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(54) **USE OF A LUBRICANT COMPOSITION FOR REDUCING KNOCKING**

(71) Applicant: **TOTAL MARKETING SERVICES**, Puteaux (FR)

(72) Inventors: **Nicholas OBRECHT**, Lyon (FR); **Steve FAURE**, Mornant (FR)

(73) Assignee: **TOTAL MARKETING SERVICES**, Puteaux (FR)

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(57) **ABSTRACT**

The present disclosure relates to a lubricant composition including at least one base oil and at least one organic compound. The lubricant composition thus makes it possible to reduce, or even to eliminate knock in a vehicle engine, preferably a motor vehicle engine.

USE OF A LUBRICANT COMPOSITION FOR REDUCING KNOCKING

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a National Phase Entry of International Patent Application No. PCT/EP2015/058615, filed on Apr. 21, 2015, which claims priority to French Patent Application Serial No. 1453752, filed on Apr. 25, 2014, both of which are incorporated by reference herein.

TECHNICAL FIELD

[0002] The present invention relates to the field of lubricants, more particularly to the field of the engine lubricants. More particularly, the present invention relates to the use of a lubricant composition in order to reduce knock in a vehicle engine, said lubricant composition comprising at least one base oil and at least one organic anti-knock compound. The lubricant composition according to the invention thus makes it possible to reduce, or even to eliminate knock in a vehicle engine, preferably a motor vehicle engine, while retaining good lubrication properties.

[0003] The present invention also relates to a lubricating process implementing this composition. The present invention also relates to a process for reducing or even eliminating knock in a vehicle engine, preferably a motor vehicle engine, utilizing this lubricant composition. The present invention also relates to the use of an organic compound in a lubricant composition in order to reduce or even eliminate knock in a vehicle engine, preferably a motor vehicle engine. The present invention also relates to the use of a composition of the additive-concentrate type comprising at least one organic compound in order to reduce or even eliminate knock in a vehicle engine, preferably a motor vehicle engine, utilizing said organic compound.

BACKGROUND

[0004] Knock is a phenomenon which occurs in a positive ignition engine of a vehicle, and more particularly in a positive ignition engine of motor vehicles and which is due to the auto-ignition of the fuel upstream of the flame front in the combustion chamber. This auto-ignition propagates at very high speed in the combustion chamber and causes high-frequency vibrations in the gaseous mass, and thermal overload of the engine which may even result serious mechanical incidents. The solutions commonly used by engine manufacturers in order to avoid this phenomenon, such as reducing the ignition advance, significantly reduce the efficiency of positive ignition engines.

[0005] Moreover, following the establishment of the Kyoto protocol, new standards protecting the environment require the automotive sector to construct vehicles with reduced polluting emissions. Nowadays there is a tendency to reduce the size of vehicle engines, which engines however have to operate at high power levels in order to optimize the gain in fuel economy. However, this saving can be very easily distorted by the knock phenomenon.

[0006] Combustion is a compromise between the speed of propagation of the flame front originating from the spark plug and the auto-ignition delay time of the fuel. When the latter is too short, knock occurs in the areas distant from the spark plug and most often close to the piston and the cylinder. A lubricant, and more particularly an engine lubricant, is used in the cylinders in order to reduce friction as well as the risks of wear. The proximity of the engine lubricant to the areas where knock appears opens up the possibility of interaction between the lubricant and the combustion. Thus, lubricants making it possible to attenuate or even to reduce engine knock have been sought.

[0007] U.S. Pat. Nos. 2,763,613 and 2,898,359 have in particular described the use of anti-knock compounds selected from organometallic compounds, and more particularly ferrocene-type compounds in a lubricant composition. Moreover, document WO2004/101717 describes the use of manganese-based organometallic compounds in a lubricant composition in order to reduce the knock phenomenon in an engine. However, the use of such organometallic compounds promotes deposits in the combustion chamber and can thus lead to abnormal combustion such as pre-ignition which can cause significant mechanical malfunction(s). Furthermore, they can present a risk to human health.

[0008] Document WO2004/104717 also describes various organic compounds of the alcohol, ester or ether type that can be used in a lubricant composition in order to reduce the knock phenomenon in an engine. Moreover, U.S. Pat. No. 8,129,320 describes oils selected from trimellitic acid esters or also compounds of the alkyl naphthalene type, as well as the use thereof in a lubricant composition in order to reduce the knock phenomenon in an engine. However, the content by weight of these oils in the lubricant is at least 50% which can greatly reduce performance(s) in terms of the reduction of friction or resistance to oxidation of the lubricant composition. Thus, there is still a need to have available organic compounds that make it possible to reduce or even to eliminate the knock phenomenon in an engine and that can be easily formulated in a lubricant composition.

[0009] An objective of the present invention is therefore to provide organic compounds as well as a lubricant composition comprising these organic compounds which overcome all or some of the abovementioned drawbacks. Another objective of the present invention is to provide a composition making it possible to reduce or even to eliminate engine knock and the formulation of which is easy to implement. Another objective of the present invention is to provide a lubricant composition making it possible to reduce or even to eliminate engine knock while avoiding the occurrence of deposits in the combustion chamber. Another objective of the present invention is to provide a lubricating process making it possible to reduce or even to eliminate engine knock.

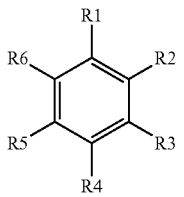
SUMMARY

[0010] An object of the invention is thus the use of a lubricant composition in order to reduce knock in a vehicle engine, preferably a motor vehicle engine, said lubricant composition comprising:

[0011] at least one base oil,

[0012] at least one compound of formula (I):

(I)



[0013] in which:

[0014] R1 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR7 group, an —NR8R9 group;

[0015] R2 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR10 group, an —NR11R12 group;

[0016] R3 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR13 group, an —NR14R15 group;

[0017] R4 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR16 group, an —NR17R18 group;

[0018] R5 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR19 group, an —NR20R21 group;

[0019] R6 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR22 group, an —NR23R24 group;

[0020] R7, R10, R13, R16, R19 and R22, identical or different, represent independently a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms;

[0021] R8, R9, R11, R12, R14, R15, R17, R18, R20, R21, R23 and R24, identical or different, represent independently a hydrogen atom or a saturated or unsaturated, substituted or unsubstituted alkyl group, comprising from 1 to 3 carbon atoms;

[0022] at least one of the R1, R2, R3, R4, R5 and R6 groups is different from a hydrogen atom.

[0023] Surprisingly, the applicant has found that the presence of a compound of formula (I) as defined above in a lubricant composition makes it possible for the lubricant composition, once utilized in an engine, to reduce or even to eliminate the knock phenomenon in the engine. Thus the present invention makes it possible to formulate lubricant compositions having both a good stability and good properties of reduction or even elimination of the knock phenomenon once utilized in an engine.

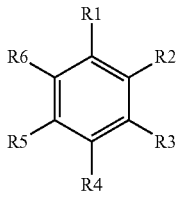
[0024] Advantageously, the lubricant compositions according to the invention have good properties of reduction or even elimination of the knock phenomenon once utilized in an engine without needing to add a high content of anti-knock compound in the lubricant composition. Advantageously, the lubricant compositions according to the invention have good properties of reduction or even elimination of the knock phenomenon once utilized in an engine without needing to add thereto other anti-knock additives, and in particular no anti-knock additives selected from the organometallic compounds. Advantageously, the lubricant compositions according to the invention have good properties of reduction or even elimination of the knock phenomenon once utilized in an engine and the formulation of which is easy to implement. Advantageously, the lubricant compositions according to the invention have good properties of reduction or even elimination of the knock phenomenon once utilized in an engine while making it possible to reduce or even to eliminate the risk of deposits in the combustion chamber.

[0025] In an embodiment of the invention, the lubricant composition essentially consists of:

[0026] at least one base oil,

[0027] at least one compound of formula (I):

(I)



[0028] in which:

[0029] R1 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR7 group, an —NR8R9 group;

[0030] R2 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR10 group, an —NR11R12 group;

[0031] R3 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR13 group, an —NR14R15 group;

[0032] R4 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR16 group, an —NR17R18 group;

[0033] R5 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR19 group, an —NR2OR21 group;

[0034] R6 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR22 group, an —NR23R24 group;

[0035] R7, R10, R13, R16, R19 and R22, identical or different, represent independently a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms;

[0036] R8, R9, R11, R12, R14, R15, R17, R18, R20, R21, R23 and R24, identical or different, represent independently a hydrogen atom or a saturated or unsaturated, substituted or unsubstituted alkyl group, comprising from 1 to 3 carbon atoms;

[0037] at least one of the R1, R2, R3, R4, R5 and R6 groups is different from a hydrogen atom.

[0038] The invention also relates to an engine oil comprising a lubricant composition as defined above. The invention also relates to the use of a lubricant composition as defined above for the lubrication of vehicle engines, preferentially motor vehicle engines. The invention also relates to the use of a lubricant composition as defined above in order to reduce or even eliminate knock in engines, preferentially motor vehicle engines.

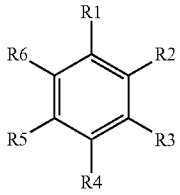
[0039] The invention also relates to a lubricating process of a vehicle engine, preferably a motor vehicle engine, said

process comprising at least one step of bringing a mechanical part of the engine into contact with a lubricant composition as defined above. The invention also relates to a process for reducing or even eliminating knock in a vehicle engine, preferentially motor vehicle engines, comprising at least one step of bringing a mechanical part of the engine of the vehicle into contact with a lubricant composition as defined above. The invention also relates to the use of a compound of formula (I) as defined above in a lubricant composition in order to reduce or even eliminate knock in engines, preferentially motor vehicle engines.

[0040] The invention also relates to the use of a composition of the additive-concentrate type in a lubricant composition comprising at least one base oil in order to reduce or even eliminate knock in engines, preferentially motor vehicle engines, said composition of the additive-concentrate type comprising:

[0041] at least one compound of formula (I):

(I)



[0042] in which:

[0043] R1 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR7 group, an —NR8R9 group;

[0044] R2 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR10 group, an —NR11R12 group;

[0045] R3 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR13 group, an —NR14R15 group;

[0046] R4 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR16 group, an —NR17R18 group;

[0047] R5 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR19 group, an —NR20R21 group;

[0048] R6 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR22 group, an —NR23R24 group;

[0049] R7, R10, R13, R16, R19 and R22, identical or different, represent independently a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms;

[0050] R8, R9, R11, R12, R14, R15, R17, R18, R20, R21, R23 and R24, identical or different, represent independently a hydrogen atom or a saturated or unsaturated, substituted or unsubstituted alkyl group, comprising from 1 to 3 carbon atoms;

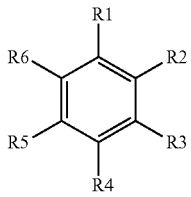
[0051] at least one of the R1, R2, R3, R4, R5 and R6 groups is different from a hydrogen atom.

[0052] at least one additive selected from the detergents, friction modifiers, anti-wear additives, dispersants, extreme-pressure additives, antioxidants, viscosity index improver polymers, flow point improvers, anti-foaming agents, thickeners and mixtures thereof.

DETAILED DESCRIPTION

[0053] The percentages indicated below correspond to percentages by weight of active ingredient. The lubricant composition comprises at least one compound of formula (I):

(I)



in which:

[0054] R1 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR7 group, an —NR8R9 group;

[0055] R2 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR10 group, an —NR11R12 group;

[0056] R3 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR13 group, an —NR14R15 group;

[0057] R4 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR16 group, an —NR17R18 group;

[0058] R5 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR19 group, an —NR20R21 group;

[0059] R6 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR22 group, an —NR23R24 group;

[0060] R7, R10, R13, R16, R19 and R22, identical or different, represent independently a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms;

[0061] R8, R9, R11, R12, R14, R15, R17, R18, R20, R21, R23 and R24, identical or different, represent independently a hydrogen atom or a saturated or unsaturated, substituted or unsubstituted alkyl group, comprising from 1 to 3 carbon atoms;

[0062] at least one of the R1, R2, R3, R4, R5 and R6 groups is different from a hydrogen atom.

[0063] Thus, the compound of formula (I) as defined above comprises no metal nor any metallic derivative. The compound of formula (I) as defined above is not an orga-

nometallic compound. The compound of formula (I) as defined above comprises at least one R1 to R6 group different from a hydrogen atom. Thus, the compound of formula (I) as defined above is different from benzene. In an embodiment of the invention, the lubricant composition comprises at least one compound of formula (I) as defined above in which R1 represents a hydrogen atom.

[0064] In a preferred embodiment of the invention, the lubricant composition comprises at least one compound of formula (I) as defined above in which:

[0065] R1 represents a hydrogen atom,

[0066] R2 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, preferably from 1 to 5 carbon atoms, advantageously from 1 to 3 carbon atoms,

[0067] R3 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, preferably from 1 to 5 carbon atoms, advantageously from 1 to 3 carbon atoms,

[0068] R4 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, preferably from 1 to 5 carbon atoms, advantageously from 1 to 3 carbon atoms,

[0069] R5 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, preferably from 1 to 5 carbon atoms, advantageously from 1 to 3 carbon atoms,

[0070] R6 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, preferably from 1 to 5 carbon atoms, advantageously from 1 to 3 carbon atoms,

[0071] at the most one of the R2 to R6 groups represents a hydrogen atom.

[0072] As an example compound of formula (I) used according to the invention 1,2,4,5-tetramethylbenzene can be mentioned. In another embodiment of the invention, the lubricant composition comprises at least one compound of formula (I) as defined above in which R1 represents a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR7 group, an —NR8R9 group, R7, R8 and R9 being as defined above.

[0073] In a preferred embodiment of the invention, the lubricant composition comprises at least one compound of formula (I) as defined above in which:

[0074] R1 represents a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferably from 1 to 3 carbon atoms, advantageously a methyl or ethyl group,

[0075] R2 represents a hydrogen atom or a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferably from 1 to 3 carbon atoms, advantageously a methyl or ethyl group,

[0076] R3 represents a hydrogen atom or a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferably from 1 to 3 carbon atoms, advantageously a methyl or ethyl group,

[0077] R4 represents a hydrogen atom or a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferably from 1 to 3 carbon atoms, advantageously a methyl or ethyl group,

[0078] R5 represents a hydrogen atom or a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferably from 1 to 3 carbon atoms, advantageously a methyl or ethyl group,

[0079] R6 represents a hydrogen atom or a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferably from 1 to 3 carbon atoms, advantageously a methyl or ethyl group,

[0080] only two of the R2 to R6 groups represent a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferably from 1 to 3 carbon atoms, advantageously a methyl or ethyl group.

[0081] Thus, as an example of the compound of formula (I) used according to the invention, 1,3,5-trimethylbenzene (or mesitylene) can be mentioned. In a preferred embodiment of the invention, the lubricant composition comprises at least one compound of formula (I) as defined above in which R5 represents a hydrogen atom. In another preferred embodiment of the invention, the lubricant composition comprises at least one compound of formula (I) as defined above in which R6 represents a hydrogen atom.

[0082] In a preferred embodiment of the invention, the lubricant composition comprises a compound of formula (I) as defined above in which R1 represents:

- **[0083]** a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;
- **[0084]** an —OR7 group in which R7 represents a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;
- **[0085]** an —NR8R9 group in which:
  - **[0086]** R8 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;
  - **[0087]** R9 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

[0088] In another preferred embodiment of the invention, the lubricant composition comprises a compound of formula (I) as defined above in which R2 represents:

- **[0089]** a hydrogen atom;
- **[0090]** a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;
- **[0091]** an —NR11R12 group in which:
  - **[0092]** R11 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;
  - **[0093]** R12 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

[0094] In another preferred embodiment of the invention, the lubricant composition comprises a compound of formula (I) as defined above in which R3 represents:

- **[0095]** a hydrogen atom;
- **[0096]** a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;
- **[0097]** an —NR14R15 group in which:
  - **[0098]** R14 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;
  - **[0099]** R15 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

[0100] In another preferred embodiment of the invention, the lubricant composition comprises a compound of formula (I) as defined above in which R4 represents:

[0101] a hydrogen atom;

[0102] a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;

[0103] an —NR17R18 group in which:

[0104] R17 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0105] R18 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

[0106] In another preferred embodiment of the invention, the lubricant composition comprises at least one compound of formula (I) in which: R1 represents:

[0107] a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;

[0108] an —OR7 group in which R7 represents a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;

[0109] an —NR8R9 group in which:

[0110] R8 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0111] R9 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms,

and R2 represents:

[0112] a hydrogen atom;

[0113] a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;

[0114] an —NR11R12 group in which:

[0115] R11 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0116] R12 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms,

and R3 represents:

[0117] a hydrogen atom;

[0118] a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;

[0119] an —NR14R15 group in which:

[0120] R14 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0121] R15 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms,

and R4 represents:

[0122] a hydrogen atom;

[0123] a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;

[0124] an —NR17R18 group in which:

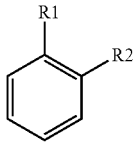
[0125] R17 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0126] R18 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms,

and R5 and R6 both represent a hydrogen atom.

[0127] In another embodiment of the invention, the lubricant composition comprises at least one compound of formulae (Ia) to (If):

(Ia)



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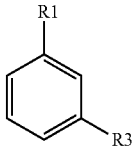

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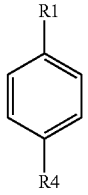

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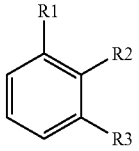

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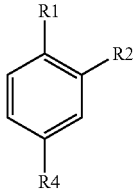

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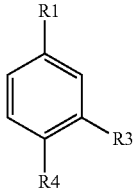


in which:

[0128] R1 represents a saturated, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR7 group, an —NR8R9 group;

[0129] R2 represents a hydrogen atom, a saturated, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR10 group, an —NR11R12 group;

[0130] R3 represents a hydrogen atom, a saturated, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR13 group, an —NR14R15 group;

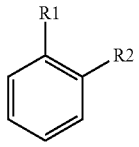
[0131] R4 represents a hydrogen atom, a saturated, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR16 group, an —NR17R18 group;

[0132] R7, R10, R13 and R16, identical or different, represent independently a saturated, linear or branched alkyl group, comprising from 1 to 10 carbon atoms;

[0133] R8, R9, R11, R12, R14, R15, R17 and R18, identical or different, represent independently a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

[0134] In a preferred embodiment of the invention, the lubricant composition comprises at least one compound of formulae (Ia) to (Ic):

(Ia)



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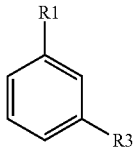
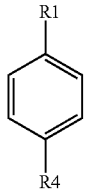


(Ic)



in which:

R1 represents:

[0135] a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;

[0136] an —OR7 group in which R7 represents a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;

[0137] an —NR8R9 group in which:

[0138] R8 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0139] R9 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms,

and R2 represents:

[0140] a hydrogen atom;

[0141] a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;

[0142] an —NR11R12 group in which:

[0143] R11 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0144] R12 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms,

and R3 represents:

[0145] a hydrogen atom;

[0146] a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;

[0147] an —NR14R15 group in which:

[0148] R14 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0149] R15 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms,

and R4 represents:

[0150] a hydrogen atom;

[0151] a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferentially from 1 to 3 carbon atoms;

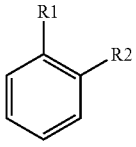
[0152] an —NR17R18 group in which:

[0153] R17 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0154] R18 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

[0155] In a more preferred embodiment of the invention, the lubricant composition comprises at least one compound of formulae (Ia) to (Ic):

(Ia)



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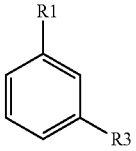

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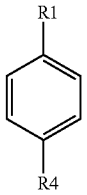


in which:

[0156] R1 represents an —OR7 group in which R7 represents a saturated alkyl group comprising from 1 to 3 carbon atoms;

[0157] R2 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0158] R3 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0159] R4 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

[0160] Advantageously, the lubricant composition comprises at least one compound of formulae (Ia) to (Ic) as defined above in which:

[0161] R1 represents an —OCH_3 or $-OC_2H_5$ group, preferably $-OC_2H_5$;

[0162] R2 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

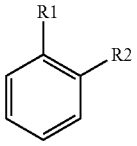
[0163] R3 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0164] R4 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

As examples of compound of formula (I) used according to the invention, methoxybenzene or ethoxybenzene can be mentioned.

[0165] In another more preferred embodiment of the invention, the lubricant composition comprises at least one compound of formulae (Ia) to (Ic):

(Ia)



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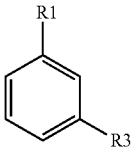

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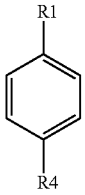


in which:

[0166] R1 represents an —NR8R9 group in which:

[0167] R8 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0168] R9 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0169] R2 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an —NR11R12 group;

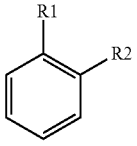
[0170] R3 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an —NR14R15 group;

[0171] R4 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an —NR17R18 group;

[0172] R11, R12, R14, R15, R17 and R18, identical or different, represent independently a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

[0173] In another even more preferred embodiment of the invention, the lubricant composition comprises at least one compound of formulae (Ia) to (Ic):

(Ia)



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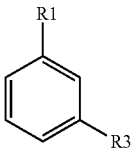

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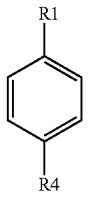


in which:

[0174] R1 represents an —NR8R9 group in which:

[0175] R8 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0176] R9 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

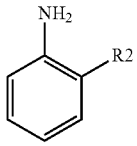
[0177] R2 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an —NH_2 group;

[0178] R3 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an —NH_2 group;

[0179] R4 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an —NH_2 group.

[0180] Advantageously, the lubricant composition comprises at least one compound of formulae (Ia) to (Ic):

(Ia)



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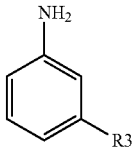

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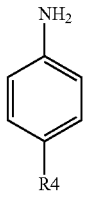


in which:

[0181] R2 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an —NH_2 group;

[0182] R3 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an —NH_2 group;

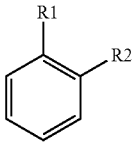
[0183] R4 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an —NH_2 group.

As examples of compound (I) used according to the invention, aniline, ortho-phenylenediamine, meta-phenylenedi-

amine, para-phenylenediamine, ortho-toluidine, meta-toluidine or para-toluidine can be mentioned.

[0184] Advantageously, the lubricant composition comprises at least one compound of formulae (Ia) to (Ic):

(Ia)



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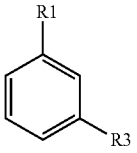

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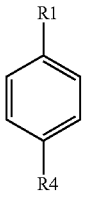


in which:

[0185] R1 represents an —NR8R9 group in which:

[0186] R8 represents a saturated alkyl group comprising from 1 to 3 carbon atoms;

[0187] R9 represents a saturated alkyl group comprising from 1 to 3 carbon atoms;

[0188] R2 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an —NH_2 group;

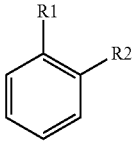
[0189] R3 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an —NH_2 group;

[0190] R4 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an —NH_2 group.

As an example of compounds of formula (I) used according to the invention dimethylaniline can be mentioned.

[0191] In another more preferred embodiment of the invention, the lubricant composition comprises at least one compound of formulae (Ia) to (Ic):

(Ia)



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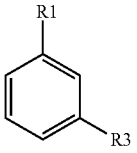

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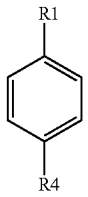


in which:

[0192] R1 represents a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms;

[0193] R2 represents a hydrogen atom or saturated, linear or branched alkyl comprising from 1 to 5 carbon atoms;

[0194] R3 represents a hydrogen atom or a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms;

[0195] R4 represents a hydrogen atom or a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms.

[0196] Advantageously, the lubricant composition used according to the invention comprises at least one compound of formulae (Ia) to (Ic) as defined above in which:

[0197] R1 represents a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms, preferably comprising from 1 to 3 carbon atoms;

[0198] R2 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0199] R3 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

[0200] R4 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

[0201] As examples of compounds of formula (I) used according to the invention, toluene, ortho-xylene, meta-xylene, para-xylene, ortho-cymene, meta-cymene or para-cymene can be mentioned. In an embodiment of the invention, the content by weight of the compound of formula (I) ranges from 0.5 to 25%, preferably from 1 to 20%, advantageously from 5 to 15% with respect to the total weight of the lubricant composition.

[0202] In an embodiment of the invention, the compound of formula (I) can be presented in a pure form. By "pure form" according to the invention is meant that the compound of formula (I) is single-component and comprise no other component other than the compound of formula (I) or is not combined with another compound.

[0203] In another embodiment of the invention, the compound of formula (I) can be encapsulated. Thus, the compound of formula (I) can be presented in the form of a capsule or of a microcapsule comprising a minimal content of the compound of formula (I), this minimal content being selected so that the content by weight of the compound of formula (I) ranges from 0.5 to 25%, preferably from 1 to 20%, advantageously from 5 to 15% with respect to the total weight of the lubricant composition. The capsules or microcapsules comprising the compound of formula (I) can be selected from any type of capsules or microcapsules known to a person skilled in the art. The capsules or microcapsules can in particular be constituted by a polymeric envelope selected from the polyurethanes, polyureas, polystyrenes,

polyesters, polyamides or copolymers thereof, the polyacrylonitriles, vinyl resins, formaldehyde-based resins or also aminoplast resins.

[0204] In a preferred embodiment of the invention, compound (I) will be released out of the capsules or microcapsules when the capsules or microcapsules are subjected to physical-chemical stresses, and more particularly when the capsules or microcapsules are subjected to high temperatures, for example temperatures greater than 150° C. as can be encountered in the areas close to the piston, or when the capsules or microcapsules are subjected to strong shear stresses, which is generally the case in an engine, corresponding for example to values of 10 to 100 million reciprocal seconds (s^{-1}), or also when the capsules or microcapsules are subjected to variations in the acidity or basicity of the surrounding medium, and more particularly to variations in acidity as can occur in the piston/liner zone. Examples of capsules or microcapsules that can be used in the present invention are in particular described in documents WO2010/134044, U.S. Patent Publication No. 2013/0146009 or WO2014/046876.

[0205] In another embodiment of the invention, compound (I) can be released by volatilization. The volatilization of the compound of formula (I) can in particular be implemented by adjustment of the distillation curve of the lubricant composition. As an example, the use of a compound of formula (I) can be mentioned, which is more volatile than the remainder of the lubricant composition and which makes it possible to extract the compound of formula (I) in the areas subjected to temperatures greater than the boiling point of the compound of formula (I) but less than the boiling point of the lighter components of the remainder of the lubricant composition. In another embodiment of the invention, the compound of formula (I) can be synthesized in situ in the lubricant composition.

Base Oil

[0206] The lubricant compositions used according to the invention can contain any type of lubricant base oil, mineral, synthetic or natural, animal or vegetable suited to their use. The base oil or oils used in the lubricant compositions used according to the present invention can be oils of mineral or synthetic origin of Groups I to V according to the classes defined in the API classification (or their equivalents according to the ATIEL classification) as summarized below, alone or in a mixture.

TABLE I

	Saturates content	Sulphur content	Viscosity index (VI)
Group I Mineral oils	<90%	>0.03%	80 ≤ VI ≤ 120
Group II Hydrocracked oils	≥90%	≤0.03%	80 ≤ VI ≤ 120
Group III Hydrocracked or hydro-isomerized oils	≥90%	≤0.03%	≥120
Group IV	Poly Alpha Olefins (PAO)		
Group V	Esters and other bases not included in bases of Groups I to IV		

[0207] The mineral base oils used according to the invention include any type of bases obtained by atmospheric and vacuum distillation of crude oil, followed by refining operations such as solvent extraction, deasphalting, solvent dewaxing, hydrotreatment, hydrocracking and hydroisomerization, hydrofinishing. The base oils of the lubricant compositions used according to the invention can also be synthetic oils, such as certain esters of carboxylic acids and alcohols, or poly alpha olefins. The poly alpha olefins used as base oils, are for example obtained from monomers having 4 to 32 carbon atoms (for example octene, decene), and a viscosity at 100° C. comprised between 1.5 and 15 cSt according to the standard ASTM D445. Their weight-average molecular weight is typically comprised between 250 and 3000 according to the standard ASTM D5296. Mixtures of synthetic oils and mineral oils can also be used. There is no limitation on the use of a particular lubricating base for producing the lubricating compositions according to the invention, except that they must have properties, in particular in terms of viscosity, viscosity index, sulphur content, oxidation resistance, suitable for use in a gearbox, in particular in a motor vehicle gearbox, in particular in a manual gearbox.

[0208] In an embodiment of the invention, the lubricating bases represent at least 50% by weight, relative to the total weight of the lubricating composition, preferentially at least 60%, or also at least 70%. Typically, they represent between 75 and 99.9% by weight, with respect to the total weight of the lubricant compositions according to the invention.

[0209] In a preferred embodiment of the invention, the lubricant compositions comprise mineral bases of Group I and/or III, or synthetic bases of Group IV according to the API classification. In another preferred embodiment of the invention, the lubricant compositions have a kinematic viscosity at 100° C. measured according to the standard ASTM D445 ranging from 3 to 25 cSt, preferably from 5 to 22 cSt, advantageously from 5 to 13 cSt. In another preferred embodiment of the invention, the lubricant compositions have a viscosity index (VI) greater than or equal to 130, preferentially greater than or equal to 140, advantageously greater than or equal to 150 measured according to the standard ISO 2909.

Other Additives

[0210] The lubricant compositions used according to the invention can in addition also contain at least one additive selected from the detergents, anti-wear additives, extreme-pressure additives, dispersants, antioxidants, flow point improvers, anti-foaming agents, thickeners, viscosity index improver polymers and mixtures thereof. The anti-wear and extreme-pressure additives protect the surfaces subject to friction by the formation of a protective film adsorbed onto these surfaces. A great variety of anti-wear additives exists, but the category most widely used in the lubricant compositions, in particular for engine oil, is that of the phosphorus- and sulphur-containing additives, such as the metallic alkylthiophosphates, in particular the zinc alkylthiophosphates, and more specifically the zinc dialkyldithiophosphates or ZnDTPs. The amine phosphates are also anti-wear additives which can be used in the lubricant compositions used according to the invention. However, the phosphorus provided by these additives acts as a poison on the catalytic systems of motor vehicles as these additives generate ashes. These effects can be minimized by partially substituting the amine phosphates with additives which do not provide phosphorus, such as, for example, the polysulphides, in particular the sulphur-containing olefins. In an embodiment,

in particular for an engine application, the anti-wear and extreme-pressure additives can be present in the lubricant composition at levels ranging from 0.01 to 6%) by weight, preferentially from 0.05 and 4%, preferentially from 0.1% to 2% with respect to the total weight of the lubricant composition.

[0211] The friction modifier additive can be a compound providing the metal elements or an ash-free compound. Among the compounds supplying metal elements, the transition metal complexes such as Mo, Sb, Sn, Fe, Cu, Zn, W can be mentioned, the ligands of which can be hydrocarbon-containing compounds containing oxygen, nitrogen, sulphur or phosphorus atoms, and in particular the molybdenum dithiocarbamates. The ash-free friction modifiers are of organic origin and can be selected from the monoesters of fatty acids and polyols, alkoxylated amines, alkoxylated fatty amines, fatty epoxides, borated fatty epoxides; fatty amines or glycerol esters of fatty acids. By "fatty" is meant, within the meaning of the present invention, a hydrocarbon group comprising from 10 to 24 carbon atoms. In an embodiment, the friction modifier additive can be present at levels ranging from 0.01 to 5% by weight, preferentially from 0.1 to 2% with respect to the total weight of the lubricant composition.

[0212] The antioxidant additives slow down the degradation of the lubricant compositions in service, in particular of the engine oils in service, degradation which can in particular result in the formation of deposits, the presence of sludges, or an increase in the viscosity of the lubricant composition, in particular of the engine oil. The antioxidant additives act in particular as radical inhibitors or hydroperoxide destroyers. Among the antioxidants commonly used, the phenolic-type or amine-type antioxidants and phosphorus- and sulphur-containing antioxidants can be mentioned. Some of these antioxidants, for example the phosphorus- and sulphur-containing additives, may generate ashes. The phenolic antioxidants may be ash-free, or be in the form of neutral or basic metal salts. The antioxidant agents can in particular be selected from the sterically hindered phenols, the sterically hindered phenols esters and the sterically hindered phenols comprising a thioether bridge, diphenylamines, the diphenylamines substituted with at least one C1-C12 alkyl group, the N,N' dialkyl aryl diamines and combinations thereof. By "sterically hindered phenol" is meant within the meaning of the present invention a compound comprising a phenol group of which at least one vicinal carbon of the carbon bearing the alcohol function is substituted by at least one C1-C10 alkyl group, preferably a C1-C6 alkyl group, preferably, a C4 alkyl group, preferably by the tert-butyl group. The amine compounds are another class of antioxidants that can be used, optionally in combination with the phenolic antioxidants. Typical examples are the aromatic amines of formula R25R26R27N, in which R25 represents an aliphatic group or an optionally substituted aromatic group, R26 represents an optionally substituted aromatic group, R27 represents a hydrogen atom, an alkyl group, an aryl group or a group of formula $R28S(O)_zR29$, where R28 represents an alkylene group or an alkenylene group, R29 represents an alkyl group, an alkenyl group or an aryl group and z represents an integer equal to 0, 1 or 2. Sulphur-containing alkyl phenols or their alkali and alkaline-earth metal salts can also be used as antioxidants. Another class of antioxidants is that of the copper-containing compounds, for example the copper thio- or dithiophosphates, salts of copper and of carboxylic acids, dithiocarbamates, sulphonates, phenates, copper acetylacetonates. Copper I and II, succinic acid or anhydride salts can also be used.

[0213] The lubricant composition used according to the invention can contain all types of antioxidant additives known to a person skilled in the art. Advantageously, ash-free antioxidants are used. In an embodiment, the lubricant composition used according to the invention can comprise from 0.5 to 2% of at least one antioxidant additive by weight with respect to the total weight of the lubricant composition.

[0214] Detergent additives reduce in particular the formation of deposits on the surface of the metal parts by dissolving the by-products of oxidation and combustion. The detergents that can be used in the lubricant composition according to the invention are well known to a person skilled in the art. The detergents commonly used in the formulation of lubricant compositions can be anionic compounds comprising a long lipophilic hydrocarbon-containing chain and a hydrophilic head. The associated cation is typically a metal cation of an alkali or alkaline-earth metal. The detergents are preferentially selected from the alkali or alkaline-earth metal salts of carboxylic acids, sulphonates, salicylates, naphthenates, as well as the salts of phenates. The alkali or alkaline-earth metals are preferentially calcium, magnesium, sodium or barium. These metal salts can contain the metal in an approximately stoichiometric quantity or in excess (in a quantity greater than the stoichiometric quantity). In the latter case, these detergents are referred to as overbased detergents. The excess metal providing the detergent with its overbased character is present in the form of metal salts which are insoluble in oil, for example carbonate, hydroxide, oxalate, acetate, glutamate, preferentially carbonate. In an embodiment, the lubricant composition according to the invention can comprise from 0.5 to 4% by weight of detergent, with respect to the total weight of the lubricant composition.

[0215] The pour point depressant additives in particular improve the low-temperature behaviour of the lubricant compositions, by slowing down the formation of paraffin crystals. As examples of pour point depressant additives, the alkyl polymethacrylates, polyacrylates, polyarylamides, polyalkylphenols, polyalkylnaphthalenes, alkylated polystyrenes can be mentioned.

[0216] In an embodiment, the lubricant composition used according to the invention can further comprise at least one dispersant. The dispersants can be selected from the groups formed by the Mannich base(s), the succinimides and derivatives thereof, in particular the borated succinimides. In an embodiment, the lubricant composition used according to the invention can comprise from 0.2 to 10%) by weight of dispersants with respect to the total weight of the lubricant composition.

[0217] The viscosity index improver polymers can be selected from the polymer esters, the copolymers based on ethylene, in particular the ethylene/propylene copolymers and ethylene/α-olefin copolymers, the homopolymers or copolymers of styrene, butadiene or isoprene, hydrogenated or not hydrogenated, the polymethacrylates (PMA). In an embodiment, the lubricant composition used according to the invention can comprise from 1 to 15% by weight of viscosity index improver polymers with respect to the total weight of the lubricant composition. The anti-foaming addi-

tives can be selected from the polyacrylates or silicon-containing compounds and derivatives thereof, and in particular the polysiloxanes.

[0218] In an embodiment of the invention, the lubricant composition comprises:

[0219] from 75 to 99.5% of at least one base oil,

[0220] from 0.5 to 25% of at least one compound of formula (I).

[0221] In another embodiment of the invention, the lubricant composition comprises:

[0222] from 75 to 99% of at least one base oil,

[0223] from 0.5 to 25% of at least one compound of formula (I),

[0224] from 0.5 to 5% of at least one other additive.

[0225] In another embodiment of the invention, the lubricant composition essentially consists of:

[0226] 75 to 99.5% of at least one base oil,

[0227] 0.5 to 25% of at least one compound of formula (I).

[0228] In another embodiment of the invention, the lubricant composition essentially consists of:

[0229] 75 to 99%) of at least one base oil,

[0230] 0.5 to 25%) of at least one compound of formula (I),

[0231] 0.5 to 5%) of at least one other additive.

[0232] All the characteristics and preferences presented above for the base oil, the compound of formula (I) and the additional additive also apply to the lubricant compositions above. In an embodiment of the invention, the lubricant composition is not an emulsion. In another embodiment of the invention, the lubricant composition is anhydrous.

[0233] An object of the invention is an engine oil comprising a lubricant composition used according to the invention. All the characteristics and preferences presented above for the lubricant composition also apply to the engine oil used according to the invention. In an embodiment of the invention, the engine oil can be of 0W-16, 0W-20 and 5W-30 grade according to the SAEJ300 classification, characterized by a kinematic viscosity at 100° C. (KV100) ranging from 5.6 to 12.5 cSt measured according to the international standard ASTM D445. In another embodiment of the invention, the engine oil can be characterized by a viscosity index, calculated according to the international standard ISO 2909, greater than or equal to 130, preferably greater than or equal to 150. In order to formulate an engine oil, base oils having a sulphur content of less than 0.3%) for example mineral oils of Group III, and sulphur-free synthetic bases, preferentially of Group IV, or mixtures thereof can advantageously be used.

[0234] An object of the invention is also the use of a lubricant composition as defined above for the lubrication of vehicle engines, preferentially motor vehicle engines, advantageously motor vehicle engines with positive ignition. A object of the invention is also the use of a lubricant composition as defined above in order to reduce or even eliminate knock in engines, preferentially motor vehicle engines, advantageously motor vehicle engines with positive ignition. An object of the invention is also the use of a lubricant composition as defined above in order to reduce the fuel consumption of vehicles, in particular motor vehicles. All the characteristics and preferences presented above for the lubricant composition also apply to the above uses.

[0235] An object of the invention is also a lubricating process for a vehicle engine, preferably a motor vehicle engine, advantageously of a motor vehicle engine with positive ignition, said process comprising at least one step of bringing a mechanical part of the engine into contact with a lubricant composition as defined above. An object of the invention is also a process for reducing or even eliminating knock in a vehicle engine, preferentially motor vehicle engines, advantageously motor vehicle engines with positive ignition comprising at least one step of bringing a mechanical part of the engine of the vehicle into contact with a lubricant composition as defined above. The reduction or even the elimination of engine knock can be assessed by any method known to a person skilled in the art. The reduction or even the elimination of engine knock by the use of a lubricant composition can in particular be assessed by measuring the power development of the engine and by measuring the development of the ignition advance parameter in the presence of the lubricant composition.

[0236] A method is more particularly described below. An object of the invention is also a process for reducing the fuel consumption of a vehicle, in particular of a motor vehicle comprising at least one step of bringing a mechanical part of the engine of the vehicle into contact with a lubricant composition as defined above. All the characteristics and preferences presented above for the lubricant composition also apply to the above processes.

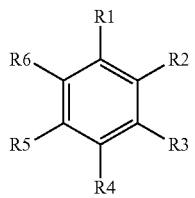
[0237] The vehicles can comprise a two- or four-stroke internal combustion engine with positive ignition. The engines can be gasoline engines intended to be supplied with standard gasoline or natural gas. By "standard gasoline" is meant within the meaning of the present invention engines which are supplied with a fuel obtained after refining an oil of mineral origin (such as petroleum for example). The engines can also be gasoline engines modified to be supplied with a fuel based on oils originating from renewable materials such as fuels based on alcohol. The vehicles can be light vehicles such as automobiles and motor cycles. The vehicles can also be lorries, construction machinery.

[0238] An object of the invention is also the use of a compound of formula (I) as defined above in a lubricant composition in order to reduce or even eliminate knock in engines, preferentially motor vehicle engines, advantageously motor vehicle engines with positive ignition. All the characteristics and preferences presented above for the lubricant composition also apply to the above use.

[0239] An object of the invention is also a composition of the additive-concentrate type comprising:

[0240] at least one compound of formula (I):

(I)



[0241] in which:

[0242] R1 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR7 group, an —NR8R9 group;

[0243] R2 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR10 group, an —NR11R12 group;

[0244] R3 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR13 group, an —NR14R15 group;

[0245] R4 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR16 group, an —NR17R18 group;

[0246] R5 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR19 group, an —NR20R21 group;

[0247] R6 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR22 group, an —NR23R24 group;

[0248] R7, R10, R13, R16, R19 and R22, identical or different, represent independently a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms;

[0249] R8, R9, R11, R12, R14, R15, R17, R18, R20, R21, R23 and R24, identical or different, represent independently a hydrogen atom or a saturated or unsaturated, substituted or unsubstituted alkyl group, comprising from 1 to 3 carbon atoms;

[0250] at least one of the R1, R2, R3, R4, R5 and R6 groups is different from a hydrogen atom.

[0251] at least one additive selected from the detergents, the friction modifiers, anti-wear additives, dispersants, extreme-pressure additives, antioxidants, viscosity index improver polymers, flow point improvers, anti-foaming agents, thickeners and mixtures thereof.

[0252] All the characteristics and preferences presented above for the compound of formula (I) and for the additional additive also apply to the composition of the additive-concentrate type above. In an embodiment of the invention, at least one base oil can be added to the composition of the additive-concentrate type used according to the invention in order to obtain a lubricant composition used according to the invention. The different objects of the present invention and their implementations will be better understood on reading the examples which follow. These examples are given by way of indication, without being limitative.

Examples

[0253] A lubricant composition No. 1 is prepared from the following compounds:

[0254] base oil 1: PAO grade 4,

[0255] base oil 2: PAO grade 6,

[0256] base oil 3: trimethylolpropane ester having a kinematic viscosity at 100° C. measured according to the standard ASTM D445 equal to 4.5 mm^2/s,

[0257] polymer: hydrogenated styrene/isoprene copolymer dispersed at 10.7% m/m in an oil of Group I,

[0258] additive package: mixture comprising a calcium salicylate as detergent, a zinc dithiophosphate as anti-wear agent, a borated succinimide dispersant, a phenolic anti-oxidant, an amine anti-oxidant (alkylated diphenylamine), a polysiloxane derivative as anti-foaming agent, a molybdenum dithiocarbamate as friction modifier and a polymethacrylate as pour point improver.

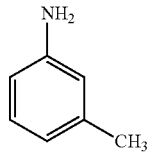
[0259] The lubricant composition No. 1 is described in Table II: the percentages indicated are percentages by weight.

TABLE II

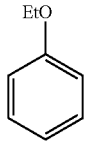
Lubricant composition	No. 1
Base oil 1	37.5
Base oil 2	35
Base oil 3	10
Polymer	6.2
Additive package	11.3

[0260] A compound of formula (I) used according to the invention was added to the lubricant composition No. 1 in order to obtain the lubricant compositions No. 2 and No. 3, the compound of formula (I) being:

[0261] meta-toluidine (marketed by the company Sigma-Aldrich) of formula:



[0262] or ethoxybenzene (marketed by the company Sigma-Aldrich) of formula:



[0263] The lubricant compositions No. 2 and No. 3 are described in Table III: the percentages indicated are percentages by weight.

TABLE III

Lubricant composition	No. 2	No. 3
Lubricant composition No. 1	90	90
Meta-toluidine	10	
Ethoxybenzene		10

[0264] The impact of the lubricant compositions No. 1 to No. 3 was assessed according to the method described below. A turbocharged 1.6 litre capacity positive ignition engine was equipped with accelerometers close to each cylinder making it possible to detect the appearance of knock. The engine control analyzes this information and reduces the ignition advance parameter in the event of knock appearing. Otherwise, if the combustion proceeds without the appearance of knock, the engine computer increases the ignition advance in order to improve the engine efficiency and to increase the power measured at the engine output.

[0265] The engine was installed in a test cell of where the speed and the power output of the engine was measured using an electromagnetic brake. The control parameters such as the engine speed, quantity of gasoline injected, ignition advance and engine power were recorded during the test. The temperature of the engine coolant was maintained at 94° C. at the engine inlet and the oil temperature was maintained at 99° C. at the engine inlet. The tests were carried out under full load and the engine speed swept was extended from 3000 to 8500 rpm.

[0266] The lubricant composition No. 1 was used as reference oil in order to verify the stability of the engine behaviour. The impact of lubricant compositions No. 2 and No. 3 on the knock phenomenon was observed by measuring the power development of the engine and by measuring the development of the ignition advance parameter by comparing each of these two lubricant compositions with the lubricant composition No. 1.

[0267] The engine power is expressed in horsepower (hp). The ignition advance is expressed in crankshaft degrees (°V). A difference of at least one hp regarding the power and a difference of at least 0.4°V are considered as significant and therefore allow the benefit of the lubricant composition on the reduction in the knock phenomenon to be validated.

[0268] The lubricant composition No. 2 was tested in the test described above, preceded and followed by the lubricant composition No. 1. The power and ignition advance improvement is determined with respect to the average of the results obtained on the lubricant composition No. 1 before and after the test with the lubricant composition No. 2. The lubricant composition No. 3 was tested in the test described above, preceded and followed by the lubricant composition No. 1. The power and ignition advance improvement is determined with respect to the average of the results obtained on the lubricant composition No. 1 before and after the test with the lubricant composition No. 3.

[0269] The results for the lubricant compositions No. 2 and No. 3 at speeds of 6500 rpm and 7500 rpm are presented in Tables IV and V (the results for the lubricant composition No. 1 are not indicated given that the lubricant composition No. 1 constituted the reference to which the lubricant compositions No. 2 and No. 3 were compared).

TABLE IV

Composition	No. 2	No. 3
Delta power (hp) at 6500 rpm	+3.0	+1.3
Delta ignition advance (° V) at 6500 rpm	+1.2	+0.4

TABLE V

Composition	No. 2	No. 3
Delta power (hp) at 7500 rpm	+1.6	+1.0
Delta ignition advance (° V) at 7500 rpm	+1.6	+1.0

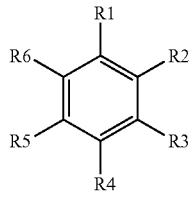
[0270] The results show that the presence of a compound of formula (I) used according to the invention in a lubricant composition (lubricant compositions No. 2 and No. 3) makes it possible to significantly reduce the knock phenomenon in an engine. It should be noted that this reduction is present over a wide range of engine speeds, and even at high engine speeds, such as for example 7500 rpm. It should also be noted that the use of lubricant compositions according to the invention (lubricant compositions No. 2 and No. 3) did not result in any abnormal deposit in the engine combustion chamber. The lubricant compositions used according to the invention (lubricant compositions No. 2 and No. 3) moreover retain good lubrication properties.

1. A method for reducing knock in a vehicle engine, comprising bringing a mechanical part of the vehicle engine into contact with a lubricant composition comprising:

at least one base oil;

at least one compound of formula (I):

(I)



in which:

R1 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR7 group, an —NR8R9 group;

R2 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR10 group, an —NR11R12 group;

R3 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR13 group, an —NR14R15 group;

R4 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR16 group, an —NR17R18 group;

R5 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR19 group, an —NR2OR21 group;

R6 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR22 group, an —NR23R24 group;

R7, R10, R13, R16, R19 and R22, identical or different, represent independently a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms;

R8, R9, R11, R12, R14, R15, R17, R18, R20, R21, R23 and R24, identical or different, represent independently a hydrogen atom or a saturated or unsaturated, substituted or unsubstituted alkyl group, comprising from 1 to 3 carbon atoms; and

at least one of the R1, R2, R3, R4, R5 and R6 groups is different from a hydrogen atom.

2. The method according to claim **1** in which R1 represents:

a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms;

an —OR7 group in which R7 represents a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms; and

an —NR8R9 group in which R8 and R9, identical or different, represent independently a hydrogen atom or a saturated or unsaturated, substituted or unsubstituted alkyl group, comprising from 1 to 3 carbon atoms

3. The method according to claim **1** in which R5 represents a hydrogen atom.

4. The method according to claim **1** in which R6 represents a hydrogen atom.

5. The method according to claim **1** in which R1 represents:

a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms;

an —OR7 group in which R7 represents a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms; and

an —NR8R9 group in which:

R8 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

R9 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

6. The method according to claim **1** in which R2 represents:

a hydrogen atom;

a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms;

an —NR11R12 group in which:

R11 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms; and

R12 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

7. The method according to claim **1** in which R3 represents:

a hydrogen atom;

a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms;

an —NR14R15 group in which:

R14 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms; and

R15 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

8. The method according to claim **1** in which R4 represents:

a hydrogen atom;

a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms;

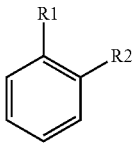
an —NR17R18 group in which:

R17 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms; and

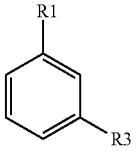
R18 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

9. The method according to claim **1** comprising a compound of formulae (Ia) to (If):

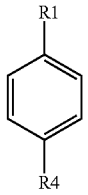
(Ia)



(Ib)



(Ic)



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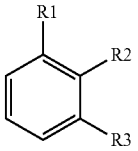
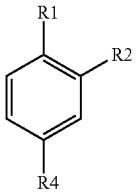
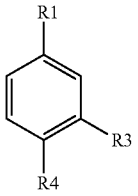


(Ie)



(If)



in which:

R1 represents a saturated, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR7 group, an —NR8R9 group;

R2 represents a hydrogen atom, a saturated, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR10 group, an —NR11R12 group;

R3 represents a hydrogen atom, a saturated, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR13 group, an —NR14R15 group;

R4 represents a hydrogen atom, a saturated, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR16 group, an —NR17R18 group;

R7, R10, R13 and R16, identical or different, represent independently a saturated, linear or branched alkyl group, comprising from 1 to 10 carbon atoms; and

R8, R9, R11, R12, R14, R15, R17 and R18, identical or different, represent independently a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

10. The method according to claim **9** comprising a compound of formulae (Ia) to (Ic) in which:

R1 represents an —OR7 group in which R7 represents a saturated alkyl group comprising from 1 to 3 carbon atoms;

R2 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

R3 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms; and

R4 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms.

11. The method according to claim **9** comprising a compound of formulae (Ia) to (Ic) in which:

R1 represents an —NR8R9 group in which:

R8 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

R9 represents a hydrogen atom or a saturated alkyl group, comprising from 1 to 3 carbon atoms;

R2 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an $—NH_2$ group;

R3 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an $—NH_2$ group; and

R4 represents a hydrogen atom, a saturated alkyl group comprising from 1 to 3 carbon atoms or an $—NH_2$ group.

12. The method according to claim **9** comprising a compound of formulae (Ia) to (Ic) in which:

R1 represents a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms;

R2 represents a hydrogen atom or a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms;

R3 represents a hydrogen atom or a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms; and

R4 represents a hydrogen atom or a saturated, linear or branched alkyl group, comprising from 1 to 5 carbon atoms.

13. The method according to claim **1** in which the content by weight of the compound of formula (I) ranges from 0.5 to 25% with respect to the total weight of the lubricant composition.

14. The method according to claim **1** further comprising at least one additive selected from the detergents, friction modifiers, dispersants, anti-wear additives, extreme-pressure additives, antioxidants, viscosity index improver polymers, flow point improvers, anti-foaming agents, thickeners and mixtures thereof.

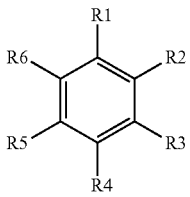
15. A method for reducing knock in a vehicle engine, comprising:

a) adding at least one base oil to a composition of the additive-concentrate type in order to obtain a lubricant composition comprising;

b) bringing a mechanical part of the vehicle engine into contact with the lubricant composition;

c) the composition of the additive-concentrate type comprising:

at least one compound of formula (I):



(I)

in which:

R1 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR7 group, an —NR8R9 group;

R2 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR10 group, an —NR11R12 group;

R3 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR13 group, an —NR14R15 group;

R4 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR16 group, an —NR17R18 group;

R5 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR19 group, an —NR2OR21 group;

R6 represents a hydrogen atom, a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms, an —OR22 group, an —NR23R24 group;

R7, R10, R13, R16, R19 and R22, identical or different, represent independently a saturated or unsaturated, substituted or unsubstituted, linear or branched alkyl group, comprising from 1 to 10 carbon atoms;

R8, R9, R11, R12, R14, R15, R17, R18, R20, R21, R23 and R24, identical or different, represent independently a hydrogen atom or a saturated or unsaturated, substituted or unsubstituted alkyl group, comprising from 1 to 3 carbon atoms;

at least one of the R1, R2, R3, R4, R5 and R6 groups is different from a hydrogen atom; and

at least one additive selected from the detergents, friction modifiers, anti-wear additives, dispersants, extreme-pressure additives, antioxidants, viscosity index improver polymers, flow point improvers, anti-foaming agents, thickeners and mixtures thereof.

16. The method according to claim **1**, in which compound of formula (I) is selected from the group consisting of ortho-toluidine, meta-toluidine and para-toluidine.

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