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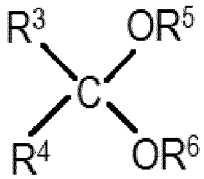
(54) **CLEANING COMPOSITION FOR METAL SURFACES**

(57) The present invention is directed to a cleaning composition suitable for metallic surfaces of vehicles, said composition comprising, based on the weight of the composition:
from 75 to 90 wt.% of A) at least one compound defined by Formula (I)

$$R^1\text{-}O\text{-}(M\text{-}O)_n\text{-}R^2 \qquad (I)$$

wherein: R^1 and R^2 are independently selected from hydrogen and C_1-C_6 alkyl groups;
each M is independently selected from C_1-C_6 alkylene groups; and,
n is an integer of from 1 to 5;

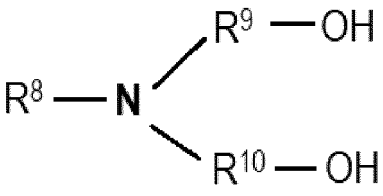
from 5 to 15 wt.% of B) at least one acetal defined by Formula (II) below:



(II)

wherein: R^3 and R^4 are independently selected from hydrogen, C_1-C_6 alkyl, C_2-C_6-alkenyl, C_6-C_{10} aryl, C_3-C_6 cycloalkyl, OR^5 and OR^6;
R^5 and R^6 are independently selected from C_1-C_{12} alkyl, C_2-C_6-alkenyl, C_6-C_{10} aryl, C_3-C_8 cycloalkyl and -(AO)x-R^7;
A is -C_2H_4-, -C_3H_7- or -C_4H_8-;
x is an integer of from 1 to 4; and,
R^7 is C_1-C_{12} alkyl, C_2-C_6-alkenyl, C_6-C_{10} aryl or C_3-C_8 cycloalkyl; and,

from 1 to 10 wt.% of C) at least hydroxyalkylamino compound defined by Formula (III) below



(III)

wherein: R^8 is selected from hydrogen, C_1-C_6 alkyl, 2-hydroxyethyl and 2-hydroxypropyl;

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(Cont. next page)

R^9 is C_2-C_6 alkyl; and,
R^{10} is C_2-C_6 alkyl.

Description

Field of the Invention

[0001] The present invention is directed to a cleaning composition for metallic surfaces. More particularly, the present invention is directed to cleaning compositions which can be formulated to have a low level of volatile organic compounds (VOC) and which are effective at removing adhesive materials from metallic surfaces.

Background of the Invention

[0002] During their manufacture and repair, automotive and other vehicular bodies and / or manufactured metallic parts can acquire unwanted materials on their surfaces including but not limited to adhesives, tar, grease and oils. The build-up of such materials can be deleterious, particularly to moving parts, and it is therefore desirable to regularly remove such unwanted materials from the bodies and parts. Given that conventional cleaning methods are often inadequate for removing adhesives and in particular resin adhesives from metallic surfaces, a number of specialist cleaning compositions have been developed in the art.

[0003] WO 1995/005446 A1 (Dottolo Research Corporation) describes an auto body cleaner and all purpose adhesive remover composition which consists essentially of: (A) d-limonene; and, (B) from 2 to 12 percent by weight of a (nonionic and anionic) surfactant that is cocamide DEA/Dihexyl sodium sulfosuccinate (CDDSS).

[0004] US Patent No. 4,370,174 (Braithwaite Jr.) describes the removal of adhesives from surfaces with a cleaning solution containing 40-80 weight percent of an organic solvent, an inorganic solid absorbent powder, and two surfactants. Such a solution contains both organic solvents and abrasives, which tend to deteriorate rubber and like soft materials often found on machined parts proximate to metallic surfaces.

[0005] Evidently, a cleaning composition should be effective and safe to use. Desirably, a cleaning composition should also be relatively free from objectionable odor and have a low level of volatile organic compounds (VOC) therein, especially given that National and State Governments are rightfully enacting legislation to control the level of volatile organic compounds (VOC) in commercial products.

[0006] US Patent No. 6,017,863 (Cala et al.) describes an aqueous cleaning solution for removing uncured adhesive resins from substrates. The cleaning solution contains a surfactant mixture of N-alkyl-2-pyrrolidone and an aminocarboxylic acid surfactant. It has been found, however, that such solutions containing only surfactants and water are ineffective for removing many wholly or partially cured adhesives, and especially resin-based adhesives.

[0007] US Patent No. 6,399,554 A (Harrington et al.) describes a cleaning composition for removing an adhesive from a hard substrate comprising: from 25 to 98 percent by weight of water; from 5 to 74 percent by weight of a chaotropic agent such as urea or guanadine hydrochloride; and, from 0.001 to 10 percent by weight of at least one surfactant.

[0008] There is a need in the art to provide an alternative composition having an effective cleaning performance but which further: has a low volatile organic compound (VOC) level; is non-corrosive of standard personal protective equipment; can itself provide protection for the cleaned surface against corrosion; and, can be fully and facilely removed from the surface. The present invention addresses this need.

Statement of the Invention

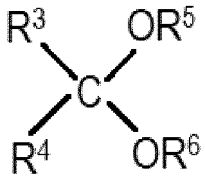
[0009] In accordance with a first aspect of the invention, there is provided a cleaning composition for metallic surfaces of vehicles as defined in the appended claims, said composition comprising, based on the weight of the composition:

from 75 to 90 wt.%, preferably from 80 to 90 wt.% of A) at least one compound defined by Formula (I)

$$R^1\text{-}O\text{-}(M\text{-}O)_n\text{-}R^2 \qquad (I)$$

wherein: R^1 and R^2 are independently selected from hydrogen and C_1-C_6 alkyl groups;
each M is independently selected from C_1-C_6 alkylene groups; and,
n is an integer of from 1 to 5;

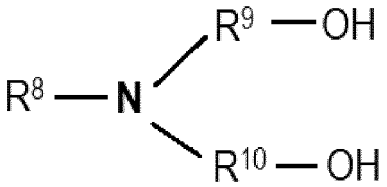
from 5 to 15 wt.%, preferably from 5 to 12 wt.% of B) at least one acetal defined by Formula (II) below:



(II)

wherein: R^3 and R^4 are independently selected from hydrogen, C_1-C_6 alkyl, C_2-C_6-alkenyl, C_6-C_{10} aryl, C_3-C_6 cycloalkyl, OR^5 and OR^6;
R^5 and R^6 are independently selected from C_1-C_{12} alkyl, C_2-C_6-alkenyl, C_6-C_{10} aryl, C_3-C_8 cycloalkyl and -(AO)x-R^7;
A is -C_2H_4-, -C_3H_7- or -C_4H_8-;
x is an integer of from 1 to 4; and,
R^7 is C_1-C_{12} alkyl, C_2-C_6-alkenyl, C_6-C_{10} aryl or C_3-C_8 cycloalkyl; and,

from 1 to 10 wt.%, preferably from 3 to 8 wt.% of C) at least hydroxyalkylamino compound defined by Formula (III) below



(III)

wherein: R^8 is selected from hydrogen, C_1-C_6 alkyl, 2-hydroxyethyl and 2-hydroxypropyl;
R^9 is C_2-C_6 alkyl; and,
R^{10} is C_2-C_6 alkyl.

[0010] When the recited components A) to C) are mixed in the stated amounts, the composition provides an effective cleaning performance without emanating an unpleasant odor. Moreover, upon application to a surface, the composition creates a wet film which can endure on the surface for several hours if left untreated: this film serves to impart to the surface a temporary protection against corrosion.

[0011] In accordance with a second aspect of the invention, there is provided a wipe comprising a substrate which is impregnated with a cleaning composition as defined hereinabove and in the appended claims.

[0012] In accordance with a third aspect of the invention, there is provided a kit of parts comprising: a cleaning composition as defined hereinabove and in the appended claims; and, a means for applying said composition to a metallic surface.

Definitions

[0013] As used herein, the singular forms "*a*", "*an*" and "*the*" include plural referents unless the context clearly dictates otherwise.

[0014] The terms "*comprising*", "*comprises*" and "*comprised* of" as used herein are synonymous with "*including*", "*includes*", *"containing*" or "*contains*", and are inclusive or open-ended and do not exclude additional, non-recited members, elements or method steps.

[0015] When amounts, concentrations, dimensions and other parameters are expressed in the form of a range, a preferable range, an upper limit value, a lower limit value or preferable upper and limit values, it should be understood that any ranges obtainable by combining any upper limit or preferable value with any lower limit or preferable value are also specifically disclosed, irrespective of whether the obtained ranges are clearly mentioned in the context.

[0016] The words "*preferred*", "*preferably*", "*desirably*" and "*particularly*" are used frequently herein to refer to embodiments of the disclosure that may afford particular benefits, under certain circumstances. However, the recitation of one or more preferable, preferred, desirable or particular embodiments does not imply that other embodiments are not useful and is not intended to exclude those other embodiments from the scope of the disclosure.

[0017] As used herein, room temperature is 23°C plus or minus 2°C.

[0018] As used herein, the term "*volatile organic compound*" (VOC) is defined as a carbon-containing compound - excluding methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, ammonium carbonate, and other exempt compounds under 40 Code of Federal Regulations (CFR) § 51.100(s) - that has a vapor

pressure of at least 0.01 kPa at standard room temperature (EC Directive 1999/13/EC).

[0019] Measurement of the VOC emissions of the compositions of the present invention should be conducted in accordance with ASTM Standard Test Method D2369-90. The measurement conditions of this standard should be directed to quantitatively measure the full content of VOC, wherein VOC is as defined above in this patent description.

[0020] As used herein, "*solvent*" refers to any liquid that completely or partially dissolves a solid, liquid, or gaseous solute.

[0021] If an organic liquid product has a boiling point region, then the onset (the lowest temperature) of the boiling point range at atmospheric pressure is taken as the nominal boiling point. Where necessary any measurement of the initial boiling point for materials should be conducted in accordance with ASTM Standard Test Method D1078-95, or its most current version.

[0022] Unless otherwise indicated, the term "*alkyl*", as used herein, refers to monovalent group that is a radical of an alkane and which includes straight chain moieties, and where the number of carbon atoms suffices, branched moieties. The alkyl group may optionally be substituted.

[0023] As used herein, the terms "C_1-C_{12} *alkyl*" group and "C_1-C_6 *alkyl*" group refer to monovalent groups that contain respectively from 1 to 12 and from 1 to 5 carbons atoms, that are radicals of an alkane and include straight-chain and branched organic groups. Examples of alkyl groups include, but are not limited to: methyl; ethyl; propyl; isopropyl; n-butyl; isobutyl; sec-butyl; tert-butyl; n-pentyl n-hexyl; n-heptyl; and, 2-ethylhexyl. In the present invention, such alkyl groups may be unsubstituted or may be substituted with one or more substituents such as halo, nitro, cyano, amido, amino, sulfonyl, sulfinyl, sulfanyl, sulfoxy, urea, thiourea, sulfamoyl, sulfamide and hydroxy. The halogenated derivatives of the exemplary hydrocarbon radicals listed above might, in particular, be mentioned as examples of suitable substituted alkyl groups.

[0024] Where the term "C_1-C_6 *alkyl group*" is used to define the substituents R^1 and R^2 of general Formula (I) herein, a preference for unsubstituted alkyl groups containing from 1-5 carbon atoms (C_1-C_5 alkyl) - for example, unsubstituted and unbranched alkyl groups containing from 2 to 4 carbon atoms (C_2-C_4 alkyl) or from 2 to 3 carbon atoms (C_2-C_3 alkyl) - should be noted.

[0025] The term "C_1-C_6 *alkylene group*" refers to divalent groups that contain from 1 to 6 carbon atoms, that are radicals of an alkane and include linear and branched organic groups, which groups may be substituted or substituted and may optionally be interrupted by at least one heteroatom. Where the term "C_1-C_6 *alkylene group*" is used to define substituent M of general Formula (I) herein, it is particularly preferred for said alkylene group to be uninterrupted and linear.

[0026] As used herein, "C_2-C_6 *alkenyl*" group refers to an aliphatic carbon group that contains 2 to 6 carbon atoms and at least one double bond disposed in any position. Like the aforementioned alkyl group, an alkenyl group can be straight or branched, and may optionally be substituted. The term "*alkenyl*" also encompasses radicals having "cis" and "trans" configurations, or alternatively, "E" and "Z" configurations, as appreciated by those of ordinary skill in the art. In general, however, a preference for unsubstituted alkenyl groups containing from 2 to 6 (C_2-C_6) or from 2 to 4 (C_2-C_4) carbon atoms should be noted. And Examples of C_2-C_6 alkenyl groups include, but are not limited to: ethenyl; 1-propenyl; 2-propenyl; 1-methyl-ethenyl; 1-butenyl; 2-butenyl; 4-methylbutenyl; 1-pentenyl; 2-pentenyl; 3-pentenyl; 4-pentenyl; 4-methyl-3-pentenyl; 1-hexenyl; 3-hexenyl; and, 5-hexenyl.

[0027] The term "C_3-C_{10} *cycloalkyl*" as used herein means an optionally substituted, saturated cyclic hydrocarbon having 3-10 carbon atoms. Exemplary cycloalkyl groups include cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, adamantane and norbornane groups.

[0028] The term "*alkoxy*", as used herein, means "-*O*-*alkyl*" or "*alkyl*-*O*-", wherein *"alkyl*" is defined as above.

[0029] As used herein, the term "C_6-C_{10} *aryl group*" refers to an aromatic monocyclic or multicyclic ring system of 6 to 10 carbon atoms. The "aryl group" may optionally be substituted with one or more C_1-C_{12} alkyl, alkylene, alkoxy, or haloalkyl groups. Exemplary aryl groups include phenyl or naphthyl, or substituted phenyl or substituted naphthyl.

[0030] The term "*substituted*" refers to substitution with at least one suitable substituent. For completeness: the substituents may connect to the specified group or moiety at one or more positions; and, multiple degrees of substitution are allowed unless otherwise stated. Further, the terms "*substitution*" or "*substituted with*" include the implicit proviso that such substitution is in accordance with permitted valence of the substituted atom and the substituent, and that the substitution results in a stable compound that does not spontaneously undergo transformation by, for instance, rearrangement, cyclization or elimination.

[0031] Where mentioned, the expression "*interrupted by at least one heteroatom*" means that the main chain of a residue comprises, as a chain member, at least one atom that differs from carbon atom. More particularly the term "*heteroatom*" refers to nitrogen, oxygen, phosphorus or sulfur. Oxygen (O) and nitrogen (N) may be mentioned as typical heteroatoms in the context of the present invention.

[0032] As used herein the term "*substantially free*" refers to a composition containing less than 0.5% by weight of the indicated component in the total composition. As a corollary, the term "*anhydrous*" as used herein to define a composition means said composition contains less than 0.5% water, based on the total weight of the composition.

[0033] The term "*additive*" as used herein, may refer to a compound or substance that may be added to another

substance or composition for its ability to alter the properties of the other substance or composition.

[0034] As used herein, "*vehicle*" means any form of self-propelled conveyance. Whilst the present invention has particular applicability to the metallic surfaces of automobiles, its use is not limited to automobiles: it may for instance find utility in the cleaning of farming equipment, earth-moving equipment, watercraft, carts and motorcycles, during the manufacture or repair of those vehicles.

[0035] As used herein, "*metallic*" means any type of metal, metal alloy, or mixture thereof, and specifically includes but is not limited to steel, iron, and stainless steel.

Detailed Description of the Invention

Component A)

[0036] Component A) of the present cleaning composition consists of at least one compound defined by general Formula (I):

$$R^1\text{-}O\text{-}(M\text{-}O)_n\text{-}R^2 \qquad (I)$$

wherein: R^1 and R^2 are independently selected from hydrogen and C_1-C_6 alkyl groups;
each M is independently selected from C_1-C_6 alkylene groups; and,
n is an integer of from 1 to 5.

[0037] Preferably, component A) comprises or consists of at least one compound of general Formula (I) which meets one, two or desirably all of the following conditions i) to iii):

i) one of R^1 and R^2 is hydrogen and the other is a C_1-C_5 alkyl group;
ii) each M is a C_2-C_4 alkylene group; and,
iii) n is from 1 to 3.

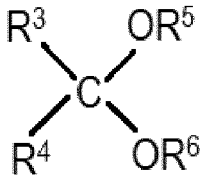
[0038] In important embodiments, component A) comprises or consists of at least one compound of general Formula (I) which meets one, two or preferably all of the following conditions i) to iii):

i) one of R^1 and R^2 is hydrogen and the other is a C_2-C_4 alkyl group;
ii) M is a C_2-C_3 alkylene group; and,
iii) n is 1.

[0039] In an exemplary embodiment, component A) consists of at least one compound selected from the group consisting of: 2-butoxy-ethanol; 2-(2-butoxyethoxy)ethanol; 2-[2-(2-butoxyethoxy)ethoxy]ethanol; tripropylene glycol methyl ether; and, (2-methoxy-methylethoxy)propanol. A preference for the use of 2-(2-butoxyethoxy)ethanol as component a) should be noted.

Component B)

[0040] Component B) of the present composition consists of at least one acetal defined by General Formula (II) below:



(II)

wherein: R^3 and R^4 are independently selected from hydrogen, C_1-C_6 alkyl, C_2-C_6-alkenyl, C_6-C_{10} aryl, C_3-C_6 cycloalkyl, OR^5 and OR^6;
R^5 and R^6 are independently selected from C_1-C_{12} alkyl, C_2-C_6-alkenyl, C_6-C_{10} aryl, C_3-C_8 cycloalkyl and -(AO)x-R^7;
A is $-C_2H_4-$, $-C_3H_7-$ or $-C_4H_8-$;
x is an integer of from 0 to 4; and,
R^7 is C_1-C_{12} alkyl, C_2-C_6-alkenyl, C_6-C_{10} aryl or C_3-C_8 cycloalkyl.

[0041] Preferably, component B) comprises or consists of at least one compound of general Formula (II) which meets one or desirably both of the following conditions i) and ii):

i) R^3 and R^4 are independently selected from hydrogen and C_1-C_6 alkyl; and
ii) R^5 and R^6 are independently selected from C_1-C_{12} alkyl.

[0042] In important embodiments, component B) comprises or consists of at least one compound of general Formula (II) which meets one or preferably both of the following conditions i) and ii):

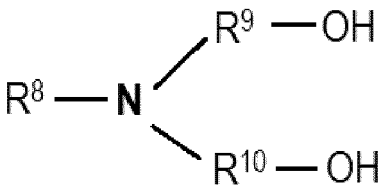
i) R^3 and R^4 are hydrogen; and,
ii) R^5 and R^6 are independently selected from C_1-C_{10} alkyl.

[0043] And in an exemplary embodiment, said component B) comprises or consists of 3-(2-ethylhexoxymethoxymethyl)heptane.

[0044] Compounds of general Formula (II) are conventionally obtained by reacting aldehyde or ketone, respectively, and alcohol in the molar ratios of from 1:1 to 1:5: typically the reactants are dissolved in suitable solvents - such as toluene - and reacted at temperatures in the range of from 85 to 130°C. Instructive disclosures regarding such reactions include *inter alia:* US Patent No. 2,796,423; US Patent. No. 2,842,499; and, US Patent No. 3,563,893.

Component C)

[0045] Component C) of the present composition consists of at least hydroxyalkylamino compound defined by general Formula (III) below



(III)

wherein: R^8 is selected from hydrogen, C_1-C_6 alkyl, 2-hydroxyethyl and 2-hydroxypropyl;
R^9 is C_2-C_6 alkyl; and,
R^{10} is C_2-C_6 alkyl.

[0046] Preferably, component C) comprises or consists of at least one compound of general Formula (III) which meets one, two or desirably all of the following conditions i) to iii):

i) R^8 is selected from 2-hydroxyethyl or 2-hydroxypropyl;
ii) R^9 is a C_2-C_4 alkyl group; and
iii) R^{10} is a C_2-C_4 alkyl group.

[0047] In important embodiments, component C) comprises or consists of at least one compound of general Formula (III) which meets one, two or desirably all of the following conditions i) to iii):

i) R^8 is selected from 2-hydroxyethyl or 2-hydroxypropyl;
ii) R^9 is a C_2-C_3 alkyl group; and
iii) R^{10} is a C_2-C_3 alkyl group.

[0048] And in an exemplary embodiment, said component C) comprises or consists of 2-[bis(2-hydroxyethyl)amino]ethanol.

[0049] Without intention to limit the present invention, it is noted that good results have been obtained where the cleaning composition comprises, based on the weight of the composition:

from 80 to 90 wt.% of 2-(2-butoxyethoxy)ethanol;
from 5 to 12 wt.% of said 3-(2-ethylhexoxymethoxymethyl)heptane; and,
from 3 to 8 wt.% of said 2-[bis(2-hydroxyethyl)amino]ethanol.

[0050] The cleaning compositions of the present invention are preferably anhydrous. However, the dilution of the cleaning compositions with up to 5 wt.% of water, based on the total weight of the composition, is not precluded. When water is included, it should preferably be of at least potable grade and more preferably be deionized or distilled.

[0051] The cleaning composition may optionally comprise *in toto* up to 5 wt.%, based on the total weight of the composition, of additives. Any additive(s) included should not have a deleterious effect on the performance of the composition and may, for instance, be selected from: stabilizers; emulsifiers; thickeners; biocides, in particular fungicides and / or bactericides; UV stabilizers; heat stabilizers; adhesion promoters, in particular silanes and/or titanates; pigments; and, fluorescent indicators or dyes. Through the use of dyes and fluorescent indicators, it is possible to determine visibly - and respectively under ambient light or with the assistance of a UV light - whether a substrate has or has not been treated with the cleaning composition. The use of fluorescent indicators can be especially advantageous when the substrate surfaces in question are visible: it is possible for the treatment to be detected but to be invisible to a viewer under normal daylight, so that the aesthetic aspect of the surface is not negatively impaired.

[0052] The cleaning composition of the present invention may only contain minor amounts of volatile organic compounds (VOC). More specifically, it is preferred that the VOC content of the cleaning composition is less than 1 wt.%, based on the total weight of the composition, or even more preferably the cleaning composition of this invention is substantially free of VOC.

[0053] The cleaning compositions of the present invention may be prepared by mixing of the components under sufficient shear forces to yield a homogeneous mixture. It is considered that this can be achieved without special conditions or special equipment. That said, suitable mixing devices might include: static mixing devices; magnetic stir bar apparatuses; wire whisk devices; augers; batch mixers; planetary mixers; C.W. Brabender or Banburry® style mixers; and, high shear mixers, such as blade-style blenders and rotary impellers.

Applications of the Cleaning Composition

[0054] There is no particular intention to limit the metallic, vehicular surfaces which are to be treated with the cleaning composition: the surfaces can be those which are disposed on the interior or exterior of the vehicle or which will be so disposed upon assembly or repair of a given part of a vehicle. Moreover, the pre-treatment of such surfaces to remove loose dirt and particulate materials prior to the application of the cleaning composition, is not precluded in the present invention and can indeed be beneficial in some circumstances.

[0055] The cleaning composition of the present invention is an eye and skin irritant and therefore its use necessitates appropriate protective apparel. That said however, the cleaning composition may still be applied to the metallic surface by conventional application methods such as wiping with an impregnated material, flooding, dipping, brushing, roll coating, doctor-blade application, air-atomized spray, air-assisted spray, airless spray, high volume low pressure spray, air-assisted airless spray and high-speed rotation bell. Whilst such application methods can be performed at quite elevated temperatures, it is here preferred that the cleaning compositions be applied at a temperature of less than 40°C, for example at less than 30°C or at room temperature.

[0056] The viscosity of the cleaning composition will generally be from 0.005 to 1 Pa.s (50 cps to 1000 cps), as measured using a Brookfield viscometer at 25°C but, as would be recognized by a skilled practitioner, the viscosities which are appropriate for the different application methods can vary considerably. In any event, the cleaning composition should generally be applied to the surface(s) to be cleaned in an amount of from 5 to 200 g/m^2, preferably from 10 to 100 g/m^2, for example from 10 to 50 g/m^2.

[0057] After application, the cleaning composition may be immediately removed or be allowed to sit upon the substrate surface - and, if applicable, penetrate the contaminants disposed on the surface - before being removed therefrom using, for example, a wipe composed of a suitable substrate. This rest or penetration time can be beneficial as a wet film of the cleaning composition formed on the surface can provide temporary corrosion protection for that surface. The appropriate rest or penetration time will depend on the amount of cleaning composition applied and the condition and morphology of the surface to be cleaned. Generally a rest or penetration time of up to 20 minutes - for example of from 0 to 15, or from 0.5 to 10 minutes - should be allowed under standard conditions (20°C, 65% Relative Humidity). However, it is noteworthy that good cleaning results have been obtained after 4 hours and even up to 24 hours after the application of the cleaning composition.

[0058] The treatment of the surface with the cleaning composition should serve to remove any contaminants from the surface. It may be necessary to remove the cleaning composition using means which allow for the application of pressure to the surface contaminants, thereby facilitating their removal. For example, manual pressure may be applied to a wipe or rag to lift or scrape away impurities, oils and uncured adhesives from a surface, either simultaneously with or subsequent to the application of the cleaning composition to the surface.

[0059] In an illustrative method, the cleaning composition is applied to a surface using a first wipe which is impregnated with a first amount of the cleaning composition. After treatment with the first wipe, further cleaning composition is applied using second and, if desired, further wipes which may be impregnated with, respectively, second, third, fourth etc.

amounts of the cleaning composition. The second and further amounts may be the same or different from the first amount: they may moreover be the same or different from eachother. It is however preferred that the second and, if applicable, further amounts of the cleaning composition are each less than said first amount to ensure that a diminished amount of the cleaning composition remains on the surface after the first wiping step.

[0060] Residual cleaning composition remaining on the surface after its treatment can form visible streaks, residues and / or Newton's rings on that surface. Such residual composition can however be fully removed from the surface through further processing. For instance, the composition can be removed in degreasing baths found, for instance, in vehicle paint shops. Special mention in this regard might be made of alkaline degreasing baths which are set at an elevated temperature of from 30° to 60°C and which further comprise surfactants.

[0061] In accordance with an aspect of the invention, there is provided a formulated wipe which is impregnated with the above described cleaning composition. The substrate used to make the formulated wipes is any substrate that can be impregnated with a cleaning composition - at least on its surface - to provide a suitable cleaning article for the surface concerned. As such, the substrate for the wipe is generally an absorbent or adsorbent material that is insoluble in the cleaning composition and which is not corrupted by that composition: a preference for wipes comprising or consisting of non-woven sheets might be mentioned.

[0062] Non-woven sheets typically contain at least one layer that is made of: natural fibers; one or more synthetic fibers; or, blends of natural fibers and said one or more synthetic fibers. Non-limiting examples of suitable synthetic fibers include: polyester fibers, such as polyethylene terephthalate fibers; rayon; viscose; nylon; polypropylene fibers; and, polyethylene fibers. Exemplary natural fibers include: wood pulp; cellulose polymers; and, starch. The constituent fibers of the sheet may be melt blown, co-formed, air laid, spun bond, wet laid, bonded, dash-carded, hydro-entangled or otherwise formed into a sheet by a combination of said methods. A binder may or may not be present in the sheet.

[0063] Non-woven sheets may be characterized by an areal weight that is dependent on the density of the fibers making up the sheet and the relative number of fibers per unit area. Without intention to the limit the present invention, suitable non-woven sheets will typically have an areal weight from 5 to 200 g/m^2, for example from 5 to 100 g/m^2, from 20 to 80 g/m^2 or from 30 to 70 g/m^2.

[0064] Aside from non-woven sheets, the use of other substrate materials capable of imbibing or impregnation with the cleaning compositions is not precluded. Such substrates might include: woven materials, such as those made from cotton fibers, from fibers of synthetic polymers, or from blends of cotton and synthetic fibers; and, foam materials, such as regenerated cellulose or polyurethane foams.

[0065] It is envisaged that the wipes can be individually sealed with a heat-sealable or glue-able thermoplastic overwrap. Equally, the wipes might be packaged as numerous individual sheets which are then impregnated or contacted with the liquid cleaning ingredients for economical dispensing: such individual wipes may be nested or interleaved within the package such that the removal of one individual wipe advances the next wipe and so forth. Still further, the wipes might be formed as a continuous web during the manufacturing process and loaded into a suitable dispenser equipped with a closure - preferably a re-sealable closure - which functions to isolate the moistened wipes from the external environment. Such a dispenser may viably be provided with a means of sizing the desired length of the wipe form the continuous web, such as a knife blade or serrated edge. In alternative embodiments, the continuous web of wipes can be scored, perforated, folded, segmented, or partially cut into uniform or nonuniform sizes or lengths.

[0066] There is no particular intention to limit the size and shape of the wipes. They should have dimensions suitable for use by a single person. Alternatively or additionally, the wipes should be small enough to be stored and transported easily, yet large enough to provide adequate cleaning of surface concerned.

[0067] The wipes are manufactured by applying the cleaning composition to a substrate by, for example, dipping, immersion or spraying. The amount of cleaning composition which is applied to the wipe can be varied to provide a desired loading of the components thereof and such variation might be effected by metering the composition during a spraying operation or by moving the substrate past an application source at a controlled rate. If necessary, excess composition can be removed from the wipe after application by shaking, rolling, drip drying and the like.

[0068] A further aspect of the present invention is constituted by a kit of parts which comprises the above described cleaning composition and a means for applying said composition. For instance, a suitable kit might comprise: a plurality of the formulated wipes as described hereinabove which are impregnated with the cleaning composition and disposed in a dispenser or packaging; and, instructions for the use of those wipes in written form, cartoon form, pictorial form or combinations thereof. Alternatively, a suitable kit may comprise: a container of the cleaning composition; a plurality of absorbent or adsorbent wipes; and, instructions for both the impregnation of those wipes with the cleaning composition and the subsequent use of the wipes. Kits may of course be provided with other items, including but not limited to: means to remove excess composition from the surface to be cleaned; and, protective clothing, masks and eye wear.

[0069] Various features and embodiments of the disclosure are described in the following examples, which are intended to be representative and not limiting.

Examples

[0070] The following materials were employed in the Examples:

Teroson RB 2165:	Solvent cleaner available from Henkel AG & Co. KGaA.
GS 200:	Cleaner available from BioCircle Surface Technology GmbH (VOC Content 19% (ASTM Standard Test Method D2369-90)).
Betaguard KP03 (AMV153 K03):	Rubber based antiflutter adhesive, available from PPG Industries.
Sika Power 415/P1(AMV160 500):	Polyurethane-epoxy adhesive, available from Sika AG.
BETAMATE 1440G (AMV167 D31):	Epoxy structural adhesive, available from The Dow Chemical Company

Cleaning Composition According to the Invention (CC1):

[0071] Using a hand-held stirrer, 85g of 2-(2-butoxyethoxy)ethanol (CAS: 112-34-5), 5g of 2-[bis(2-hydroxyethyl)amino] ethanol (CAS: 102-71-6) and 10g of 3-(2-Ethylhexoxymethoxymethyl)heptane (CAS: 22174-70-5) were mixed. The resultant composition was characterized by a VOC content of 0% as measured in accordancee with ASTM Standard Test Method D2369-90.

Sample preparation:

[0072] Serial panel parts - trunk lids - having an oiled surface were removed from a production line. Linear adhesive strips were applied on the surface of each panel to a thickness 1.5 mm. The number of adhesive strips which were applied was set to allow for the following operation to be repeated twice for each tested cleaning composition.

[0073] Wiping rags were prepared having an initial loading of 7-8 grams of the respective cleaning compositions described hereinbelow. In a 1st wipe, the wet rags were manually pushed slightly into the applied adhesive on the test panel and moved down the panel until the wet area of the rag passed the end of adhesive strip. Subsequently, 3-4 grams of the respective cleaning compositions were applied to the same wet rag and a second wipe was performed using the same technique (2nd wipe). The application of 3-4 grams of the cleaning compositions and further wiping operations were repeated until the adhesive strips were removed from the panel (3rd and further wipes).

Example 1:

[0074] In this Example, the applied adhesive was Sika Power 415/P1. The number of wipes needed to completely remove the adhesive was recorded. Further, any residual stains remaining on the panel surface were observed. The results are shown in Table 1 below.

Table 1

Cleaning Composition	Required Number of Wipes	Observed Residual Stain
Teroson RB 2165	3-4	Large
Invention (CC1)	3	Slight
GS 200	3	Large

Example 2:

[0075] In this Example, the applied adhesive was Betaguard KP03. The number of wipes needed to completely remove the adhesive was recorded. Further, any residual stains remaining on the panel surface were observed. The results are shown in Table 2 below.

Table 2

Cleaning Composition	Required Number of Wipes	Observed Residual Stain
Teroson RB 2165	4-5	**None**

(continued)

Cleaning Composition	Required Number of Wipes	Observed Residual Stain
Invention (CC1)	3	None
GS 200	4-5	None

[0076] The reduced number of wipes required to completely remove the adhesive in this Example equates to a lower required consumption of the cleaning composition of the present invention as compared to the tested commercial products.

Example 3:

[0077] A pair of Yellow Nitrile Fully Coated Gloves conforming to EN Standard 388 was provided from SoSafe Specialty Products PTY Ltd. (Product Code SS 5101FC). For a period of 7 hours, one glove was placed in contact with the GS200 cleaning composition and the second glove was placed in contact with the cleaning composition of the present invention (CC1). The respective cleaning compositions contacted substantially all of the internal (palm) surface of the glove: the gloves were not however completely immersed in the respective cleaning compositions. While GS200 cleaning composition heavily attacked the coating of the gloves to an extent that protection against penetration of liquids is no longer available and gloves cannot be put on a second time the durability of the gloves in contact with the coating composition of the present invention, CC1, was not visibly effected.

Example 4:

[0078] The cleaning composition of the present invention (CC1) was tested according to various industrial standards to examine the impact on the corrosion performance after corrosion protection pretreatment and application of a lacquer as well as the electrocoatability and adhesion to a PVC plastisol for underbody applications. Moreover, the removability of CC1 from zinc coated steel panels (HDG and EGPh) without ageing and after ageing was tested. Table 3 summarizes the test results also in comparison to the GS200 cleaning composition. CC1 cleaning composition passed all tests and proved to be superior to the GS 200 cleaning composition with respect to removability.

[0079] In view of the foregoing description and examples, it will be apparent to those skilled in the art that equivalent modifications thereof can be made without departing from the scope of the claims.

Table 3

Cleaning Composition	Corrosion Test[1]	E-Coatability[2]	PVC adhesion[3]	Removability[4]
Invention (CC1)	passed	passed	passed	passed
GS 200	(*)	passed	passed	failed

[1] hot dip galvanized steel (HDG, Type C) and zinc phosphated EG (2.8 - 3.0 g/m^2 PO4) ecoated with Enviro-Prime® generation 6 (W974/W780) from PPG Industries Inc. in a dry-film thickness of approx. 20 μ m tested after 30 cycles according to VW PV 1210; "passed" requires chip stone resistance equivalent to a reference sample (*) cleaned with conventional cleaner GS 200

[2] standard zinc phosphated CRS panels (Gardobond® OC; Chemetall) ecoated with Enviro-Prime® generation 6 (W974/W780) from PPG Industries Inc. applied in a dry-film thickness of approx. 20 μm and tested according to VDA 621-508 point 8.1.; "passed" requires not more than 5 paint craters per 100 cm^2

[3] standard zinc phosphated CRS panels (Gardobond® OC; Chemetall) ecoated with Enviro-Prime® generation 6 (W974/W780) from PPG Industries Inc. applied in a dry-film thickness of approx. 20 μm and tested according to PV 14.02 after application of PVC plastisol (Efseam® PS S01, Eftec); "passed" requires cohesion failure when the panel has been pulled off

[4] on degreased hot dip galvanized steel (HDG, Type C) and zinc phosphated EG (2.8 - 3.0 g/m^2 PO4) panels 0,034 grams of the respective cleaning composition were applied and spreaded with a paper cloth and tested according to VDA 230-213 point 5.10 or additoinallly heated up to 165°C PMT ("ageing") and thereafter tested according to VDA 230-213 point 5.10; "passed" requires water film integrity after degreasing

Claims

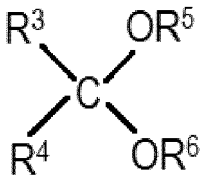
1. A cleaning composition for metallic surfaces of vehicles, said composition comprising based on the weight of the composition:

from 75 to 90 wt.% of A) at least one compound defined by Formula (I)

$$R^1\text{-}O\text{-}(M\text{-}O)_n\text{-}R^2 \qquad (I)$$

wherein: R^1 and R^2 are independently selected from hydrogen and C_1-C_6 alkyl groups;
each M is independently selected from C_1-C_6 alkylene groups; and,
n is an integer of from 1 to 5;

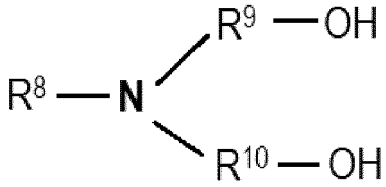
from 5 to 15 wt.% of B) at least one acetal defined by Formula (II) below:



(II)

wherein: R^3 and R^4 are independently selected from hydrogen, C_1-C_6 alkyl, C_2-C_6-alkenyl, C_6-C_{10} aryl, C_3-C_6 cycloalkyl, OR^5 and OR^6;
R^5 and R^6 are independently selected from C_1-C_{12} alkyl, C_2-C_6-alkenyl, C_6-C_{10} aryl, C_3-C_8 cycloalkyl and -(AO)x-R^7;

A is $-C_2H_4-$, $-C_3H_7-$ or $-C_4H_8-$;
x is an integer of from 1 to 4; and,
R^7 is C_1-C_{12} alkyl, C_2-C_6-alkenyl, C_6-C_{10} aryl or C_3-C_8 cycloalkyl; and,
from 1 to 10 wt.% of C) at least hydroxyalkylamino compound defined by Formula (III) below



(III)

wherein: R^8 is selected from hydrogen, C_1-C_6 alkyl, 2-hydroxyethyl and 2-hydroxypropyl;
R^9 is C_2-C_6 alkyl; and,
R^{10} is C_2-C_6 alkyl.

2. The composition according to claim 1, wherein said component A) comprises or consists of a compound defined by Formula (I) which meets at least one of the following conditions i) to iii) :

i) one of R^1 and R^2 is hydrogen and the other is a C_1-C_5 alkyl group;
ii) the or each M is a C_2-C_4 alkylene group; and,
iii) n is from 1 to 3.

3. The composition according to claim 1, wherein said component A) comprises or consists of a compound defined by Formula (I) which meets at least one of the following conditions i) to iii) :

i) one of R^1 and R^2 is hydrogen and the other is a C_2-C_4 alkyl group;
ii) M is a C_2-C_3 alkylene group; and,
iii) n is 1.

4. The composition according to any one of claims 1 to 3, wherein said component A) consists of at least one compound selected from the group consisting of: 2-butoxy-ethanol; 2-(2-butoxyethoxy)ethanol; 2-[2-(2-butoxyethoxy)ethoxy] ethanol; tripropylene glycol methyl ether; and, (2-methoxy-methylethoxy)propanol.

5. The composition of claim 4, wherein said component A) comprises or consists of 2-(2-butoxyethoxy)ethanol.

6. The composition according to any one of claims 1 to 5, wherein said component B) comprises or consists of a compound defined by Formula (II) which meets at least one of the following conditions i) and ii):

i) R^3 and R^4 are independently selected from hydrogen and C_1-C_6 alkyl; and
ii) R^5 and R^6 are independently selected from C_1-C_{12} alkyl.

7. The composition according to any one of claims 1 to 5, wherein said component B) comprises or consists of a compound defined by Formula (II) which meets at least one of the following conditions i) and ii):

i) R^3 and R^4 are hydrogen; and,
ii) R^5 and R^6 are independently selected from C_1-C_{10} alkyl.

8. The composition of claim 7, wherein said component B) comprises or consists of 3-(2-ethylhexoxymethoxymethyl)heptane.

9. The composition according to any one of claims 1 to 8, wherein said component C) comprises or consists of a compound defined by Formula (III) which meets at least one of the following conditions i) to iii):

i) R^8 is selected from 2-hydroxyethyl or 2-hydroxypropyl;
ii) R^9 is a C_2-C_4 alkyl group; and
iii) R^{10} is a C_2-C_4 alkyl group.

10. The composition according to claim 9, wherein said component C) comprises or consists of 2-[bis(2-hydroxyethyl)amino]ethanol.

11. The composition according to any one of claims 1 to 10 comprising, based on the weight of the composition:

from 80 to 90 wt.% of component A);
from 5 to 12 wt.% of said component B); and,
from 3 to 8 wt.% of said component C).

12. The composition according to claim 1 comprising based on the weight of the composition:

from 80 to 90 wt.% of 2-(2-butoxyethoxy)ethanol;
from 5 to 12 wt.% of said 3-(2-ethylhexoxymethoxymethyl)heptane; and,
from 3 to 8 wt.% of said 2-[bis(2-hydroxyethyl)amino]ethanol.

13. A wipe comprising a substrate which is impregnated with a cleaning composition as defined in any one of claims 1 to 12.

14. The wipe according to claim 13, wherein the substrate comprises a non-woven sheet.

15. A kit of parts comprising:

a cleaning composition as defined in any one of claims 1 to 12; and,
a means for applying said composition to a metallic surface.

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EUROPEAN SEARCH REPORT

Application Number
EP 18 19 1788

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Place of search	Date of completion of the search	Examiner
The Hague	28 January 2019	Loiselet-Taisne, S

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