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(54) Title: TEMPERATURE STABLE SYNTHETIC OIL

(57) Abstract

A synthetic lubricant composition resistant to hydrolysis at high temperature which composition comprises any one or more of a C_{16-42} ester, a C_{16-42} polyester, a C_{16-42} amide or a C_{16-42} polyamide.

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TEMPERATURE STABLE SYNTHETIC OIL

The present invention relates to a temperature stable synthetic oil.

In particular, the present invention relates to a synthetic oil based on alkyl esters or amides which are non-toxic and biodegradable and exhibit a high resistance to hydrolysis at elevated temperatures. These products are suitable for use as synthetic oils in applications where resistance to hydrolysis is important, such as in wellbore drilling.

Some synthetic oils for wellbore drilling are disclosed in EP-A-0386636, EP-A-0386638 and WO 93/23491.

Current technology uses esters or polyesters which are subject to severe hydrolysis at about 150°C which causes problems. For example, breakdown of the esters yields alcohols which being water soluble can upset the osmotic pressure of the aqueous phase. Many of these ester alcohols are volatile and flammable and may collect in airspaces, presenting a possible explosion risk. In addition they can be inhaled by the drilling rig operators causing drowsiness and other health problems.

The present invention seeks to overcome these problems.

According to a first aspect of the present invention there is provided a synthetic lubricant composition resistant to hydrolysis at high temperature which composition comprises any one or more of a C_{16-42} ester, a C_{16-42} polyester, a C_{16-42} amide or a C_{16-42} polyamide.

According to a second aspect of the present invention there is provided a synthetic lubricant composition resistant to hydrolysis at high temperature which composition comprises any one or more of a non-aromatic C_{16-42} ester, a non-aromatic C_{16-42} polyester, a non-aromatic C_{16-42} amide or a non-aromatic C_{16-42} polyamide.

According to a third aspect of the present invention there is provided a synthetic lubricant composition resistant to hydrolysis at high temperature which composition comprises a non-aromatic C_{16-42} amide.

Preferably the amide has one or more of the following features:

1. the carbon atom adjacent the carbonyl group is not linked to a hydrogen

2. the carbon adjacent the nitrogen of the amide group is not linked to a hydrogen.

Preferably the ester, polyester, amide or polyamide is prepared from a diacid.

Preferably the amide or polyamide is prepared from a dialkylamine, preferably a N,N di-alkylamine.

Preferably the ester, polyester, amide or polyamide are prepared from a C_{5-20} saturated or olefinic, mono or polyfunctional alcohol or amine, respectively, wherein the alcohol or amine can optionally have one or more alkyl substitutions on the primary carbon atom or on the secondary carbon atom relative to the functional group, preferably on the primary carbon atom.

Preferably the substitutions are cycloaliphatics with the functional groups attached to the ring.

Preferably the alcohol or amine is a secondary or a tertiary alcohol or a secondary or a tertiary amine, respectively, more preferably the alcohol is a secondary alcohol and the amine is a secondary or tertiary amine. Preferably the amine is an N-alkyl alkylamine.

Preferably the alcohol or amine has limited water solubility, low volatility and has a flash point >35°C.

Preferably the ester, polyester, amide or polyamide are prepared from mono or polyfunctional, saturated or olefinic reactants comprising free acid groups and free amine groups or free hydroxl groups respectively, wherein the number of free acid groups matches the number of free amine or hydroxyl groups.

Preferably the ester, polyester, amide or polyamide are prepared from an acid having substituted on the secondary carbon one or more alkyl groups such that the total number of carbon atoms in the substituents exceeds 2.

Preferably the ester, polyester, amide or polyamide are prepared from an acid having the secondary carbon atom as part of a cyclic structure.

Preferably the ester, polyester, amide or polyamide is a cyclic structure.

Preferably the ester or amide is converted into a cyclic polyester or polyamide respectively.

Preferably the ester or amide is blended with other oils of similar or different structures, in order to achieve the desired physical characteristics.

Preferably the composition is or is part of a synthetic oil for use in, for example, oil-based wellbore drilling muds.

A preferred aspect of the present invention therefore relates to the use of non-aromatic C_{5-20} saturated or olefinic, mono or polyfunctional alcohols or amines with low volatility and low water solubility, with flash points >35°C, having substitution on the primary (relative to the functional group(s)), or less preferably on the secondary, carbon atom(s). The alcohols and amines can be derived from natural products such as terpineols or synthetic materials such as cyclohexane 1,2-diol. Optionally, the alkyl amines may be N-substituted alkyl amines. The organic acids that are reacted with the alcohols or amines (either by direct reaction with the acid or via the acid chloride or a suitable ester (e.g. methyl)) are non-aromatic, saturated or

olefinic and can be mono or polyfunctional, chosen such that the total number of carbon atoms in the molecules described by this invention is in the range 16–42 and the number of acid groups matches the number of free amine or alcohol groups. Optional substitution by bulky sidegroups (i.e. $>C_2$ e.g. as dimethyl or ethyl groups) on the secondary carbon atom in the acid aliphatic chain impart a small further improvement in hydrolytic stability. Where the structure of the components permits, the products may optionally be arranged in cyclic structures (e.g. 2,7–dimethyl–1,8–dioxane–9,18–dione from sebacoyl chloride and 2,5–dimethyl, 2,5–hexane diol). This results in a structure with poor low temperature properties but with increased oxidation stability.

In general, the use of unsaturated compounds results in oils with better low temperature rheology, improved biodegradability, but poorer oxidation stability. The oils produced according to this invention may be blended with other oils in order to produce a final blend with the desired characteristics.

Thus the prefered alcohols or amines are chosen from either a) cycloaliphatics, with the functional group(s) attached to the ring (e.g. terpinen–4–ol, borneol, cyclopentanol, cyclohexamine, cyclohexane 1,2–diol, 1,4–diamino cyclohexane); or b) secondary or tertiary alcohols or amines (e.g. α–terpineol, 2,3 dimethyl butane 2,3–diol, 2–aminoheptane).

The present invention will now be described only by way of example.

Examples:

1. 2,3–dimethyl 2,3–butane dioleate has a viscosity of 40 cP at 25 °C and a value of 150 cP at 0°C. In the ASTM D2619 hydrolytic stability test, the oil showed an increase in acid value of 0.07 mgKOH/g after 48 hours at 93 °C. The oil showed 97 % biodegradability after 21 days in accordance with the European Community Biodegradability Test Method CEC–L–33–T–82.

2. The α-terpineol diester of 1,8-octanedioic acid has a viscosity of 30 cP at 25°C and 60 cP at 0°C. In the ASTM D2619 hydrolytic stability test, the oil showed an increase in acid value of 0.06 mgKOH/g after 48 hours at 93 °C. The oil showed 90 % biodegradability after 21 days (CEC-L-33-T-82).

3. The reaction product of two moles of dicyclohexylamine with dimethyl adipate yields an oil with a viscosity of 35 cP at 25 °C and 200 cP at 0 °C. In the ASTM D2619 hydrolytic stability test the acid value increase was 0.01 mgKOH/g after 48 hours at 93 °C. The oil showed 80 % biodegradability after 21 days (CEC-L-33-T-82).

4. The reaction product of two moles of Versatic 10® acid chloride with 2,5-dimethyl 2,5-hexane diol yields and oil with a viscosity of 10 cP at 25 °C and a value of 40 cP at 0 °C. The ASTM hydrolytic stability test gave an increase in acid of 0.05 mgKOH/g after 48 hours at 93 °C. The oil showed 90 % biodegradability after 21 days (CEC-L-33-T-82).

In summation the present invention relates to a synthetic lubricant composition resistant to hydrolysis at high temperature which composition comprises any one or more of a C_{16-42} ester, a C_{16-42} polyester, a C_{16-42} amide or a C_{16-42} polyamide. Preferably the present invention relates to a synthetic oil based on alkyl esters or amides which are non-toxic and biodegradable and exhibit a high resistance to hydrolysis at elevated temperatures. These products are suitable for use as synthetic oils in applications where resistance to hydrolysis is important, such as in wellbore drilling. Preferably non-aromatic C_{5-20} saturated or olefinic, mono or polyfunctional alcohols or amines, having substitution on the primary carbon atom(s) or less preferably on the secondary carbon atom(s), are reacted with non-aromatic mono- or poly-functional acids to yield (poly)esters or (poly)amides with a total number of carbon atoms between 16 and 42. The acid may optionally have substitution on the secondary carbon atom(s).

Other modifications of the present invention will be apparent to those skilled in the art.

CLAIMS

1. A synthetic lubricant composition resistant to hydrolysis at high temperature which composition comprises any one or more of a C_{16-42} ester, a C_{16-42} polyester, a C_{16-42} amide or a C_{16-42} polyamide.

2. A synthetic lubricant composition resistant to hydrolysis at high temperature which composition comprises any one or more of a non-aromatic C_{16-42} ester, a non-aromatic C_{16-42} polyester, a non-aromatic C_{16-42} amide or a non-aromatic C_{16-42} polyamide.

3. A synthetic lubricant composition resistant to hydrolysis at high temperature which composition comprises a non-aromatic C_{16-42} amide.

4. A composition according to any one of claims 1 to 3 wherein the amide has one or more of the following features:

   1. the carbon atom adjacent the carbonyl group is not linked to a hydrogen

   2. the carbon adjacent the nitrogen of the amide group is not linked to a hydrogen.

5. A composition according to any one of claims 1 to 4 wherein the ester, polyester, amide or polyamide is prepared from a diacid.

6. A composition according to any one of claims 1 to 5 wherein the amide or polyamide is prepared from a dialkylamine, preferably a N,N di-alkylamine.

7. A composition according to any one of the preceding claims wherein the ester, polyester, amide or polyamide are prepared from a C_{5-20} saturated or olefinic, mono or polyfunctional alcohol or amine, respectively, wherein the alcohol or amine can optionally have one or more alkyl substitutions on the primary carbon

atom or on the secondary carbon atom relative to the functional group, preferably on the primary carbon atom.

8. A composition according to claim 7 wherein the substitutions are cycloaliphatics with the functional groups attached to the ring.

9. A composition according to claim 7 or claim 8 wherein the alcohol or amine is a secondary or tertiary alcohol or amine, respectively.

10. A composition according to any one of claims 7 to 9 wherein the alcohol or amine has limited water solubility, low volatility and has a flash point >35°C.

11. A composition according to any one of claims 7 to 10 wherein the amine is an N–alkyl alkylamine.

12. A composition according to any one of the preceding claims wherein the ester, polyester, amide or polyamide are prepared from mono or polyfunctional, saturated or olefinic reactants comprising free acid groups and free amine groups or free hydroxl groups respectively, wherein the number of free acid groups matches the number of free amine or hydroxyl groups.

13. A composition according to any one of claims 7 to 12 wherein the ester, polyester, amide or polyamide are prepared from an acid having substituted on the secondary carbon one or more alkyl groups such that the total number of carbon atoms in the substituents exceeds 2.

14. A composition according to any one of claims 7 to 12 wherein the ester, polyester, amide or polyamide are prepared from an acid having the secondary carbon atom as part of a cyclic structure.

15. A composition according to any one of the preceding claims wherein the ester, polyester, amide or polyamide is a cyclic structure.

16. A composition according to any one of the preceding claims wherein the ester or amide is converted into a cyclic polyester or polyamide respectively.

17. A composition according to any one of the preceding claims wherein the ester or amide is blended with other oils of similar or different structures, in order to achieve the desired physical characteristics.

18. A composition according to any one of the preceding claims wherein the composition is or is part of a synthetic oil for use in, for example, oil-based wellbore drilling muds.

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C10M105/32 C10M105/68 C09K7/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C09K C10M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO-A-91 19771 (HENKEL) 26 December 1991 see page 5, line 22 - page 7, line 4 see page 11, line 17 - page 12, line 15 see page 13, line 13 - page 14, line 6 see page 18, line 10 - line 19 ---	1,2,5,7, 17,18
X	DE-A-40 18 228 (HENKEL) 12 December 1991 see page 6, line 23 - line 39 see page 7, line 5 - line 36 see claims 1-21 ---	1,2,5,7, 17,18
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A	see page 3, line 12 - page 5, line 14 see page 10, line 2 - line 24 --- -/--	4

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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X,P	EP-A-0 606 553 (CONOCO INC.) 20 July 1994 see page 2, line 1 - page 5, line 26 see page 8, line 22 - line 25 see page 9, line 39 - line 55; claims 1,3-6,14-28	1,2,7, 17,18
X	EP-A-0 374 672 (HENKEL) 27 June 1990 see page 3, line 30 - page 4, line 2 see page 4, line 38 - page 6, line 7	1,2,7, 17,18
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X	EP-A-0 398 113 (HENKEL) 22 November 1990 see page 7, line 17 - line 44 see page 8, line 3 - line 16 see page 8, line 31 - line 45	1,2,7, 17,18

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