- 4) A gelling method and composition as in claim 1a wherein organoclay grease gellant is used as gelling agent for the biodiesel into a grease-like lubricant.
- 5) A gelling method and composition as in claim 1b wherein the sulfur anti-wear additives contain a sulfur content of **0.5% to 38%.**
- 6) A gelling method and composition as in claim 1b wherein the Zinc anti-wear additives is selected from any one of the combination of ZDDP, ZnDTP or ZDP
- 7) A gelling method and composition as in claim 1c wherein the chlorine extreme pressure additives contains a chlorine content of 15 to 52% w/w, wherein the said grease-like lubricant has a Timken OK Load of 105 kilograms (ASTM-D-2509)
- 8) A gelling method and composition as in claim 1d wherein the anti-oxidant agent is Aminic or Zinc phosphate chemical family.

- 9) A gelling method and composition as in claim 1e wherein the water repellent additives is a modified montmorillonite.
- 10) A gelling method and composition as in claim 4 wherein the organoclay grease gellant 4% to 25 wt % is used to gel up the biodiesel to grease-like lubricant.
- 11) A gelling method and composition as in claim 4 wherein the silicone dioxide 4 to 25 wt % is used to gel up the biodiesel to grease-like lubricant from NGLI 000 to 6 consistencies.
- 12) A gelling method and composition as in claim 5 wherein the sulfur or zinc anti-wear agent is blended with biodiesel at temperature range of 25° C up to 85° C to increase the anti-wear properties.
- 13) A gelling method and composition as in claim 8 wherein 0.1 to 5 wt % of aminic or zinc phosphate anti-oxidant is added to the grease-like lubricant.
- 14) A gelling method and composition as in claim 1 wherein in step b) sulfur or zinc additives is added into the biodiesel at temperature of 25° C to 30° C prior to the addition of organoclay grease gellant
- 15) A gelling method and composition as in claim 1 wherein in step c) chlorine or phosphorous additives is added into the biodiesel at temperature of 25° C to 30° C prior to the addition of organoclay grease gellant to increase the load bearing carrying capabilities.
- 16) A gelling method and composition as in claim 1 wherein in step c) aminic anti-oxidant is added to the biodiesel at temperature of 25° C to 30° C prior to the addition of organoclay grease gellant.
- 17) A gelling method and composition as in claim 1 in step d) aminic anti-oxidant additives is added into biodiesel at temperature of 25° C to 30° C prior to the addition of organoclay grease gellant.
- 18) A gelling method and composition as in claim 1 wherein in step d) organoclay grease gellant is added in to the biodiesel and at temperature of 25° C to 30° C and stir till it gels into grease-like lubricant with a NGLI grease consistency of 00 to 4.
- 19) A grease-like lubricant composition prepared in accordance with the method of claim 1, a grease-like lubricant composition comprising:
 - a) 65-85 wt % biodiesel
 - b) 0.1-4 wt % sulfur or zinc phosphate additives

- c) 0.1- 9 wt % of chlorine or phosphorous or boron additives
- d) 5 – 25 wt % organo-clay grease gellant or silicone dioxide gelling agent
- e) 0.1- 3 wt % anti-oxidant
- f) 1-6 wt % water repellent additives.
- g) 0.5 to 5 wt % corrosion inhibitors

20) A grease-like lubricant as claim in 19 comprising of

- a) 79 wt % biodiesel**
- b) 2 wt % sulfur or zinc phosphate additives**
- c) 3 wt% chlorine or phosphorous or boron**
- d) 12 wt % silicone dioxide or organoclay grease gellant**
- e) 0.2 wt % aminic anti-oxidant or Zinc dithiophosphate anti-oxidant**
- f) 2.8 wt % water repellent additives**
- g) 1 wt% corrosion inhibitor**