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(21) International Application Number: PCT/US97/07080 (22) International Filing Date: 28 April 1997 (28.04.97) (30) Priority Data: 96870056.7 3 May 1996 (03.05.96) EP <i>(34) Countries for which the regional or international application was filed:</i> BE et al. (71) Applicant (for all designated States except US): THE PROCTER & GAMBLE COMPANY [US/US]; One Procter & Gamble Plaza, Cincinnati, OH 45202 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): RIGONI, Monica [IT/IT]; Via B. Gozzoli, 34, I-00144 Rome (IT). TRANI, Marina [IT/IT]; Via Gualtierio Serafino, 20, I-00136 Rome (IT). (74) Agents: REED, T., David et al.; The Procter & Gamble Company, 5299 Spring Grove Avenue, Cincinnati, OH 45217 (US).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: CLEANING COMPOSITIONS (57) Abstract <p>A cleaning composition which provides effective cleaning and shine performance, said composition comprising a surfactant system comprising an alkyl sulphate and a betaine or sulphobetaine surfactant in a weight ratio of alkyl sulphate to betaine or sulphobetaine of 5.5:1 to 100:1, and wherein the pH of the composition is of at least 4. Preferably, the composition comprises a solvent for enhanced cleaning and shine performance of the composition.</p>		

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Cleaning compositions

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Technical field of the Invention

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The present invention relates to a cleaning composition which provides an effective cleaning and shine performance on surfaces, especially hard surfaces.

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Background of the invention

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The formulation of compositions which provide cleaned shiny surfaces is a problem known in the art to the formulator of a cleaning composition. More particularly, the problem of providing shiny surfaces is often compromised by residues of the compositions which are left on said surfaces and which appear as streaks as water evaporation is completed. The problem of the residuality is even more noticeable where the composition is used to clean surfaces made of glossy materials, such as glossy ceramic tiles, windows and mirrors, or such materials as polyurethane-coated PVC which is widely used in Northern America. Furthermore, nowadays, many products are formulated or can be used as no-rinse products. In such conditions or with such products, the problem of residuality has become more acute.

Accordingly, there is a need for a composition which provides effective cleaning performance but also provides the cleaned surfaces with a shiny effect without any residues.

5 Numerous solutions have been proposed in the art to solve this need, including the use of an acid, magnesium ions, or the use of certain solvents as described in WO 95/21229, EP 0 639 833 or US 3,839,234.

10 The applicant has now surprisingly found that this need could also be met by formulating a composition which comprises a surfactant system comprising an alkyl sulphate surfactant and a betaine or a sulphobetaine surfactant in specific ratios and wherein the pH of the composition is at least 4.

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This finding is especially surprising as the use of alkyl sulphate surfactants, which provide effective cleaning, has been found to form crystals upon drying, which resulted in spotting residues on the cleaned surface; while on
20 the other hand the use of betaine or sulphobetaine surfactants, also effective cleaning component, left amorphous residues resulting in a greasy film on the surface. Surprisingly, the use of a mixture of an alkyl sulphate and a betaine or a sulphobetaine surfactant in specific ratios not only provides an effective cleaning of the surfaces but also causes said residues
25 to appear less, or even not to appear anymore.

The applicant has further found that the addition of solvents to this surfactant system provides an enhanced cleaning and shine benefit.

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It is therefore an advantage of the invention to provide a composition which provides effective cleaning and shine performance on surfaces.

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It is another advantage of the invention to provide a composition with effective disinfection performance.

- 5 It is another advantage of the invention to provide a composition which is mild to the skin.

Summary of the Invention

- 10 The present invention relates to a cleaning composition comprising a surfactant system comprising an alkyl sulphate and a betaine or a sulphobetaine surfactant in a weight ratio of alkyl sulphate to betaine or sulphobetaine of 5.5:1 to 100:1, and wherein the pH of the composition is of at least 4.

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In a preferred embodiment of the invention, the composition comprises a solvent for enhanced cleaning and shine performance of the composition.

- 20 In another preferred embodiment of the invention, the composition further comprises a peroxygen bleach for providing the composition with effective disinfecting performance.

Detailed description of the invention

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- 30 An essential feature of the invention is a surfactant system, said system comprising an alkyl sulphate and a betaine or a sulphobetaine surfactant in specific weight ratios of alkyl sulphate to betaine or a sulphobetaine surfactant.

Alkyl sulphate surfactant

- 35 Alkyl sulphate surfactants to be used herein are those of formula $\text{ROSO}_3^- \text{M}^+$, wherein R represents an alkyl group containing from 6 to 24 carbon atoms, more preferably 6 to 16 and most preferably 8 to 14 carbon atoms.

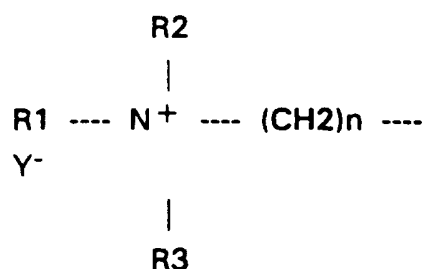
M represents a water-solubilising cation. The alkyl group can be in straight or branched configuration, and preferably in straight configuration.

5 Alkyl sulphate is commercially available from Rhone Poulenc under the tradename Rhodapon® or from Albright & Wilson under the tradename EMPICOL®. A preferred commercial alkyl sulphate for use herein is EMPICOL® 0137/A.

10 Betaine or a sulphobetaine surfactant

The composition according to the present invention comprises a betaine or a sulphobetaine surfactant, or derivatives thereof, or mixtures thereof. A further advantage of the invention is the mild action profile of said betaine
15 and/or sulphobetaine surfactants. Accordingly, the compositions herein may be particularly suitable for the cleaning of delicate surfaces, e.g. delicate laundry or surfaces in contact with food and/or babies. Furthermore, betaine and/or sulphobetaine surfactants are also extremely mild to the skin, and thus contribute to the convenience of use of the compositions of the present
20 invention by the user.

Suitable betaine/sulphobetaine surfactants to be used in the compositions of the present invention are the betaine/sulphobetaine wherein the molecule contains both basic and acidic groups which form an inner salt giving the
25 molecule both cationic and anionic hydrophilic groups over a broad range of pH values. Some common examples of these detergents are described in U.S. Pat. Nos. 2,082,275, 2,702,279 and 2,255,082, incorporated herein by reference. Preferred betaine or sulphobetaine surfactants have the
30 formula



wherein R1 is an alkyl radical containing from about 1 to about 24 carbon atoms, preferably from 8 to 18, and more preferably from 12 to 14, wherein R2 and R3 contain from 1 to 3 carbon atoms, and preferably 1 carbon atom, wherein n is an integer of from 1 to 10, preferably from 1 to 6 and more preferably is 1, Y is selected from the group consisting of carboxyl and sulfonyl radicals and wherein the sum of R1, R2 and R3 radicals is from about 14 to about 24 carbon atoms, or mixtures thereof.

- 10 Examples of particularly suitable betaine surfactants include C12-C18 alkyl dimethyl betaine such as the coconut betaine and C10-C16 alkyl dimethyl betaine such as the lauryl betaine.

- 15 Coconut betaine and Lauryl betaine are commercially available from Seppic and Albright & Wilson respectively, under the trade name of Amony 265® and Empigen BB/L® respectively.

- 20 Typically, the compositions herein comprise at least 0.005% by weight of the total composition of said betaine or sulphobetaine surfactant, or derivatives thereof, or mixtures thereof, preferably from 0.01% to 10%, and more preferably from 0.1% to 5%.

- 25 The weight ratios of alkyl sulphate to betaine or sulphobetaine are an important feature of the invention. Hence, ratios outside the range below, such as those where the betaine or sulphobetaine surfactant is in a higher proportion than the alkyl sulphate, would not provide the cleaning and shine benefit but only the cleaning benefit while still leaving greasy residues. On the other hand, a ratio above 100:1 of alkyl sulphate to betaine or sulphobetaine surfactant would result in a surface showing spotty residues

of the crystalline type. Thus, it is an important feature that the alkyl sulphate and betaine or sulphobetaine surfactant be present within the composition in a weight ratio of alkyl sulphate to betaine of 5.5:1 to 100:1, preferably from 10:1 to 50:1. For more optimum cleaning and shine performance, a weight
5 ratio of alkyl sulphate to betaine of 15:1 to 30:1 is most preferred.

pH

Another important feature of the invention is the pH of the composition.
10 Hence compositions comprising the specific surfactant system mentioned above and having a pH below 4 have been found to produce a precipitate in the solution. The pH of the composition is measured at 20°C in the neat composition where the composition is an aqueous composition or measured as a 1% solution in distilled water at 20°C where the composition is a solid
15 composition. Accordingly, it is an essential feature of the invention that the pH of the composition is of at least 4. Preferably, the compositions according to the present invention are aqueous liquid cleaning compositions. Said aqueous compositions preferably have a pH as is of not more than 12.0, more preferably from 4 to 10. The pH of the compositions can be
20 adjusted by using organic or inorganic acids, or alkalising agents.

Additional components

25 The composition of the invention may, optionally, contain additional components such as solvents, peroxygen bleach, chelants and mixtures thereof.

30 Solvents

When used, solvents will, advantageously, give an enhanced cleaning and shine performance to the composition. Suitable solvents for incorporation in the compositions according to the present invention include propylene glycol
35 derivatives such as n-butoxypropanol or n-butoxypropoxypropanol, water-soluble CARBITOL® solvents or water-soluble CELLOSOLVE® solvents.

Water-soluble CARBITOL® solvents are compounds of the 2-(2-alkoxyethoxy)ethanol class wherein the alkoxy group is derived from ethyl, propyl or butyl. A preferred water-soluble carbitol is 2-(2-butoxyethoxy)ethanol also known as butyl carbytol. Water-soluble
5 CELLOSOLVE® solvents are compounds of the 2-alkoxyethoxyethanol class, with 2-butoxyethoxyethanol being preferred. Other suitable solvents are benzyl alcohol, ethanol, isopropyl alcohol and diols such as 2-ethyl-1,3-hexanediol and 2,2,4-trimethyl-1,3-pentanediol and mixture thereof. Preferred solvents for use herein are n-butoxypropoxypropanol, butyl carbitol
10 ® and mixtures thereof. A most preferred solvent for use herein is butyl carbitol®.

The solvents will typically be present within the undiluted composition of the invention at a level of 0.01% to 10% by weight, preferably 3% to 7% by
15 weight of the composition.

Peroxygen bleach

Another suitable additional component for use herein is a peroxygen bleach.
20 Peroxygen bleach, especially hydrogen peroxide, persulfate and the like, in the compositions of the present invention advantageously contribute to the disinfection properties of said compositions. Hence, not to be bound by theory, it is believed that said peroxygen bleach may attack the vital function of the micro-organism cells, for example, it may inhibit the
25 assembling of ribosomes units within the cytoplasm of the micro-organism cells. Also, said peroxygen bleach like hydrogen peroxide, is a strong oxidizer that generates hydroxyl free radicals which attack proteins and nucleic acids. Furthermore, the presence of said peroxygen bleach, especially hydrogen peroxide, provides strong stain removal benefits which
30 are particularly noticeable for example in laundry and hard surfaces applications.

As used herein a hydrogen peroxide source refers to any compound which produces hydrogen peroxide when said compound is in contact with water. Suitable water-soluble sources of hydrogen peroxide for use herein include percarbonates, persilicate, persulphate such as monopersulfate, perborates and peroxyacids such as diperoxydodecandioic acid (DPDA), magnesium perphthalic acid and mixtures thereof.

A preferred peroxygen bleach is hydrogen peroxide, or a water soluble source thereof, or mixtures thereof. A most preferred peroxygen bleach is hydrogen peroxide.

In addition to the peroxygen bleach, other classes of peroxides can be used as an alternative to hydrogen peroxide and sources thereof or in combination with hydrogen peroxide and sources thereof. Suitable classes include dialkylperoxides, diacylperoxides, preformed percarboxylic acids, organic and inorganic peroxides.

Typically, the compositions herein comprise at least 0.01% by weight of the total composition of said peroxygen bleach or mixtures thereof, preferably from 0.1% to 15%, and more preferably from 1% to 10%.

The following disinfecting test method may be applied to measure the disinfection property of the composition:

Disinfecting test method

Disinfection properties of a composition may be measured by the bactericidal activity of said composition. A test method to evaluate the bactericidal activity of a composition is described in European Standard, prEN 1276, CEN/TC 216 N 59, dated November 1995 issued by the European Committee for Standardisation, Brussels. European Standard, prEN 1276, CEN/TC 216 N 59, specifies a test method and requirements for the minimum bactericidal activity of a disinfecting composition. The test is passed if the bacterial colonies forming units (cfu) are reduced from a 10^7 cfu (initial level) to a 10^2 cfu (final level after contact with the disinfecting product), i.e. a 10^5 reduction of the viability is necessary.

Chelating agents

Chelating agents are also additional components which may be suitable for use herein. Preferred chelating agents are those selected from the group of
5 aminophosphonates. Suitable amino phosphonate compounds for use herein include amino alkylene poly (alkylene phosphonate), alkali metal ethane 1-hydroxy diphosphonates, nitrilo trimethylene phosphonates, ethylene diamine tetra methylene phosphonates, and diethylene triamine penta methylene phosphonates. The phosphonate compounds may be present
10 either in their acid form or as salts of different cations on some or all of their acid functionalities. Preferred amino phosphonate chelants to be used herein is diethylene triamine penta methylene phosphonate. Such phosphonate chelant is commercially available from Monsanto under the trade name DEQUEST®.

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Said chelating agents, especially phosphonate chelating agents like diethylene triamine penta methylene phosphonates, are particularly preferred in the compositions according to the present invention as they have been found to
20 further contribute to the disinfecting properties of hydrogen peroxide.

Typically, the compositions according to the present invention comprise up to 5% by weight of the total composition of a chelating agent, or mixtures
25 thereof, preferably from 0.002% to 3% by weight and more preferably from 0.002% to 1.5% by weight of the composition.

Optional compounds

30 The compositions herein may further comprise a variety of other optional compounds including antimicrobial compounds such as Eugenol commercially available for example from Sigma, Systems - Bioindustries (SBI) - Manheimer Inc, builders, buffers, bactericides, enzymes, hydrotropes, colorants, stabilizers, bleach activators, soil suspenders, dye transfer agents,
35 brighteners, perfumes, anti dusting agents, dispersant, dye transfer inhibitors, pigments, perfumes and dyes.

Formulation form of the compositions

5 The compositions according to the present invention may be formulated either as solids or liquids. In the case where the compositions are formulated as solids, they will be mixed with an appropriate solvent, typically water, before use. In liquid form, the compositions are preferably but not necessarily formulated as aqueous compositions. Liquid compositions are preferred herein for convenience of use.

Packaging form of the compositions

10 The compositions herein may be packaged in a variety of suitable detergent packaging known to those skilled in the art. The liquid compositions herein may desirably be packaged in manually operated spray dispensing containers, which are usually made of synthetic organic polymeric plastic materials. Accordingly, the present invention also encompasses liquid cleaning compositions of the invention packaged in a spray dispenser, preferably in a trigger spray dispenser. Indeed, said spray-type dispensers allow to uniformly apply to a relatively large area of a surface to be cleaned the liquid cleaning compositions suitable for use according to the present invention; thereby contributing to the cleaning properties of said compositions. Such spray-type dispensers are particularly suitable to clean vertical surfaces.

25 Suitable spray-type dispensers to be used according to the present invention include manually operated foam trigger-type dispensers sold for example by Specialty Packaging Products, Inc. or Continental Sprayers, Inc. These types of dispensers are disclosed, for instance, in US-4,701,311 to Dunning et al. and US-4,646,973 and US-4,538,745 both to Focarracci. Particularly preferred to be used herein are spray-type dispensers such as T 8500® commercially available from Continental Spray International or T 8100® commercially available from Canyon, Northern Ireland. In such a dispenser the liquid composition is divided in fine liquid droplets resulting in a spray that is directed onto the surface to be treated. Indeed, in such a spray-type dispenser the composition contained in the body of said

dispenser is directed through the spray-type dispenser head via energy communicated to a pumping mechanism by the user as said user activates said pumping mechanism. More particularly, in said spray-type dispenser head the composition is forced against an obstacle, e.g. a grid or a cone or
5 the like, thereby providing shocks to help atomise the liquid composition, i.e. to help the formation of liquid droplets.

The compositions of the present invention may also be executed in the form of wipes. By "wipes" it is meant herein disposable paper towels
10 incorporating a liquid composition according to the present invention. Accordingly, the present invention also encompasses wipes, e.g. disposable paper towels, incorporating a liquid composition according to the present invention. In the preferred execution said wipes are impregnated, more preferably wetted with said liquid compositions. Preferably said wipes are
15 packaged in a plastic box. The advantage of this execution is a faster usage of a cleaning composition by the user, this even outside the house, i.e. there is no need to pour the liquid compositions according to the present invention on the surfaces to be treated and to dry it out with a cloth. In other words, wipes allow cleaning of surfaces in one step.

20

The present invention encompasses a process for cleaning surfaces wherein a composition according to the present invention is applied onto said surfaces.

By "surface" it is meant herein any surface including hard-surfaces like
25 bathroom, kitchen, floors, table tops, refrigerators, walls, tiles, wash surfaces and the like.

In the process of cleaning surfaces according to the present invention said compositions may be applied to the surface to be disinfected in its neat form or in its diluted form.

30 By "diluted form" it is meant herein that the compositions to be used in the cleaning process herein being either in a liquid or solid form may be diluted by the user typically up to 1000 times their weight of water, preferably up to 300 times, more preferably into 80 to 30 times their weight of water, and most preferably 60 to 40 times.

In a preferred embodiment of the process of the present invention wherein said composition is applied to a surface to be cleaned, such as a hard-surface, in its diluted form, it is not necessary to rinse the surface after the composition has been applied; indeed, no visible residues are left onto the surface.

The invention is illustrated in the following non limiting examples, in which all percentages are on a weight basis unless otherwise stated.

The following test methods applied to measure the cleaning and shine benefit are as follows:

Cleaning test method

Standard enamel plates were soiled by applying on them a grease/particulate matter and then baking them. The tested compositions were then applied on a sponge and then placed onto a Gardner Machine. The Gardner machine measured the number of strokes needed to reach 95-99% clean plates. The performance was measured as such (i.e undiluted) and upon dilution at 1.5% in water.

Shine test method

Five millimeters of test product are applied to one face of a wetted sponge. The wetted sponge is applied in one motion with even pressure from top to bottom of a previously cleaned, with isopropyl alcohol, black tile. The tile with the applied product(s) is allowed to dry for ten minutes before grading by expert judges. The control reference is made by repeating the above test with a wetted sponge but without the tested product.

Expert judges are employed to evaluate the specific area of product application for amount of filming/streaking. A numerical value describing the amount of filming/streaking is assigned to each product. For the test results, a 0-4 scale is used

0=There is no difference between the tested product and the control reference, i.e. poor filming/streaking performance of the tested product.

4=There is a clear difference between the product and the control reference, i.e. no filming/streaking with the tested product.

5

In the examples, the abbreviated component identifications have the following meanings:

alkyl sulphate : Empicol 0137/A
 betaine : Coco alkyldimethyl betaine available from Albright
 & Wilson under the trade name of Empigen BB/L®
 butyl carbitol : 2-(2-butoxyethoxy)ethanol
 ®

10 Example 1

The following composition, according to the present invention, was made by mixing the listed ingredients in the listed proportions :

15

	A	B	C	E
Alkyl sulphate	1	1	1	1
betaine	0.05	0.05	0.05	0.05
butyl carbitol®	-	5	-	5
hydrogen peroxide	-	-	2	2
Water and minors up to 100				
H ₂ SO ₄ up to pH 4				

Example 2

The following compositions are in accordance with the invention:

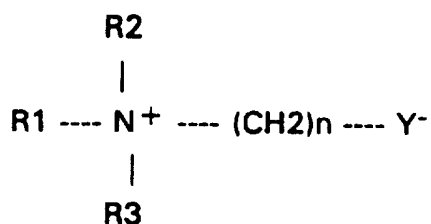
	F	G	H	I
Alkyl sulphate	1	2	8	5
betaine	0.05	0.1	0.5	0.2
butyl carbitol®	-	5	-	5
hydrogen peroxide	-	-	1	2
Water and minors up to 100				
H ₂ SO ₄ up to pH 5				

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	J	K	L	M
Alkyl sulphate	1	2	8	5
betaine	0.05	0.1	0.5	0.2
butyl carbitol®	-	5	-	5
hydrogen peroxide	-	-	1	2
Water and minors up to 100				
H ₂ SO ₄ up to pH 9				

What is claimed is:

- 1- A cleaning composition comprising a surfactant system comprising an alkyl sulphate and a betaine or sulphobetaine surfactant in a weight ratio of alkyl sulphate to betaine or sulphobetaine of 5.5:1 to 100:1, and wherein the pH of the composition is of at least 4.
- 2- A cleaning composition according to Claim 1, wherein said ratio of alkyl sulphate to betaine or sulphobetaine is of 10:1 to 50:1, preferably 15:1 to 30:1.
- 3- A cleaning composition according to either one of Claim 1 or 2, wherein said alkyl sulphate is according to the formula $\text{ROSO}_3^-\text{M}^+$ wherein R represents an alkyl group containing from 6 to 24 carbon atoms, preferably 6 to 16 and more preferably 8 to 14 carbon atoms, and wherein M represents a water-solubilising cation.
- 4- A cleaning composition according to any one of Claims 1-3, wherein said betaine or sulphobetaine surfactant is according to the formula



wherein R1 is an alkyl radical containing from about 1 to about 24 carbon atoms, preferably from 8 to 18, and more preferably from 12 to 14, wherein R2 and R3 contain from 1 to 3 carbon atoms and preferably 1 carbon atom, wherein n is an integer of from 1 to 10, preferably from 1 to 6 and more preferably is 1, Y is selected from the group consisting of carboxyl and sulfonyl radicals and wherein the sum of R1, R2 and R3 radicals is from about 14 to about 24 carbon atoms, or mixtures thereof.

- 5- A cleaning composition according to any one of Claims 1-4, wherein said composition further comprises a solvent.
- 5 6- A cleaning composition according to Claim 5, wherein said solvent is selected from the propylene glycol derivatives, 2-(2-alkoxyethoxy)ethanol class, 2-alkoxyethoxyethanol class, benzyl alcohol, ethanol, isopropyl alcohol, diols and mixtures thereof, preferably selected from the propylene glycol derivatives and 2-(2-alkoxyethoxy)ethanol class.
- 10 7- A cleaning composition according to any one of Claims 1-6, wherein said composition further comprises a peroxygen bleach.
- 15 8- A wipe incorporating a cleaning composition according to any one of Claims 1-7.
- 9- A cleaning composition according to any one of Claims 1-7, wherein said composition is packaged in a spray dispenser, preferably in a trigger spray dispenser.
- 20 10- A process for cleaning a surface by applying on said surface a composition as defined in any one of claims 1-7.
- 25 11- A process for cleaning a surface according to claim 8, wherein said composition is diluted up to 1000 times its weight of water, preferably up to 300 times, more preferably into 80 to 40 times its weight of water, and most preferably 60 to 30 times, before it is applied to said surface.
- 30 12- A process according to claim 11, wherein said surface is not rinsed after said composition has been applied.
- 35 13- The use of an alkyl sulphate and betaine or sulphobetaine surfactant system in a cleaning composition, for providing cleaning and shine to the surfaces being cleaned with said composition.

- 14- The use of a solvent in a cleaning composition as defined in any one of Claims 1-7, for providing cleaning and shine to the surfaces being cleaned with said composition.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US97/07080

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : C11D 1/37; 1/29; 1/90

US CL : 510/426, 428, 417,416 ,433, 499

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 510/426, 428, 417,416 ,433, 499

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS: betaine# or sulphobetaine# or zwitterionic# or dimethyl(2a)betaine#

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P --- Y,P	US 5,540,864 A (MICHAEL) 30 July 1996, column. 2, lines 30-column. 3, line 45) and examples.	1-3 ----- 1-3
X,P --- Y,P	US 5,543,074 A (HAGUE ET AL) 06 August 1996, column. 5, line 42-column 6, line 55; column 7, line 7-17; example 1.	1-3 ---- 1-3
Y,P	US 5,604,195 A (MISSELYN ET AL) 18 February 1997, column 13, line 10-21; column 8, line 6-67; column 17, line 15-52.	1-3 ---- 1-3
X,P --- Y,P	US 5,565,421 A (ASZMAN ET AL) 15 October 1996 column 3, line 43-52; column 6, line 19-52; example 1.	1-3 ---- 1-3

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:	*T	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Date of the actual completion of the international search 09 JUNE 1997	Date of mailing of the international search report 05 AUG 1997
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer <i>Nicholas Ogden</i> Necholus Ogden Telephone No. (703) 308-0661

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/07080

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☒ Claims Nos.: 4-14
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US97/07080

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P --- Y,P	US 5,580,848 A (DRAPIER) 03 December 1996, column 5, lines 20-36; column 7, line 12-22; column 8, line 13-47; examples 1 and 2	1-3 ----- 1-3