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**(54) USE OF FISCHER-TROPSCH BASE OIL FOR REDUCING THE TOXICITY OF USED LUBRICATING COMPOSITIONS**

VERWENDUNG VON FISCHER-TROPSCH BASISÖL ZUR REDUZIERUNG DER TOXIZITÄT  
GEBRAUCHTER SCHMIERMITTELZUSAMMENSETZUNGEN

UTILISATION D'HUILE DE BASE FISCHER-TROPSCH POUR RÉDUIRE LA TOXICITÉ DE  
COMPOSITIONS LUBRIFIANTES USÉES

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**Description**Field of the Invention

5     **[0001]** The present invention relates to the use of a Fischer-Tropsch derived base oil for the purpose of reducing the toxicity of used lubricating compositions.

Background of the Invention

10    **[0002]** The primary purpose of lubrication is separation of surfaces moving relative to one another, to minimise friction and wear. The materials most frequently used for this purpose are oils and greases. The choice of lubricant is mostly determined by the particular application.

15    **[0003]** The lubricating oils in all engines are at risk of contamination from fuel components, with the consequential reduction in lubricating properties exhibited by the lubricating oil. In addition, fuel contamination results in an increase in the toxicity of the lubricant due to accumulation of toxic fuel components in the lubricant. This is especially the case with spark ignition engines where Platformate (a gasoline blending component) causes significant light poly-cyclic aromatics accumulation in the lubricant.

20    **[0004]** The toxicity increase is a particular issue for the recycling of so-called "used oil". "Used oil" can be defined as any petroleum-based or synthetic oil that, through use or handling, has become unsuitable for its original purpose due to the presence of impurities or loss of original properties. Some examples of types of products that after use can be labeled as used oil are hydraulic oil, transmission oil, brake fluids, motor oil, crankcase oil, gear box oil, synthetic oil, and grades #1, 2, 3, and 4 fuel oil.

**[0005]** Used oil can be used for various purposes including as a fuel in, for example, industrial furnaces or boilers.

25    **[0006]** As mentioned above however, one disadvantage of used lubricants from spark ignition engines is that they contain toxic materials as a result of having been contaminated by gasoline fuel components during use. Since it is desirable to recycle these used lubricants for other purposes, it would be useful to find a way to reduce the toxicity of the used lubricants from spark ignition engines, such that handling and further processing becomes safer and more manageable.

30    **[0007]** It has now surprisingly been found that by using a particular base oil in the lubricating composition contained in a spark ignition internal combustion engine, the used lubricating composition has a reduced toxicity.

Summary of the Invention

35    **[0008]** According to the present invention there is provided the use of a Fischer-Tropsch derived base oil for the purpose of reducing the toxicity of a used lubricating composition obtained from a spark ignition internal combustion engine fuelled with a gasoline composition wherein the Fischer-Tropsch derived base oil is incorporated into the lubricating composition before use in an engine.

Detailed Description of the Invention

40    **[0009]** As used herein the term "used lubricating composition" means a petroleum-based or synthetic-based lubricating composition that, through use, in a gasoline-fuelled spark ignition internal combustion engine, has become unsuitable for its original purpose due to the presence of impurities or loss of original properties. The term "through use" in this context means that the vehicle powered by the gasoline-fuelled spark ignition internal combustion engine has preferably done at least 3000 miles. It is recognised by a person skilled in the art that in the case of a bench engine test, e.g. the API Sequence III G engine test or the ACEA TU-5JP-L4 engine test, the severity of the bench test is equivalent to the engine having done preferably at least 3000 miles.

45    **[0010]** The present invention involves the use of a Fischer-Tropsch derived base oil, wherein the Fischer-Tropsch derived base oil is incorporated into the lubricating composition before use in an engine, as defined in the appended claims. Such a use results in a used lubricating composition having a significantly reduced toxicity.

50    **[0011]** As used herein the term "reducing the toxicity of the used lubricating composition" means that the used lubricating composition obtained from a gasoline-fuelled spark ignition internal combustion engine and containing a Fischer-Tropsch derived base oil has a significantly reduced Mutagenicity Index and preferably a significantly reduced Fold Increase, as measured by the Modified Ames Test Method (according to ASTM E1687), compared to a used lubricating composition obtained from a gasoline-fuelled spark ignition internal combustion engine but not containing a Fischer-Tropsch derived base oil.

55    **[0012]** The gasoline composition for use in the present invention comprises gasoline base fuel. The gasoline may be any gasoline suitable for use in an internal combustion engine of the spark-ignition (petrol) type known in the art. The

gasoline used as the base fuel in the liquid fuel composition of the present invention may conveniently also be referred to as 'base gasoline'.

[0013] Gasolines typically comprise mixtures of hydrocarbons boiling in the range from 25 to 230 °C (EN-ISO 3405), the optimal ranges and distillation curves typically varying according to climate and season of the year. The hydrocarbons in a gasoline may be derived by any means known in the art, conveniently the hydrocarbons may be derived in any known manner from straight-run gasoline, synthetically-produced aromatic hydrocarbon mixtures, thermally or catalytically cracked hydrocarbons, hydro-cracked petroleum fractions, catalytically reformed hydrocarbons or mixtures of these.

[0014] The specific distillation curve, hydrocarbon composition, research octane number (RON) and motor octane number (MON) of the gasoline are not critical.

[0015] Conveniently, the research octane number (RON) of the gasoline may be at least 80, for instance in the range of from 80 to 110, preferably the RON of the gasoline will be at least 90, for instance in the range of from 90 to 110, more preferably the RON of the gasoline will be at least 91, for instance in the range of from 91 to 105, even more preferably the RON of the gasoline will be at least 92, for instance in the range of from 92 to 103, even more preferably the RON of the gasoline will be at least 93, for instance in the range of from 93 to 102, and most preferably the RON of the gasoline will be at least 94, for instance in the range of from 94 to 100 (EN 25164); the motor octane number (MON) of the gasoline may conveniently be at least 70, for instance in the range of from 70 to 110, preferably the MON of the gasoline will be at least 75, for instance in the range of from 75 to 105, more preferably the MON of the gasoline will be at least 80, for instance in the range of from 80 to 100, most preferably the MON of the gasoline will be at least 82, for instance in the range of from 82 to 95 (EN 25163).

[0016] Typically, gasolines comprise components selected from one or more of the following groups; saturated hydrocarbons, olefinic hydrocarbons, aromatic hydrocarbons, and oxygenated hydrocarbons. Conveniently, the gasoline may comprise a mixture of saturated hydrocarbons, olefinic hydrocarbons, aromatic hydrocarbons, and, optionally, oxygenated hydrocarbons.

[0017] Typically, the olefinic hydrocarbon content of the gasoline is in the range of from 0 to 40 percent by volume based on the gasoline (ASTM D1319); preferably, the olefinic hydrocarbon content of the gasoline is in the range of from 0 to 30 percent by volume based on the gasoline, more preferably, the olefinic hydrocarbon content of the gasoline is in the range of from 0 to 20 percent by volume based on the gasoline.

[0018] Typically, the aromatic hydrocarbon content of the gasoline is in the range of from 0 to 70 percent by volume based on the gasoline (ASTM D1319), for instance the aromatic hydrocarbon content of the gasoline is in the range of from 10 to 60 percent by volume based on the gasoline; preferably, the aromatic hydrocarbon content of the gasoline is in the range of from 0 to 50 percent by volume based on the gasoline, for instance the aromatic hydrocarbon content of the gasoline is in the range of from 10 to 50 percent by volume based on the gasoline.

[0019] The benzene content of the gasoline is at most 10 percent by volume, more preferably at most 5 percent by volume, especially at most 1 percent by volume based on the gasoline.

[0020] The gasoline preferably has a low or ultra low sulphur content, for instance at most 1000 ppmw (parts per million by weight), preferably no more than 500 ppmw, more preferably no more than 100, even more preferably no more than 50 and most preferably no more than even 10 ppmw.

[0021] The gasoline also preferably has a low total lead content, such as at most 0.005 g/l, most preferably being lead free - having no lead compounds added thereto (i.e. unleaded).

[0022] When the gasoline comprises oxygenated hydrocarbons, at least a portion of non-oxygenated hydrocarbons will be substituted for oxygenated hydrocarbons. The oxygen content of the gasoline may be up to 35 percent by weight (EN 1601) (e.g. ethanol per se) based on the gasoline. For example, the oxygen content of the gasoline may be up to 25 percent by weight, preferably up to 10 percent by weight. Conveniently, the oxygenate concentration will have a minimum concentration selected from any one of 0, 0.2, 0.4, 0.6, 0.8, 1.0, and 1.2 percent by weight, and a maximum concentration selected from any one of 5, 4.5, 4.0, 3.5, 3.0, and 2.7 percent by weight.

[0023] Examples of oxygenated hydrocarbons that may be incorporated into the gasoline include alcohols, ethers, esters, ketones, aldehydes, carboxylic acids and their derivatives, and oxygen containing heterocyclic compounds. Preferably, the oxygenated hydrocarbons that may be incorporated into the gasoline are selected from alcohols (such as methanol, ethanol, propanol, 2-propanol, butanol, tert-butanol, iso-butanol and 2-butanol), ethers (preferably ethers containing 5 or more carbon atoms per molecule, e.g., methyl tert-butyl ether) and esters (preferably esters containing 5 or more carbon atoms per molecule); a particularly preferred oxygenated hydrocarbon is ethanol.

[0024] When oxygenated hydrocarbons are present in the gasoline, the amount of oxygenated hydrocarbons in the gasoline may vary over a wide range. For example, gasolines comprising a major proportion of oxygenated hydrocarbons are currently commercially available in countries such as Brazil and U.S.A, e.g. ethanol per se and E85, as well as gasolines comprising a minor proportion of oxygenated hydrocarbons, e.g. E10 and E5. Therefore, the gasoline may contain up to 100 percent by volume oxygenated hydrocarbons. Preferably, the amount of oxygenated hydrocarbons present in the gasoline is selected from one of the following amounts: up to 85 percent by volume; up to 65 percent by volume; up to 30 percent by volume; up to 20 percent by volume; up to 15 percent by volume; and, up to 10 percent by

volume, depending upon the desired final formulation of the gasoline. Conveniently, the gasoline may contain at least 0.5, 1.0 or 2.0 percent by volume oxygenated hydrocarbons.

**[0025]** Examples of suitable gasolines include gasolines which have an olefinic hydrocarbon content of from 0 to 20 percent by volume (ASTM D1319), an oxygen content of from 0 to 5 percent by weight (EN 1601), an aromatic hydrocarbon content of from 0 to 50 percent by volume (ASTM D1319) and a benzene content of at most 1 percent by volume.

**[0026]** Whilst not critical to the present invention, the base gasoline or the gasoline composition of the present invention may conveniently additionally include one or more fuel additive(s). The concentration and nature of the fuel additive(s) that may be included in the base gasoline or the gasoline composition of the present invention is not critical. Non-limiting examples of suitable types of fuel additives that can be included in the base gasoline or the gasoline composition of the present invention include anti-oxidants, corrosion inhibitors, detergents, dehazers, antiknock additives, metal deactivators, valve-seat recession protectant compounds, dyes, friction modifiers, carrier fluids, diluents and markers. Examples of suitable such additives are described generally in US Patent No. 5,855,629.

**[0027]** Conveniently, the fuel additives can be blended with one or more diluents or carrier fluids, to form an additive concentrate, the additive concentrate can then be admixed with the base gasoline or the gasoline composition of the present invention.

**[0028]** The (active matter) concentration of any additives present in the base gasoline or the gasoline composition of the present invention is preferably up to 1 percent by weight, more preferably in the range from 5 to 1000 ppmw, advantageously in the range of from 75 to 300 ppmw, such as from 95 to 150 ppmw.

**[0029]** There is no particular limitation on the type of lubricating composition which can be used in the present invention, provided it is suitable for use in a spark ignition internal combustion engine and provided it contains a Fischer-Tropsch derived base oil.

**[0030]** Fischer-Tropsch derived base oils are known in the art. By the term "Fischer-Tropsch derived" is meant that a base oil is, or is derived from, a synthesis product of a Fischer-Tropsch process. A Fischer-Tropsch derived base oil may also be referred to as a GTL (Gas-To-Liquids) base oil. Suitable Fischer-Tropsch derived base oils that may be conveniently used as the base oil in the lubricating composition are those as for example disclosed in EP 0 776 959, EP 0 668 342, WO97/21788, WO 00/15736, WO 00/14188, WO 00/14187, WO 00/14183, WO 00/14179, WO 00/08115, WO 99/41332, EP 1 029 029, WO 01/18156 and WO 01/57166.

**[0031]** A preferred base oil for use in the lubricating composition herein is a Fischer-Tropsch derived base oil, for example GTL 5 (having a kinematic viscosity at 100°C of approximately 5 mm<sup>2</sup>/s) and GTL 8 (having a kinematic viscosity at 100°C of approximately 8 mm<sup>2</sup>/s), both of which may be prepared according to the method described in WO02/070631.

**[0032]** The Fischer-Tropsch derived base oil is preferably present in the lubricating composition in an amount in the range of from 60% to 95%, more preferably in the range of from 70% to 95% and even more preferably in the range of from 80% to 90%, by weight of the lubricating composition.

**[0033]** The lubricating composition may comprise other types of base oils in addition to the Fischer-Tropsch derived base oil, as well as lubricant performance additives. WO2007/128740 discloses suitable lubricating base oils and additives which may be incorporated into the lubricating composition herein.

**[0034]** Typically the lubricating composition has a relatively low phosphorus content such as below 0.12 wt.% (according to ASTM D 5185). Preferably, the lubricating composition has a phosphorus content of less than 0.08 wt.%. Preferably, the composition has a phosphorus content of above 0.06 wt.%.

**[0035]** Also, it is preferred that the lubricating composition has a sulphur content of less than 0.6 wt.% (according to ASTM D 5185).

**[0036]** Further it is preferred that the lubricating composition has a chlorine content of less than 200 ppm (according to ASTM D 808).

**[0037]** According to an especially preferred embodiment, the lubricating composition has an ash content of below 2.0 wt.% (according to ASTM D 874).

**[0038]** According to an especially preferred embodiment of the present invention, the lubricating composition comprises a zinc dialkyl dithiophosphate (ZDDP) compound. Typically, if present, the ZDDP compound is present in an amount of 0.01-1.5 wt.%, preferably 0.4-1.0 wt.%. The ZDDP compound may have been made from primary, secondary, tertiary alcohols or mixtures thereof, preferably containing less than 12 carbon atoms. Preferably, the ZDDP compound has been made from secondary alcohols containing 3 to 8 carbon atoms.

**[0039]** There are no particular limitations regarding the additional base oils which can be used in the lubricating composition, and various conventional mineral oils, synthetic oils as well as naturally derived esters such as vegetable oils may be conveniently used.

**[0040]** Any additional base oil used may conveniently comprise mixtures of one or more mineral oils and/or one or more synthetic oils; thus, the term "base oil" may refer to a mixture containing more than one base oil. Mineral oils include liquid petroleum oils and solvent-treated or acid-treated mineral lubricating oil of the paraffinic, naphthenic, or mixed paraffinic/naphthenic type which may be further refined by hydrofinishing processes and/or dewaxing.

**[0041]** Suitable base oils for use in the lubricating oil composition are Group I-III mineral base oils, Group IV poly-

alpha olefins (PAOs), and mixtures thereof.

**[0042]** By "Group I", "Group II", "Group III" and "Group IV" base oils are meant lubricating oil base oils according to the definitions of American Petroleum Institute (API) for categories I-IV. These API categories are defined in API Publication 1509, 16th Edition, Appendix E, April 2007.

**[0043]** Synthetic oils include hydrocarbon oils such as olefin oligomers (including polyalphaolefin base oils; PAOs), dibasic acid esters, polyol esters, polyalkylene glycols (PAGs), alkyl naphthalenes and dewaxed waxy isomerates. Synthetic hydrocarbon base oils sold by the Shell Group under the designation "Shell XHVI" (trade mark) may be conveniently used.

**[0044]** Poly-alpha olefin base oils (PAOs) and their manufacture are well known in the art. Preferred poly-alpha olefin base oils that may be used in the lubricating compositions may be derived from linear C<sub>2</sub> to C<sub>32</sub>, preferably C<sub>6</sub> to C<sub>16</sub>, alpha olefins. Particularly preferred feedstocks for said poly-alpha olefins are 1-octene, 1-decene, 1-dodecene and 1-tetradecene.

**[0045]** The total amount of base oil (including the Fischer-Tropsch derived base oil) incorporated in the lubricating composition is preferably present in an amount in the range of from 60 to 99 wt.%, more preferably in an amount in the range of from 65 to 98 wt.%, even more preferably in an amount in the range of from 70 to 95 wt.%, and especially in an amount in the range of from 80% to 90 wt.%, with respect to the total weight of the lubricating composition.

**[0046]** Preferably, the finished lubricating composition has a kinematic viscosity in the range of from 2 to 80 mm<sup>2</sup>/s at 100 °C, more preferably in the range of from 3 to 70 mm<sup>2</sup>/s, most preferably in the range of from 4 to 30 mm<sup>2</sup>/s.

**[0047]** The lubricating composition may further comprise additional additives such as anti-wear additives, anti-oxidants, dispersants, detergents, friction modifiers, viscosity index improvers, pour point depressants, corrosion inhibitors, defoaming agents and seal fix or seal compatibility agents.

**[0048]** As the person skilled in the art is familiar with the above and other additives, these are not further discussed here in detail. Specific examples of such additives are described in for example Kirk-Othmer Encyclopedia of Chemical Technology, third edition, volume 14, pages 477-526.

**[0049]** Preferably the detergent, if present, is selected from phenate- and sulphonate-type detergents; accordingly.

**[0050]** The lubricating compositions may be conveniently prepared by admixing the additives that are usually present in lubricating compositions, for example as hereinbefore described, with the base oil.

**[0051]** The used lubricating composition obtained from a spark-ignition internal combustion engine and comprising a Fischer-Tropsch derived base oil has a reduced toxicity, i.e. it has a significant reduced Mutagenicity Index and also preferably a significantly reduced Fold Increase as measured by the Modified Ames Test (according to ASTM E 1687), compared with a used lubricating composition obtained from a spark ignition internal combustion engine not containing a Fischer-Tropsch derived base oil, e.g. compared with a used lubricating composition based on a mineral oil base oil.

**[0052]** In one embodiment, at the end of the API Sequence III G test the used lubricating composition has a Mutagenicity Index of less than 0.2 as measured by the Modified Ames Test Method.

**[0053]** In another embodiment, at the end of the ACEA TU-5JP-L4 test the used lubricating composition has a

**[0054]** Mutagenicity Index of less than 1.5 as measured by the Modified Ames Test Method.

**[0055]** In a further embodiment the difference in Mutagenicity Index as measured by the Modified Ames Test Method between said used lubricating composition containing a Fischer-Tropsch derived base oil and a used lubricating composition not containing a Fischer-Tropsch derived base oil is 0.1 or greater.

**[0056]** The used lubricating composition is suitable for a variety of uses, such as a fuel in, for example, industrial furnaces or boilers.

**[0057]** The present invention will now be described by reference to the following Examples which are not intended to limit the scope of the invention in any way.

#### Examples

**[0058]** To determine the effect of a Fischer-Tropsch derived base oil on the mutagenicity of used lubricants from gasoline-fuelled spark ignition engines, compared to a mineral oil based used lubricant, industry standard engine tests were carried out.

**[0059]** The first standard engine test was the API Sequence III G test, a test for ILSAC GF-4 and GF-5 and API SM and SN performance level categories. Two different lubricants were used in these tests (Lubricants 1 and 2). The formulations of these two lubricants are set out in Table 1 below. The gasoline fuel used in the test was the industry standard fuel required for the Sequence III G engine test.

Table 1

|                              | Lubricant 1 (5W-20 GTL) | Lubricant 2 (5W-20 Motiva) |
|------------------------------|-------------------------|----------------------------|
| Performance Additive Package | 12                      | 12                         |

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(continued)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Lubricant 1 (5W-20 GTL) | Lubricant 2 (5W-20 Motiva) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------------|
| Viscosity Modifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3                       | 3.2                        |
| Pour Point Depressant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.2                     | 0.2                        |
| Motiva Star 5+ <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0                       | 69.6                       |
| Motiva Star 6 <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0                       | 15                         |
| GTL base oil (4 cSt) <sup>3</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 48.8                    | 0                          |
| GTL base oil (8 cSt) <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 36                      | 0                          |
| 1. A Group II mineral oil base oil commercially available from Motiva Enterprises LLC, Port Arthur, TX, USA<br>2. A Group II mineral oil base oil commercially available from Motiva Enterprises LLC, Port Arthur, TX, USA<br>3. A Fischer-Tropsch derived base oil having a kinematic viscosity at 100°C at approximately 4 cSt which may be conveniently prepared by the process described in WO 02/070631<br>4. A Fischer-Tropsch derived base oil having a kinematic viscosity at 100°C of approximately 8 cSt which may be conveniently prepared by the process described in WO 02/070631 |                         |                            |

**[0060]** The second standard engine test was the ACEA TU-5JP-L4 test, a test for e.g. ACEA A1-02, ACEA A2-96, ACEA A3-02, ACEA A5-2 and ACEA C4 performance level categories. Two different lubricants were used in this test (Lubricants 3 and 4). The formulations of these two lubricants are set out in Table(s) 2 below. The gasoline fuel used in the trial was the industry standard fuel required for the ACEA TU-5JP-L4 engine test.

Table 2

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Lubricant 3 (5W-30 Yubase) %m | Lubricant 4 (5W-30 GTL) %m |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------------------|
| Performance Additive Package                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 12                            | 12                         |
| Pour Point Depressant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.5                           | 0.5                        |
| Antifoam agent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.1                           | 0.1                        |
| Viscosity Modifier concentrate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 5.0                           | 3.7                        |
| GTL base oil (4 cSt) <sup>5</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0                             | 22.5                       |
| GTL base oil (8 cSt) <sup>6</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0                             | 61.2                       |
| Yubase 4 <sup>7</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 49.4                          | 0                          |
| Yubase 6 <sup>8</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 33.0                          | 0                          |
| 5. A Fischer-Tropsch derived base oil having a kinematic viscosity at 100°C of approximately 4 cSt which may be conveniently prepared by the process described in WO 02/070631<br>6. A Fischer-Tropsch derived base oil having a kinematic viscosity at 100°C of approximately 8 cSt which may be conveniently prepared by the process described in WO 02/070631<br>7. API Group III base oil commercially available from SK Energy, Ulsan, South Korea<br>8. API Group III base oil commercially available from SK Energy, Ulsan, South Korea |                               |                            |

**[0061]** Each engine test type used the appropriate standard gasoline fuel and one lubricant (1, 2, 3 or 4) as shown in Table 3 below. The Mutagenicity Index (MI) of each of the lubricants was measured before the vehicle had done any mileage (designated as "start" of the test in Table 3 below) and was measured again at the end of the industry standard test, (designated as "end" of the test in Table 3 below) using the Modified Ames Test Method (according to ASTM E1687). The results are shown in Table 3 below.

Table 3

| Test No. | Engine Test Type        | Lubricant (1/2/3/4) | Start/ End of Test | MI  |
|----------|-------------------------|---------------------|--------------------|-----|
| 1        | API Sequence III G test | 1 (5W-20 GTL)       | Start              | 0   |
| 1        | API Sequence III G test | 1 (5W-20 GTL)       | End                | 0.1 |

(continued)

| Test No. | Engine Test Type        | Lubricant (1/2/3/4)       | Start/ End of Test | MI   |
|----------|-------------------------|---------------------------|--------------------|------|
| 2        | API Sequence III G test | 2 (5W-20 Motiva Group II) | Start              | 0    |
| 2        | API Sequence III G test | 2 (5W-20 Motiva Group II) | End                | 0.21 |
| 3        | ACEA TU-5JP-L4          | 3 (5W-30 Yubase)          | Start              | 0    |
| 3        | ACEA TU-5JP-L4          | 3 (5W-30 Yubase)          | End                | 1.6  |
| 4        | ACEA TU-5JP-L4          | 4 (5W-30 GTL)             | Start              | 0    |
| 4        | ACEA TU-5JP-L4          | 4 (5W-30 GTL)             | End                | 1.2  |

### Discussion

**[0062]** As can be seen from the results in Table 3 Lubricants 1 and 4 (containing a GTL base oil) had a much lower Mutagenicity Index at the end of the relevant test than their corresponding Lubricants 2 and 3 (not containing a GTL base oil).

### Claims

1. Use of a Fischer-Tropsch derived base oil for the purpose of reducing the toxicity of a used lubricating composition obtained from a spark ignition internal combustion engine fuelled with a gasoline composition, wherein the Fischer-Tropsch derived base oil is incorporated into the lubricating composition before use in an engine.
2. Use according to Claim 1 wherein the Fischer-Tropsch derived base oil has a kinematic viscosity at 100°C in the range of from 2.5 to 25 mm<sup>2</sup>/s.
3. Use according to Claim 1 or 2 wherein the Fischer-Tropsch derived base oil has a kinematic viscosity at 100°C in the range of from 3.5 to 15 mm<sup>2</sup>/s.
4. Use according to any of Claims 1 to 3 wherein the Fischer-Tropsch derived base oil is present in an amount of from 70% to 95%, by weight of the lubricating composition.
5. Use according to any of Claims 1 to 4 wherein the lubricating composition comprises one or more lubricant additives.

### Patentansprüche

1. Verwendung eines nach dem Fischer-Tropsch-Verfahren abgeleiteten Basisöls zum Zweck des Verringerns der Toxizität einer gebrauchten Schmiermittelzusammensetzung, erhalten aus einem Verbrennungsmotor mit Fremdzündung, der mit einer Benzinzusammensetzung betrieben wird, wobei das nach dem Fischer-Tropsch-Verfahren abgeleitete Basisöl vor der Verwendung in einem Motor in die Schmiermittelzusammensetzung aufgenommen wird.
2. Verwendung nach Anspruch 1, wobei das nach dem Fischer-Tropsch-Verfahren abgeleitete Basisöl eine kinematische Viskosität bei 100 °C im Bereich von 2,5 bis 25 mm<sup>2</sup>/s aufweist.
3. Verwendung nach Anspruch 1 oder 2, wobei das nach dem Fischer-Tropsch-Verfahren abgeleitete Basisöl eine kinematische Viskosität bei 100 °C im Bereich von 3,5 bis 15 mm<sup>2</sup>/s aufweist.
4. Verwendung nach einem der Ansprüche 1 bis 3, wobei das nach dem Fischer-Tropsch-Verfahren abgeleitete Basisöl in einer Menge von 70 Gew.-% bis 95 Gew.-% bezogen auf die Schmiermittelzusammensetzung vorliegt.
5. Verwendung nach einem der Ansprüche 1 bis 4, wobei die Schmiermittelzusammensetzung einen oder mehrere Schmiermittelzusätze umfasst.

**Revendications**

1. Utilisation d'une huile de base dérivée de Fischer-Tropsch dans le but de réduire la toxicité d'une composition lubrifiante usée obtenue à partir d'un moteur à combustion interne à allumage par étincelle alimenté par une composition d'essence, l'huile de base dérivée de Fischer-Tropsch étant incorporée dans la composition lubrifiante avant d'être utilisée dans un moteur.
2. Utilisation selon la revendication 1, dans laquelle l'huile de base dérivée de Fischer-Tropsch a une viscosité cinématique à 100°C dans la plage de 2,5 à 25 mm<sup>2</sup>/s.
3. Utilisation selon la revendication 1 ou 2, dans laquelle l'huile de base dérivée de Fischer-Tropsch a une viscosité cinématique à 100°C dans la plage de 3,5 à 15 mm<sup>2</sup>/s.
4. Utilisation selon l'une quelconque des revendications 1 à 3, dans laquelle l'huile de base dérivée de Fischer-Tropsch est présente en une quantité de 70 % à 95 % en poids de la composition lubrifiante.
5. Utilisation selon l'une quelconque des revendications 1 à 4, dans laquelle la composition lubrifiante comprend un ou plusieurs additifs lubrifiants.

**REFERENCES CITED IN THE DESCRIPTION**

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