(19) Europäisches Patentamt
European Patent Office
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(11) **EP 3 144 373 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.03.2017 Bulletin 2017/12

(51) Int Cl.:
C11D 1/825 *(2006.01)* ***C11D 11/00*** *(2006.01)*

(21) Application number: **15185397.5**

(22) Date of filing: **16.09.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA

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(54) **NEUTRAL AQUEOUS CLEANING COMPOSITION**

(57) Suggested is a neutral aqueous cleaning composition comprising
(a) at least one fatty acid alkyl ester alkoxylate, and
(b) at least one alcohol alkoxylate; and
(c) at least one amine oxide,

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Description

FIELD OF INVENTION

[0001] The present invention belongs to the area of metal cleaning and refers to improved aqueous compositions for hard surface cleaning.

STATE OF THE ART

[0002] Many industries, such as, for example, lubricants and automobile parts repair and replacement services and the like, require that component mechanical parts be cleaned prior to inspection, repair, or replacement thereof. Generally, such parts have been exposed to various industrial-type soil contaminants such as dirt, grease, oil, ink and the like, which must be removed for effective repair or service.

[0003] A variety of metal cleaners have been used to clean such mechanical parts. For example, solvent-based metal cleaners have been used which contain either halogenated or non-halogenated hydrocarbons. Aqueous-based, highly alkaline detergent systems have also been used to clean metal parts. However, the use of such solvent-based or aqueous-based cleaners has risen environmental and/or worker safety concerns.

[0004] For example, although halogenated hydrocarbon solvents such as chlorofluorocarbons (CFCs), trichloromethane, methylene chloride and trichloroethane (methyl chloroform) have been widely used in industry for metal cleaning, the safety, environmental and cost factors associated with their use coupled with waste disposal problems are negative aspects of the use of such solvents. A world-wide and U.S. ban on most halogenated solvents is soon in the offing by virtue of the Montreal Protocol, Clean Air Act and Executive and Departmental directives.

[0005] Non-halogenated hydrocarbon solvents such as toluene, Stoddard solvent and like organic compounds such as ketones and alcohols are generally flammable and highly volatile and have dubious ability to be recycled for continuous use. These factors, along with unfavourable safety, environmental and cost factors make the non-halogenated hydrocarbon solvents unattractive for practical consideration. For example, the most useful organic solvents, classified as volatile organic compounds (VOCs), pollute the atmosphere, promote formation of a toxic zone at ground level, and add to the inventory of greenhouse gases.

[0006] Aqueous cleaning systems have been developed to overcome some of the inherent negative environmental and health aspects associated with the solvent-based cleaning systems.

[0007] For example EP 0782610 B1 (CHURCH & DWIGHT) discloses an organic solvent-free aqueous metal cleaning composition comprising at least one alkaline salt and a surfactant, said surfactant comprises from about 10 wt. % to about 50 wt. % of the cleaning composition based on dry components of the cleaning composition, said surfactant consists essentially of non-phenolic alkoxylated non-ionic surfactants, N-alkyl pyrrolidones and mixtures thereof, an aqueous solution containing about 0.1 to about 20% of said composition being characterized as having complete phase separation ability of contaminants whereby the contaminants form a distinct and substantially complete phase from the aqueous solution, said composition having a phosphate content of less than 3 wt. % based on phosphorous, and having an initial foam

[0008] EP 0908534 B1 (CHURCH & DWIGHT) covers an alkaline, aqueous metal-cleaning composition capable of effectively removing industrial-type soil contaminants from a metal surface at temperatures as low as ambient temperature and in the absence of substantial agitation contains (A) an active-ingredient portion containing an alkalinity-providing component, and a surfactant mixture containing: (a) at least one first non-ionic, ethoxylated linear primary alcohol surfactant having a hydrophobic carbon chain length of from 9 to 11 carbon atoms and being ethoxylated with (i) an average of 2.5 moles of ethylene oxide or (ii) an average of 5.0 moles of ethylene oxide; and (b) at least one second non-ionic, ethoxylated linear primary alcohol surfactant having a hydrophobic carbon chain length of from 9 to 11 carbon atoms and being ethoxylated with an average of 6.0 moles of ethylene oxide; and (B) an aqueous portion.

[0009] EP 1590503 B1 (HENKEL) discloses an aqueous cleaning composition for formed metal articles, the cleaning composition comprising (a) an adduct of 10 to 41 EO to a C_{12}-C_{25} aliphatic alcohol, (b) an inorganic pH adjusting component present in an amount such that the pH of the cleaning composition is less than 2; and (c) at least one non-ionic surfactant that is different than component (a) present in an amount from about 0.1 to about 3 g/l, wherein the cleaning composition has a water-break-free percent from 84% to 100%, and wherein the inorganic pH adjusting component comprises inorganic acid present in an amount of greater than 1 gram/litre to an amount of less than or equal to about 20 gram/litre of the cleaning composition.

[0010] WO 2003 029393 A2 (ECOLAB) refers to cleaning compositions for metal surfaces, including both concentrate and ready-to-use solutions. These compositions include a source of calcium ion, a source of alkalinity, a chelating agent, and a surfactant; optionally a watersoluble or water-dispersible acid-substituted polymer is also included. The formulations are directed to cleaning compositions for metal surfaces, including both concentrate and ready-to-use solutions.

[0011] Finally, US 8,697,622 BB (ECOLAB) is directed to synergistic combinations alkoxylated surfactants and co-

surfactants, emulsions or micro-emulsions and cleaning compositions incorporating the same. Disclosed is a surfactant system which includes alkoxylated non-ionic surfactants, and a linker surfactant, particularly partial glycerides. This system forms stable emulsions or micro-emulsions with oils, including non-trans fats and fatty acids and these emulsions or micro-emulsions are stable, irreversible and can be created at low temperature.

[0012] Unfortunately, aqueous cleaning systems also have drawbacks. For example, aqueous solutions used to clean industrial-type soil contaminants from metal surfaces are generally effective only at relatively high wash temperatures, 80 °C and above. Such high wash temperatures are disadvantageous because of the higher energy costs which are involved relative to lower temperature washing and the difficulty with maintaining such high temperatures. Unfortunately, with aqueous solutions, a reduced wash temperature usually leads to reduced cleaning versus that obtained at higher wash temperatures. It would be desirable, therefore, to provide an aqueous metal-cleaning composition which provides high cleaning performance at relatively low wash temperatures.

[0013] Another advantage associated with the use of aqueous cleaners stems from the high surface tension of water and the propensity of the detersive agents in the aqueous cleaner to foam upon agitation of the cleaning bath such as induced in the bath or by the use of spray nozzles to apply the cleaning solution to the metal components being cleaned. The foaming profile of an aqueous cleaner is an important characteristic. The presence of foam often renders the use of machines with high mechanical agitation impractical due to excessive foaming. High foaming cleaners are particularly problematic in spray equipment. In addition to foam exiting the equipment, foaming can cause pump cavitation and selective loss of surfactants. Also, the presence of foam can cause the overflow of liquids onto floors as well as cause difficulties with viewing the cleaning process through vision ports and the like contained in the machinery. Contrary to popular belief, foaming does not contribute to cleaning and, therefore, is not necessary for immersion or spray cleaning. Generally, low foaming cleaners are preferred because they can be used in dip, immersion, ultrasonic and spray equipment.

[0014] It has been found that, in conventional aqueous metal-cleaning compositions, foam formation will decrease with increased temperature. Thus, with such compositions, the use of relatively low wash temperatures tends to lead to high foam formation, which renders such cleaning compositions unsuitable for use at low temperatures.

[0015] As stated above, agitation of the cleaning solution appears to induce foaming. Thus, one way to reduce foam formation would be to reduce or eliminate the agitation of the cleaning solution. It would be desirable, therefore, to provide an aqueous metal-cleaning composition which is capable of substantially removing industrial-type soil contaminants from metal surfaces at low wash temperatures without substantial agitation of the cleaning composition, thereby avoiding excessive foaming during use of the composition.

[0016] A further drawback associated with aqueous cleaners containing sodium hydroxide or organic solvents such as alkanolamines, ethers, alcohols, glycols and the like, is that such cleaners tend to be exceedingly alkaline, i.e., having pH values of 13 and above. These exceedingly alkaline aqueous solutions are highly corrosive to metal surfaces, highly toxic and can be dangerous to handle, thus requiring extreme safety measures to avoid contact with the skin. Organic solvent-containing aqueous cleaners have the toxicity and environmental problems discussed previously herein.

[0017] It is also important that the aqueous metal cleaners be reusable to render such cleaners economically viable. Thus, it is not practical on an industrial scale to sewer an aqueous cleaning bath upon a single usage thereof. Many of the aqueous-based cleaners now available use detersive agents which are effective in removing the dirt, grease or oil from the metal surface but which unfortunately readily emulsify the contaminants such that the contaminants are highly dispersed or solubilized throughout the aqueous solution. These highly emulsified cleaning solutions are difficult to treat to separate the contaminants from the aqueous cleaner and, accordingly, the cleaning solution gets spent in a relatively short period of time and must be replaced to again achieve effective cleaning of the metal parts and the like. It would be desirable to provide an aqueous metal cleaner which could effectively remove the contaminants from the metal surface but which would allow the ready separation of such contaminants from the cleaning solution to allow effective and prolonged reuse of the solution

[0018] Therefore, the problem underlying the present invention has been to provide a low-temperature aqueous metal cleaning composition which is not highly corrosive to metal surfaces, and exhibits simultaneously improved cleaning performance, high emulsifying capacity and low foaming behaviour. Finally, the new composition should be environmental friendly, particularly free of boron compounds, and safe to humans.

DESCRIPTION OF THE INVENTION

[0019] A first object of the present invention is a neutral aqueous cleaning composition comprising

(a) at least one fatty acid alkyl ester alkoxylate,

(b) at least one alcohol alkoxylate, and

(c) at least one amine oxide,

[0020] Surprisingly, it has been observed that the aqueous compositions according to the present invention fully comply with the complex profile described above. In particular the compositions provide superior cleaning performance when compared with products one can find in the market. They also show higher emulsifying capacity and thus higher shelf time, and they either do not exhibit foam at all or the foam collapses in very short time. The formulations can easily be reused or run in cycles. The compositions are either fully or in the alternative to a major extend based on renewable sources, not corrosive to metal surfaces, readily biodegradable and safe to skin.

FATTY ACID ALKYL ESTER ALKOXYLATES

[0021] Adducts of alkylene oxides (which includes ethylene oxide, propylene oxide, butylene oxides and their mixtures) - form component (a) of the present invention. They belong to the group of non-ionic surfactants, although they are less common as for example adducts of AO to fatty alcohols. Preferably they follow general formula (II)

$$R^4CO\text{-}(OCH_2CHR^5)_nOR^6 \qquad (II)$$

in which R^4CO stands for a saturated or unsaturated, linear or branched acyl radical having 12 to 22 carbon atoms, R^5 means either hydrogen or methyl, R^6 stands for an alkyl group having 1 to 4 carbon atoms and n represents an integer of from 5 to 12, and preferably 7 to 10. The acyl moiety of the molecules can be derived from individual fatty acids, but preferably from technical sources as for example coconut oil, palm oil, palm kernel oil, olive oil, soy oil and in particular rape seed oil. The chain length of the acyl radical differs between 12 and 22; preferred alternatives are those having a focus on C_{12}-C_{14} or C_{16}-C_{18}. The acyl group may be saturated or unsaturated, in the latter case having 1, 2 or 3 double bonds. Typically, the acyl group represents a mixture of species having different chain lengths and numbers of double bonds.

[0022] In a preferred embodiment the fatty acid alkyl ester alkoxylates are fatty acid methyl ester alkoxylates.

[0023] In another preferred embodiment the fatty acid alkyl ester alkoxylates are fatty acid alkyl ester ethoxylates.

[0024] The overall preferred fatty acid alkyl ester alkoxylates encompass

(b1) a $C_{12/18}$ fatty acid methyl ester ethoxylate and/or

(b2) a $C_{16/18}$ fatty acid methyl ester ethoxylate.

[0025] More particular, the preferred species encompass the following individuals:

- $C_{12/18}$ fatty acid methyl ester + 7EO;
- $C_{12/18}$ fatty acid methyl ester + 10EO;
- $C_{16/18}$ fatty acid methyl ester + 7EO;
- $C_{16/18}$ fatty acid methyl ester + 10EO;

and mixtures thereof.

[0026] The results from the application examples show that it is advantageous to use a composition comprising at least two different fatty acid alkyl ester ethoxylates, differing in acyl chain length and/or degree of alkoxylation.

ALCOHOL ALKOXYLATES

[0027] Adducts of alkylene oxide to alcohols, preferably aliphatic alcohols, form component (b). Preferably the alkoxylates follow general formula (III)

$$R^7(OCH_2CHR^8)_mOH \qquad (III)$$

in which R^7 stands for an alkyl group having 6 to 12 carbon atoms, R^8 means either hydrogen or methyl and m represents an integer of from 2 to 10. The preferred alcohol alkoxylates are chosen from the following individuals:

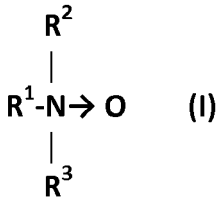
- Octanol+2.5EO;

- Octanol+4EO;
- Octanol+6EO;
- Octanol+8EO;
- Octanol+10EO;
- Decanol+2.5EO
- Decanol-4EO
- Decanol+6EO;
- Decanol+8EO;
- Decanol+10 EO;

and mixtures thereof.

AMINE OXIDES

[0028] Amine oxides, forming component (c) of the composition according to the present invention, are well-known non-ionic surfactants, which work as hydrotropes. Preferably the compounds follow general formula (I)



in which R^1 stands for an alkyl group having 10 to 14, preferably 12 to 14 carbon atoms and R^2 and R^3 independently from each other for hydrogen or an alkyl group having 1 to 4 carbon atoms. The preferred amine oxide is $C_{12/14}$ alkyl dimethylamine oxide.

COMPOSITIONS

[0029] In another preferred embodiment the composition of the present invention comprise

(a) about 0.1 to about 10 % b.w., preferably about 1 to about 8 % b.w., more preferably about 2 to about 5 % b.w. of at least one fatty acid alkyl ester alkoxylate;

(b) about 0.1 to about 8 % b.w., preferably about 1 to about 6 % b.w., more preferably about 2 to about 5 % b.w. of at least one alcohol alkoxylate; and

(c) about 0.1 to about 10 % b.w., preferably about 0.5 to 5 % b.w., more preferably about 0.9 to about 3 % b.w. of at least one amine oxide;
on condition that the amounts add with water and optionally further additives to 100 % b.w.

[0030] Preferably the compositions show a pH-value of from about 5 to about 8 and more preferably of about 7. It should be understood that the preferred embodiments with regard to specific chain length and degree of ethoxylation as explained above also apply for the compositions without being repeated again.

INDUSTRIAL APPLICATION

[0031] Another object of the present invention is related to a method for cleaning hard surfaces, comprising the following

steps:

(a) providing a hard surface, said surface being made of stainless steel, copper metals or aluminium alloys;

(b) bringing said hard surface in contact with an amount of the neutral cleaning composition of the present invention sufficient to clean the surface; and

(c) cleaning said surface by removing the cleaner along with the stains.

[0032] Finally, the present invention also encompasses the use of the neutral cleaning composition as described above for cleaning hard surfaces particularly made from stainless steel, copper metals and/or aluminium alloys.

[0033] EXAMPLES 1 to 3, Comparative Examples C1 and C2

[0034] For evaluating the cleaning power the lower parts of a tared plate were dipped into motor oil. After sticked oil had dripped off, the plates were weighed. Subsequently the lower part of said plate was dipped into a 100 ml beaker glass containing 90 g of a cleaning composition. The solution was stirred for 10 minutes at 20 °C at 1.000 rpm. The plates were removed and dried for 10 minutes at 105 °C. Finally the plates were weighed again and cleaning performance calculated according to the following equation:

$$\text{Cleaning performance (\%)} = \frac{[\text{metal plate + oil(BEFORE cleaning)} - \text{metal plate}] - [\text{metal plate + oil (AFTER cleaning)} - \text{metal plate}]}{[\text{metal plate + oil (BEFORE cleaning)} - \text{metal plate}]}$$

[0035] The results are compiled in **Table 1**. Examples 1 to 3 are according to the invention, Comparison examples C1 and C2 refer to market products (C1: "Bike Clean" (Motorex); C2: "Nigrin Performance" (Evotec).

Table 1

Cleaning power					
Composition	**1**	**2**	**3**	**C1**	**C2**
Libranox AO12/14 (30 % b.w. solution) $C_{12/14}$ dimethylamine oxide	10,0	10,0	10,0		
Greenbentin XES/070 $C_{16/18}$ Rapeseed fatty acid methyl ester + 7EO	2.0	2.0	-		
Greenbentin XES/100 $C_{16/18}$ Rapeseed fatty acid methyl ester + 10EO	2.0	2.0	-		
Greenbentin MLS/070 $C_{12/14}$ fatty acid methyl ester + 7EO	-	-	2.0		
Greenbentin MLS/100 $C_{12/14}$ fatty acid methyl ester + 7EO	-	-	2.0		
Greenbentin DE/060 Decanol+6EO	2.0	-	-		
Greenbentin DE/080 Decanol+8EO	-	2.0	2.0		
pH-value	7.25	7.09	7.29	8.98	5.13
Water	Ad 100				
Cleaning performance (%)	87	85	87	76	76

[0036] The examples and comparative examples clearly demonstrate that the compositions according to the present invention provide a significantly superior cleaning performance.

[0037] EXAMPLES 4 to 6, Comparative Examples C3 and C4

[0038] For evaluating the foam behavior 40 ml of five different cleaners were placed at room temperature in 100 ml glass cylinders and shaken for 30 seconds. Subsequently foam heights after 5, 10 and 15 minutes were determined. The results are compiled in **Table 2**. Examples 4 to 6 are according to the invention, Comparison examples C3 and C4 refer to market products (C3: "Bike Clean" (Motorex); C4: "Nigrin Performance" (Evotec).

Table 2

Foam behavior					
Composition	**4**	**5**	**6**	**C3**	**C4**
Libranox AO12/14 (30 % b.w. solution) $C_{12/14}$ dimethylamine oxide	10,0	10,0	10,0		
Greenbentin XES/070 $C_{16/18}$ Rapeseed fatty acid methyl ester + 7EO	2.0	2.0	-		
Greenbentin XES/100 $C_{16/18}$ Rapeseed fatty acid methyl ester + 10EO	2.0	2.0	-		
Greenbentin MLS/070 $C_{12/14}$ fatty acid methyl ester + 7EO	-	-	2.0		
Greenbentin MLS/100 $C_{12/14}$ fatty acid methyl ester + 7EO	-	-	2.0		
Greenbentin DE/060 Decanol+6EO	2.0	-	-		
Greenbentin DE/080 Decanol+8EO	-	2.0	2.0		
pH-value	7.25	7.09	7.29	8.98	5.13
Water	Ad 100				
Foam heights (mm)					
- after 5 min	90	45	100	100	100
- after 10 minutes	58	43	55	100	100
- after 15 minutes	51	42	42	55	100

[0039] The examples and comparative examples clearly demonstrate that the compositions according to the present invention provide significant a lower foaming power.

[0040] **EXAMPLES 7 to 9, Comparative Examples C5 and C6**

[0041] For evaluating the emulsifying capacity 80 ml of five different cleaners and 20 ml Vaseline oil were mixed by Ultraturrax (20 °C, 2 min, 8.400 rpm). Subsequently the amount of water recovered from the emulsion was determined. The results are compiled in **Table 3**. Examples 7 to 9 are according to the invention, Comparison examples C5 and C6 refer to market products (C5: "Bike Clean" (Motorex); C6: "Nigrin Performance" (Evotec).

Table 3

Emulsifying capacity					
Composition	**7**	**8**	**9**	**C5**	**C6**
Libranox AO12/14 (30 % b.w. solution) $C_{12/14}$ dimethylamine oxide	10,0	10,0	10,0		
Greenbentin XES/070 $C_{16/18}$ Rapeseed fatty acid methyl ester + 7EO	2.0	2.0	-		
Greenbentin XES/100 $C_{16/18}$ Rapeseed fatty acid methyl ester + 10EO	2.0	2.0	-		
Greenbentin MLS/070	-	-	2.0		

(continued)

Emulsifying capacity					
Composition	**7**	**8**	**9**	**C5**	**C6**
$C_{12/14}$ fatty acid methyl ester + 7EO					
Greenbentin MLS/100 $C_{12/14}$ fatty acid methyl ester + 7EO	-	-	2.0		
Greenbentin DE/060 Decanol+6EO	2.0	-	-		
Greenbentin DE/080 Decanol+8EO	-	2.0	2.0		
pH-value	7.25	7.09	7.29	8.98	5.13
Water	Ad 100				
Water recovery (%)					
- after 0.5 h	18	21	7	20	22
- after 1 h	36	38	7	42	45
- after 2 h	58	58	7	58	60
- after 3 h	62	63	7	76	76
- after 5 h	65	65	50	85	87

[0042] The examples and comparative examples clearly demonstrate that the compositions according to the present invention provide emulsions with significantly higher emulsion stability.

Claims

1. A neutral aqueous cleaning composition comprising

(a) at least one fatty acid alkyl ester alkoxylate,
(b) at least one alcohol alkoxylate, and
(c) at least one amine oxide,

2. The composition of claim 1, wherein the fatty acid alkyl ester alkoxylate follows general formula (II)

$$R^4CO\text{-}(OCH_2CHR^5)_nOR^6 \qquad (II)$$

in which R^4CO stands for a saturated or unsaturated, linear or branched acyl radical having 12 to 22 carbon atoms, R^5 means either hydrogen or methyl, R^6 stands for an alkyl group having 1 to 4 carbon atoms and n represents an integer of from 5 to 12.

3. The composition of Claim 1, wherein the fatty acid alkyl ester alkoxylate is a fatty acid methyl ester alkoxylate.

4. The composition of Claim 1, wherein the fatty acid alkyl ester alkoxylate is a fatty acid alkyl ester ethoxylate.

5. The composition of Claim 1, wherein the fatty acid alkyl ester alkoxylate is

(b1) a $C_{12/18}$ fatty acid methyl ester ethoxylate and/or
(b2) a $C_{16/18}$ fatty acid methyl ester ethoxylate.

6. The composition of Claim 1, wherein the fatty acid alkyl ester alkoxylate is selected from the group consisting of the following individuals:

$C_{12/18}$ fatty acid methyl ester + 7EO;
$C_{12/18}$ fatty acid methyl ester + 10EO;
$C_{16/18}$ fatty acid methyl ester + 7EO;
$C_{16/18}$ fatty acid methyl ester + 10EO;
and mixtures thereof.

7. The composition of Claim 1, comprising at least two different fatty acid alkyl ester ethoxylates, differing in acyl chain length and/or degree of alkoxylation.

8. The composition of Claim 1, wherein the alcohol alkoxylate (compound c) follows general formula (III)

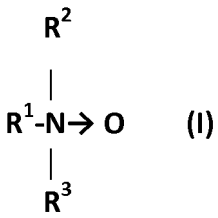
$$R^7(OCH_2CHR^8)_mOH \qquad (III)$$

In which R^7 stands for an alkyl group having 6 to 12 carbon atoms, R^8 means either hydrogen or methyl and m represents an integer of from 2 to 10.

9. The composition of Claim 1, wherein the alcohol alkoxylate is selected from the group consisting of the following individuals:

Octanol+2.5EO;
Octanol+4EO;
Octanol+6EO;
Octanol+8EO;
Octanol+10EO;
Decanol+2.5EO Decanol+4EO Decanol+6EO;
Decanol+8EO;
Decanol+10 EO;
and mixtures thereof.

10. The composition of claim 1, wherein the amine oxide follows general formula (I)



$$R^1\text{-}N(\rightarrow O)(R^2)(R^3) \qquad (I)$$

in which R^1 stands for an alkyl group having 10 to 14 carbon atoms and R^2 and R^3 independently from each other for hydrogen or an alkyl group having 1 to 4 carbon atoms.

11. The composition of Claim 1, wherein the amine oxide is $C_{12/14}$ alkyl dimethylamine oxide.

12. The composition of Claim 1 comprising

(a) about 0.1 to about 10 % b.w. of at least one fatty acid alkyl ester alkoxylate;
(b) about 0.1 to about 8 % b.w. of at least one alcohol alkoxylate; and
(c) about 0.1 to about 10 % b.w. of at least one amine oxide;
on condition that the amounts add with water and optionally further additives to 100 % b.w.

13. The composition of Claim 1 having a pH-value of from about 5 to about 8.

14. A method for cleaning hard surfaces, comprising the following steps:

(a) providing a hard surface, said surface being made of stainless steel, copper metals or aluminium alloys;
(b) bringing said hard surface in contact with an amount of the neutral cleaning composition of claim 1 sufficient

to clean the surface; and
(c) cleaning said surface by removing the cleaner along with the stains.

15. Use of the neutral cleaning composition of Claim 1 for cleaning hard surfaces particularly made from stainless steel, copper metals and/or aluminium alloys.

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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 5397

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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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	29 February 2016	Pfannenstein, Heide

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 18 5397

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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