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(54) **SOLVENT CONTAINING HARD SURFACE CLEANING COMPOSITIONS**

(57) The need for an antimicrobial composition which does not reduce surface shine and does not leave visible residues on the surface, which is also preferably suitable for surfaces which contact food, is met by formulating the antimicrobial composition comprising a quaternary ammonium compound in combination with a C_1-C_6 diol, C_1-C_6 triol, and mixtures thereof.

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Description

FIELD OF THE INVENTION

[0001] Hard surface cleaning compositions comprising a cationic biocide agent and solvent, which provides improvements in shine.

BACKGROUND OF THE INVENTION

[0002] Hard surface cleaning compositions are used for cleaning and treating hard surfaces. Preferably, the hard surface cleaning composition is formulated to be an "all purpose" hard surface cleaning composition. That is, the hard surface cleaning composition is formulated to be suitable for cleaning as many different kinds of surfaces as possible.

[0003] For treating surfaces where high levels of hygiene is desired, such as kitchen toilets, bathrooms, and surfaces that small infants can come into contact with, it is desirable that the hard surface cleaning composition comprises cationic biocide agents such as a quaternary ammonium compound. However, such antimicrobial hard surface cleaning compositions typically leave a residue in order to provide the antimicrobial efficacy, and hence reduces surface shine and can give the impression that the surface has not been well cleaned. In addition, such compositions are often less suitable for use on surfaces that are in contact with food.

[0004] Therefore, a need remains for an antimicrobial hard surface treatment composition which does not reduce surface shine and does not leave visible residues on the surface, while also preferably being suitable for surfaces which contact food.

[0005] US 8648027 B relates to a cleaning composition for sanitizing and/or disinfecting hard surfaces, comprising: a cationic biocide, surfactant and low levels of VOC solvents. GB2318585 A relates to an aqueous based cleaning compositions which include one or more quaternary amine compounds as disinfecting active agents, an organic solvent system which includes glycol mono-n-butyl ether or a binary system including a glycol ether with a linear primary alcohol, and either one or more betaines, or one or more amine oxides as a surfactant constituent. EP 0691397 A relates to an aqueous, antimicrobial hard surface cleaner comprising: a C_{1-6} alkanol or C_{3-24} alkylene glycol ether; surfactant selected from amphoteric, nonionic surfactants, and mixtures thereof; quaternary ammonium surfactant; builder; and water. GB 2353044 B relates to aqueous based cleaning compositions which comprise a quaternary ammonium surfactant compound having germicidal properties; an amine oxide, a surfactant selected from carboxylates and N-acyl amino acid surfactants; a glycol ether solvent; an alcohol, an alkalizing agent such as an alkylamine; and water. WO 2008/127803 A1 relates to cleaning compositions and cleaning systems comprising an anionic surfactant, a nonionic surfactant, lactic acid, hydrogen peroxide and water, and optionally a glycol ether solvent.

SUMMARY OF THE INVENTION

[0006] The present invention relates to an antimicrobial hard surface cleaning composition comprising: a nonionic surfactant; a quaternary ammonium compound; a solvent selected form the group consisting of: C_1-C_6 diol, C_1-C_6 triol, and mixtures thereof; and water. The present invention further relates to a method for cleaning a hard surface, comprising the steps of: optionally diluting the hard surface cleaning composition according to any preceding claim; applying the hard surface cleaning composition to a hard surface; leaving the hard surface to dry without rinsing the surface. The present invention further relates to the use of a solvent selected form the group consisting of: C_1-C_6 diol, C_1-C_6 triol, and mixtures thereof in an antimicrobial composition, to reduce surface streaks and/or improve surface shine.

DETAILED DESCRIPTION OF THE INVENTION

[0007] Hard surface cleaning compositions of the present invention, comprising a detergent surfactant, a cationic biocide agent, and a C_1-C_6 diol or C1-C6 triol provide improved surface shine.

[0008] Such C1-C6 diols and triols have low chemical reactivity and so are unlikely to interfere with the actives of the antimicrobial composition. The C1-C6 diols and triols have been found to provide shine improvements by changing the physical pattern of composition residues after application to the surface. It is believed that the C1-C6 diols and triols reduce the size of the crystals formed by the product residues on the surface upon drying to a particle size that is not visible to the naked eye, and which results in less scattering of incident light. As such, the compositions of the present invention reduce surface streaks and/or improve surface shine when treating the surface with the antimicrobial hard surface cleaning composition. They are also typically suitable for use on surfaces which contact food.

As defined herein, "essentially free of" a component means that no amount of that component is deliberately incorporated into the respective premix, or composition. Preferably, "essentially free of" a component means that no amount of that component is present in the respective premix, or composition.

[0009] As defined herein, "stable" means that no visible phase separation is observed for a premix kept at 25°C for a period of at least two weeks, or at least four weeks, or greater than a month or greater than four months.

[0010] All percentages, ratios and proportions used herein are by weight percent of the composition, unless otherwise specified. All average values are calculated "by weight" of the composition, unless otherwise expressly indicated. All ratios are calculated as a weight/weight level, unless otherwise specified.

[0011] All measurements are performed at 25°C unless otherwise specified.

[0012] Unless otherwise noted, all component or composition levels are in reference to the active portion of that component or composition, and are exclusive of impurities, for example, residual solvents or by-products, which may be present in commercially available sources of such components or compositions.

Antimicrobial hard surface cleaning compositions:

[0013] By "hard surface cleaning composition", it is meant herein a composition for cleaning hard surfaces found in households, especially domestic households. Surfaces to be cleaned include kitchens and bathrooms, e.g., floors, walls, tiles, windows, cupboards, sinks, showers, shower plastified curtains, wash basins, WCs, fixtures and fittings and the like made of different materials like ceramic, vinyl, no-wax vinyl, linoleum, melamine, glass, steel, kitchen work surfaces, any plastics, plastified wood, metal or any painted or varnished or sealed surface and the like. Household hard surfaces also include household appliances including, but not limited to refrigerators, freezers, washing machines, automatic dryers, ovens, microwave ovens, dishwashers and so on. Such hard surfaces may be found both in private households as well as in commercial, institutional and industrial environments. The hard surface cleaning composition is preferably a liquid hard surface cleaning composition.

[0014] In a preferred embodiment, the liquid compositions herein are aqueous compositions, comprising at least 10% by weight of water. Therefore, they may comprise from 30% to 99.5% by weight of the total composition of water, preferably from 50% to 98% and more preferably from 80% to 97%.

[0015] The compositions of the present invention preferably have a viscosity of from 50 Pa.s to 1200 Pa.s, more preferably 100 Pa.s to 800Pa.s, most preferably 200 Pa.s to 600 Pa.s when measured at 20°C with a AD 1000 Advanced Rheometer from Atlas® shear rate 10 s^{-1} with a coned spindle of 40mm with a cone angle 2° and a truncation of $\pm 60\mu m$.

[0016] For improved cleaning, especially greasy soil and particulate greasy soil cleaning performance, the composition pH is preferably greater than 7.0, more preferably greater than 9.5. For improved antibacterial efficacy, in addition to improved cleaning, the pH is still more preferably greater than 10, most preferably greater than 11. For improved surface safety, the pH is preferably less than 13, more preferably less than 12, most preferably less than 11.5. Accordingly, the compositions herein may further comprise an acid or base to adjust pH as appropriate.

[0017] A suitable acid for use herein is an organic and/or an inorganic acid. A preferred organic acid for use herein has a pKa of less than 6. A suitable organic acid is selected from the group consisting of: citric acid, lactic acid, glycolic acid, succinic acid, glutaric acid and adipic acid and mixtures thereof. A suitable inorganic acid can be selected from the group consisting of: hydrochloric acid, sulphuric acid, phosphoric acid and mixtures thereof.

[0018] A typical level of such acids, when present, is from 0.01% to 5.0% by weight of the total composition, preferably from 0.04% to 3.0% and more preferably from 0.05% to 1.5 %.

[0019] A suitable base to be used herein is an organic and/or inorganic base. Suitable bases for use herein are the caustic alkalis, such as sodium hydroxide, potassium hydroxide and/or lithium hydroxide, and/or the alkali metal oxides such, as sodium and/or potassium oxide or mixtures thereof. A preferred base is a caustic alkali, more preferably sodium hydroxide and/or potassium hydroxide. Other suitable bases include ammonia, ammonium carbonate, K_2CO_3, Na_2CO_3 and alkanolamines (such as monoethanolamine, triethanolamine, aminomethylpropanol, and mixtures thereof).

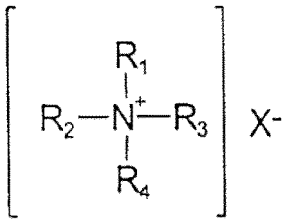
[0020] Typical levels of such bases, when present, are from 0.01% to 5.0% by weight of the total composition, preferably from 0.05% to 3.0% and more preferably from 0.1% to 2.0 %.

[0021] The total amount of surfactant is preferably from 2 to 20, more preferably from 3 to 15 and most preferably from 5 to 12% by weight of the composition.

[0022] The present hard surface cleaning compositions have improved transparency, and thus reduced haziness. Preferably, the hard surface cleaning compositions have a % haze of from 0 to 15, more preferably 0 to 7, most preferably 0 to 5.

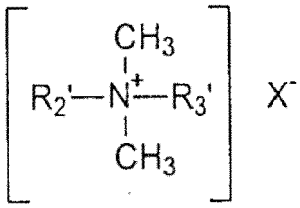
Quaternary ammonium compounds:

[0023] Suitable quaternary ammonium compounds are cationic antimicrobial agents. Preferred quaternary ammonium compounds are those of the formula:



wherein at least one of R_1, R_2, R_3 and R_4 is a hydrophobic, aliphatic, aryl aliphatic or aliphatic aryl radical of from 6 to 26 carbon atoms, and the entire cation portion of the molecule has a molecular weight of at least 165. The hydrophobic radicals maybe long-chain alkyl, long-chain alkoxy aryl, long-chain alkyl aryl, halogen-substituted long-chain alkyl aryl, long-chain alkyl phenoxy alkyl, aryl alkyl, etc. The remaining radicals on the nitrogen atoms other than the hydrophobic radicals are substituents of a hydrocarbon structure usually containing a total of no more than 12 carbon atoms. The radicals R_1, R_2, R_3 and R_4 may be straight chained or may be branched, but are preferably straight chained, and may include one or more amide or ester linkages. The radical X may be any salt- forming anionic radical, and preferably aids in the solubilization of the quaternary ammonium germicide in water. X can be a halide, for example a chloride, bromide or iodide, or X can be a methosulfate counterion, or X can be a carbonate ion.

[0024] More preferred quaternary ammonium compounds used in the compositions of the invention include those of the structural formula:



wherein R_2' and R_3' may be the same or different and are selected from C8-C12 alkyl, preferably R_2' and R_3' are C10, or R_2' is alkyl, preferably C12-C18 alkyl, C8-C18 alkylethoxy, C8-C18 alkylphenolethoxy and R_3' is benzyl or substituted benzyl, preferably ethyl benzyl. X is a halide, for example a chloride, bromide or iodide, or X is a methosulfate counterion. The alkyl groups recited in R_2' and R_3' may be linear or branched, but are preferably substantially linear, or fully linear.

[0025] Exemplary quaternary ammonium compounds include the alkyl ammonium halides such as cetyl trimethyl ammonium bromide, alkyl aryl ammonium halides such as octadecyl dimethyl benzyl ammonium bromide, N-alkyl pyridinium halides such as N-cetyl pyridinium bromide, and the like. Other suitable types of quaternary ammonium compounds include those in which the molecule contains either amide or ester linkages such as octyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride, N-(laurylcocoaminoformylmethyl)-pyridinium chloride, and the like. Other very effective types of quaternary ammonium compounds which are useful as germicides include those in which the hydrophobic radical is characterized by a substituted aromatic nucleus as in the case of lauryloxyphenyltrimethyl ammonium chloride, cetylaminophenyltrimethyl ammonium methosulfate, dodecylphenyltrimethyl ammonium methosulfate, dodecylbenzyltrimethyl ammonium chloride, chlorinated dodecylbenzyltrimethyl ammonium chloride, and the like.

[0026] Particularly useful quaternary germicides include compositions presently commercially available under the tradenames BARDAC, BARQUAT, BTC, and HYAMINE. These quaternary ammonium compounds are usually provided in a solvent, such as a C2 to C6 alcohol (such as ethanol, n-propanol, isopropanol, n-butanol, sec-butanol, and the like), glycols such as ethylene glycol, or in an mixtures containing water, such alcohols, and such glycols. Particularly preferred is didecyl dimethyl ammonium chloride, such as supplied by Lonza under tradenames such as: Bardac 2250™, Bardac 2270™, Bardac 2270E ™, Bardac 2280 ™, and/or a blend of alkyl, preferably C12-C18, dimethyl benzyl ammonium chloride and alkyl, preferably C12-C18, dimethyl ethylbenzyl ammonium chloride, such as supplied by Lonza under the brand names: Barquat 4280Z™. In preferred embodiments, the alkyl dimethyl benzyl ammonium chloride and alkyl dimethyl ethylbenzyl ammonium chloride are present in a ratio of from 20:80 to 80:20, or 40:60 to 60:40, with a ratio of 50:50 being the most preferred.

[0027] Other suitable, but less preferred, antimicrobial agents include germicidal amines, particularly germicidal triamines such as LONZA-BAC 12, (ex. Lonza, Inc., Fairlawn, NJ and/or from Stepan Co., Northfield IL, as well as other sources).

[0028] In the cleaning compositions according to the invention, the antimicrobial agent, preferably quaternary ammonium compound, is required to be present in amounts which are effective in exhibiting satisfactory germicidal activity - against selected bacteria sought to be treated by the cleaning compositions. Such efficacy may be achieved against

less resistant bacterial strains with only minor amounts of the quaternary ammonium compounds being present, while more resistant strains of bacteria require greater amounts of the quaternary ammonium compounds in order to destroy these more resistant strains.

[0029] The quaternary ammonium compound need only be present in germicidally effective amounts, which can be as little as 0.001 wt%. In more preferred compositions, the hard surface cleaning composition comprises the antimicrobial agent at a level of from 0.05 wt% to 5.00 wt%, preferably from 0.1 wt% to 3.0 wt%, more preferably from 0.9 % to 1.5 by weight of the composition, for improved shine in addition to germicidal efficacy.

[0030] A germicidally effective amount of the antimicrobial agent is considered to result in at least a log 4.5, preferably at least a log 5 reduction of staphylococcus aureus, using the method of EN1276 (Chemical Disinfectants Bactericidal Activity Testing), in less than 3 minutes.

Solvent:

[0031] The solvents used in this invention are selected form the group consisting of: C_1-C_6 diol, C_1-C_6 triol, and mixtures thereof, and are generally liquid at ambient temperature. Said solvents are employed herein to provide shine improvements to the antimicrobial compositions, however said solvents may also be selected to provide secondary benefits in addition to shine, such as improved grease cleaning, formula stability, suds control, composition viscosity or provide additional antimicrobial potentiation. Suitable solvents comprises 2 or 3 hydroxyl (-OH) groups covalently bonded to one or more carbon atoms within the same molecule. Suitable glycol solvents include germinal diols (two hydroxyl groups on the same carbon atom), vicinal diols (at least two hydroxyl groups are on adjacent carbon atoms), and distant diols (two hydroxyl groups are separated by more than one carbon atom). Examples of geminal diols include dihydroxyacetone and the like; examples of vicinal diols include propylene glycol, glycerin, 1,2-dihydroxy benzene (catechol) and the like; examples of distant glycols include 1,3-butanediol, 1,3-dihydroxybenzene (resorcinol), diethylene glycol, triethylene glycol, dipropylene glycol, and the like.

Suitable solvents can be selected from the group consisting of: propylene glycol, dipropylene glycol, glycerin, 1,2 butylene glycol, 1,3 butylene glycol, ethylene glycol, diethylene glycol, triethylene glycol and mixtures thereof, preferably propylene glycol, 1,3 butylene glycol, ethylene glycol, diethylene glycol, and mixtures thereof; more preferably propylene glycol, ethylene glycol, and mixtures thereof, most preferably propylene glycol.

The C_1-C_6 diol or C_1-C_6 triol solvent can be present at a level of from 0.01% to 10%, preferably from 0.05% to 5.0%, more preferably from 0.1% to 1.0%, most preferably from 0.2% to 0.5%. The solvent is preferably selected from those solvents that are approved for use in products designed for cleaning or sanitizing food-contact surfaces, as defined by United States Environmental Protection Agency. The solvent may also be chosen to be non-VOC (Volatile Organic Compound), or VOC (e.g. propylene glycol). A VOC solvent may be present at a concentration of less than about 0.5% by weight of the ready-to-use composition.

Without being bound by theory, it is believed that such solvents improve the wetting of the antimicrobial composition across the surface during application. Consequently, the composition is more effectively dispersed across the surface, resulting in smaller crystal residues upon drying and therefore improved visual shine performance.

Nonionic surfactant:

[0032] The antimicrobial hard surface cleaning composition preferably comprises a nonionic surfactant. The nonionic surfactant can be selected from the group consisting of: alkoxylated nonionic surfactants, alkyl polyglycosides, amine oxides, and mixture thereof. Typically, the antimicrobial hard surface cleaning composition may comprise from 1.0 wt% to 10.0 wt% by weight of the total composition of said nonionic surfactant, preferably from 3.0 wt% to 9.5 wt%, more preferably from 4.0 wt% to 9.0 wt% and most preferably from 5.0 wt% to 8.0 wt%.

[0033] For dilute compositions, comprising a total amount of surfactant of from 2 to 10 wt%, preferably from 2 to 5 wt%, the nonionic surfactant is preferably present at a level of from 1.0 wt% to 5.0 wt%, more preferably from 2.0 wt% to 4.0 wt%, most preferably from 2.2 wt% to 3.5 wt% of the antimicrobial hard surface cleaning composition.

[0034] The hard surface cleaning composition can comprise from 1 wt% to 10 wt%, preferably from 1.5wt% to 8 wt%, more preferably from 2 wt% to 7 wt% and most preferably from 2 wt% to 6 wt% of the composition of alkoxylated alcohol, preferably ethoxylated alcohol.

[0035] Suitable alkoxylated nonionic surfactants include primary C_6-C_{16} alcohol polyglycol ether i.e. ethoxylated alcohols having 6 to 16 carbon atoms in the alkyl moiety and 4 to 30 ethylene oxide (EO) units. When referred to for example $C_{9\text{-}14}$ it is meant average carbons and alternative reference to for example EO8 is meant average ethylene oxide units.

[0036] Suitable alkoxylated nonionic surfactants are according to the formula RO-$(A)_nH$, wherein: R is a C_6 to C_{18}, preferably a C_8 to C_{16}, more preferably a C_8 to C_{12} alkyl chain, or a C_6 to C_{28} alkyl benzene chain; A is an ethoxy or propoxy or butoxy unit, and wherein n is from 1 to 30, preferably from 1 to 15 and, more preferably from 4 to 12 even

more preferably from 5 to 10. Preferred R chains for use herein are the C_8 to C_{22} alkyl chains. Even more preferred R chains for use herein are the C_9 to C_{12} alkyl chains. R can be linear or branched alkyl chain.

[0037] Suitable ethoxylated nonionic surfactants for use herein are Dobanol® 91-2.5 (HLB = 8.1; R is a mixture of C_9 and C_{11} alkyl chains, n is 2.5), Dobanol® 91-10 (HLB =14.2 ; R is a mixture of C_9 to C_{11} alkyl chains, n is 10), Dobanol® 91-12 (HLB =14.5 ; R is a mixture of C_9 to C_{11} alkyl chains, n is 12), Greenbentine DE80 (HLB = 13.8, 98 wt% C10 linear alkyl chain, n is 8), Marlipal 10-8 (HLB = 13.8, R is a C10 linear alkyl chain, n is 8), Lialethl® 11-5 (R is a C_{11} alkyl chain, n is 5), Isalchem® 11-5 (R is a mixture of linear and branched C11 alkyl chain, n is 5), Lialethl® 11-21 (R is a mixture of linear and branched C_{11} alkyl chain, n is 21), Isalchem® 11-21 (R is a C_{11} branched alkyl chain, n is 21), Empilan® KBE21 (R is a mixture of C_{12} and C_{14} alkyl chains, n is 21) or mixtures thereof. Preferred herein are Dobanol® 91-5 , Neodol® 11-5, Lialethl® 11-21 Lialethl® 11-5 Isalchem® 11-5 Isalchem® 11-21 Dobanol® 91-8, or Dobanol® 91-10, or Dobanol® 91-12, or mixtures thereof. These Dobanol®/Neodol® surfactants are commercially available from SHELL. These Lutensol® surfactants are commercially available from BASF and these Tergitol® surfactants are commercially available from Dow Chemicals.

[0038] Suitable chemical processes for preparing the alkoxylated nonionic surfactants for use herein include condensation of corresponding alcohols with alkylene oxide, in the desired proportions. Such processes are well known to the person skilled in the art and have been extensively described in the art, including the OXO process and various derivatives thereof. Suitable alkoxylated fatty alcohol nonionic surfactants, produced using the OXO process, have been marketed under the tradename NEODOL® by the Shell Chemical Company. Alternatively, suitable alkoxylated nonionic surfactants can be prepared by other processes such as the Ziegler process, in addition to derivatives of the OXO or Ziegler processes.

[0039] Preferably, said alkoxylated nonionic surfactant is selected from the group consisting of alkoxylated nonionic surfactants and mixtures thereof. More preferably, said alkoxylated nonionic surfactant is a C_{9-11} EO5 alkylethoxylate, C_{12-14} EO5 alkylethoxylate, a C_{11} EO5 alkylethoxylate, C_{12-14} EO21 alkylethoxylate, C_{9-11} E08 alkylethoxylate, or a mixture thereof. Most preferably, said alkoxylated nonionic surfactant is a C_{11} EO5 alkylethoxylate, a C_{9-11} EO8 alkylethoxylate, a C_{10} EO8 alkylethoxylate, and mixtures thereof. Suitable C_{10} EO8 alkylethoxylate include Marlipal® 10/8 supplied by Sasol, and Greenbentin® DE/080.

[0040] Alkyl polyglycosides are biodegradable nonionic surfactants which are well known in the art, and can also be used in the compositions of the present invention. Suitable alkyl polyglycosides can have the general formula $C_nH_{2n+1}O(C_6H_{10}O_5)_xH$ wherein n is preferably from 9 to 16, more preferably 11 to 14, and x is preferably from 1 to 2, more preferably 1.3 to 1.6.

[0041] Suitable amine oxide surfactants include: $R_1R_2R_3NO$ wherein each of R_1, R_2 and R_3 is independently a saturated or unsaturated, substituted or unsubstituted, linear or branched hydrocarbon chain having from 10 to 30 carbon atoms. Preferred amine oxide surfactants are amine oxides having the following formula: $R_1R_2R_3NO$ wherein R_1 is an hydrocarbon chain comprising from 1 to 30 carbon atoms, preferably from 6 to 20, more preferably from 8 to 16 and wherein R_2 and R_3 are independently saturated or unsaturated, substituted or unsubstituted, linear or branched hydrocarbon chains comprising from 1 to 4 carbon atoms, preferably from 1 to 3 carbon atoms, and more preferably are methyl groups. R_1 may be a saturated or unsaturated, substituted or unsubstituted linear or branched hydrocarbon chain. Preferably, the antimicrobial hard surface cleaning composition comprises from 0.05 wt % to 6 wt%, preferably from 0.1 wt% to 5 wt%, more preferably from 0.1 wt% to 4.5 wt% and most preferably from 0.1wt% to 4 wt% of the composition of amine oxide surfactant.

[0042] A highly preferred amine oxide is C_{12}-C_{14} dimethyl amine oxide, commercially available from Albright & Wilson, C_{12}-C_{14} amine oxides commercially available under the trade name Genaminox® LA from Clariant or AROMOX® DMC from AKZO Nobel.

[0043] The nonionic surfactant is preferably a low molecular weight nonionic surfactant, having a molecular weight of less than 950 g/mol, more preferably less than 500 g/mol.

Anionic surfactant:

[0044] The antimicrobial hard surface cleaning composition can comprise low levels of an anionic surfactant. The anionic surfactant can be selected from the group consisting of: an alkyl sulphate, an alkyl alkoxylated sulphate, a sulphonic acid or sulphonate surfactant, and mixtures thereof. The antimicrobial hard surface cleaning composition can comprise up to 2.0 wt%, preferably up to 1.0 wt%, or up to 0.1 wt% of anionic surfactant. In most preferred embodiments, the composition is essentially free, or free of, of anionic surfactant.

[0045] If anionic surfactant is used, alkyl ethoxylated sulphates, especially those with an ethoxylation degree of 1 to 8, preferably 2 to 5, are preferred.

[0046] Suitable alkyl sulphates for use herein include water-soluble salts or acids of the formula $ROSO_3M$ wherein R is a C_6-C_{18} linear or branched, saturated or unsaturated alkyl group, preferably a C_8-C_{16} alkyl group and more preferably a C_{10}-C_{16} alkyl group, and M is H or a cation, e.g., an alkali metal cation (e.g., sodium, potassium, lithium), or ammonium or substituted ammonium (e.g., methyl-, dimethyl-, and trimethyl ammonium cations and quaternary ammonium cations,

such as tetramethyl-ammonium and dimethyl piperdinium cations and quaternary ammonium cations derived from alkylamines such as ethylamine, diethylamine, triethylamine, and mixtures thereof, and the like).

[0047] Particularly suitable linear alkyl sulphates include C_{12-14} alkyl sulphate like EMPICOL® 0298/, EMPICOL® 0298/F or EMPICOL® XLB commercially available from Huntsman. By "linear alkyl sulphate" it is meant herein a non-substituted alkyl sulphate wherein the linear alkyl chain comprises from 6 to 16 carbon atoms, preferably from 8 to 14 carbon atoms, and more preferably from 10 to 14 carbon atoms, and wherein this alkyl chain is sulphated at one terminus.

[0048] Suitable sulphonated anionic surfactants for use herein are all those commonly known by those skilled in the art. Preferably, the sulphonated anionic surfactants for use herein are selected from the group consisting of: alkyl sulphonates; alkyl aryl sulphonates; naphthalene sulphonates; alkyl alkoxylated sulphonates; and C_6-C_{16} alkyl alkoxylated linear or branched diphenyl oxide disulphonates; and mixtures thereof.

[0049] Suitable alkyl sulphonates for use herein include water-soluble salts or acids of the formula RSO_3M wherein R is a C_6-C_{18} linear or branched, saturated or unsaturated alkyl group, preferably a C_8-C_{16} alkyl group and more preferably a C_{10}-C_{16} alkyl group, and M is H or a cation, e.g., an alkali metal cation (e.g., sodium, potassium, lithium), or ammonium or substituted ammonium (e.g., methyl-, dimethyl-, and trimethyl ammonium cations and quaternary ammonium cations, such as tetramethyl-ammonium and dimethyl piperdinium cations and quaternary ammonium cations derived from alkylamines such as ethylamine, diethylamine, triethylamine, and mixtures thereof, and the like).

[0050] Suitable alkyl aryl sulphonates for use herein include water-soluble salts or acids of the formula RSO_3M wherein R is an aryl, preferably a benzyl, substituted by a C_6-C_{18} linear or branched saturated or unsaturated alkyl group, preferably a C_8-C_{16} alkyl group and more preferably a C_{10}-C_{16} alkyl group, and M is H or a cation, e.g., an alkali metal cation (e.g., sodium, potassium, lithium, calcium, magnesium and the like) or ammonium or substituted ammonium (e.g., methyl-, dimethyl-, and trimethyl ammonium cations and quaternary ammonium cations, such as tetramethyl-ammonium and dimethyl piperdinium cations and quaternary ammonium cations derived from alkylamines such as ethylamine, diethylamine, triethylamine, and mixtures thereof, and the like).

[0051] Particularly suitable linear alkyl sulphonates include C_{12}-C_{16} paraffin sulphonate like Hostapur ® SAS commercially available from Clariant. Particularly preferred alkyl aryl sulphonates are alkyl benzene sulphonates commercially available under trade name Nansa® available from Huntsman.

[0052] By "linear alkyl sulphonate" it is meant herein a non-substituted alkyl sulphonate wherein the alkyl chain comprises from 6 to 18 carbon atoms, preferably from 8 to 16 carbon atoms, and more preferably from 10 to 16 carbon atoms, and wherein this alkyl chain is sulphonated at one terminus.

[0053] Suitable alkoxylated sulphonate surfactants for use herein are according to the formula $R(A)_mSO_3M$, wherein R is an unsubstituted C_6-C_{18} alkyl, hydroxyalkyl or alkyl aryl group, having a linear or branched C_6-C_{18} alkyl component, preferably a C_8-C_{16} alkyl or hydroxyalkyl, more preferably C_{12}-C_{16} alkyl or hydroxyalkyl, and A is an ethoxy or propoxy or butoxy unit, and m is greater than zero, typically between 0.5 and 6, more preferably between 0.5 and 3, and M is H or a cation which can be, for example, a metal cation (e.g., sodium, potassium, lithium, calcium, magnesium, etc.), ammonium or substituted-ammonium cation. Alkyl ethoxylated sulphonates, alkyl butoxylated sulphonates as well as alkyl propoxylated sulphonates are contemplated herein. Specific examples of substituted ammonium cations include methyl-, dimethyl-, trimethylammonium and quaternary ammonium cations, such as tetramethyl-ammonium, dimethyl piperdinium and cations derived from alkanolamines such as ethylamine, diethylamine, triethylamine, mixtures thereof, and the like.

[0054] Exemplary surfactants are C_{12}-C_{18} alkyl polyethoxylate (1.0) sulphonate (C_{12}-C_{18}E(1.0)SM), C_{12}-C_{18} alkyl polyethoxylate (2.25) sulphonate (C_{12}-C_{18}E(2.25)SM), C_{12}-C_{18} alkyl polyethoxylate (3.0) sulphonate (C_{12}-C_{18}E(3.0)SM), and C_{12}-C_{18} alkyl polyethoxylate (4.0) sulphonate (C_{12}-C_{18}E(4.0)SM), wherein M is conveniently selected from sodium and potassium. Particularly suitable alkoxylated sulphonates include alkyl aryl polyether sulphonates like Triton X-200® commercially available from Dow Chemical.

[0055] Preferably said sulphated or sulphonated anionic surfactant for use herein is selected from the group consisting of alkyl sulphates (AS) preferably C_{12}, C_{13}, C_{14} and C_{15} AS, sodium linear alkyl sulphonate (NaLAS), sodium paraffin sulphonate $NaPC_{12-16}S$, and mixtures thereof. Most preferably sulphated or sulphonated anionic surfactant for use herein is selected from the group consisting of alkyl sulphates (AS) preferably, C_{12}, C_{13}, C_{14} and C_{15} AS, sodium linear alkyl sulphonate (NaLAS), sodium paraffin sulphonate $NaPC_{12-16}S$ and mixtures thereof.

Additional Surfactant:

[0056] The hard surface cleaning composition may comprise up to 15% by weight of an additional surfactant, preferably selected from: an amphoteric, zwitterionic, and mixtures thereof. More preferably, the hard surface cleaning composition can comprise from 0.5% to 5%, or from 0.5% to 3%, or from 0.5% to 2% by weight of the additional surfactant.

[0057] Suitable zwitterionic surfactants typically contain both cationic and anionic groups in substantially equivalent proportions so as to be electrically neutral at the pH of use, and are well known in the art. Some common examples of zwitterionic surfactants (such as betaine/sulphobetaine surfacants) are described in US. Pat. Nos. 2,082,275, 2,702,279

and 2,255,082.

[0058] Amphoteric surfactants can be either cationic or anionic depending upon the pH of the composition. Suitable amphoteric surfactants include dodecylbeta-alanine, N-alkyltaurines such as the one prepared by reacting dodecylamine with sodium isethionate, as taught in US. Pat. No. 2,658,072, N-higher alkylaspartic acids such as those taught in U.S. Pat. No. 2,438,091, and the products sold under the trade name "Miranol", as described in US. Pat. No. 2,528,378. Other suitable additional surfactants can be found in McCutcheon's Detergents and Emulsifers, North American Ed. 1980.

Optional ingredients:

[0059] *Chelating agent:* The antimicrobial hard surface cleaning composition can comprise a chelating agent or crystal growth inhibitor. Suitable chelating agents, in combination with the surfactant system, improve the shine benefit. Chelating agent can be incorporated into the compositions in amounts ranging from 0.05% to 5.0% by weight of the total composition, preferably from 0.1% to 3.0%, more preferably from 0.2% to 2.0% and most preferably from 0.2% to 0.4%.

[0060] Suitable phosphonate chelating agents include ethylene diamine tetra methylene phosphonates, and diethylene triamine penta methylene phosphonates (DTPMP), and can be present either in their acid form or as salts.

[0061] A preferred biodegradable chelating agent for use herein is ethylene diamine N,N'- disuccinic acid, or alkali metal, or alkaline earth, ammonium or substitutes ammonium salts thereof or mixtures thereof, for instance, as described in US patent 4, 704, 233. A more preferred biodegradable chelating agent is L-glutamic acid N,N-diacetic acid (GLDA) commercially available under tradename Dissolvine 47S from Akzo Nobel.

[0062] Suitable amino carboxylates include ethylene diamine tetra acetates, diethylene triamine pentaacetates, diethylene triamine pentaacetate (DTPA), N- hydroxyethylethylenediamine triacetates, nitrilotriacetates, ethylenediamine tetrapropionates, triethylenetetraaminehexa-acetates, ethanoldiglycines, and methyl glycine diacetic acid (MGDA), both in their acid form, or in their alkali metal, ammonium, and substituted ammonium salt forms. Particularly suitable amino carboxylate to be used herein is propylene diamine tetracetic acid (PDTA) which is, for instance, commercially available from BASF under the trade name Trilon FS® and methyl glycine di-acetic acid (MGDA). Most preferred aminocarboxylate used herein is diethylene triamine pentaacetate (DTPA) from BASF. Further carboxylate chelating agents for use herein include salicylic acid, aspartic acid, glutamic acid, glycine, malonic acid or mixtures thereof.

[0063] *Additional polymers:* The antimicrobial hard surface cleaning composition may comprise an additional polymer. It has been found that the presence of a specific polymer as described herein, when present, allows further improving the grease removal performance of the liquid composition due to the specific sudsing/foaming characteristics they provide to the composition. Suitable polymers for use herein are disclosed in co-pending EP patent application EP2272942 (09164872.5) and granted European patent EP2025743 (07113156.9).

[0064] The polymer can be selected from the group consisting of: a vinylpyrrolidone homopolymer (PVP); a polyethyleneglycol dimethylether (DM-PEG); a vinylpyrrolidone/dialkylaminoalkyl acrylate or methacrylate copolymers; a polystyrenesulphonate polymer (PSS); a poly vinyl pyridine-N-oxide (PVNO); a polyvinylpyrrolidone/ vinylimidazole copolymer (PVP-VI); a polyvinylpyrrolidone/ polyacrylic acid copolymer (PVP-AA); a polyvinylpyrrolidone/ vinylacetate copolymer (PVP-VA); a polyacrylic polymer or polyacrylicmaleic copolymer; and a polyacrylic or polyacrylic maleic phosphono end group copolymer; and mixtures thereof.

[0065] Typically, the antimicrobial hard surface cleaning composition may comprise from 0.005% to 5.0% by weight of the total composition of said polymer, preferably from 0.10% to 4.0%, more preferably from 0.1% to 3.0% and most preferably from 0.20% to 1.0%.

[0066] Fatty acids are less preferred since they can affect the performance of many antimicrobial agents. If present, the fatty acid is preferably present at low levels of less than 0.5 wt% and can include the alkali salts of a C_8-C_{24} fatty acid. Such alkali salts include the metal fully saturated salts like sodium, potassium and/or lithium salts as well as the ammonium and/or alkylammonium salts of fatty acids, preferably the sodium salt. Preferred fatty acids for use herein contain from 8 to 22, preferably from 8 to 20 and more preferably from 8 to 18 carbon atoms. Suitable fatty acids may be selected from caprylic acid, capric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, and mixtures of fatty acids suitably hardened, derived from natural sources such as plant or animal esters (e.g., palm oil, olive oil, coconut oil, soybean oil, castor oil, tallow, ground oil, whale and fish oils and/or babassu oil. For example coconut fatty acid is commercially available from KLK OLEA under the name PALMERAB1211.

[0067] Typically, the antimicrobial hard surface cleaning composition may comprise up to 6.0% by weight of the total composition of said fatty acid, preferably from 0.1% to 3.0%, more preferably from 0.1% to 2.0% and most preferably from 0.15% to 1.5% by weight of the total composition of said fatty acid.

[0068] Typically, the antimicrobial hard surface cleaning composition may comprise up to 2.0% by weight of the total composition of said branched fatty alcohol, preferably from 0.10% to 1.0%, more preferably from 0.1 % to 0.8% and most preferably from 0.1% to 0.5%.

[0069] *Solvent:* The liquid compositions of the present invention may comprise a solvent or mixtures thereof as a preferred optional ingredient.

[0070] Suitable solvent is selected from the group consisting of: ethers and diethers having from 4 to 14 carbon atoms; glycols or alkoxylated glycols; alkoxylated aromatic alcohols; aromatic alcohols; alkoxylated aliphatic alcohols; aliphatic alcohols; C_8-C_{14} alkyl and cycloalkyl hydrocarbons and halohydrocarbons; C_6-C_{16} glycol ethers; terpenes; and mixtures thereof. Ethers such as n-butoxypropanol and glycol ethers such as dipropylene glycol n-butyl ether are particularly preferred.

[0071] When present, the solvent can be present at a level of from 0.1 wt% to 10 wt%, or 0.2 wt% to 5 wt%, or 0.5 wt% to 3 wt%.

Thickener:

[0072] The hard surface cleaning composition can further comprise a thickener. A thickener provides a higher viscosity cleaning composition which gives longer contact time for improving antimicrobial efficacy, and more time for the composition to penetrate greasy soil and/or particulated greasy soil to improve cleaning effectiveness. A thickener can also improve product stability.

[0073] Suitable thickeners are herein include polyacrylate based polymers, preferably hydrophobically modified polyacrylate polymers; hydroxyl ethyl cellulose, preferably hydrophobically modified hydroxyl ethyl cellulose, xanthan gum, hydrogenated castor oil (HCO) and mixtures thereof.

[0074] Preferred thickeners are polyacrylate based polymers, preferably hydrophobically modified polyacrylate polymers. Preferably a water soluble copolymer based on main monomers acrylic acid, acrylic acid esters, vinyl acetate, methacrylic acid, acrylonitrile and mixtures thereof, more preferably copolymer is based on methacrylic acid and acrylic acid esters having appearance of milky, low viscous dispersion. Most preferred hydrologically modified polyacrylate polymer is Rheovis® AT 120, which is commercially available from BASF.

[0075] Other suitable thickeners are hydroxethylcelluloses (HM-HEC) preferably hydrophobically modified hydroxyethylcellulose.

[0076] Suitable hydroxethylcelluloses (HM-HEC) are commercially available from Aqualon/Hercules under the product name Polysurf76® and W301 from 3V Sigma.

[0077] Xanthan gum is one suitable thickener used herein. Xanthan gum is a polysaccharide commonly used rheoligy modifier and stabilizer. Xanthan gum is produced by fermentation of glucose or sucroce by *the xanthomonas campestris* bacterium.

[0078] Suitable Xanthan gum is commercially available under trade anem Kelzan T® from CP Kelco.

[0079] Hydrogenated castor oil is one suitable thickener used herein. Suitable hydrogenated castor oil is available under trade name THIXCIN R from Elementis.

[0080] The most preferred thickener used herein are hydrophobic alkali swellable emulsion (HASE) thickeners. As such, the liquid hard surface cleaning composition preferably comprises from 0.1% to 10.0% by weight of the total composition of said thickener, preferably from 0.2% to 5.0%, more preferably from 0.2% to 2.5% and most preferably from 0.2% to 2.0%.

[0081] The thickening polymer preferably has a weight average molecular weight of from 50,000 Da to 2,000,000 Da, more preferably from 100,000 Da to 1,000,000 Da, most preferably from 300,000 Da to 600,000 Da.

[0082] Suitable hydrophobically modified alkali swellable emulsions (HASE) are sold under the various brand names by Lubrizol Corporation, Clariant, Akzo Nobel, Coatex, 3V Sigma, SEPPIC, Ashland and BASF. Particularly suited, are Rheovis AT120, Novethix L10 and Novethix HC200 (Lubrizol), Crystasense Sapphire (Clariant), Alcoguard 5800 (Akzo Nobel), Rheosolve 637 and Rheosolve 650 (Coatex), Polygel W30 (3V Sigma), Capigel98 (SEPPIC), Jaypol AT4 (Ashland), Salcare SC80 and Luvigel FIT (BASF)."

[0083] *Other optional ingredients:* The antimicrobial hard surface cleaning compositions may comprise a variety of other optional ingredients depending on the technical benefit aimed for and the surface treated. Suitable optional ingredients for use herein include perfume, builders, other polymers, buffers, bactericides, hydrotropes, colorants, stabilisers, radical scavengers, abrasives, soil suspenders, brighteners, anti-dusting agents, dispersants, dye transfer inhibitors, pigments, silicones and/or dyes.

Method of cleaning a surface:

[0084] The antimicrobial hard surface cleaning compositions described herein are particularly suited for cleaning surfaces selected from the group consisting of: glazed or non-glazed ceramic tiles, enamel, stainless steel, Inox®, Formica®, vinyl, no-wax vinyl, linoleum, melamine, glass, plastics and plastified wood, and combinations thereof. In particular, the compositions are particularly suited for reducing or removing antimicrobial activity from the surface, and for cleaning when an amine oxide surfactant, other nonionic surfactant, and mixtures thereof is present.

[0085] For general cleaning, especially of floors and counter-tops, the preferred method of cleaning comprises the steps of:

a) optionally diluting the hard surface cleaning composition of the present invention;

b) applying the hard surface cleaning composition to a hard surface;

c) leaving the surface to dry, without wiping or rinsing the surface.

[0086] The antimicrobial hard surface cleaning composition may be diluted to a level of from 0.1% to 2.0%, or from 0.3% to 1.5% by volume. The antimicrobial hard surface cleaning composition may be diluted to a level of from 0.4% to 0.6% by volume, especially where the antimicrobial hard surface cleaning composition has a total surfactant level of greater than or equal to 5% by weight. Where the antimicrobial hard surface cleaning composition has a total surfactant level of less than 5% by weight, the antimicrobial hard surface cleaning composition may be diluted to a level of from 0.7% to 1.4% by volume. In preferred embodiments, the antimicrobial hard surface cleaning composition is diluted with water.

[0087] The dilution level is expressed as a percent defined as the fraction of the antimicrobial hard surface cleaning composition, by volume, with respect to the total amount of the diluted composition. For example, a dilution level of 5% by volume is equivalent to 50 ml of the antimicrobial hard surface cleaning composition being diluted to form 1000 ml of diluted composition.

[0088] The diluted composition can be applied by any suitable means, including using a mop, sponge, cloth, or other suitable implement.

[0089] Alternatively, the antimicrobial hard surface cleaning composition can be a "ready-to-use" composition, where dilution is not necessary. Such ready-to-use compositions can be comprised in a spray container.

[0090] In addition, for particularly dirty or greasy spots, or spots which have been contacted by microbes, the antimicrobial hard surface cleaning compositions, can be applied neat to the hard surface. When amine oxide and a further non-ionic surfactant is present, the composition provides improves penetration and removal of the stain, and especially of greasy stains, leading to improved surfactancy action and stain removal, as well as improved hygiene.

[0091] By "neat", it is to be understood that the liquid composition is applied directly onto the surface to be treated without undergoing any significant dilution, i.e., the liquid composition herein is applied onto the hard surface as described herein, either directly or via an implement such as a sponge, without first diluting the composition. By "without undergoing any significant dilution", what is meant is that the composition is diluted by less than 10 wt%, preferably less than 5 wt%, more preferably less than 3 wt%. Such dilutions can arise from the use of damp implements to apply the composition to the hard surface, such as sponges which have been "squeezed" dry.

[0092] In another preferred embodiment of the present invention said method of cleaning a hard surface includes the steps of applying, preferably spraying, said liquid composition onto said hard surface, leaving said liquid composition to act onto said surface for a period of time to allow said composition to act, with or without applying mechanical action.

METHODS:

[0093]

A) pH measurement:

The pH is measured on the neat composition, at 25°C, using a Sartarius PT-10P pH meter with gel-filled probe (such as the Toledo probe, part number 52 000 100), calibrated according to the instructions manual.

B) Shine:

Experiments to evaluate surface residues (i.e. shine performance) of the antimicrobial formulations were conducted using the following procedure. A clean, dry, glossy, black ceramic tile (20cm x 30cm) was used as a representative hard surface. 0.5 mL of the ready-to-use antimicrobial formulation was applied diagonally across the tile surface from bottom left to top right to create a continuous liquid deposit on the tile. The liquid deposit was then wiped across the tile using a damp cotton cloth (8cm x10cm folded into quarters) using a pattern of x8 wipes horizontally (back and forth), x10 wipes vertically (up and down) and x8 wipes horizontally (back and forth). This wiping regime was conducted in a single continuous motion without lifting the cloth from the tile. The tile was then allowed to dry for 20 minutes. Panelists were then asked to grade the severity of residues on the tile according to the following scale:

0 = No streaks
1 = Very slight streaks

2 = Slight streaks
3 = Slight to moderate streaks
4 = Moderate streaks
5 = Moderate to heavy streaks
6 = Heavy streaks

[0094] At least 8 panelists evaluated each tile. Mean streak gradings were compared using Dunnett's statistical test with nil solvent as the control, unless specified otherwise.

EXAMPLES

[0095] Examples of ready-to-use compositions of the present invention are shown in Table 1. The compositions can be made by mixing the components together, either as ready-to-use concentrations directly, or by first preparing a concentrated composition and then diluting in deionized water, such as a 1:10 dilution, to achieve the ready-to-use composition. The concentration of each component in a given composition corresponds to the weight of the component, provided on an active basis, as a percent of the total weight composition.

	Ex.1 wt%	Ex.2 wt%	Ex.3 wt%	Ex.4 wt%	Ex.5 wt%	Ex.6 wt%
C10 dimethyl amine oxide[1]	0.2	-	0.4	-	-	-
C12-14 dimethyl amine oxide[1]	-	0.1		1.5	-	-
C9-11 alcohol ethoxylate E08[2]	0.1	-	2	-	-	-
Alkylpolyglucoside[3]	-	0.3	-	-	2	-
Cocoamidopropyl hydroxysultaine[4]	-	-	-	-	-	0.2
50:50 Blend of alkyl dimethyl benzyl ammonium chloride and alkyl dimethyl ethylbenzyl ammonium chloride[5]	-	0.07	-	0.1	0.2	-
Didecyl dimethyl ammonium chloride[6]	0.05	-	0.15	-	-	0.04
Citric acid	-	-	0.2	0.3	-	0.2
Sodium carbonate	-	0.1	0.5	-	0.3	-
Monoethanolamine	-	0.4	0.35	-	0.4	0.2
Diethylentriamine-penta-(methlyen-phosphonic) acid	0.1	0.2	0.1	0.05	-	0.1
Perfume	0.3	0.5	0.3	0.7	0.4	0.15
Propylene glycol	0.5	-	0.5	-	-	0.5
1,3 Butylene glycol	-	0.5	-	2.0	2.0	-
Rheovis AT 120[7]						
pH (trimmed with NaOH or HCl)	7	10.5	11	7	11.1	8
Deionized water	to 100	to 100	to 100	to 100	to 100	to 100

[1] Supplied by Huntsman
[2] Marlipal 10/8, straight chain ethoxylated nonionic surfactant, supplied by Sasol
[3] Triton™ BG-10 and Triton™ CG-110, supplied by DOW
[4] Amphosol® CS-50, supplied by Stepan
[5] Barquat 4280Z™, supplied by Lonza
[6] Bardac 2280R™, supplied by Lonza
[7] Rheovis® AT120, a HASE rheology modifiying agent supplied by BASF.

[0096] Table 2 shows the shine performance of a composition based on 0.5% ethanolamine, 0.1% sodium carbonate, 0.5%C12-C14 amine oxide, 0.1% Marlipal C10 with 8 ethoxylates, 0.1% Bardac 2250E and 0.15% perfume, with the addition of 2% by weight glycol solvent (propylene glycol) in comparison to a nil solvent control:

Table 2: Shine performance of a quat containing antimicrobial composition		
Solvent addition (2%)	**Mean streak grade**	**Difference**
Nil solvent (control)	1.6	(ref)
Propylene glycol	0.6	-1.0

[0097] The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as "40 mm" is intended to mean "about 40 mm".

Claims

1. An antimicrobial hard surface cleaning composition comprising:

a. a nonionic surfactant;
b. a quaternary ammonium compound;
c. a solvent selected form the group consisting of: C_1-C_6 diol, C_1-C_6 triol, and mixtures thereof; and
d. water.

2. The composition according to claim 1, wherein the solvent is selected from the group consisting of: propylene glycol, dipropylene glycol, glycerin, 1,2 butylene glycol, 1,3 butylene glycol, ethylene glycol, diethylene glycol, triethylene glycol and mixtures thereof, preferably propylene glycol, 1,3 butylene glycol, ethylene glycol, diethylene glycol, and mixtures thereof; more preferably propylene glycol, ethylene glycol, and mixtures thereof, most preferably propylene glycol.

3. The composition according to any preceding claim, wherein the solvent is present at a level of from 0.01% to 10%, preferably from 0.05% to 5.0%, more preferably from 0.1% to 1.0%, most preferably from 0.2% to 0.5%.

4. The composition according to any preceding claim, wherein said quaternary ammonium compound is selected from the group consisting of: didecyl dimethyl ammonium chloride, a blend of alkyl dimethyl benzyl ammonium chloride and alkyl dimethyl ethylbenzyl ammonium chloride, and mixtures thereof.

5. The composition according to any preceding claims, wherein the quaternary ammonium compound is present at a level of from 0.05 wt% to 5.00 wt%, preferably from 0.1 wt% to 3.0 wt%, more preferably from 0.9 % to 1.5 by weight of the composition.

6. The hard surface cleaning composition according to any preceding claims, wherein the composition comprises from 0.1 wt% to 5 wt%, more preferably from 0.30 to 3.5 wt%, most preferably from 0.50 to 2.50 wt% of amine oxide surfactant.

7. The hard surface cleaning composition according to any preceding claims, wherein the amine oxide surfactant has the structure $R_1R_2R_3NO$ wherein each of R_1, R_2 and R_3 is independently a saturated or unsaturated, substituted or unsubstituted, linear or branched hydrocarbon chain having from 1 to 30 carbon atoms.

8. The hard surface cleaning composition according to claim 7, wherein R_1 is an hydrocarbon chain comprising from 1 to 30 carbon atoms, preferably from 6 to 20, more preferably from 8 to 16 and wherein R_2 and R_3 are independently saturated or unsaturated, substituted or unsubstituted, linear or branched hydrocarbon chains comprising from 1 to 4 carbon atoms, preferably from 1 to 3 carbon atoms, and more preferably are methyl groups.

9. The hard surface cleaning composition according to any preceding claims, wherein the composition comprises up to 2.0 wt%, preferably up to 1.0 wt%, more preferably up to 0.1 wt%, even more preferably being essentially free, or free of anionic surfactant.

10. A method for cleaning a hard surface, comprising the steps of:

a. optionally diluting the hard surface cleaning composition according to any preceding claim;
b. applying the hard surface cleaning composition to a hard surface;
c. leaving the hard surface to dry without rinsing the surface.

11. The use of a solvent selected form the group consisting of: C_1-C_6 diol, C_1-C_6 triol, and mixtures thereof in an antimicrobial composition, to reduce surface streaks and/or improve surface shine.

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EUROPEAN SEARCH REPORT

Application Number
EP 17 17 7171

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 September 2017	Hillebrecht, Dieter

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