



US 20090105102A1

(19) **United States**(12) **Patent Application Publication**
Rapenne-Jacob et al.(10) **Pub. No.: US 2009/0105102 A1**(43) **Pub. Date: Apr. 23, 2009**(54) **BENZOTRIAZOLE COMPOSITIONS**(30) **Foreign Application Priority Data**(76) Inventors: **Isabelle Rapenne-Jacob**, Mulhouse
(FR); **Samuel Evans**, Marly (CH);
Peter Rohrbach, Liestal (CH);
Martin Von Buren, MuttENZ (CH)

Nov. 22, 2004 (EP) 04105973.4

Publication Classification(51) **Int. Cl.**
C10M 133/44 (2006.01)(52) **U.S. Cl.** **508/281**(57) **ABSTRACT**

The invention relates to novel (benzo)triazole compositions comprising mixtures of benzotriazoles and N-substituted benzotriazoles in functional liquids, e.g. mineral oil. The mixtures can be prepared from readily obtainable starting materials, such as tolutriazole (TTA), alkyl aldehydes and cycloalkanols. The invention furthermore relates to a process for protecting metals, which are in contact with functional liquids comprising the mixtures.

Correspondence Address:

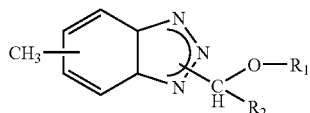
JoAnn Villamizar
Ciba Corporation/Patent Department
540 White Plains Road, P.O. Box 2005
Tarrytown, NY 10591 (US)(21) Appl. No.: **11/667,779**(22) PCT Filed: **Nov. 14, 2005**(86) PCT No.: **PCT/EP05/55934**§ 371 (c)(1),
(2), (4) Date: **May 15, 2007**

BENZOTRIAZOLE COMPOSITIONS

[0001] The invention relates to novel benzotriazole compositions comprising mixtures of benzotriazoles and N-substituted benzotriazoles, the process for preparing N-substituted benzotriazoles and a method for improving the functional properties of lubricants, hydraulic or metal-working fluids or coating compositions.

[0002] Additives, which can be used as metal deactivators display their protective action in functional liquids, such as mineral oil or fuels, by deactivating the metal ions, such as copper or iron, contained therein. These metal ions can have catalytic effects in undesired oxidative decomposition processes of mineral oil or fuels. The protective action is explained by the formation of film-like layers on the surface of metals or by complex formation with metal ions.

[0003] EP-A-365 476 discloses benzotriazole compounds:



[0004] Wherein R_1 represents C_1 - C_{12} straight or branched chain alkyl; and

[0005] R_2 represents C_1 - C_{12} straight or branched chain alkyl interrupted by one or more O-atoms or represents C_5 - C_{12} cycloalkyl;

and lubricant compositions comprising these benzotriazole compounds.

[0006] Owing to their volatility at high operating temperatures of machines, metal deactivators of the triazole type are problematic. Because of high temperatures, in particular in internal combustion engines and turbines, which are exposed to oils and fuels, the deactivator concentration can rapidly decrease with a corresponding reduction in the protective action.

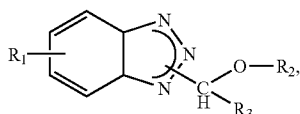
[0007] It is the object of the invention to prepare, from readily obtainable starting materials, such as tolutriazole (TTA), alkyl aldehydes and cycloalkanols, additive components which can be used in lubricant compositions as metal deactivators, possess improved solubility and, in functional liquids, have lower volatility than tolutriazole itself.

[0008] This object is achieved by the present invention, which relates to novel benzotriazole compositions comprising mixtures of benzotriazoles and N-substituted benzotriazoles.

[0009] The invention relates to a composition comprising

[0010] A) A mixture consisting essentially of:

[0011] a) A benzotriazole compound:

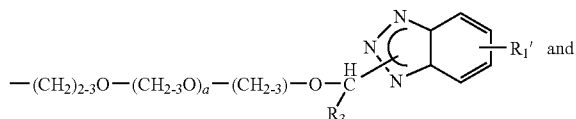


(I)

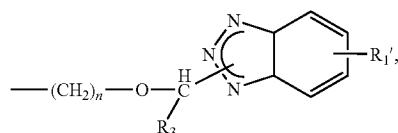
[0012] Wherein R_1 represents hydrogen or C_1 - C_4 alkyl;

[0013] R_2 represents a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ C_5 - C_7 cycloalkyl, C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl,

(A)



(B)



[0014] Wherein R_1' is as defined as R_1 ;

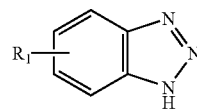
[0015] The index a represents a numeral from 1 to 10; and

[0016] The index n represents a numeral from 2 to 8; and

[0017] R_3 represents hydrogen or a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ C_5 - C_7 cycloalkyl, C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl, phenyl, phenyl- C_1 - C_4 alkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ phenyl and $(C_1$ - C_4 alkyl) $_{1-3}$ phenyl- C_1 - C_4 alkyl;

[0018] b) A benzotriazole compound:

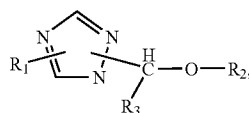
(II)



[0019] Wherein R_1 represents hydrogen or C_1 - C_4 alkyl; and, optionally,

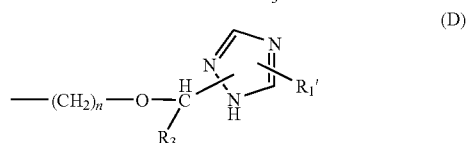
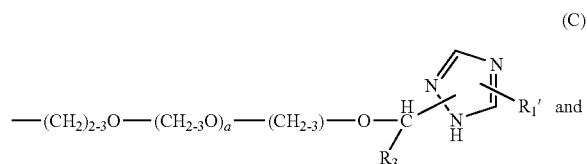
[0020] c) A triazole compound:

(III)



[0021] Wherein R_1 represents hydrogen or C_1 - C_4 alkyl;

[0022] R_2 represents a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ C_5 - C_7 cycloalkyl, C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl,



[0023] Wherein R_1' is as defined as R_1 ; and

[0024] The index a represents a numeral from 1 to 10;

[0025] The index n represents a numeral from 2 to 8; and

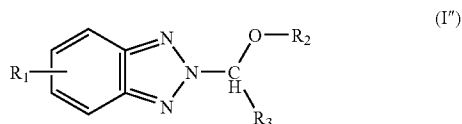
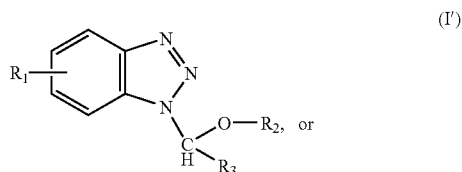
[0026] R_3 represents hydrogen or a substituent selected from the group consisting of $\text{C}_1\text{--C}_{12}$ alkyl, $\text{C}_5\text{--C}_7$ cycloalkyl, $(\text{C}_1\text{--C}_4\text{alkyl})_{1-3}\text{C}_5\text{--C}_7$ cycloalkyl, $\text{C}_5\text{--C}_7$ cycloalkyl- $\text{C}_1\text{--C}_4$ alkyl, phenyl, phenyl- $\text{C}_1\text{--C}_4$ alkyl, $(\text{C}_1\text{--C}_4\text{alkyl})_{1-3}$ phenyl and $(\text{C}_1\text{--C}_4\text{alkyl})_{1-3}$ phenyl- $\text{C}_1\text{--C}_4$ alkyl;

[0027] B) A functional fluid selected from the group consisting of lubricants, hydraulic agents, metal working fluids and coating agents.

[0028] A more specific embodiment of the invention relates to a composition comprising

[0029] A) A mixture consisting essentially of:

[0030] a) A benzotriazole compound:

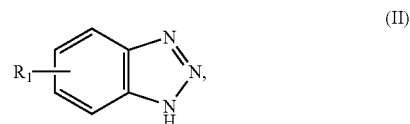


[0031] Wherein R_1 represents hydrogen or $\text{C}_1\text{--C}_4$ alkyl;

[0032] R_2 represents a substituent selected from the group consisting of $\text{C}_1\text{--C}_{12}$ alkyl, $\text{C}_5\text{--C}_7$ cycloalkyl, $(\text{C}_1\text{--C}_4\text{alkyl})_{1-3}\text{C}_5\text{--C}_7$ cycloalkyl and $\text{C}_5\text{--C}_7$ cycloalkyl- $\text{C}_1\text{--C}_4$ alkyl; and

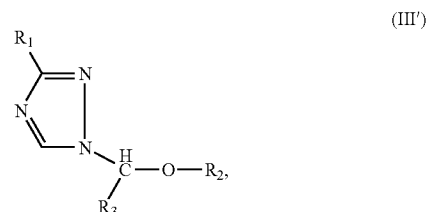
[0033] R_3 represents hydrogen or a substituent selected from the group consisting of $\text{C}_1\text{--C}_{12}$ alkyl, $\text{C}_5\text{--C}_7$ cycloalkyl, $(\text{C}_1\text{--C}_4\text{alkyl})_{1-3}\text{C}_5\text{--C}_7$ cycloalkyl, $\text{C}_5\text{--C}_7$ cycloalkyl- $\text{C}_1\text{--C}_4$ alkyl, phenyl, phenyl- $\text{C}_1\text{--C}_4$ alkyl, $(\text{C}_1\text{--C}_4\text{alkyl})_{1-3}$ phenyl and $(\text{C}_1\text{--C}_4\text{alkyl})_{1-3}$ phenyl- $\text{C}_1\text{--C}_4$ alkyl;

[0034] b) A benzotriazole compound:



[0035] Wherein R_1 represents hydrogen or $\text{C}_1\text{--C}_4$ alkyl; and, optionally,

[0036] c) A triazole compound:



[0037] Wherein R_1 represents hydrogen or $\text{C}_1\text{--C}_4$ alkyl;

[0038] R_2 represents a substituent selected from the group consisting of $\text{C}_1\text{--C}_{12}$ alkyl, $\text{C}_5\text{--C}_7$ cycloalkyl, $(\text{C}_1\text{--C}_4\text{alkyl})_{1-3}\text{C}_5\text{--C}_7$ cycloalkyl and $\text{C}_5\text{--C}_7$ cycloalkyl- $\text{C}_1\text{--C}_4$ alkyl; and

[0039] R_3 represents hydrogen or a substituent selected from the group consisting of $\text{C}_1\text{--C}_{12}$ alkyl, $\text{C}_5\text{--C}_7$ cycloalkyl, $(\text{C}_1\text{--C}_4\text{alkyl})_{1-3}\text{C}_5\text{--C}_7$ cycloalkyl, $\text{C}_5\text{--C}_7$ cycloalkyl- $\text{C}_1\text{--C}_4$ alkyl, phenyl, phenyl- $\text{C}_1\text{--C}_4$ alkyl, $(\text{C}_1\text{--C}_4\text{alkyl})_{1-3}$ phenyl and $(\text{C}_1\text{--C}_4\text{alkyl})_{1-3}$ phenyl- $\text{C}_1\text{--C}_4$ alkyl; and

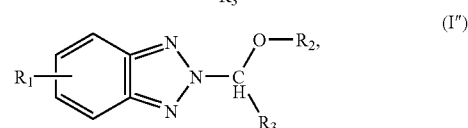
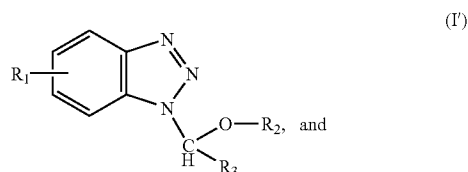
[0040] B) A functional fluid selected from the group consisting of lubricants, hydraulic agents, metal working fluids and coating agents.

[0041] The compositions defined above are prepared by conventional mixing procedures and are suitable as metal deactivators in functional liquids.

[0042] The expressions and terms used above and below are preferably defined as follows in the description of the present invention:

Component A)

[0043] The compounds (I) present in the compositions according to the invention are defined by the following isomeric structures:



[0044] Wherein R_1 , R_2 and R_3 are as defined above.

[0045] The term isomer includes any structural and positional isomers, tautomeric forms, cis-trans isomers and stereoisomers, e.g. enantiomeric forms and racemic mixtures.

[0046] R_1 and R_1' defined as C_1 - C_4 alkyl represents methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl or tert-butyl. According to a preferred embodiment, R_1 represents methyl.

[0047] R_2 represents a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, (C_1 - C_4 alkyl)₁₋₃, C_5 - C_7 cycloalkyl or C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl.

[0048] R_2 defined as C_1 - C_{12} alkyl represents C_1 - C_4 alkyl as defined above with regard to R_1 and R_1' and additionally represents straight chain or branched C_5 - C_{12} alkyl, e.g. pentyl, hexyl, heptyl, octyl, nonyl, undecyl or dodecyl.

[0049] R_2 defined as C_5 - C_7 cycloalkyl is preferably cyclopentyl or cyclohexyl.

[0050] R_2 defined as (C_1 - C_4 alkyl)₁₋₃ C_5 - C_7 cycloalkyl is preferably cyclopentyl or cyclohexyl substituted with C_1 - C_4 alkyl, e.g. methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl or tert-butyl.

[0051] R_2 defined as C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl is e.g. cyclopentylmethyl, cyclohexylmethyl, cyclopentyl-1,1-ethyl, cyclohexyl-1,1-ethyl, cyclopentyl-1,2-ethyl or cyclohexyl-1,2-ethyl.

[0052] In the compound (I) the index a represents a numeral from 1 to 10, and the index n represents a numeral from 2 to 8.

[0053] According to a preferred embodiment, the index a represents a numeral from 1 to 6, and the index n represents a numeral from 2 to 6.

[0054] According to a highly preferred embodiment, the index a represents a numeral from 1 to 4, and the index n represents a numeral from 2 to 4.

[0055] R_3 represents a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, (C_1 - C_4 alkyl)₁₋₃ C_5 - C_7 cycloalkyl, C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl, phenyl, phenyl- C_1 - C_4 alkyl, (C_1 - C_4 alkyl)₁₋₃phenyl and (C_1 - C_4 alkyl)₁₋₃phenyl- C_1 - C_4 alkyl.

[0056] R_3 defined as C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, (C_1 - C_4 alkyl)₁₋₃ C_5 - C_7 cycloalkyl and C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl has the same meanings as defined above with regard to R_2 .

[0057] R_3 defined as phenyl, phenyl- C_1 - C_4 alkyl, (C_1 - C_4 alkyl)₁₋₃phenyl and (C_1 - C_4 alkyl)₁₋₃phenyl- C_1 - C_4 alkyl is, for example, phenyl, benzyl, 1- or 2-phenylethyl, 4-methyl or 4-ethyl, cumyl or 4-methylbenzyl.

[0058] Compounds of the formula (I) are known from the disclosure of EP 0 365 476, or can be prepared in a manner analogous to the methods as described therein, e.g. by the acid catalysed reaction of the R_1 -substituted benzotriazole, e.g. toluotriazole (tolyltriazole), with the aldehyde R_3 -C(=O)-H and the alcohol R_2 -OH in a solvent inert to the reactants, while continuously removing an azeotropic mixture of solvent and water formed during the reaction.

[0059] Suitable acid catalysts include mineral acids, e.g. sulphuric acid, acid clays, e.g. bentonite, montmorillonite, Bleicherde Tonsil® (Supreme 110 FF, 126 FF) or Fuller's earth, acid ion-exchange resins, e.g. Amberlyst® 15, and sulphonic acids, e.g. p-toluene sulphonic acid.

[0060] The inert solvent may be cyclohexane, benzene, toluene, xylene or carbon tetrachloride.

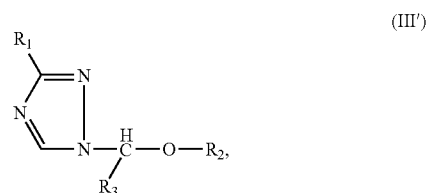
[0061] Compounds (I) wherein R_2 represents a group of the partial formulae (A) or (B), can be prepared in an analogous manner by the acid catalysed reaction of the R_1 -substituted

benzotriazole, e.g. toluotriazole (tolyltriazole), with the diol $HO-(CH_2)_{2-3}O-(CH_2)_{2-3}O-(CH_2)_{2-3}OH$ and 2 equivalents of the aldehyde $R_3-C(=O)-H$, or with the diol $HO-(CH_2)_n-OH$ and 2 equivalents of the aldehyde $R_3-C(=O)-H$.

[0062] In a compound (II) R_1 defined as C_1 - C_4 alkyl represents methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl or tert-butyl. According to a preferred embodiment, R_1 represents methyl.

[0063] Compounds (II) are known and are commercially available, e.g. Irgamet® (Ciba Specialty Chemicals) TTA.

[0064] The compounds (III) present in the compositions according to the invention are preferably defined by the following isomeric structure:



[0065] Wherein R_1 , R_2 and R_3 are as defined above.

[0066] Compounds (III), according to the optional component c), can be prepared in a manner analogous to EP 0 365 476, e.g. by the acid catalysed reaction of a R_1 -substituted triazole, e.g. triazole or methyltriazole, with the aldehyde $R_3-C(=O)-H$ and the alcohol R_2-OH .

[0067] Compounds (III), wherein R_2 represents a group of the partial formula (A) or (B), can be prepared in an analogous manner by the acid catalysed reaction of the R_1 -substituted triazole, e.g. triazole or methyltriazole, with the diol $HO-(CH_2)_{2-3}O-(CH_2)_{2-3}O-(CH_2)_{2-3}OH$ and 2 equivalents of the aldehyde $R_3-C(=O)-H$, or with the diol $HO-(CH_2)_n-OH$ and 2 equivalents of the aldehyde $R_3-C(=O)-H$.

Component B)

[0068] The term functional liquid selected from the group consisting of lubricants, hydraulic agents, metal working fluids and coating agents includes non-aqueous, partially aqueous and aqueous liquids which are in contact with metals to be deactivated, in particular copper or iron.

[0069] Examples of non-aqueous functional liquids are fuels, e.g. hydrocarbon mixtures comprising mineral oil fractions which are liquid at room temperature and are suitable for use in internal combustion engines, e.g. internal combustion engines with external (petrol engines) or internal ignition (diesel engines), e.g. petrol having different octane contents (regular grade or premium grade petrol) or diesel fuel, and lubricants, hydraulic fluid, metal working fluid, engine coolants, transformer oil and switch gear oil.

[0070] Examples of suitable partially aqueous functional liquids are hydraulic fluids based on aqueous polyglycol/polyglycol ether mixtures or glycol systems, water-in-oil or oil-in-water systems and engine cooling systems based on aqueous glycol.

[0071] Examples of aqueous functional liquids are industrial cooling water, filling compositions of a water conditioning plant, steam generation systems, sea water evaporation

systems, sugar evaporation systems, irrigation systems, hydrostatic boilers and heating systems or cooling systems having a closed circulation.

[0072] The compositions according to the invention preferably comprise 0.01 to 5.0% by weight, in particular 0.02 to 1.0% by weight, of a compound (I), based on the weight of the functional liquid.

[0073] Non-aqueous functional liquids are preferred, in particular base oils of lubricating viscosity, which can be used for the preparation of greases, metal working fluids, gear fluids and hydraulic fluids.

[0074] Suitable greases, metal working fluids, gear fluids and hydraulic fluids are based, for example, on mineral or synthetic oils or mixtures thereof. The lubricants are familiar to a person skilled in the art and are described in the relevant literature, such as, for example, in *Chemistry and Technology of Lubricants*; Mortier, R. M. and Orszulik, S. T. (Editors); 1992 Blackie and Son Ltd. for GB, VCH-Publishers N.Y. for U.S., ISBN 0-216-92921-0, cf. pages 208 et seq. and 269 et seq.; in *Kirk-Othmer Encyclopedia of Chemical Technology, Fourth Edition* 1969, J. Wiley & Sons, New York, Vol. 13, page 533 et seq. (Hydraulic Fluids); *Performance Testing of Hydraulic Fluids*; R. Tournet and E. P. Wright, Hyden & Son Ltd. GB, on behalf of The Institute of Petroleum London, ISBN 0 85501 317 6; *Ullmann's Encyclopedia of Ind. Chem., Fifth Completely Revised Edition*, Verlag Chemie, DE-Weinheim, VCH-Publishers for U.S., Vol. A 15, page 423 et seq. (Lubricants), Vol. A 13, page 165 et seq. (Hydraulic Fluids).

[0075] The lubricants are in particular oils and greases, for example based on mineral oil or vegetable and animal oils, fats, tallow and wax or mixtures thereof. Vegetable and animal oils, fats, tallow and wax are, for example, palm kernel oil, palm oil, olive oil, colza oil, rapeseed oil, linseed oil, soy bean oil, cotton wool oil, sunflower oil, coconut oil, maize oil, castor oil, walnut oil and mixtures thereof, fish oils, and chemically modified, e.g. epoxidised or sulphoxidised, forms or forms prepared by genetic engineering, for example soy bean oil prepared by genetic engineering.

[0076] Examples of synthetic lubricants include lubricants based on aliphatic or aromatic carboxylic esters, polymeric esters, polyalkylene oxides, phosphoric acid esters, poly- α -olefins or silicones of the diester of a dibasic acid with a monohydric alcohol, e.g. dioctyl sebacate or dinonyl adipate, of a triester of trimethylolpropane with a monobasic acid or with a mixture of such acids, e.g. trimethylolpropane tripelargonate, trimethylolpropane tricaprilate or mixtures thereof, of a tetra ester of pentaerythritol with a monobasic acid or with a mixture of such acids, e.g. pentaerythrityl tetracaprilate, or of a complex ester of monobasic and dibasic acids with polyhydric alcohols, e.g. a complex ester of trimethylolpropane with caprylic and sebacic acid or of a mixture thereof. Particularly suitable in addition to mineral oils are, for example, poly- α -olefins, ester-based lubricants, phosphates, glycols, polyglycols and polyalkylene glycols and mixtures thereof with water.

[0077] Said lubricants or mixtures thereof can also be mixed with an organic or inorganic thickener (base fat). Metal working fluids and hydraulic fluids can be prepared on the basis of the same substances as described above for the lubricants. These are frequently also emulsions of such substances in water or other liquids.

Additional Components

[0078] A further embodiment of the invention relates to a composition, which comprises additional additives selected

from the group consisting of metal deactivators, antioxidants, rust inhibitors, viscosity index improvers, pour-point depressants, dispersants, surfactants, extreme-pressure additives, and antiwear additives.

[0079] Such additives are added in the amounts customary in each case for the purpose, each in the range from 0.01 to 10.0% by weight. Examples of further additives are listed below:

[0080] 1. Phenolic antioxidants

[0081] 1.1. Alkylated monophenols: 2,6-di-tert-butyl-4-methylphenol, 2-butyl-4,6-dimethylphenol, 2,6-di-tert-butyl-4-ethylphenol, 2,6-di-tert-butyl-4-n-butylphenol, 2,6-di-tert-butyl-4-iso-butylphenol, 2,6-dicyclopentyl-4-methylphenol, 2-(α -methylcyclohexyl)-4,6-dimethylphenol, 2,6-dioctadecyl-4-methylphenol, 2,4,6-tricyclohexylphenol, 2,6-di-tert-butyl-4-methoxymethylphenol, linear nonylphenols or nonylphenols which are branched in the side chain, e.g. 2,6-dinonyl-4-methylphenol, 2,4-dimethyl-6-(1'-methylundec-1'-yl)-phenol, 2,4-dimethyl-6-(1'-methylheptadec-1'-yl)-phenol, 2,4-dimethyl-6-(1'-methyltridec-1'-yl)-phenol and mixtures thereof

[0082] 1.2. Alkylthiomethylphenols: 2,4-dioctylthiomethyl-6-tert-butylphenol, 2,4-dioctylthiomethyl-6-methylphenol, 2,4-dioctylthiomethyl-6-ethylphenol, 2,6-didodecylthiomethyl-4-nonylphenol

[0083] 1.3. Hydroquinones and alkylated hydroquinones: 2,6-di-tert-butyl-4-methoxyphenol, 2,5-di-tert-butylhydroquinone, 2,5-di-tert-amylhydroquinone, 2,6-diphenyl-4-octadecyl-oxyphenol, 2,6-di-tert-butylhydroquinone, 2,5-di-tert-butyl-4-hydroxyanisole, 3,5-di-tert-butyl-4-hydroxyanisole, 3,5-di-tert-butyl-4-hydroxyphenylstearate, bis(3,5-di-tert-butyl-4-hydroxyphenyl)adipate

[0084] 1.4. Tocopherols: α -, β -, γ - or δ -tocopherols and mixtures thereof (vitamin E)

[0085] 1.5. Hydroxylated thiodiphenyl ethers: 2,2'-thiobis(6-tert-butyl-4-methylphenol), 2,2'-thio-bis(4-octylphenol), 4,4'-thiobis(6-tert-butyl-3-methylphenol), 4,4'-thio-bis(6-tert-butyl-2-methylphenol), 4,4'-thiobis(3,6-di-sec-amylphenol), 4,4'-bis(2,6-dimethyl-4-hydroxy-phenyl)disulphide

[0086] 1.6. Alkylidene bisphenols: 2,2'-methylenebis(6-tert-butyl-4-methylphenol), 2,2'-methylenebis(6-tert-butyl-4-ethylphenol), 2,2'-methylenebis[4-methyl-6-(α -methylcyclohexyl)-phenol], 2,2'-methylenebis(4-methyl-6-cyclohexylphenol), 2,2'-methylenebis(6-nonyl-4-methylphenol), 2,2'-methylenebis(4,6-di-tert-butylphenol), 2,2'-ethylenedibis(4,6-di-tert-butylphenol), 2,2'-ethylenedibis(6-tert-butyl-4-isobutylphenol), 2,2'-methylene-bis[6-(α -methylbenzyl)-4-nonylphenol], 2,2'-methylenebis[6-(α , α -dimethyl benzyl)-4-nonylphenol], 4,4'-methylenebis(2,6-di-tert-butylphenol), 4,4'-methylenebis(6-tert-butyl-2-methylphenol), 1,1-bis(5-tert-butyl-4-hydroxy-2-methylphenyl)butane, 2,6-bis(3-tert-butyl-5-methyl-2-hydroxybenzyl)-4-methylphenol, 1,1,3-tris(5-tert-butyl-4-hydroxy-2-methylphenyl)butane, 1,1-bis(5-tert-butyl-4-hydroxy-2-methylphenyl)-3-n-dodecylmercaptobutane, ethylene glycol bis[3,3-bis(3'-tert-butyl-4'-hydroxyphenyl)-butyrate], bis(3-tert-butyl-4-hydroxy-5-methylphenyl)dicyclopentadiene, bis[2-(3'-tert-butyl-2'-hydroxy-5'-methylbenzyl)-6-tert-butyl-4-methylphenyl]terephthalate, 1,1-bis(3,5-dimethyl-2-hydroxyphenyl)-butane, 2,2-bis(3,5-di-tert-butyl-4-hydroxyphenyl)-propane, 2,2-bis(5-tert-butyl-4-hydroxy-

- 2-methylphenyl)-4-n-dodecylmercaptobutane, 1,1,5,5-tetra(5-tert-butyl-4-hydroxy-2-methylphenyl)pentane
- [0087] 1.7. O—, N- and S-benzyl compounds: 3,5,3',5'-tetra-tert-butyl-4,4'-dihydroxydibenzyl ether, octadecyl 4-hydroxy-3,5-dimethylbenzylmercaptoacetate, tridecyl-4-hydroxy-3,5-di-tert-butylbenzyl mercaptoacetate, tris(3,5-di-tert-butyl-4-hydroxybenzyl)amine, bis(4-tert-butyl-3-hydroxy-2,6-dimethylbenzyl)dithioterephthalate, bis(3,5-di-tert-butyl-4-hydroxybenzyl)sulphide, isoocetyl 3,5-di-tert-butyl-4-hydroxybenzylmercaptoacetate
- [0088] 1.8. Hydroxybenzylated malonates: dioctadecyl 2,2-bis(3,5-di-tert-butyl-2-hydroxybenzyl)-malonate, dioctadecyl 2-(3-tert-butyl-4-hydroxy-5-methylbenzyl)malonate, didodecyl mercaptoethyl-2,2-bis(3,5-di-tert-butyl-4-hydroxybenzyl)malonate, di-[4-(1,1,3,3-tetramethylbutyl)-phenyl]-2,2-bis(3,5-di-tert-butyl-4-hydroxybenzyl)malonate
- [0089] 1.9. Hydroxybenzyl aromatics: 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)-2,4,6-trimethyl-benzene, 1,4-bis(3,5-di-tert-butyl-4-hydroxybenzyl)-2,3,5,6-tetramethyl benzene, 2,4,6-tris(3,5-di-tert-butyl-4-hydroxybenzyl)phenol
- [0090] 1.10. Triazine compounds: 2,4-bisocetylmercapto-6-(3,5-di-tert-butyl-4-hydroxyanilino)-1,3,5-triazine, 2-octylmercapto-4,6-bis(3,5-di-tert-butyl-4-hydroxyanilino)-1,3,5-triazine, 2-octylmercapto-4,6-bis(3,5-di-tert-butyl-4-hydroxyphenoxy)-1,3,5-triazine, 2,4,6-tris(3,5-di-tert-butyl-4-hydroxyphenoxy)-1,2,3-triazine, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)isocyanurate, 1,3,5-tris(4-tert-butyl-3-hydroxy-2,6-dimethylbenzyl) isocyanurate, 2,4,6-tris(3,5-di-tert-butyl-4-hydroxyphenylethyl)-1,3,5-triazine, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)-hexahydro-1,3,5-triazine, 1,3,5-tris(3,5-dicyclohexyl-4-hydroxybenzyl)isocyanurate
- [0091] 1.11. Acylaminophenols: 4-hydroxylauranilide, 4-hydroxystearanilide, octyl N-(3,5-di-tert-butyl-4-hydroxyphenyl)carbamate
- [0092] 1.12. Esters of beta-(3,5-di-tert-butyl-4-hydroxyphenyl)-propionic acid: with monohydric or polyhydric alcohols, e.g. with methanol, ethanol, n-octanol, isooctanol, octadecanol, 1,6-hexanediol, 1,9-nonanediol, ethylene glycol, 1,2-propanediol, neopentylglycol, thiodiethylene glycol, diethylene glycol, triethylene glycol, pentaerythritol, tris(hydroxyethyl)isocyanurate, N,N'-bis(hydroxyethyl)oxalamide, 3-thiaundecanol, 3-thiapentadecanol, trimethylhexanediol, trimethylolpropane, 4-hydroxymethyl-1-phospha-2,6,7-trioxabicyclo[2.2.2]octane
- [0093] 1.13. Esters of beta-(5-tert-butyl-4-hydroxy-3-methylphenyl)propionic acid: with monohydric or polyhydric alcohols, e.g. the alcohols with methanol, ethanol, n-octanol, isooctanol, octadecanol, 1,6-hexanediol, 1,9-nonanediol, ethylene glycol, 1,2-propanediol, neopentylglycol, thiodiethylene glycol, diethylene glycol, triethylene glycol, pentaerythritol, tris(hydroxyethyl)isocyanurate, N,N'-bis(hydroxyethyl)-oxalamide, 3-thiaundecanol, 3-thiapentadecanol, trimethylhexanediol, trimethylolpropane, 4-hydroxymethyl-1-phospha-2,6,7-trioxabicyclo[2.2.2]octane
- [0094] 1.14. Esters of beta-(3,5-dicyclohexyl-4-hydroxyphenyl)propionic acid: with monohydric or polyhydric alcohols, e.g. the alcohols stated under 13
- [0095] 1.15. Ester of 3,5-di-tert-butyl-4-hydroxyphenylacetic acid: with monohydric or polyhydric alcohols, e.g. the alcohols stated under 13
- [0096] 1.16. Amides of beta-(3,5-di-tert-butyl-4-hydroxyphenyl)propionic acid: N,N'-bis(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)hexamethylenediamine, N,N'-bis(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)trimethylenediamine, N,N'-bis(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)hydrazine
- [0097] 1.17. Ascorbic acid (vitamin C)
- [0098] 1.18. Amine antioxidants: N,N'-diisopropyl-p-phenylenediamine, N,N'-di-sec-butyl-p-phenylenediamine, N,N'-bis(1,4-dimethylpentyl)-p-phenylenediamine, N,N'-bis(1-ethyl-3-methylpentyl)-p-phenylenediamine, N,N'-bis(1-methyl-heptyl)-p-phenylenediamine, N,N'-dicyclohexyl-p-phenylenediamine, N,N'-diphenyl-p-phenylenediamine, N,N'-di-(naphth-2-yl)-p-phenylenediamine, N-isopropyl-N'-phenyl-p-phenylenediamine, N-(1,3-dimethyl-butyl)-N'-phenyl-p-phenylenediamine, N-(1-methylheptyl)-N'-phenyl-p-phenylenediamine, N-cyclohexyl-N'-phenyl-p-phenylenediamine, 4-(p-toluenesulphonamido)diphenylamine, N,N'-dimethyl-N,N'-di-sec-butyl-p-phenylenediamine, diphenylamine, N-allyldiphenylamine, 4-isopropoxy-diphenylamine, N-phenyl-1-naphthylamine, N-(4-tert-octylphenyl)-1-naphthylamine, N-phenyl-2-naphthylamine, octylated diphenylamine, e.g. p, p'-di-tert-octyldiphenylamine, 4-n-butylaminophenol, 4-butyrylaminophenol, 4-nonanoylaminophenol, 4-dodecanoylaminophenol, 4-octadecanoylaminophenol, di-(4-methoxyphenyl)amine, 2,6-di-tert-butyl-4-dimethylaminomethylphenol, 2,4'-diaminodiphenylmethane, 4,4'-diaminodiphenylmethane, N,N,N',N'-tetramethyl-4,4'-diaminodiphenyl methane, 1,2-di-[(2-methyl-phenyl)-amino]ethane, 1,2-di-(phenylamino)-propane, (o-tolyl)biguanide, di-[4-(1',3'-dimethyl-butyl)phenyl]amine, tert-octylated N-phenyl-1-naphthylamine, mixture of mono- and dialkylated tert-butyl/tert-octyldiphenylamines, mixture of mono- and dialkylated nonyldiphenylamines, mixture of mono- and dialkylated dodecyldiphenylamines, mixture of mono- and dialkylated isopropyl/isohexyldiphenylamines, mixtures of mono- and dialkylated tert-butylidiphenylamines, 2,3-dihydro-3,3-dimethyl-4H-1,4-benzothiazine, phenothiazine, mixture of mono- and dialkylated tert-butyl tert-octylphenothiazines, mixture of mono- and dialkylated tert-octylphenothiazines, mixture of mono- and dialkylated nonylphenothiazines, N-allylphenothiazine, N,N,N',N'-tetraphenyl-1,4-diaminobut-2-ene, N,N-bis-(2,2,6,6-tetramethyl piperidin-4-yl)-hexamethylenediamine, bis-(2,2,6,6-tetramethylpiperidin-4-yl)sebacate, 2,2,6,6-tetramethylpiperidin-4-one, 2,2,6,6-tetramethylpiperidin-4-ol
- [0099] 2. Further antioxidants: aliphatic or aromatic phosphites, esters of thiodipropionic acid or thiodiacetic acid or salts of dithiocarbamic or dithiophosphoric acid, 2,2,12,12-tetramethyl-5,9-dihydroxy-3,7,11-trithiamidecane and 2,2,15,15-tetramethyl-5,12-dihydroxy-3,7,10,14-tetrathiahexadecane
- [0100] 3. Further metal deactivators, e.g. for copper:
- [0101] 3.1. Benzotriazoles and derivatives thereof: 2-mercaptobenzotriazole, 2,5-dimercaptobenzotriazole, 4- or 5-alkylbenzotriazoles (e.g. toluotriazole) and derivatives thereof, 4,5,6,7-tetrahydrobenzotriazole, 5,5'-methylenebisbenzotriazole; Mannich bases of benzotriazole or toluotriazole, such as 1-[di(2-ethylhexylaminomethyl)]toluotriazole and 1-[di(2-ethylhexylaminomethyl)]benzotriazole

zole; alkoxyalkylbenzotriazoles, such as 1-(nonyloxymethyl)-benzotriazole, 1-(1-butoxyethyl)benzotriazole and 1-(1-cyclohexyloxybutyl)tolutriazole

[0102] 3.2. 1,2,4-Triazoles and derivatives thereof: 3-alkyl (or aryl)-1,2,4-triazoles, Mannich bases of 1,2,4-triazoles, such as 1-[di(2-ethylhexyl)aminomethyl]-1,2,4-triazole; alkoxyalkyl-1,2,4-triazoles, such as 1-(1-butoxyethyl)-1,2,4-triazole; acylated 3-amino-1,2,4-triazoles

[0103] 3.3. Imidazole derivatives: 4,4'-methylenebis(2-undecyl-5-methylimidazole), bis[(N-methyl)imidazol-2-yl] carbinol octyl ether

[0104] 3.4. Sulphur-containing heterocyclic compounds: 2-mercaptobenzothiazole, 2,5-dimercapto-1,3,4-thiadiazole, 2,5-dimercaptobenzothiadiazole and derivatives thereof; 3,5-bis[di-(2-ethylhexyl)aminomethyl]-1,3,4-thiadiazolin-2-one

[0105] 3.5. Amino compounds: salicylidenepropylenediamine, salicylamino guanidine and salts thereof

[0106] 4. Corrosion inhibitors

[0107] 4.1. Organic acids, their esters, metal salts, amine salts and anhydrides: e.g. alkyl- and alkenylsuccinic acids and partial esters thereof with alcohols, diols or hydroxycarboxylic acids, partial amides of alkyl- and alkenylsuccinic acids, 4-nonylphenoxyacetic acid, alkoxy- and alkoxyethoxycarboxylic acids, such as dodecyloxyacetic acid, dodecyloxy(ethoxy)acetic acid and amine salts thereof, and furthermore N-oleoylsarcosine, sorbitan monooleate, lead naphthenate, alkenylsuccinic anhydrides, e.g. dodecenylsuccinic anhydride, 2-(2-carboxyethyl)-1-dodecyl-3-methylglycerol and salts thereof, in particular sodium salts and triethanolamine salts

[0108] 4.2. Nitrogen-containing compounds:

[0109] 4.2.1 Tertiary aliphatic and cycloaliphatic amines and amine salts of organic and inorganic acids, e.g. oil-soluble alkylammonium carboxylates, and furthermore 1-[N,N-bis-(2-hydroxyethyl)amino]-3-(4-nonylphenoxy)propan-2-ol

[0110] 4.2.2 Heterocyclic compounds, e.g. substituted imidazolines and oxazolines, e.g. 2-heptadecenyl-1-(2-hydroxyethyl)-imidazoline

[0111] 5. Sulphur-containing compounds: barium dinonylnaphthalenesulphonates, calcium petroleum sulphonates, alkylthio-substituted aliphatic carboxylic acids, esters of aliphatic 2-sulphocarboxylic acids and salts thereof

[0112] 6. Viscosity index improvers: polyacrylates, polymethacrylates, vinylpyrrolidone/methacrylate copolymers, polyvinylpyrrolidones, polybutenes, olefin copolymers, styrene/acrylate copolymers, polyethers

[0113] 7. Pour point depressants: poly(meth)acrylates, ethylene-vinyl acetate copolymers, alkyl polystyrenes, fumarate copolymers, alkylated naphthalene derivatives

[0114] 8. Dispersants/Surfactants: polybutenylsuccinamides or polybutenylsuccinimides, polybutenylphosphonic acid derivatives, basic magnesium, calcium and barium sulphonates and phenolates

[0115] 9. High pressure and antiwear additives: sulphur- and halogen-containing compounds, e.g. chlorinated paraffins, sulphonated olefins or vegetable oils (soy bean oil, rapeseed oil), alkyl or aryl di- or trisulphides, benzotriazoles or derivatives thereof, such as bis(2-ethylhexyl)aminomethyl tolutriazoles, dithiocarbamates, such as methylenebisdiethyl dithiocarbamate, derivatives of 2-mercaptobenzothiazole, such as 1-[N,N-bis(2-ethylhexyl)aminomethyl]-2-mercapto-1H-1,3-benzothiazole,

derivatives of 2,5-dimercapto-1,3,4-thiadiazole, such as 2,5-bis(tert-nonyldithio)-1,3,4-thiadiazole

[0116] 10. Substances for reducing the coefficient of friction: lard oil, oleic acid, tallow, rapeseed oil, sulphurised fats, amines. Further examples are stated in EP-A-0 565 487

[0117] 11. Special additives for use in water/oil metal processing and hydraulic fluids:

[0118] 11.1 Emulsifiers: petroleum sulphonates, amines, such as polyoxyethylated fatty amines, non-ionic surface-active substances

[0119] 11.2 Buffers: alkanolamines

[0120] 11.3 Biocides: triazines, thiazolinones, trisnitromethane, morpholine, sodium pyridinethiol

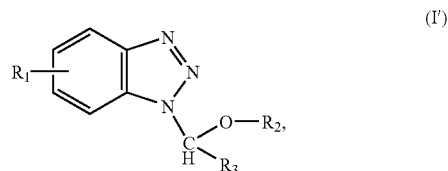
[0121] 11.4 Processing speed improvers: calcium sulphonates and barium sulphonates.

[0122] Said components can be mixed with the lubricants in a manner known per se. It is also possible to prepare a concentrate or a so-called additive packet, which can be diluted to the concentrations of use for the corresponding lubricant according to consumption.

[0123] A preferred embodiment of the invention relates to a composition comprising

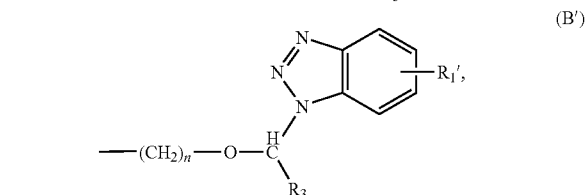
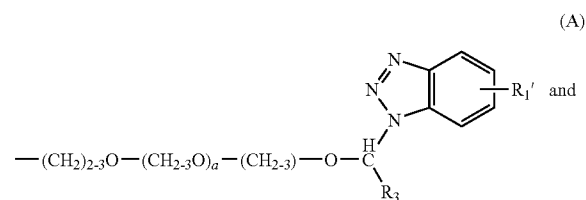
[0124] A) A mixture consisting essentially of

[0125] a) A benzotriazole compound:



[0126] Wherein R_1 represents hydrogen or methyl;

[0127] R_2 represents a substituent selected from the group consisting of C_1 - C_8 alkyl, C_5 - C_7 cycloalkyl,



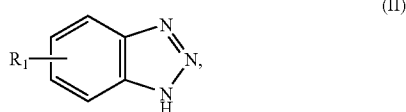
[0128] Wherein R_1' is as defined as R_1 ;

[0129] The index a represents a numeral from 1 to 10;

[0130] The index n represents a numeral from 2 to 8; and

[0131] R_3 represents hydrogen or a substituent selected from the group consisting of C_1 - C_8 alkyl, C_5 - C_7 cycloalkyl and phenyl or an isomer of the compound (I'); and

[0132] b) A benzotriazole compound:



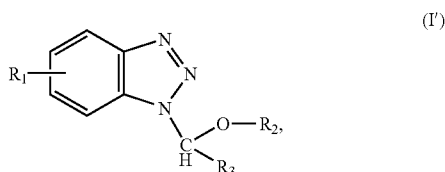
[0133] Wherein R_1 represents hydrogen or methyl; and

[0134] A) A functional fluid selected from the group consisting of lubricants, hydraulic agents, metal working fluids and coating agents.

[0135] A highly preferred embodiment of the invention relates to a composition comprising

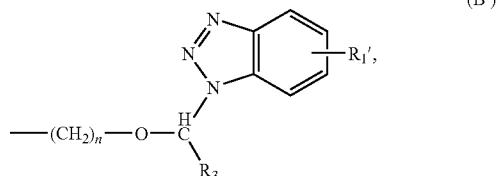
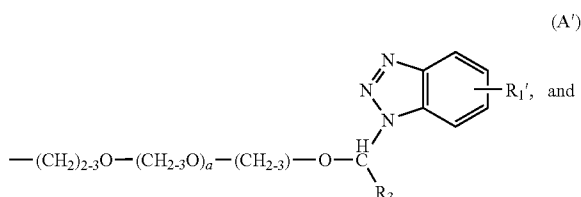
[0136] A) A mixture consisting essentially of

[0137] a) A benzotriazole compound:



[0138] Wherein R_1 represents hydrogen or methyl;

[0139] R_2 represents a substituent selected from the group consisting of C_1 - C_8 alkyl, C_5 - C_7 cycloalkyl,



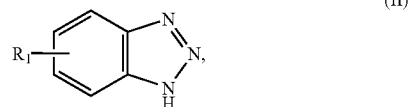
[0140] Wherein R_1' is as defined as R_1 ,

[0141] The index a represents a numeral from 1 to 10;

[0142] The index n represents a numeral from 2 to 8, and

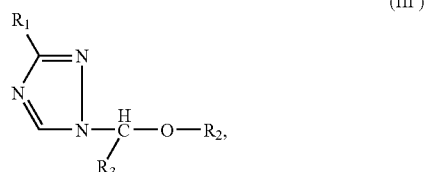
[0143] R_3 represents hydrogen or a substituent selected from the group consisting of C_1 - C_8 alkyl, C_5 - C_7 cycloalkyl and phenyl or an isomer of the compound (I');

[0144] b) A benzotriazole compound:



[0145] Wherein R_1 represents hydrogen or methyl; and

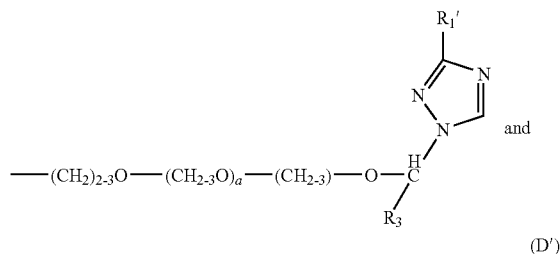
[0146] c) A triazole compound:



[0147] Wherein R_1 represents hydrogen or methyl;

[0148] R_2 represents a substituent selected from the group consisting of C_1 - C_8 alkyl, C_5 - C_7 cycloalkyl,

(C')



[0149] Wherein R_1' is as defined as R_1 ; and

[0150] The index a represents a numeral from 1 to 10;

[0151] The index n represents a numeral from 2 to 8; and

[0152] R_3 represents hydrogen or a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl and phenyl; and

[0153] B) A functional fluid selected from the group consisting of lubricants, hydraulic agents, metal working fluids and coating agents.

[0154] The invention particularly refers to a composition comprising

[0155] A) A mixture consisting essentially of

[0156] a) A benzotriazole compound (I'), wherein

[0157] R_1 represents hydrogen or methyl;

[0158] R_2 represents C_5 - C_7 cycloalkyl or the group (A'), wherein R_1' is as defined as R_1 ;

[0159] And the index a represents a numeral from 1 to 8; and

[0160] R_3 represents C_1 - C_8 alkyl or C_5 - C_7 cycloalkyl or an isomer of the compound (I'); and

- [0161] b) A benzotriazole compound (II), wherein
- [0162] R_1 represents hydrogen or methyl; and
- [0163] B) A functional fluid selected from the group consisting of lubricants, hydraulic agents, metal working fluids and coating agents.
- [0164] Another highly preferred embodiment of the invention relates to composition comprising
- [0165] A) A mixture consisting essentially of
- [0166] a) A benzotriazole compound (I'), wherein
- [0167] R_1 represents hydrogen or methyl;
- [0168] R_2 represents C_5 - C_7 cycloalkyl or the group (A'), wherein R_1' is as defined as R_1 ;
- [0169] And the index a represents a numeral from 1 to 8; and
- [0170] R_3 represents C_1 - C_8 alkyl or C_5 - C_7 cycloalkyl or an isomer of the compound (I'); and
- [0171] b) A benzotriazole compound (II), wherein
- [0172] R_1 represents hydrogen or methyl; and
- [0173] c) A triazole compound (III), wherein
- [0174] R_1 represents hydrogen or methyl;
- [0175] R_2 represents C_5 - C_7 cycloalkyl or the group (B), wherein R_1' is as defined as R_1 ; and
- [0176] The index a represents a numeral from 1 to 8; and
- [0177] R_3 represents C_1 - C_8 alkyl or C_5 - C_7 cycloalkyl or an isomer of the compound (I'); and
- [0178] B) A functional fluid selected from the group consisting of lubricants, hydraulic agents, metal working fluids and coating agents.
- [0179] A further embodiment of the invention relates to a mixture comprising
- [0180] a) A benzotriazole compound (I), wherein
- [0181] R_1 represents hydrogen or C_1 - C_4 alkyl;
- [0182] R_2 represents a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ C_5 - C_7 cycloalkyl and C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl or represents the group (A),
- [0183] Wherein R_1' is as defined as R_1 ; and
- [0184] The index a represents a numeral from 1 to 10; and
- [0185] R_3 represents hydrogen or a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ C_5 - C_7 cycloalkyl, C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl, phenyl, phenyl- C_1 - C_4 alkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ phenyl and $(C_1$ - C_4 alkyl) $_{1-3}$ phenyl- C_1 - C_4 alkyl;
- [0186] b) A benzotriazole compound (II), wherein
- [0187] R_1 , represents hydrogen or C_1 - C_4 alkyl; and, optionally,
- [0188] c) A triazole compound (III), wherein
- [0189] R_1 represents hydrogen or C_1 - C_4 alkyl;
- [0190] R_2 represents a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ C_5 - C_7 cycloalkyl and C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl or represents the group (B), wherein
- [0191] R_1' is as defined as R_1 ; and
- [0192] The index a represents a numeral from 1 to 10; and
- [0193] R_3 represents hydrogen or a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ C_5 - C_7 cycloalkyl,

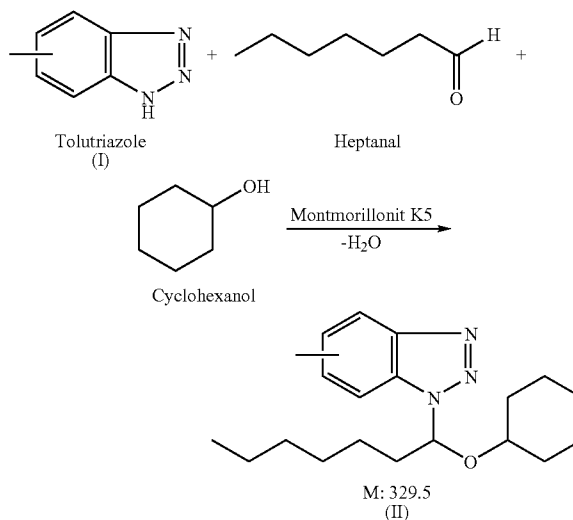
C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl, phenyl, phenyl- C_1 - C_4 alkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ phenyl and $(C_1$ - C_4 alkyl) $_{1-3}$ phenyl- C_1 - C_4 alkyl.

[0194] The mixtures defined above is particularly useful in method for improving the functional properties of lubricants, hydraulic or metal-working fluids or coating compositions, which comprises adding to a functional fluid the mixture defined above and, optionally, further additives.

[0195] The following examples illustrate the invention:

EXAMPLE 1

[0196]



[0197] 99.9 g (0.75 mol) tolutriazole (IRGAMET TTA, 2:3 mixture of 4(5)-methyl-1H-benzotriazole (2:3)), 75.15 g (0.75 mol) cyclohexanol (Riedel 24217) and 18.8 g (7% per weight based on the weight of all reactants) Montmorillonite K5 (Fluka 69908) are added to 147.0 g cyclohexane. The suspension is stirred and heated under reflux conditions. The water from the earth clay is removed for 30 min. in the gas phase and separated. 90.06 g (0.789 mol) heptanal are added within a time period of 30 min. The mixture is stirred and heated for 4 h under reflux conditions and, when the separation of water ceases, cooled to room temperature and filtered. The solvent is removed from the yellowish filtrate in the vacuum and a yellowish oil is obtained, which contains less than 1% TTA (HPLC). In the gas chromatogram 0.7% TTA, 1.1% heptanal and 0.8% cyclohexanol are found.

Elemental Analysis [%]:

[0198]

	C	H	N
Calc.	72.91	9.48	12.75
Found	72.85/72.86	9.60/9.64	12.52/12.51

[0199] According to an alternative embodiment of the process, Montmorillonit is replaced with Bleicherde Tonsil® Supreme 110FF.

EXAMPLE 2

[0200] Mixtures comprising different amounts of toluetria-zole (I) with regard to the condensation product (II) are prepared in a manner analogous to Example 1 by adding excess amounts of (I) to the reaction mixture:

Components	Amounts [% by weight]						
	B-1	B-2	B-3	B-4	B-5	B-6	B-7
(II)	95.0	92.5	90.0	87.5	85.0	82.5	80.0
(I)	5.0	7.5	10.0	12.5	15.0	17.5	20.0
Total Weight (I)	112.7	119.1	125.5	131.9	138.3	147.7	151.1
Excess of (I)	12.8	19.2	25.6	32.0	38.4	47.8	51.2

EXAMPLE 3

Application Tests

3.1 Methods

3.1.1 Rotary Bomb Oxidation Test ASTM D-2272

[0201] A 0.05% solution of the test composition in a mineral oil of turbine quality is prepared, which oil has a viscosity

of 26.2 mm²/sec (40° C.) and 4.8 mm²/sec (100° C.) and a sulphur content of 0.54%. The solution can also contain a phenolic or amine antioxidant. The time required at a temperature of 150° C. for a minimum pressure drop of 1.75 bar starting from the maximum pressure of 6.2 bar is measured.

3.1.2 Modified ASTM D-130 Copper Strip Test

[0202] A 0.04% solution of the test composition in a poly-alpha-olefin (PAO), which has a viscosity of 7.7-8.0 cSt (100° C.) and a content of 50 ppm of elemental sulphur, is prepared. A copper strip (50×10×1 mm) is polished with grade 150 silicon carbide, which was absorbed with a wool pad wet with high-boiling petroleum ether. The polished strip is then completely immersed in the prepared solution, which is kept at 100° C. for two hours. The strip is then removed, washed with isooctane and dried and its colour is compared with the standardized colour samples of the tarnish chart, which is applicable for the corrosion test of copper strips according to ASTM D130.

3.2 Compositions Tested

[0203]

Components	Composition Tested [% by weight]									
	Control 1	Control 2	Control 3	1 (B-1)	2 (B-2)	3 (B-3)	4 (B-4)	5 (B-5)	6 (B-6)	7 (B-7)
Base Fluid ¹⁾	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.	Bal.
Antifoam ²⁾	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Base	—	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Formulation ³⁾										
(II)	—	—	0.04							
Blends	—	—		0.04	0.04	0.04	0.04	0.04	0.04	0.04

¹⁾Group II, ISO 46 (blend of Jurong 150 and 500)

²⁾IRGALUBE AF 1

³⁾Base Formulation

Components	Amount [% by weight]
IRGANOX L57	39.5
IRGANOX L135	39.5
PANA	15.8
IRGACOR NPA	2.6
Sarkosyl O	2.6

3.3 Results

[0204]

Test	Composition Tested [% by weight]									
	Control 1	Control 2	Control 3	1 (B-1)	2 (B-2)	3 (B-3)	4 (B-4)	5 (B-5)	6 (B-6)	7 (B-7)
RPVOT ¹⁾	28	452	507	581	582	646	640	640	645	651
D 130 rating	4a	4a	3b	1b+	1b+	1b+	1b+	1b+	1b+	1b+

¹⁾RPVOT: Average of duplicates, minutes; ASTM D 2272

²⁾Copper corrosion per ASTM D 130, 3 h at 125° C. with 50 ppm elemental sulphur present

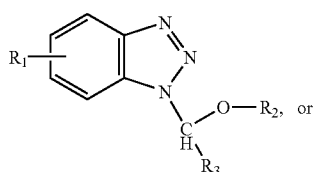
[0205] The findings in the RPVOT show outstanding anti-oxidative properties exerted by representative compositions in a non-aqueous functional fluid in the presence of phenolic and aminic antioxidants.

[0206] The findings in the copper corrosion test show outstanding deactivation of copper, which is achieved in a non-aqueous functional fluid in the presence of representative blends.

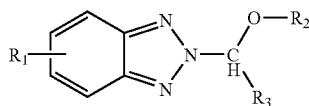
1. A composition comprising

A) A mixture consisting essentially of:

a) A benzotriazole compound:



(I')



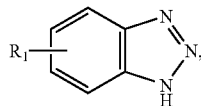
(I'')

Wherein R_1 represents hydrogen or C_1 - C_4 alkyl;

R_2 represents a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ C_5 - C_7 cycloalkyl and C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl; and

R_3 represents hydrogen or a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ C_5 - C_7 cycloalkyl, C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl, phenyl, phenyl- C_1 - C_4 alkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ phenyl and $(C_1$ - C_4 alkyl) $_{1-3}$ phenyl- C_1 - C_4 alkyl;

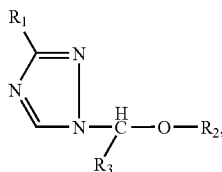
b) A benzotriazole compound:



(II)

Wherein R_1 represents hydrogen or C_1 - C_4 alkyl; and, optionally,

c) A triazole compound:



(III')

Wherein R_1 represents hydrogen or C_1 - C_4 alkyl;

R_2 represents a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ C_5 - C_7 cycloalkyl and C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl; and

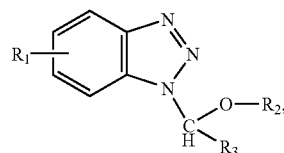
R_3 represents hydrogen or a substituent selected from the group consisting of C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ C_5 - C_7 cycloalkyl, C_5 - C_7 cycloalkyl- C_1 - C_4 alkyl, phenyl, phenyl- C_1 - C_4 alkyl, $(C_1$ - C_4 alkyl) $_{1-3}$ phenyl and $(C_1$ - C_4 alkyl) $_{1-3}$ phenyl- C_1 - C_4 alkyl; and

B) A functional fluid selected from the group consisting of lubricants, hydraulic agents, metal working fluids and coating agents.

2. A composition comprising

A) A mixture consisting essentially of

a) A benzotriazole compound:



(I')

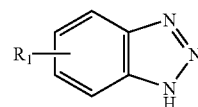
Wherein

R_1 represents hydrogen or methyl;

R_2 represents C_1 - C_8 alkyl or C_5 - C_7 cycloalkyl;

R_3 represents hydrogen or a substituent selected from the group consisting of C_1 - C_8 alkyl, C_5 - C_7 cycloalkyl and phenyl or an isomer of the compound (I'); and

b) A benzotriazole compound:



(II)

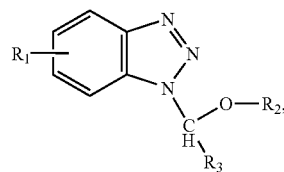
Wherein R_1 represents hydrogen or methyl; and

C) A functional fluid selected from the group consisting of lubricants, hydraulic agents, metal working fluids and coating agents.

3. A composition according to claim 1 comprising

A) A mixture consisting essentially of

a) A benzotriazole compound:



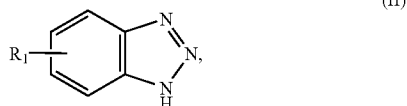
(I')

Wherein R_1 represents hydrogen or methyl;

R_2 represents a C_1 - C_8 alkyl or C_5 - C_7 cycloalkyl; and

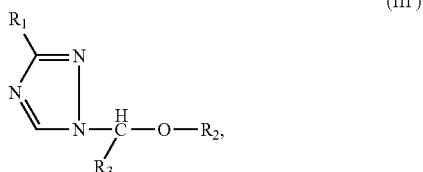
R_3 represents hydrogen or a substituent selected from the group consisting of C_1 - C_8 alkyl, C_5 - C_7 cycloalkyl and phenyl or an isomer of the compound (I');

b) A benzotriazole compound:



Wherein R₁ represents hydrogen or methyl; and

c) A triazole compound:



Wherein R₁ represents hydrogen or methyl;

R₂ represents a C₁-C₈alkyl or C₅-C₇cycloalkyl; and

R₃ represents hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl, C₅-C₇cycloalkyl and phenyl or an isomer of the compound (III'); and

B) A functional fluid selected from the group consisting of lubricants, hydraulic agents, metal working fluids and coating agents.

4. A composition according to claim 2 comprising

A) A mixture consisting essentially of

a) A benzotriazole compound (I'), wherein

R₁ represents hydrogen or methyl;

R₂ represents C₅-C₇cycloalkyl; and

R₃ represents C₁-C₈alkyl or C₅-C₇cycloalkyl or an isomer of the compound (I'); and

b) A benzotriazole compound (II), wherein

R₁ represents hydrogen or methyl; and

B) A functional fluid selected from the group consisting of lubricants, hydraulic agents, metal working fluids and coating agents.

5. A composition according to claim 1 comprising

A) A mixture consisting essentially of

a) A benzotriazole compound (I'), wherein

R₁ represents hydrogen or methyl;

R₂ represents C₅-C₇cycloalkyl; and

R₃ represents C₁-C₈alkyl or C₅-C₇cycloalkyl or an isomer of the compound (I');

b) A benzotriazole compound (II), wherein

R₁ represents hydrogen or methyl; and

c) A triazole compound (III'), wherein

R₁ represents hydrogen or methyl;

R₂ represents C₅-C₇cycloalkyl; and

R₃ represents C₁-C₈alkyl or C₅-C₇cycloalkyl or an isomer of the compound (I'); and

B) A functional fluid selected from the group consisting of lubricants, hydraulic agents, metal working fluids and coating agents.

6. A composition according to claim 1, which comprises additional additives selected from the group consisting of metal deactivators, antioxidants, rust inhibitors, viscosity index improvers, pour-point depressants, dispersants, surfactants, extreme-pressure additives and antiwear additives.

7. A mixture comprising

a) A benzotriazole compound (I), wherein

R₁ represents hydrogen or C₁-C₄alkyl;

R₂ represents a substituent selected from the group consisting of C₁-C₁₂alkyl, C₅-C₇cycloalkyl, (C₁-C₄alkyl)₁₋₃C₅-C₇cycloalkyl and C₅-C₇cycloalkyl-C₁-C₄alkyl; and

R₃ represents hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl, C₅-C₇cycloalkyl, (C₁-C₄alkyl)₁₋₃C₅-C₇cycloalkyl, C₅-C₇cycloalkyl-C₁-C₄alkyl, phenyl, phenyl-C₁-C₄alkyl, (C₁-C₄alkyl)₁₋₃phenyl and (C₁-C₄alkyl)₁₋₃phenyl-C₁-C₄alkyl;

b) A benzotriazole compound (II), wherein

R₁ represents hydrogen or C₁-C₄alkyl; and, optionally,

c) A triazole compound (III'), wherein

R₁ represents hydrogen or C₁-C₄alkyl;

R₂ represents a substituent selected from the group consisting of C₁-C₁₂alkyl, C₅-C₇cycloalkyl, (C₁-C₄alkyl)₁₋₃C₅-C₇cycloalkyl and C₅-C₇cycloalkyl-C₁-C₄alkyl; and

R₃ represents hydrogen or a substituent selected from the group consisting of C₁-C₁₂alkyl, C₅-C₇cycloalkyl, (C₁-C₄alkyl)₁₋₃C₅-C₇cycloalkyl, C₅-C₇cycloalkyl-C₁-C₄alkyl, phenyl, phenyl-C₁-C₄alkyl, (C₁-C₄alkyl)₁₋₃phenyl and (C₁-C₄alkyl)₁₋₃phenyl-C₁-C₄alkyl.

8. A method for improving the functional properties of lubricants, hydraulic or metal-working fluids or coating compositions, which comprises adding to a functional fluid the mixture according to claim 7 and, optionally, further additives.

* * * * *