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It is provided an aqueous sanitary cleaning composition having biocidal activity comprising benzalkonium chloride in an amount of up to 5 wt.%, a hydroxycarboxylic acid and water, wherein the weight ratio of the benzalkonium chloride to the hydroxycarboxylic acid is 1:5 to 1:1. The cleaning composition can be used for cleaning of, disinfecting of, and/or lime removal from surfaces made of brass, copper, aluminium, stainless steel, zinc, polyvinylchloride (PVC), polypropylene, acrylonitrile butadiene styrene (ABS), polyacetate, polystyrene, polyethylene, polymethyl methacrylate (PMMA, plexiglas), polycarbonate, ceramic, tiles, porcelain, painted and plastic coated surfaces and enamel or any other surfaces which can be found in, for example, sanitary or kitchen areas.

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SANITARY CLEANER

Field Of The Invention

The present invention relates to an aqueous sanitary cleaning composition having biocidal activity and to the use of said cleaning composition for cleaning of, disinfecting of, and/or lime removal from surfaces, especially from surfaces in bathrooms, kitchens and the like.

Background

Aqueous cleaning compositions for the removal of dirt and lime in sanitary or kitchen areas are well-known. These compositions normally are based on inorganic and/or organic acids as well as surfactants. As additional agents these compositions often further comprise colouring agents, perfumes, viscosity control agents, disinfecting and bleaching agents, preservatives, and further auxiliary substances.

For the removal of persistent lime scale it is required that the cleaning compositions have a high acidity. Since strong inorganic acids such as hydrochloric acid and sulphuric acid lead to corrosion of metallic surfaces, material incompatibility and cause environmental pollution, cleaning compositions are widely used which are based on sulfamic acid. Sulfamic-acid-based cleaning compositions have a high scale-removing capability. Additional advantages of these cleaning compositions are that they can be used safely and that they are eco-friendly.

Cleaning compositions merely based on sulfamic acid have some disadvantages with respect to biocide regulations, material compatibility, perfume stability, and oxidation problems.

Sulfamic acid has some drawbacks with respect to its oxidative properties. Sulfamic acid causes corrosion when it comes into contact with metal surfaces. In contact with plastic surfaces it causes an accelerated aging of the plastic materials that may lead to, for example, stress corrosion cracking. Another problem that is sometimes observed with cleaning compositions according to the state of the art is that the plastic bottles in which the compositions are filled begin to shrink after a certain storage time. This is not acceptable for safety and aesthetics reasons. Therefore, it is also desirable to provide a sanitary cleaning composition being less corrosive to metal surfaces and more compatible to various other materials such as plastics.

Another problem which can be observed when formulating cleaning compositions with sulfamic acid as the sole acid component is that the stability of perfumes also contained in the cleaning composition may be reduced. It is assumed that due to the oxidative properties of the sulfamic acid the perfumes decompose within a few weeks or months when storing the aqueous composition.

It is also desirable that these cleaning compositions have biocidal activity. By the term “biocidal” it is meant that proliferation of microorganisms can be controlled by employing the cleaning composition. Microorganisms for which sanitary compositions are useful to limit proliferation include, but are not limited to, Gram positive bacteria, Gram negative bacteria, yeasts, fungi, and algae. Certain of these microorganisms, when uncontrolled, can grow to dangerous levels resulting in food contamination or may directly infect humans. According to European biocide directives and European standards for proofed chemical disinfectants and antiseptics used in food, industrial, domestic, and institutional areas, disinfectant products sold

in Europe must pass the following standards. The standards are found in the document entitled, "Chemical Disinfectants and Antiseptics – Application of European Standards for Chemical Disinfectants and Antiseptics prEN 14885," which is hereby incorporated by reference in its entirety for all purposes of this application. In particular, that document includes standards for testing the efficacy of disinfectants and antiseptics. These standards are referred to as, "Chemical disinfectants and antiseptics – Quantitative suspension test for the evaluation of bactericidal activity of chemical disinfectants and antiseptics used in food, industrial, domestic, and institutional areas NF EN 1276 and NF EN 1650 and NF EN 13697." The tests run and standards required are dependent upon the use of the product and the class of microbes the product is attempting to reduce. That is, a different standard is followed for bacteria as compared to yeast.

Therefore, it is the aim of the present invention to provide an aqueous sanitary cleaning composition having biocidal activity which has an increased material compatibility, enables higher perfume stability, and is less corrosive to metal surfaces such as steel and aluminium, but nevertheless has good lime-removing capacity and good cleaning properties.

Summary Of The Invention

It has surprisingly been found that the above-defined object can be achieved by providing an aqueous sanitary cleaning composition comprising benzalkonium chloride in an amount of up to about 5 wt.%, a hydroxycarboxylic acid in an amount up to about 10 wt.% and water, wherein the weight ratio of the benzalkonium chloride to the hydroxycarboxylic acid is about 1:5 up to about 1:1.

The combination of benzalkonium chloride with the presence of the hydroxycarboxylic acid gives the cleaning composition of the invention good biocidal activity along with good lime-removal properties as well as a good material compatibility with respect to plastic and metallic materials. Furthermore, the perfume stability of such a composition is better when compared with cleaning compositions of the state of the art based solely on sulfamic acid.

Optionally, an additional acid may be added to the invention. In order to further improve the material compatibility, the perfume stability and to further reduce the skin-irritant properties either sulfonic acid or sulfamic acid is included in an alternative embodiment of the present invention. Sulfonic or sulfamic acid is present in an amount of only up to about 6 wt.%, preferably in an amount of up to about 5 wt.% or below. In order to ensure sufficient lime-removing properties of the cleaning composition according to the invention, sulfamic acid is preferably present in a minimum amount of up to about 1 wt.% and more preferably in a minimum amount of up to about 2 wt.%. The sulfamic acid to be used is favourably sulfamic acid itself but is not limited to this acid. Also, for example, N-alkyl, N-aryl, or N-allyl derivatives thereof, if highly soluble in water, can be used.

Detailed Description of the Invention

For the following defined terms, these definitions shall be applied, unless a different definition is given in the claims or elsewhere in this specification.

All numeric values are herein assumed to be modified by the term "about," whether or not explicitly indicated. The term "about" generally refers to a range of numbers that one of skill in the art would consider equivalent to the recited value

(i.e., having the same function or result). In many instances, the terms "about" may include numbers that are rounded to the nearest significant figure.

Weight percent, percent by weight, % by weight, wt.%, and the like are synonyms that refer to the concentration of a substance as the weight of that substance divided by the weight of the composition and multiplied by 100.

The recitation of numerical ranges by endpoints includes all numbers subsumed within that range (e.g. 1 to 5 includes 1, 1.5, 2, 2.75, 3, 3.80, 4, and 5).

As used in this specification and the appended claims, the singular forms "a", "an", and "the" include plural referents unless the content clearly dictates otherwise. Thus, for example, reference to a composition containing "a compound" includes a mixture of two or more compounds. As used in this specification and the appended claims, the term "or" is generally employed in its sense including "and/or" unless the content clearly dictates otherwise.

The term "surfactant" or "surface active agent" refers to an organic chemical that when added to a liquid changes the properties of that liquid at a surface.

Hydrocarboxylic acids are defined as organic acids having at least one hydroxyl group and at least one carboxyl group in the molecule. A wide range of hydrocarboxylic acids can be used in the cleaning compositions according to the invention. These acids include for example lactic acid, maleic acid, citric acid, glycolic acid, tartaric acid, hydracylic acid, α-hydroxybutyric acid, glyceric acid, tartronic acid, salicylic acid, m-hydroxybenzoic acid, p-hydroxybenzoic acid, gallic acid, mandelic acid, and tropic acid or mixtures thereof.

In a preferred embodiment the selected hydrocarboxylic acid is lactic acid. Lactic acid provides the advantage that it is slightly antimicrobial. That is why lactic

acid is notified as having disinfecting properties whereas, for example, sulfamic acid is not notified accordingly. Notification procedures follow European biocide regulations. In Germany they are integrated in the chemical regulations started in the year 2002. The advantage of using lactic acid as a component in a sanitary cleaning composition therefore is that such a composition additionally has disinfecting properties and may be labelled accordingly.

The hydroxycarboxylic acid of the sanitary cleaning composition according to the invention is present in an amount of up to about 12 wt.%. An amount of up to 10 wt.% or even above about 0.5 wt.% is also sufficient with respect to the aimed properties of the cleaning composition according to the invention. In order to ensure a sufficient perfume-stability of the cleaning composition according to the invention the hydroxycarboxylic acid is preferably present in a minimum amount of about 1 wt.% and more preferably in a minimum amount of 2 wt.%. One skilled in the art will recognize that in order to achieve desirable biocidal activity, the amount of hydroxycarboxylic acid will vary according to the other components of the composition. For example, if the amount of benzalkonium chloride is raised, the amount of lactic acid may be lowered while still having effective biocidal activity and limescale removal properties.

Benzalkonium chloride (alkyl dimethyl benzyl ammonium chloride) is a mixture of alkylbenzyl dimethylammonium chlorides of various alkyl chain lengths.

In a further aspect of the invention the sanitary cleaning composition optionally comprises urea. The cleaning composition according to the invention comprises urea especially in the case that perfumes are also contained in the composition. Urea increases the solubility and stability of the perfumes in the

aqueous cleaning composition. If urea is used it is present in an amount of about 0.25 to about 10 wt.%, preferably about 0.5 to about 8 wt.%, and more preferably in an amount of about 1 to about 6 wt.%.

The composition according to the invention may comprise one or more surfactants in addition to the benzalkonium chloride that is a cationic surfactant, preferably selected from the group consisting of cationic, non-ionic, and/or amphoteric surfactants, or mixtures thereof. The preferred surfactants are non-ionic surfactants. If additional surfactants are used they are usually present in the composition in an amount of about 0.1 to about 10 wt.%, preferably about 0.5 to about 5 wt.%, and more preferably in an amount of about 1 to about 4 wt.%.

Non-ionic, cationic, and amphoteric surfactants useful in the context of aqueous cleaning compositions are well-known to the skilled artisan. All members of these known surfactants can be used in the cleaning compositions according to the present invention as long as they are compatible with the other compounds used in these compositions. Furthermore, it is within the routine work of a person skilled in the art to choose an appropriate surfactant from the groups of cationic, non-ionic, or amphoteric surfactants or a mixture of more than one such surfactants. However, in the cleaning composition according to the present invention the surfactant or the mixture of surfactants is preferably selected from the group of non-ionic and/or cationic surfactants that comprises, for example, ethoxylates of alcohols, amines, amides and acids. Preferred surfactants are non-ionic surfactants such as alcohol ethoxylates.

Other compounds that can be used as auxiliary or optional compounds in the sanitary cleaning composition are perfumes and dyes. If one or more perfumes are

used in the cleaning composition of the invention they are usually present in an amount of about 0.01 to about 2 wt.%, preferably in an amount of about 0.05 to about 0.8 wt.%, and most preferably in an amount of about 0.1 to about 0.6 wt.%. If one or more dyes are used they are usually present in an amount of about 0.0001 to about 0.1 wt.%, preferably in an amount of about 0.0005 to about 0.01 wt.%, and most preferably in an amount of about 0.001 to about 0.005 wt.%.

An auxiliary or optional compound that may also be included in the cleaning composition according to the invention is one or more alcohol. The alcohol can be used to solve the perfume and/or other auxiliary compounds in a premix solution that is then used to formulate the cleaning composition. A preferred alcohol is ethanol. If one or more alcohols are used they are usually present in an amount of about 0.05 to about 10 wt.%, preferably in an amount of about 0.1 to about 5 wt.%, and most preferably in an amount of about 0.5 to about 2 wt.%.

In further embodiments the sanitary cleaning composition of the invention may optionally comprise additional agents like disinfecting agents, preservatives, corrosion inhibitors, complex builders, enzymes and bleaching agents.

In order to provide a sanitary cleaning composition being less irritant to the human skin the pH value of the freshly formulated cleaning composition according to the invention is adjusted to be equal or above about 0.8, preferably equal or above about 0.9, and most preferably equal or above about 1.05. However, it is generally observed that after a storage time of a few weeks or month the pH value of such cleaning compositions increases due to decomposing reactions. Therefore, a cleaning composition according to the invention that had a pH value of, for example, 1.05 freshly after formulation may have a pH value of up to about 1.4 after 4 months

storage at 40 °C. Preferably, the pH of the invention formulation remains below about 2 even after extended storage of up to about 6 months.

In one embodiment of the present invention the cleaning composition comprises hydroxycarboxylic acid in an amount of up to about 12 wt.%, benzalkonium chloride in an amount of up to about 6 wt.%, one or more surfactants in an amount of about 0.5 to about 5 wt.%, urea in an amount of about 1 to about 8 wt.%, one or more alcohols in an amount of about 0.1 to about 5 wt.%, wherein the weight ratio of the hydroxycarboxylic acid to the benzalkonium chloride is between about 5:1 and about 1:1. Optional additional ingredients include but are not limited to one or more perfumes in an amount of about 0.05 to about 0.8 wt.%, one or more dyes in an amount of about 0.0005 to about 0.01 wt.% and water.

In an alternate embodiment of the present invention the cleaning composition comprises an additional acid, either sulfonic or sulfamic acid in an amount of about 1 to 10 wt.%, hydroxycarboxylic acid in an amount of about 1 up to about 12 wt.%, one or more non-ionic surfactants in an amount of about 1 to about 4 wt.%, urea in an amount of about 1 to about 3 wt.%, one or more alcohols in an amount of about 0.5 to about 2 wt.%. Optionally, the following ingredients may also be added. These include but are not limited to one or more perfumes in an amount of about 0.1 to about 0.6 wt.%, one or more dyes in an amount of about 0.001 to about 0.005 wt.% and water, wherein the weight ratio of the hydroxycarboxylic acid to the benzalkonium chloride is between about 1:5 and about 1:1.

In a further preferred aspect of the invention the sanitary cleaning composition does not comprise any thickening agents, for example does not comprise polysaccharide thickener. However, in other aspects of the invention

thickening agents may also be present in the sanitary cleaning composition according to the invention.

Furthermore, the cleaning composition according to the invention preferably does not comprise ammonium sulfate as an auxiliary compound. However, in a special aspect of the invention also ammonium sulfate may be comprised in the composition.

In a preferred embodiment of the present invention the cleaning composition comprises lactic acid in an amount of about 2 up to about 12 wt.%, benzalkonium chloride in an amount of about 2 up to about 4 wt.%, one or more non-ionic surfactants in an amount of about 1 to about 3 wt.%, urea in an amount of about 1 to about 3 wt.%, ethanol in an amount of about 0.5 to about 2 wt.%, one or more perfumes in an amount of about 0.1 to about 0.6 wt. %, one or more dyes in an amount of about 0.001 to about 0.005 wt.% and water, wherein the weight ratio of the lactic acid to the benzalkonium chloride is between about 1:5 and 1:1. In yet another embodiment, the composition does not include a thickening agent or sulfamic acid.

The invention may be provided in the form of a concentrate. The concentrate may be formulated without any water or can be provided with a relatively small amount of water in order to reduce the expense of transporting the concentrate. Then the concentrate is provided as a liquid, it may be desirable to provide it in a flowable form so that it can be pumped or aspirated. It has been found that it is generally difficult to accurately pump a small amount of a liquid. It is generally more effective to pump a larger amount of a liquid. Accordingly, although it is desirable to provide the concentrate with as little water as possible in order to reduce

transportation costs, it is also desirable to provide a concentrate that can be dispensed accurately. As a result, a concentrate according to the invention, when it includes water, it can include water in an amount of between about 0.1 wt. % and about 99 wt %, between about 30 wt % and about 90 wt. %, and between about 60 wt. % and about 89 wt. %.

The water that is provided as part of the concentrate may be relatively free of hardness such as deionized water. Alternatively, the water that is part of the concentrate may have some hardness. The concentrate may then be diluted with either deionized water, or more likely, it will be diluted with local water containing varying amounts of hardness. That is, the concentrate may be formulated with water that includes dissolved solids, and can be formulated with water that can be characterized as hard water. In a preferred embodiment, water substantially free of dissolved solids is used in both the concentrate, if one is provided, and as the water of dilution to prepare a use composition.

The sanitary cleaning composition according to the invention can be used for cleaning of, disinfecting of, and/or lime removal from various surfaces. Examples for such surfaces which can be found in sanitary or kitchen areas are brass, copper, aluminium, stainless steel, zinc, polyvinylchloride (PVC), polypropylene, acrylonitrile butadiene styrene (ABS), polyacetate, polystyrene, polyethylene (PE), polymethyl methacrylate (PMMA, plexiglas), polycarbonate, ceramic, tiles, porcelain, painted and plastic coated surfaces and enamel or any other surfaces in sanitary or kitchen areas. The sanitary cleaning composition of the invention has limited corrosivity on various surfaces. It was surprisingly found that the composition of the invention exhibited the desirable properties of (1) biocidal

activity, (2) removes lime scale, (3) has better material compatibility, and (4) is substantially biodegradable. It is remarkable that a cleaning composition meets all of these desirable criteria.

The sanitary cleaning composition according to the invention can be used as a concentrated composition. However, typically it is used as a ready-to-use solution in any desired dilution in the range of 10:1 to 1:400 of the composition in water. A preferred dilution is 1:10 in water. The ready-to-use solution can be applied by spraying or as a foam cleaner.

The sanitary cleaning composition according to the invention is useful for biocidal purposes. That is, to reduce the proliferation of microbes. For the purposes of this application, “microbes” or “microorganisms” as used herein includes but is not limited to Gram positive and Gram negative bacteria, algae, fungi, and yeasts. Any microbe or microorganism that can cause pathology in humans is desirable to eliminate or reduce the colony forming units thereof. In a preferred embodiment, a composition of the invention is effective in reducing the colony forming units of a Gram positive bacteria, such as *Staphylococcus aureus*, by a logarithm of 3, preferably 4, and most preferably 5 when contacting a sample for about 5 minutes at 20 degrees C.

The aqueous sanitary cleaning composition according to the invention can be formed by mixing together all compounds comprised in the composition, preferably beginning with water. Then the other compounds are added to the water. If desired, a ready-to-use composition can then be prepared as mentioned above. An additional pre-mix step is normally not required especially not for the perfume added to the aqueous mixture. In cleaning compositions which are only sulfamic-acid-based

according to the state of the art it is normally necessary to dissolve the perfume compound in, for example, ethanol and then to add this pre-mix to the aqueous mixture prepared before. Therefore, it is a further advantage of the sanitary cleaning composition of the present invention that this pre-mix step can be avoided.

Examples

In the following tests aqueous sanitary cleaning compositions according to the invention and according to the state of the art were prepared and compared with respect to their lime-removal capacity, their cleaning capacity, their biocidal activity, and their material compatibility and corrosiveness.

Cleaning compositions were prepared according to amounts listed in Table 1. Examples C1-C4 are comparative examples lacking the benzalkonium chloride component. Example 1 is illustrative of the invention.

Table 1

Component	Exp. C1	Exp. C2	Exp. C3	Exp. C4	Exp. 1
Water Deionized	76.3085	76.3085	81.5285	76.3085	80.5485
Fatty alcohol C10-14; 6 EO					1.2
Isotridecanol Ethoxylate (8 EO)	1.20	1.20	1.20	1.20	
Secondary Alkane Sulfonate (SAS)	1.29	1.29	1.29	1.29	
Sodium alkane sulphonate	0.60	0.60	0.60	0.60	
Alkyl Dimethyl Benzyl Ammonium Chloride 50%					4.9
Urea technical	5.00	5.00	5.00	5.00	2.00
Sulfamic Acid	10.00				
Lactic Acid 80%		10.00	4.78	5.00	10.00
Citric Acid				5.00	
Ethanol	5.00	5.00	5.00	5.00	1.00
DET Perfume	0.60	0.60	0.60	0.60	
Tropeach perfume					0.35
Basic Violet 10	0.00025	0.00025	0.00025	0.00025	0.00025
Acid Yellow 3	0.00125	0.00125	0.00125	0.00125	0.00125

LIME-REMOVAL CAPACITY

The lime-removal capacity was tested using the marble-block method according to which marble blocks of 30x30x20 mm dimension were brushed under water and dried for 24 hours in a drying chamber at 50°C. For the examination of the lime-removing capacity the marble-block is placed in 200 ml of the aqueous sanitary cleaning composition for 1 hour at room temperature. The lime-removing capacity is the amount of marble in milligrams that dissolves within 1 hour. The difference in weight of the marble block at the beginning and in the end of the dissolving procedure is equal to the lime-removing capacity.

The formulation from Example 1 shown above in Table 1 was tested for lime-removal capacity. Table 2 shows the lime-removing capacity at room temperature of the cleaning compositions according to the Example 1. Room temperature, as used herein refers to temperatures in the range of 68 to 74 degrees

Fahrenheit. The lime-removing capacity was tested with the composition concentrate (Example 1 formulation) as shown in column 1 and with 5 wt % concentrate diluted in water and 2 wt % concentrate diluted in water (columns 2 & 3). The samples were run in duplicate.

As can be seen from Table 2, the best lime-removing capacity is observed with the concentrated composition, however, the diluted Example 1 compositions also demonstrate lime-removing capacity.

Table 2

		Mass (mg)	1 concentrate	2 5%	3 2%
t = 1 Hour	Sample 1	initial	47.9265	46.2734	45.7025
		final	45.0036	46.2133	45.6841
		Weight loss	2.9229	0.0601	0.0184
	Sample 2	initial	46.9602	46.0626	48.2787
		final	44.0681	45.9994	48.2614
		Weight loss	2.8921	0.0632	0.0173
		$m_{lost,average}$	2.9075	0.0617	0.0178
		$\%_{lost,average}$	6.1287	0.1335	0.0380

COMPARATIVE LIME REMOVAL CAPABILITY

Formulations according to Examples C2, C3, and C4 provided in Table 1 above were prepared and lime removal capabilities of each were compared against Example 1. As described above, the lime-removal capacity was tested using the marble-block method according to which marble blocks of 30x30x20 mm dimension were brushed under water and dried for 24 hours in a drying chamber at 50°C. For the examination of the lime-removing capacity the marble-block is put in 200 ml of the aqueous sanitary cleaning composition to be tested for 1 hour at room temperature. The lime-removing capacity is the amount of marble in that dissolves

within the 1 hour the block was in the 200 ml aqueous cleaning solution. The difference in weight as measured in milligrams of the marble block at the beginning and in the end of the dissolving procedure is equal to the lime-removing capacity.

Results are shown in Table 3 below. The formulation of Example 1 prepared according to the present invention performed well against the comparative examples. Only Example C2 performed better in the lime removal test as compared to the invention.

Table 3

Formulation	**Exp. C2**	**Exp. C3**	**Exp. C4**	**Exp. 1**
% scale removal after 24 hours	25.73	17.93	8.78	21.49

WETTING POWER

Samples were prepared having different surfactant compositions. Table 4 shows the compositions of each Example. Microfiber cloths were soaked in 100ml of each of the Examples provided below. The cloths were wrung for 3 seconds and the saturated cloths were then applied to a previously washed and dried black PVC slab. The formulation of Example 1 from Table 1 is repeated below for convenience.

Table 4

Example	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Component									
Water (DI)	80.9	80.2	81.4	77.8	81	80	78.2	80.6	82.1
Lactic Acid 80%	10	10	10	10	10	10	10	10	10
Alkyl Dimethyl Benzyl Ammonium Chloride 50%	4.9	4	4	4	4	4.9	4.9	4.9	4.9
Ethanol	1	1	1	1	1	1	1	1	1
Urea	2	2	2	2	2	2	2	2	2
Isotridecanol Ethoxylate; 8 EO		2.8				2.1			
Fatty alcohol C10-14 6EO	1.2		1.6						
Cocodimethylaminoxide 30%				5.2			3.9		
Long chain alcohol alkoxylated					2			1.5	

Upon wiping the surface with the prepared microfiber cloths, each of the Examples had excellent wetting power meaning that the surface had a uniform moistened film.

CLEANING CAPACITY

The cleaning capacity is measured. Test soil is prepared with the formulation according to Table 5 below.

Table 5 – Soil Solution

Component	**Mass (% by weight)**
Degussa Special Black 4 (pigments)	7.0
Henkel KgaA Myritol 318 (oil)	17.0
Esso Telura 310 – (oil)	40.0
White Spirit 80/110 – (fuel)	36.0

The oil (Esso Telura 310 and the Henkel KgaA Myritol) and white spirit were combined. To this combination the pigments (Degussa Special Black) were added and mixed. The combination was mixed 8 hours. The combination was then allowed to sit for 3 days and the combination was mixed again 5 hours or until combined. The combination then sat for an additional 11 days for a total of 14 days.

The combination was then mixed for 1 hour before use. White PVC strips (White PVC-film Benova 4812080, 1.3 m / 50 m / 0.12mm as purchased from Benecke-Kaliko AG) were coated with the soil solution using a flat paintbrush with flat bristles, about 55 mm wide. The prepared strip was either (a) wiped 10 times with soil solution and allowed to dry for at least 30 minutes, or (b) wiped twice with soil solution and allowed to dry for 2-3 hours.

Two grams test soil was applied with the flat brush on the white PVC foil. Horizontal strokes were alternated with vertical strokes 7 times in each direction. The final coat was at right angles to the scouring movement. The soil was allowed to dry for one hour.

For the evaluation of the cleaning capacity the following test was undertaken for the compositions provided in Table 4 above diluted at 1 wt% in hard water to prepare use compositions. The test results are shown in Table 6 below.

A polyester sponge submerged in water was removed from the water and allowed to drain. The sponge was compressed for 10 seconds in a sponge press and placed in a Gardner apparatus with a weight of 400 g. Twelve ml use composition was poured on top of the soiled strip and the sponge. The cycle counter on the Gardner apparatus Gardner wet abrasion scrub tester apparatus model 494 (DIN-ASTM-515); supplied by Erichsen GmbH & Co. KG. was set to 10. Upon completion of the wipe cycle, the sponge was discarded. The test strip was rinsed under running deionized water. The test strips were hung for drying. Each use composition was tested on 6 strips.

The test strip's whiteness was analyzed by a Minolta Chroma Meter CR-200 chromatometer. The instrument was calibrated with the provided white tile. The

reflection was taken at 7 different spots per strip. The average of the result gives the percentage of the cleanability. Single large deviating results were rejected from the calculation.

Valuation of the results:

For the use composition and a possible comparative dilution, the average is calculated for all measurements:

$$\bar{x} = \frac{1}{N}\sum_{i=1}^{N} x_i$$

N = number of measurements (6 x 7 = 42)

x = degree of whiteness per measure spot

x_{arithm} = Average cleaning performance

Standard deviation:

$$s_X^2 = \frac{1}{N-1}\sum_{i=1}^{N}(x_i - \bar{x})^2$$

Control:

The measurements are influenced by the quality of water and the environmental conditions in the lab (temperature and humidity). Therefore, only the results achieved at once and on the same day are comparable.

Table 6: Cleaning capacity

Example # diluted at 1 wt% in hard water	Total avg. L % Stain Removal
1	66.48
2	62.97
3	64.52
4	62.99
5	65.60
6	58.62
7	61.17
8	66.01
9	57.91

As can be seen from the results in Table 6, the cleaning capacity of the aqueous sanitary cleaning composition prepared according to the invention including surfactants (Examples 1-8) performed better than Example 9 that did not contain additional surfactants.

CORROSIVENESS

The corrosiveness of Example 1 (shown in Table 1 above) was tested on samples of brass, copper, chromed brass, aluminium, and stainless steel (50x20x2 mm). The test samples were entirely submerged in the aqueous sanitary cleaning composition. The loss of mass of the test samples was evaluated after their exposure to the cleaning composition for three weeks at room temperature. The results are listed in Table 7 below.

Table 7: Corrosiveness Week 1

Sample #	**Example 1 –**	**Material**	**Initial Mass (g)**	**Mass after 1 week (g)**	**Mass Difference (g)**	**% Mass Difference**
A		Brass	43.7458	43.6948	-0.0510	0.1166
B		Copper	44.870	44.7074	-0.1646	-0.3668
C		Chromed Brass	45.6103	45.6005	-0.0098	-0.0215
D		Aluminum	19.9675	19.9515	-0.0160	-0.0801
E		Stainless Steel	38.6937	38.6942	0.0005	0.0013
F		Zinc	37.7150	36.9467	-0.7683	-2.0371

Table 8: Corrosiveness Week 2

Sample #	**Example 1**	**Material**	**Initial Mass (g)**	**Mass after 2 weeks (g)**	**Mass Difference (g)**	**% Mass Difference**
A		Brass	43.7458	43.6447	-0.1011	-.2311
B		Copper	44.870	44.5310	-0.3410	-0.7599
C		Chromed Brass	45.6103	45.5770	-0.0333	-0.0730
D		Aluminum	19.9675	19.9300	-0.0375	-0.1878
E		Stainless Steel	38.6937	38.6934	-0.0003	-0.0008
F		Zinc	37.7150	36.7716	-0.9434	-2.5014

Table 9: Corrosiveness Week 3

Sample #	Example 1 – 5 wt% in water	Material	Initial Mass (g)	Mass after 3 weeks (g)	Mass Difference (g)	% Mass Difference
A		Brass	43.7458	43.5893	-0.1565	-0.3577
B		Copper	44.870	44.1371	-0.7349	-1.6378
C		Chromed Brass	45.6103	45.5502	-0.0601	-0.1318
D		Aluminum	19.9675	19.9128	-0.0547	-0.2739
E		Stainless Steel	38.6937	38.6941	0.0004	0.0010
F		Zinc	37.7150	36.6194	-1.0956	-2.9049

As can be seen from Tables 7-9, the loss of mass is well within acceptable ranges, that being very low, when the metal sheets were exposed to the sanitary cleaning composition according to the invention (Example 1).

The results demonstrate that the sanitary cleaning composition according to the invention is minimally corrosive to metal surfaces.

MATERIAL COMPATIBILITY

Another example for good material compatibility or even, depending on the point of view, less corrosiveness can be observed when plates of copper or brass are exposed for 3 weeks to diluted cleaning compositions according to Example 1 as provided in Tables 7-9 above. There was little change in the appearance of the copper and the brass plates that were put into a composition according to Example 1.

In summary, the above evaluations show that the cleaning compositions according to the invention have good material compatibility, are minimally corrosive to metal surfaces such as steel and aluminium, but nevertheless have good lime-removing capacity and good cleaning properties.

BIOCIDAL ACTIVITY

Example 1 was used to test the biocidal activity of the invention. Example 1 was diluted on a percent by volume basis with hard water (300 mg/Kg $CaCO_3$) to prepare 0.5%, 1%, and 2% use compositions. Bacterial suspensions were prepared using the listed bacterial genus species and having the listed colony forming units as shown in Table 10 below. One ml of each bacterial suspension was added to an 8 ml sample of each of the prepared use compositions. The mixtures were maintained at 20 degrees C +/- 1 degree C for 5 minutes +/- 10 seconds by placing the sample in a bath. At the end of the contact time, one ml of each test sample was placed in 8 ml of a neutralizing agent (composition provided below) to stop the activity of the disinfectant and to remove the residual inhibitory effect of the product.

A one ml aliquot of each neutralized sample was than plated in duplicate via the pour method on Petri dishes containing Tryptone Soy Agar (see composition below).

Neutralizing Agent:

Component	**Amount**
Lecithin	3 grams
Polysorbate 80	30 grams
Disodium phosphate ($12H_20$)	9 grams
Monopotassium phosphate	1.5 grams
Distilled water	1000 ml

Tryptone Soy Agar

Tryptone, pancreatic digest of casein	15.0g
Soya peptone, papaic digest of soybean meal	5.0g
Sodium chloride	5.0g
Agar	15.0g
Water	1,000ml

Results are shown in Table 10 below. According to the European Standards, concentrations are considered bactericidal when the number of viable cells is reduced by at least 5 log (10^5).

Table 10

V_C : Viable count
N : Number of cfu/ml of the bacterial test suspension
N_a : Number of cfu/ml in the test mixture
R : Reduction in viability

Test Organisms	Bacterial Test Suspension		Test procedure at concentration % (v/v)		
			0.5%	**1%**	**2%**
Pseudomonas aeruginosa **ATCC 15442**	**N : 1.9 x 10^8**	V_c	> 300 ; > 300	29 ; 28	3 ; 2
		N_a	> 3 x 10^3	2.85 x 10^2	< 1.50 x 10^2
		R	< 6.33 x 10^3	6.67 x 10^4	**> 1.27 x 10^5**
Escherichia coli **ATCC 10536**	**N : 3.0 x 10^8**	V_c	41 ; 47	0 ; 0	0 ; 0
		N_a	4.40 x 10^2	< 1.50 x 10^2	< 1.50 x 10^2
		R	6.82 x 10^4	**> 2.00 x 10^5**	**> 2.00 x 10^5**
			1%	**2%**	**3%**
Staphylococcus aureus **ATCC 6538**	**N : 3.2 x 10^8**	V_c	> 300 ; > 300	16 ; 12	1 ; 0
		N_a	> 3 x 10^3	< 1.50 x 10^2	< 1.50 x 10^2
		R	< 1.07 x 10^4	**> 2.13 x 10^5**	**> 2.13 x 10^5**
			0.05%	**0.1%**	**0.5%**
Enterococcus hirae **ATCC 10541**	**N : 1.8 x 10^8**	V_c	> 300 ; > 300	> 300 ; > 300	0 ; 0
		N_a	> 3 x 10^3	> 3 x 10^3	< 1.50 x 10^2
		R	< 6.00 x 10^3	< 6.00 x 10^3	**> 1.20 x 10^5**

Claims

1. Aqueous sanitary cleaning composition comprising:

a) a hydroxycarboxylic acid in an amount up to 12 wt.-%,

b) a benzalkonium chloride, and

c) water,

wherein the weight ratio of the hydroxycarboxylic acid to the benzalkonuim chloride is between about 5:1 and 1:1 and the composition is effective in reducing the colony forming units of microorganisms by at least 3 logarithm when contacted with the sanitary cleaning composition for five minutes at 20 degrees C.

2. The composition according to claim 1, wherein the benzalkonium chloride is present in an amount of up to about 5 wt.%.

3. The composition according to claim 1, wherein the hydroxycarboxylic acid is present in an amount of up to about 10 wt.%.

4. The composition according to claim 1, wherein the weight ratio of the hydroxycarboxylic acid to the benzalkonium chloride is 5:1.

5. The composition according to claim 1, wherein the hydroxycarboxylic acid is selected from the group comprising lactic acid, maleic acid, citric acid, glycolic acid, tartaric acid, hydracylic acid, α-hydroxybutyric acid, glyceric acid, tartronic acid, salicylic acid, m-hydroxybenzoic acid, p-hydroxybenzoic acid, gallic acid, mandelic acid and tropic acid or mixtures thereof.

6. The composition according to claim 1, wherein the hydroxycarboxylic acid is lactic acid.

7. The composition according to claim 1, further comprising sulfamic or sulfonic acid.

8. The composition according to claim 7 wherein the sulfamic acid is a N-alkyl, N-aryl or N-allyl derivative thereof, preferably sulfamic acid.

9. The composition according to claim 1, further comprising urea.

10. The composition according to claim 9, wherein the urea is present in an amount of 0.5 to 10 wt.%, preferably in an amount of 1 to 5 wt.%.

11. The composition according to claim 1, further comprising a surfactant, preferably selected from the group of nonionic surfactants.

12. The composition according to claim 1, further comprising one or more of the compounds selected from the group comprising perfumes, dyes and alcohols.

13. The composition according to claim 1 wherein the colony forming units of microorganisms is reduced by at least 4 logarithm.

14. The composition according to claim 1 wherein the colony forming units of microorganisms is reduced by at least 5 logarithm.

15. An aqueous sanitary cleaning composition comprising lactic acid in an amount of up to 12 wt.%, benzalkonium chloride in an amount of up to 6 wt.%, one or more surfactants in an amount of 0.5 to 5 wt.%, urea in an amount of 1 to 5 wt.%, one or more alcohols in an amount of 0.1 to 5 wt.%, one or more perfumes in an amount of 0.05 to 0.8 wt.%, one or more dyes in an amount of 0.0005 to 0.01 wt.% and water, wherein the weight ratio of the benzalkonium chloride to the lactic acid is between below 1:5 and 1:1.

16. The composition according to any of the preceding claims, wherein the pH value is equal to or less than 3.

17. The composition according to claim 1 or 15, wherein substantially no thickening agents, preferably substantially no polysaccharide thickeners are present.

18. The composition according to claims 1 or 15, wherein substantially no ammonium sulfate is present.

19. A ready-to-use solution of the composition according claim 1 or 15, wherein the composition is diluted with water in a range of 10:1 to 1:400.

20. Use of the aqueous sanitary cleaning composition or the ready-to-use solution according to claim 1 or 15 for cleaning of, disinfecting of and/or lime removal from surfaces.

21. The use according to claim 20, wherein the aqueous sanitary cleaning composition or the ready-to-use solution is applied to the surfaces by spraying or as a foam cleaner.

22. The use according to claim 21, wherein the material of the surface is selected from the group comprising brass, chrome, copper, aluminum, stainless steel, zinc, polyvinylchloride (PVC), polypropylene, acrylonitrile butadiene styrene (ABS), polyacetate, polystyrene, polyethylene, polymethyl methacrylate (PMMA, plexiglas), polycarbonate, ceramic, tiles, porcelain, painted and plastic coated surfaces and enamel.