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(54) **Title**: NEUTRALIZER SOLID FOR AUTOMATED INSTRUMENT REPROCESSING

(57) **Abstract**: The present invention relates to an acidic solid composition for neutralizing alkaline residues and a method for automated neutralizing processing of alkaline residues from surfaces and/or alkaline solutions with an effective neutralizing composition. The acidic solid composition for neutralizing alkaline solutions and/or alkaline residues comprises: a) urea; b) phosphoric acid; c) sulfamic acid; d) at least one weak organic acids; wherein the weight ratio of the phosphoric acid to sulfamic acid is in the range of about 1 : 0.05 to 1 : 1.

Neutralizer solid for automated instrument reprocessing

Field of the Invention

The invention relates to an acidic solid composition for neutralizing alkaline residues and a method for automated neutralizing processing of alkaline residues from surfaces and/or alkaline solutions with an effective neutralizing composition. In particular, the invention relates to compositions for neutralizing alkaline residues useful in the neutralizing alkaline solutions and/or of alkaline residues from articles or surfaces, including plastic articles, plastic surfaces, ceramic articles, ceramic surfaces, metal articles, metal surfaces, such as surgical, medical, and dental instruments.

Background of the Invention

Many commercial and domestic articles include surface plastic, ceramic and/or metal layers. Such articles are known to those skilled in a variety of occupations or domestic activities, particularly those working in industrial plants, hospitals, maintenance and repair services, manufacturing facilities, kitchens, restaurants and the like. Surgical, medical, and dental instruments after use are typically contaminated with blood and other body matter and potentially with infectious microorganisms. Before being reused in a future procedure these instruments must be washed and disinfected with aqueous alkali cleaners, since aqueous alkali cleaners are known as effective cleaning agents.

Aqueous alkali cleaners are known as effective cleaning agents. However, alkali cleaners may have disadvantages when used on alkaline sensitive metals, such as, aluminum. For example, one problem with using aqueous alkali systems to clean surfaces is the potential to corrode and/or discolor, in particular metal surfaces. In particular, alkaline residues or alkaline spots that may remain on the so cleaned surface may have the potential to corrode and/or discolor the article.

Further, alkaline residues that remain after an automated cleaning process on surfaces of surgical, medical, diagnostic and dental instruments may cause chemical "burns" if contacted to skin.

Also, alkaline residues such as small spots or there like may present a non proper cleaned appearance to the user.

Another disadvantage of known commercial alkaline surface cleaners is that they do not satisfactory prevent the deposition of lime scale on the surface within an automated cleaning apparatus.

In an automated cleaning processing alkalinity that remains from using an alkaline cleaner is aftertreated by at least one rinsing step with water. The pH-value of the rinsing water used in the rinsing step is raised up from about pH-value 7 to a pH-value of above pH 9.

Thus, there is a need in prior art to provide a composition for neutralizing and removing alkaline residues that prevents corrosion or discolor of the surfaces exposed to the neutralizing composition, for example in an automated cleaning processing of hard and/or soft surfaces.

In particular, it is a need to provide a composition for neutralizing and removing alkaline residues from surfaces cleaned with an alkaline cleaner in an automated cleaning processing. Further, there is a need of neutralizing rinsing water that became alkaline in a rinsing step.

Moreover, there is a need to provide a composition for neutralizing and removing alkaline residues, which is not bulky, avoids the disadvantages of transport and storage of liquids, provides a rapid dissolution in water, and develops after dissolution based on a low active concentration a good neutralizing and removing effect.

Summary of the Invention

The object of the present invention is to provide an acidic composition for neutralizing and removing alkaline residues that prevents corrosion or discolor of the surfaces exposed to the neutralizing composition, for example in an automated cleaning processing of hard and/or soft surfaces.

According to the present invention an acidic solid composition for neutralizing alkaline solutions and/or alkaline residues is provided that comprising:

a) urea;
b) phosphoric acid;
c) sulfamic acid;
d) at least one weak organic acids; wherein the weight ratio of the phosphoric acid to sulfamic acid is in the range of about 1 : 0.05 to 1 : 1.

It has surprisingly found, that the acidic composition of the invention for neutralizing alkaline solutions and/or alkaline residues is remarkable sensitive to metal articles, metal surfaces, ceramic articles, ceramic surfaces plastic articles and/or plastic surfaces. Thus, the acidic composition of the present invention prevents corrosion and/or discoloring, for example of metal surfaces, that are exposed to the composition for neutralizing and removing alkaline residues.

Furthermore, the acidic composition of the invention for neutralizing alkaline solutions and/or alkaline residues can remove limescale.

The term “neutralizing” means as used in the present invention that an alkaline pH-value is reduced to a pH-value to about ≥ 3 and ≤ 7. The term ”acidic sensitive metal” identifies those metals that exhibit corrosion and/or discoloration when exposed for example to an aqueous acidic solution. An aqueous acidic solution is an aqueous solution having a pH that is less than about ≤ 6 pH, preferably ≤ 5.5 pH. Exemplary acidic sensitive metals include soft metals such as aluminum, nickel, tin, zinc/copper, brass, bronze, and mixtures thereof.

The term “the composition” comprises a solid composition and a liquid composition, if not otherwise stated.

The term “the liquid composition” comprises a concentrated liquid composition and ready-to-use liquid composition, if not otherwise stated.

References herein to a “solid” composition are to those, which are solid at least about 45° C. Preferably, the solid composition of the present invention may be form stable and/or rigid.

A solvent, preferably water, can be added “add. 100 wt.-%” to the acidic composition of the invention. The solvent content “add. 100 wt.-%”, such as the water content “add. 100 wt.-%”, of the acidic composition according to the invention is simply determined by subtracting the amounts of all the usual ingredients, except the solvent, from 100 wt. % of the total composition.

The weight-% (wt.-%) of the components, also named as ingredients, are calculated based on the total weight amount of the acidic composition, if not otherwise stated.

The ratio of components is parts by weight, if not otherwise stated.

The total amount of all components of the acidic composition does not exceed 100 wt.-%.

The term “acidic composition” stands for a solid and/or liquid acidic composition of the invention, if not otherwise stated.

It should be understood that the addition of surfactants, also named as tensides, to the acidic composition for neutralizing alkaline residues, preferably in an automated processing of hard and/or soft surfaces, is not preferred and is most preferred omitted. A suitable composition of the invention for neutralizing and removing alkaline residues shows no or practical no foam formation.

Therefore, it can be most preferred that the acidic composition of the invention is free of a surfactant.

It should be understood that the acidic composition of the invention can be free of polyethylene glycol (PEG).

It should be understood that the acidic composition of the invention can be free of an alkaline source.

It should be understood that the acidic composition of the invention can be free of a hydrotrope component.

It should be understood that the acidic composition of the invention can be free of a zeolite.

It should be understood that the acidic composition of the invention can be free of a sequestrant agent with the exception of a polyacrylic acid.

It should be understood that the acidic composition of the invention can be free of a corrosion inhibitor.

It should be understood that the acidic composition of the invention can be free of at least one additive, preferably all additives, selected from the group of antimicrobials, fungicides, fragrances, dyes, antistatic agents, UV absorbers, reducing agents and/or buffering compounds.

Using an acidic composition to neutralize alkaline solutions and/or alkaline residues on a cleaned article may cause corrosion and/or discoloration. It has been surprisingly found that the combination of phosphoric acid and sulfamic acid reduces the corrosion and discoloration potential of acidic composition of the invention. The corrosion potential can be minimized if the ratio of the phosphoric acid to sulfamic acid is adjusted within a defined range. Thus, the weight ratio of the phosphoric acid to the sulfamic acid can be in the range of about 1 : 0.05 to 1 : 1, preferably in the range of about 1 : 0.1 to 1 : 0.8, further preferred in the range of about 1 : 0.3 to 1 : 0.6, and more preferred in the range of about 1 : 0.4 to 1 : 0.5.

It has be found, that the corrosion and/or discoloring effect of the acidic composition of the invention can additional decreased using at least one weak organic acids in combination with a phosphoric acid and a sulfamic acid. Preferably, the weak organic acid can be solid. It can be further preferred that the weak organic acid has a pKs1 of about ≥ 2, preferably a pKs1 of about ≥ 2.5 and further preferred a pKs1 of about ≥ 3 to ≤ 4.

The weight ratio of the phosphoric acid to the weak organic acid, preferably the weak organic acid is a solid, and most preferred the weak organic acid can be citric acid, can be in the range of about 1 : 0.5 to 1 : 3 preferably in the range of about 1 : 0.7 to 1 : 2.5, further preferred in the range of about 1 : 1.0 to 1 : 2.2, and more preferred in the range of about 1 : 1.3 to 1 : 2.

The weight ratio of the sulfamic acid to the weak organic acid, preferably the weak organic acid is a solid, and most preferred the weak organic acid can be citric acid, can be in the range of about 1 : 1 to 1 : 6, preferably in the range of about 1 : 1.5 to 1 : 5, further preferred in the range of about 1 : 2 to 1 : 4, and more preferred in the range of about 1 : 2.5 to 1 : 3.

In order to adjust the viscosity of a liquid acidic composition of the present invention, the acidic solid composition of the invention may comprises at least one polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids. Increasing the viscosity of an acidic liquid composition may prolong the contact period of a liquid composition of the invention on the surface article and improves the neutralization effect and alkaline residue removal properties. In addition, the polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8-carboxylic acids may function as a sequestering agent.

Biocides or also known as preservative components can be added to the acidic composition of the present invention. Preservative components protect the acidic composition of the invention and the treated article against biological infestation and growth.

According to a preferred embodiment of the present invention the acidic composition may comprises in addition at least one polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids; and/or at least one preservative component.

A further preferred embodiment of an acidic solid composition of the invention comprises:

a) about ≥ 5 wt.-% to about ≤ 25 wt.-%, preferably about ≥ 10 wt.-% to about ≤ 20 wt.-%, more preferred about ≥ 12 wt.-% to about ≤ 18 wt.-%, and most preferred about ≥ 15 wt.-% to about ≤ 16 wt.-% urea;

b) about ≥ 10 wt.-% to about ≤ 40 wt.-%, preferably about ≥ 15 wt.-% to about ≤ 35 wt.-%, more preferred about ≥ 20 wt.-% to about ≤ 30 wt.-%, and most preferred about ≥ 25 wt.-% to about ≤ 28 wt.-% phosphoric acid;

c) about ≥ 5 wt.-% to about ≤ 20 wt.-%, preferably about ≥ 7 wt.-% to about ≤ 18 wt.-%, more preferred about ≥ 9 wt.-% to about ≤ 15 wt.-%, and most preferred about ≥ 11 wt.-% to about ≤ 13 wt.-% sulfamic acid;

d) about ≥ 20 wt.-% to about ≤ 50 wt.-%, preferably about ≥ 25 wt.-% to about ≤ 45 wt.-%, more preferred about ≥ 30 wt.-% to about ≤ 40 wt.-%, and most preferred about ≥ 34 wt.-% to about ≤ 36 wt.-% of at least one weak organic acid, preferably the weak organic acid is solid;

e) about ≥ 0 wt.-% to about ≤ 5 wt.-%, preferably about ≥ 0.5 wt.-% to about ≤ 4 wt.-%, more preferred about ≥ 1 wt.-% to about ≤ 3.5 wt.-%, and most preferred about ≥ 2 wt.-% to about ≤ 3 wt.-% of at least one polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids;

f) about ≥ 0 wt.-% to about ≤ 2 wt.-%, preferably about ≥ 0.2 wt.-% to about ≤ 1.5 wt.-%, more preferred about ≥ 0.4 wt.-% to about ≤ 1 wt.-%, and most preferred about ≥ 0.5 wt.-% to about ≤ 0.6 wt.-% of at least one preservative component; wherein

the weight % of the components are based on the total weight of the solid composition and the total weight of all components does not exceed 100 wt.-%.

The solid composition of the present invention may comprise in addition a solvent. The amount of solvent, preferably water and/or alcohol is selected such that the composition remains as a solid.

An acidic solid composition of the invention can be obtained by mixing the components of the acidic composition at elevated temperatures; casting the mixed components into a form for forming a shaped article, and solidifying the cast components obtaining the acidic solid composition.

Liquid acidic composition

Another aspect of the present invention is directed to an acidic liquid composition for neutralizing alkaline solutions and/or alkaline residues, preferably of a rinsing water solution used in an automated cleaning processing of articles with an alkaline cleaning composition, comprising the components of the solid composition of the invention dissolved in a solvent. The acidic liquid composition of the invention can be a concentrated acidic solution or a ready-to-use acidic solution. A ready-to use acidic liquid composition can be obtained by dissolving the acidic solid composition of the invention with a solvent, preferably water.

Preferably, a ready-to-use acidic liquid composition can be obtained, wherein a concentrated acidic liquid composition is further diluted by admixing a solvent, preferably water, thereto. This highly diluted liquid acidic composition obtained from the concentrated liquid composition of the invention is referred to as “ready-to-use” acidic liquid composition.

The concentrated acidic liquid composition and the ready-to-use acidic composition show no foam or practical no foam formation in use. Especially in the dispensing draw of an apparatus for cleaning processing as well as in the cleaning chamber no foam or practical no foam formation is observed. Due to none or marginal foam formation the automated pumping flow rate of solvent dissolved compositions, in particular water-dissolved composition, according to the present invention is not affected.

Another advantage of the liquid acidic composition of the present invention is that they possess a high alkaline neutralization activity but cause no or no significant corrosion of the so treated surface of an article, such as metal surfaces. The combination of the selected three acids provides a metal sensitive liquid acidic composition that can be used in an automated cleaning process for neutralizing alkaline residues on the surface of cleaned articles. The mildness of the liquid acidic composition of the present invention is surprising because acids in general are known to be aggressive especially to metal surface and cause serious corrosion and/or discoloring.

Another advantage of the liquid acidic composition of the present invention is that lime scale can be removed or minimized on surfaces contacted to water containing cleaning compositions, for example in an automated cleaning processing of metal articles, such as metal instruments. In particular, lime scale that can be precipitate using alkaline cleaning compositions, can be removed by the use of a liquid acidic composition of the present invention. Thus, the use of the acidic composition of the present invention protects cleaning devices such as automated washing machines for medical instrument against lime scale deposition.

An acidic liquid composition can be obtained, wherein a solid composition of the invention can be dissolved in a solvent in a weight ratio of solid composition to solvent of about 1 : 10 to about 1 : 50000, preferably in a weight ratio of about 1 : 100 to about 1 : 10000, further preferred in a weight ratio of about 1 : 250 to about 1 : 7000, more preferred in a weight ratio of about 1 : 500 to about 1 : 3500, and more preferred in a weight ratio of about 1 : 1000 to about 1 : 2500.

The pH of the acidic liquid composition of the present invention can be in the range of about ≥ 0 pH to ≤ 5 pH, preferably in the range of about ≥ 1 pH to ≤ 4.5 pH, more preferred in the range of about ≥ 2 pH to ≤ 4 pH and also preferred in the range of about ≥ 2.5 pH to ≤ 3.5 pH.

The pH of a concentrated acidic liquid composition of the present invention can be in the range of about ≥ 0 pH to ≤ 5 pH, preferably in the range of about ≥ 0.5 pH to ≤ 3 pH, more preferred in the range of about ≥ 1.0 pH to ≤ 2 pH and also preferred in the range of about ≥ 1.2 pH to ≤ 1.5 pH.

The pH of a ready-to-use acidic liquid composition of the present invention can be in the range of about ≥ 2 pH to ≤ 4 pH, preferably in the range of about ≥ 2.5 pH to ≤ 3.8 pH, more preferred in the range of about ≥ 2.7 pH to ≤ 3.5 pH and also preferred in the range of about ≥ 2.9 pH to ≤ 3.3 pH.

Solvent that can be suitable used can be selected from the group comprising water, alcohols, glycols, glycol ethers and/or esters. However, most preferred is the use of water as a solvent.

A preferred embodiment of a concentrated liquid acidic composition of the invention comprises urea; phosphoric acid; sulfamic acid; a weak organic solid acid, preferably citric acid; and a solvent.

A more preferred embodiment of a concentrated liquid acidic composition of the invention comprises at least urea; phosphoric acid; sulfamic acid; a weak organic solid acid, preferably citric acid; a preservative component, preferably phenylphenol, and more preferred o-phenylphenol; and a solvent.

A further preferred embodiment of a concentrated liquid acidic composition of the invention comprises at least urea; phosphoric acid; sulfamic acid; a weak organic solid acid, preferably citric acid; a polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids, preferably polyacrylic acid; and a solvent.

Another preferred embodiment of a concentrated liquid acidic composition of the invention comprises at least urea; phosphoric acid; sulfamic acid; a weak organic solid acid, preferably citric acid; a preservative component, preferably phenylphenol, and more preferred o-phenylphenol; a polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids, preferably polyacrylic acid; and a solvent.

It can be preferred that a concentrated liquid composition of the invention comprises:

a) about ≥ 0.5 wt.-% to about ≤ 2.5 wt.-%, preferably about ≥ 0.75 wt.-% to about ≤ 2.25 wt.-%, more preferred about ≥ 1 wt.-% to about ≤ 2 wt.-%, and most preferred about ≥ 1.5 wt.-% to about ≤ 1.7 wt.-% urea;

b) about ≥ 1 wt.-% to about ≤ 4 wt.-%, preferably about ≥ 1.5 wt.-% to about ≤ 3.5 wt.-%, more preferred about ≥ 2 wt.-% to about ≤ 3 wt.-%, and most preferred about ≥ 2.5 wt.-% to about ≤ 2.8 wt.-% phosphoric acid;

c) about ≥ 0.1 wt.-% to about ≤ 2.5 wt.-%, preferably about ≥ 0.5 wt.-% to about ≤ 2 wt.-%, more preferred about ≥ 0.75 wt.-% to about ≤ 1.5 wt.-%, and most preferred about ≥ 1.0 wt.-% to about ≤ 1.25 wt.-% sulfamic acid;

d) about ≥ 1 wt.-% to about ≤ 5 wt.-%, preferably about ≥ 1.5 wt.-% to about ≤ 4.5 wt.-%, more preferred about ≥ 2 wt.-% to about ≤ 4 wt.-%, and most preferred about ≥ 2.5 wt.-% to about ≤ 3.5 wt.-% of at least one weak organic acid, preferably the weak organic acid is solid, and more preferred the weak organic acid is citric acid;

e) about ≥ 0 wt.-% to about ≤ 0.5 wt.-%, preferably about ≥ 0.05 wt.-% to about ≤ 0.4 wt.-%, more preferred about ≥ 0.1 wt.-% to about ≤ 0.3 wt.-%, and most preferred about ≥ 0.2 wt.-% to about ≤ 0.25 wt.-% of at least one polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids, and more preferred the polymer is polyacrylic acid;

f) about ≥ 0 wt.-% to about ≤ 0.2 wt.-%, preferably about ≥ 0.01 wt.-% to about ≤ 0.1 wt.-%, more preferred about ≥ 0.03 wt.-% to about ≤ 0.08 wt.-%, and most preferred about ≥ 0.05 wt.-% to about ≤ 0.06 wt.-% of at least one preservative component, preferably the preservative component is phenylphenol, and more preferred the preservative component is o-phenylphenol;

g) about ≥ 80 wt.-% to about ≤ 95 wt.-%, preferably about ≥ 85 wt.-% to about ≤ 94 wt.-%, more preferred about ≥ 87 wt.-% to about ≤ 93 wt.-%, and most preferred about ≥ 90 wt.-% to about ≤ 92 wt.-% of at least one solvent; wherein the weight % of the components are based on the total weight of the concentrated liquid composition and the total weight of all components does not exceed 100 wt.-%.

A preferred embodiment of a ready-to-use liquid acidic composition of the invention comprises urea; phosphoric acid; sulfamic acid; a weak organic solid acid, preferably citric acid; and a solvent.

A more preferred embodiment of a ready-to-use liquid acidic composition of the invention comprises at least urea; phosphoric acid; sulfamic acid; a weak organic solid acid, preferably citric acid; a preservative component, preferably phenylphenol, and more preferred o-phenylphenol; and a solvent.

A further preferred embodiment of a ready-to-use liquid acidic composition of the invention comprises at least urea; phosphoric acid; sulfamic acid; a weak organic solid acid, preferably citric acid; a polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids, preferably polyacrylic acid; and a solvent.

Another preferred embodiment of a ready-to-use liquid acidic composition of the invention comprises at least urea; phosphoric acid; sulfamic acid; a weak organic solid acid, preferably citric acid; a preservative component, preferably phenylphenol, and more preferred o-phenylphenol; a polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids, preferably polyacrylic acid; and a solvent.

A suitable ready-to-use acidic liquid composition may comprise:

a) about ≥ 0.0005 wt.-% to about ≤ 0.0075 wt.-%, preferably about ≥ 0.0008 wt.-% to about ≤ 0.007 wt.-%, more preferred about ≥ 0.0012 wt.-% to about ≤ 0.006 wt.-%, and most preferred about ≥ 0.0015 wt.-% to about ≤ 0.005 wt.-% urea;

b) about ≥ 0.0001 wt.-% to about ≤ 0. 1 wt.-%, preferably about ≥ 0.0005 wt.-% to about ≤ 0.05 wt.-%, more preferred about ≥ 0.001 wt.-% to about ≤ 0.01 wt.-%, and most preferred about ≥ 0.0025 wt.-% to about ≤ 0.009 wt.-% phosphoric acid;

c) about ≥ 0.0001 wt.-% to about ≤ 0.01 wt.-%, preferably about ≥ 0.0004 wt.-% to about ≤ 0.008 wt.-%, more preferred about ≥ 0.0007 wt.-% to about ≤ 0.006 wt.-%, and most preferred about ≥ 0.001 wt.-% to about ≤ 0.004 wt.-% sulfamic acid;

d) about ≥ 0.0005 wt.-% to about ≤ 0.02 wt.-%, preferably about ≥ 0.001 wt.-% to about ≤ 0.017 wt.-%, more preferred about ≥ 0.0025 wt.-% to about ≤ 0.015 wt.-%, and most preferred about ≥ 0.0035 wt.-% to about ≤ 0.012 wt.-% of at least one weak organic acid, preferably the weak organic acid is solid, and more preferred the weak organic acid is citric acid;

e) about ≥ 0 wt.-% to about ≤ 0.05 wt.-%, preferably about ≥ 0.00005 wt.-% to about ≤ 0.03 wt.-%, more preferred about ≥ 0.0001 wt.-% to about ≤ 0.01 wt.-%, and most preferred about ≥ 0.00025 wt.-% to about ≤ 0.0075 wt.-% of at least one polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids, and more preferred the polymer is polyacrylic acid;

f) about ≥ 0 wt.-% to about ≤ 0.001 wt.-%, preferably about 0.0001 wt.-% to about ≤ 0.0005 wt.-%, more preferred about ≥ 0.0003 wt.-% to about ≤ 0.0003 wt.-%, and most preferred about ≥ 0.0005 wt.-% to about ≤ 0.00015 wt.-% of at least one preservative component, preferably the preservative component is phenylphenol, and more preferred the preservative component is o-phenylphenol;

g) about ≥ 99 wt.-% to about < 100 wt.-%, preferably about ≥ 99.9 wt.-%, more preferred about ≥ 99.99 wt.-%, and most preferred add. 100 wt.-% of at least one solvent, preferably water; wherein the weight % of the components are based on the total weight of the ready-to-use liquid composition and the total weight of all components does not exceed 100 wt.-%.

The composition of the invention, comprising the acidic solid composition, the acidic concentrated composition and the acidic ready-to-use composition can contain at least one or more of the following components.

Phosphoric acid

The composition used in the process of the invention comprises at least one phosphoric acid. Suitable phosphoric acids include a monomer of phosphoric acid, a polymer of phosphoric acid; an ortho phosphoric acid, a meta phosphoric acid, a tripolyphosphoric acid, or a combination thereof; tripolyphosphoric acid and other higher linear and cyclic polyphosphoric acid species, pyrophosphoric acid, and glassy polymeric meta-phosphoric acid; and the like; or a combination thereof. Most preferred is phosphoric acid.

Weak organic acid

The weak organic acid can be selected from the group comprising citric acid, lactic acid, acetic acid, hydroxyacetic acid, glycolic acid, adipic acid, tartaric acid, succinic acid, propionic acid, maleic acid, alkane sulfonic acids, cycloalkane sulfonic acids, and most preferred is citric acid.

Polymer

Polymers of monomers of monoethylenically unsaturated C_3-C_8-carboxylic acid, can be selected from the group comprising acrylic acid, methacrylic acid, polyitaconic acid, polymaleic acid, and mixtures thereof , most preferred is a polyacrylic acid. Suitable polyacrylic acid polymers are Sokalan, for example Sokalan CP 5 and/or Sokalan CP 10, obtainable from BASF.

The polymers tend to be water-soluble or at least colloidally dispersible in water. The molecular weight of these polymers may vary over a broad range although it is preferred to use polymers having an average molecular weights (Mw) ranging from ≥ 1,000 up to ≤ 1,000, 000, preferably ≥ 2.000 up to ≤ 800, 000, further preferred ≥ 2.500 up to ≤ 500, 000, also preferred ≥ 3,000 up to ≤ 250, 000, more preferred ≥ 3,500 up to ≤ 100, 000, especially preferred ≥ 4,000 up to ≤ 50, 000 and in particular preferred ≥ 4,500 up to ≤ 10, 000.

The polymers or copolymers, either the acid-substituted polymers or other added polymers may be prepared by either addition or hydrolytic techniques. Thus, maleic anhydride copolymers are prepared by the addition polymerization of maleic anhydride and another comonomer such as styrene.

Preferably salts of acid substituted polymers of monomers of acrylate, methacrylate, salts of polyitaconic acid, salts of polymaleic acid, and mixtures thereof. In particular preferred are salts of polyacrylic acid.

The low molecular weight acrylic acid polymer may be prepared by addition polymerization of acrylic acid or its salts either with itself or other vinyl comonomers.

Alternatively, such polymers may be prepared by the alkaline hydrolysis of low molecular weight acrylonitrile homopolymers or copolymers.

More preferred can be the use of at least one polymer of monomers of monoethylenically unsaturated C_3-C_8-carboxylic acid in form of a homo polyacrylic acid and/or a homo polyacrylate. Most preferred is the use of a homo polyacrylic acid and/or a homo polyacrylate having a Mw ranging from $\geq$ 1,000 up to $\leq$ 1,000, 000, preferably $\geq$ 2.000 up to $\leq$ 800, 000, further preferred $\geq$ 2.500 up to $\leq$ 500, 000, also preferred $\geq$ 3,000 up to $\leq$ 250, 000, more preferred $\geq$ 3,500 up to $\leq$ 100, 000, especially preferred $\geq$ 4,000 up to $\leq$ 50, 000 and in particular preferred $\geq$ 4,500 up to $\leq$ 10, 000.

It should be understood that other polymers and/or a polymer of monomers of monoethylenically unsaturated C_3-C_8-carboxylic acids or salts thereof, can be omitted.

Preservative component

The acidic solid composition of the invention may comprise a preservative component. The preservative component can be selected from the group comprising phenyl substituted compounds, preferably phenylphenol, o-phenylphenol, C_8-C_{18}-alkyldimethylbenzyl-ammonium chloride, and/or phenoxy ethanol, sodium benzoate, 5-chloro-2 methyl-1,2 thiatol-3-one. However, most preferred can be o-phenylphenol. It should be understood that a preservative component can be omitted.

Sequestering Agent

It should be understood that a sequestering agent can be omitted. Thus, it is preferred that the acidic solid composition is free of a sequestering agent, with the exception of polyacrylic acid.

The solid acidic composition according to the present invention can comprise at least one sequestering agent. The amount of sequestering agent can be about $\geq$ 5 wt.-% to about $\leq$ 40 wt.-%, preferably about $\geq$ 10 wt.-% to about $\leq$ 35 wt.-%, further preferred about $\geq$ 20 wt.-% to about $\leq$ 30 wt.-%, and more preferred about $\geq$ 25 wt.-% to about $\leq$ 28 wt.-%, wherein the weight-% of the components are based on the total weight of the solid acidic composition.

The sequestering agent can be selected from the group of gluconic acid, diethylenetriamine pentaacetic acid, glucoheptonic acid, ethylene diamine tetraacetic acid, hydroxyethyl ethylene diamine triacetic acid, nitrilotriacetic acid, diethanolglycine, hydroxymonocarboxylic acid compounds, hydroxydicarboxylic acid, amine containing carboxylic acids, N,N-bis(carboxylatomethyl)-L-glutamic acid (GDLA) and mixtures thereof.

The sequestering agent can be provided as part of the composition. Exemplary sequestering agents that can be preferably used according to the invention include gluconic acid, diethylenetriamine pentaacetic acid (available under the name Versenex 80), glucoheptonic acid, ethylene diamine tetraacetic acid (EDTA), hydroxyethyl ethylene diamine triacetic acid (HEDTA), hydroxyethyl ethylene diamine triacetic acid, nitrilotriacetic acid (NTA), nitrilotriacetic acid, diethanolglycine (DEG), ethanoldiglycine (EDG), N,N-bis(carboxylatomethyl)-L-glutamic acid (GLDA), methyl glycine diacetic acid (MGDA) and mixtures thereof.

A variety of phosphonic acid or phosphonic acid based sequestering agents can be used including, for example, organic phosphonic acids, condensed phosphonic acids, mixture thereof, or the like. Such sequestrants are commercially available. Suitable condensed phosphonic acids include orthophosphonic acid, pyrophosphonic acid, tripolyphosphonic acid, hexametaphosphonic acid, preferably of tripolyphosphonic acid. Condensed phosphonic acids are preferred.

The sequestrant may include an organic phosphonic acid, such as an organic-phosphonic acid. Some examples of suitable organic phosphonic acids include:
1-hydroxyethane-1,1-diphosphonic acid:
$CH_3C(OH)[PO(OH)_2]_2$;
aminotri(methylenephosphonic acid);
$N[CH_2PO(OH)_2]_3$;
aminotri(methylenephosphonic acid);
2-hydroxyethyliminobis(methylenephosphonic acid);
$HOCH_2CH_2N[CH_2PO(OH)_2]_2$;
diethylenetriaminepenta(methylenephosphonic acid);
$(HO)_2POCH_2N[CH_2CH_2N[CH_2PO(OH)_2]_2]_2$;
diethylenetriaminepenta(methylene-phosphonic acid);
hexamethylenediamine(tetramethylenephosphonic acid);
bis(hexamethylene)triamine(pentamethylenephosphonic acid);
$(HO_2)POCH_2N[CH_2)_6N[CH_2PO(OH)_2]_2]_2$;
phosphorus acid H_3PO_3;
2-hydroxyethyliminobis(methylenephosphonic acid);
$HOCH_2CH_2N[CH_2PO(OH)_2]_2$;
diethylenetriaminepenta(methylenephosphonic acid);
$(HO)_2POCH_2N[CH_2CH_2N[CH_2PO(OH)_2]_2]_2$;
diethylenetriaminepenta(methylenephosphonic acid);
hexamethylenediamine(tetramethylenephosphonic acid);
bis(hexamethylene)triamine(pentamethylenephosphonic acid);
$(HO_2)POCH_2N[CH_2)_6N[CH_2PO(OH)_2]_2]_2$;
phosphorus acid H_3PO_3; and other similar organic phosphonic acids, and mixtures thereof.

It should be understood that the sequestering agent can include mixtures of different sequestering agents.

Solvents

Suitable solvents include, but are not limited to, water, alcohols, glycols, glycol ethers, esters, and the like, or combinations thereof. Suitable alcohols include, but are not limited to, ethanol, isopropanol (propan-2-ol), 2-butoxy ethanol (butyl glycol), 1-decanol, benzyl alcohol, glycerin, monoethanolamine (MEA), and the like, or combinations thereof.

Suitable glycols include, but are not limited to, ethylene glycol (monoethylene glycol or MEG), diethylene glycol (propylene glycol or butoxy diglycol or DEG), triethylene glycol (TEG), tetraethylene glycol (TETRA EG), glycerin, propylene glycol, dipropylene glycol, hexylene glycol, and the like, or combinations thereof.

Preferably, the composition comprises at least two solvents and more preferred the composition comprises water and hexylene glycol.

Tensides

It is preferred that the composition of the present invention is free of a tenside.

It is preferred that the composition of the present invention is free of nonionic tensides. It is preferred that the composition of the present invention is free of a nonyl phenol ethoxylate, in particular free of a nonyl phenol 6.5 mole ethoxylate and free of a nonyl phenol 9.5 mole ethoxylate.

It is preferred that the composition of the present invention is free of cationic tensides.

It is preferred that the composition of the present invention is free of anionic tensides.

It is preferred that the composition of the present invention is free of amphoteric tensides.

Method of neutralizing alkaline residues

Another aspect of the present invention is directed to a method of neutralizing and removing alkaline residues and/or alkaline soil. For neutralizing alkaline residues on an article an acidic composition of the invention can be contacted with at least one surface of the article.

The method for neutralizing alkaline residues on an article according to the present invention comprise the steps:

a) cleaning at least one surface of an article with an alkaline cleaning composition,
b) rinsing the cleaned article with a solvent, preferably water, to remove residues of the alkaline cleaning composition,
c) adding to the rinsing solvent of step b) an acidic composition of the invention for neutralizing the rinsing solvent of step b) and/or rinsing the so cleaned article with a liquid acidic composition of the invention for neutralizing alkaline residues that are remained on the surface of the article.

The article that can be treated by the method of the present invention can be selected from the group comprising metal, ceramic and/or plastic articles, articles having a metal surface, ceramic surface and/or plastic surface, preferably metal instruments, ceramic instruments, plastic instruments, instruments with a metal surface, ceramic surface and/or instruments with a metal surface.

Cleaning device

Another object of the invention is directed to a cleaning device. The cleaning device is used to neutralize alkaline residues and/or to remove alkaline soil from metal, ceramic and/or plastic articles, preferably articles having a metal, ceramic and/or plastic surface, such as surgical, medical, and/or dental instruments.

The cleaning device, also referred to as “Apparatus”, can receive an acidic solid composition of the invention, and comprise means for dissolving at least partly the acidic solid composition to an acidic liquid composition according to the invention.

In more detail, the cleaning device may include at least a container to receive the acidic solid composition of the invention; a first tank for receiving an acidic liquid composition, preferably the first tank comprises the acidic liquid concentrated composition; optional at least a second tank for receiving the ready-to-use solution of said liquid acidic composition of the first tank, at least one or more water feeds, and at least one or more solution lines.

The container is for receiving the acidic solid composition. An acidic concentrated liquid composition or an acidic ready-to-use liquid composition can be obtained by dissolving the acidic solid composition with a solvent, preferably water. The water can be sprayed by a nozzle or by water supplying means into the container to partly or completely dissolve the acidic solid composition. The solvent, preferably water can be recirculated, to dissolve the acidic solid composition. Depending on the amount of solvent an acidic concentrated or ready-to-use solution can be obtained. It is preferred that the first tank comprises an acidic concentrated solution obtained by dissolving the acidic solid composition.

The first component tank can be provided for containing the acidic liquid concentrated composition of the invention. The first component tank can be provided for mixing water to the acidic liquid composition to provide the ready-to-use solution. The acidic liquid composition can be mixed with a solution, preferably water. Alternatively, the first tank can be used as a so called “day” tank and all or a part of the formed acidic concentrated solution can be filled up to the second tank and diluted there to the acidic ready-to-use liquid composition of the invention.

The optional second component tank can be provided for receiving the acidic ready-to-use liquid composition of the invention or an acidic concentrated liquid composition for mixing with a solvent, preferably water, to provide the alkaline ready-to-use solution.

Preferably, the method of manufacture an acidic ready-to-use solution of the solid composition according of the invention may comprise the steps of:

(i) Positioning in a product dissolving chamber that is connected to a solvent source an acidic solid composition for neutralizing alkaline residues,

(ii) Obtaining an acidic concentrated solution by dissolving said acidic solid composition with sufficient solvent,

(iii) Flushing-out said acidic concentrated solution, preferably step-wise,

(iv) Dissolving said acidic concentrated solution by adding additional solvent to obtain an acidic ready-to-use solution for neutralizing alkaline residues,

(v) Transmitting the acidic ready-to-use solution for neutralizing alkaline residues to the place of operation.

The acidic ready-to-use liquid composition or the acidic concentrated liquid composition of the invention can be in any form including liquid, gel and slurry.

The acidic liquid composition, i.e. acidic ready-to-use liquid composition and/or the acidic concentrated liquid composition of the invention, are suitable to treat any metal surface contaminated with a wide variety of alkaline contaminants. The acidic liquid composition, i.e. the acidic ready-to-use liquid composition and/or the acidic concentrated liquid composition of the invention, are suitable to use for neutralizing alkaline residues, preferably in an automated instrument processing , on metal, ceramic and/or plastic articles, articles having a metal surface, ceramic surface and/or plastic surface, preferably metal instruments, ceramic instruments, plastic instruments, instruments with a metal surface, ceramic surface and/or instruments with a metal surface. In particular, the acidic liquid composition of the invention, , i.e. the acidic ready-to-use liquid composition and/or the acidic concentrated liquid composition of the invention, can be used for neutralizing alkaline residues, preferably in an automated instrument processing , on metal, ceramic and/or plastic articles, articles having a metal surface, ceramic surface and/or plastic surface, preferably metal instruments, ceramic instruments, plastic instruments, instruments with a metal surface, ceramic surface and/or instruments with a metal surface.

The acidic liquid composition of this invention, i.e. acidic ready-to-use liquid composition and/or the acidic concentrated liquid composition of the invention may be used at any temperature, including room temperature, an elevated temperature of from about 5° C to 70° C, preferably 15° C to 60° C and more preferred 20° C to 40° C. After contact with the acidic liquid composition of this invention, i.e. acidic ready-to-use liquid composition and/or the acidic concentrated liquid composition of the invention, the liquid composition can be removed from the article surface, such as metal surface, with a solvent, such as water.

The contact time of the acidic liquid composition of this invention, i.e. acidic ready-to-use liquid composition and/or the acidic concentrated liquid composition of the invention, in an automated process with the article surface, such as metal surfaces, will vary depending upon the degree of contamination but broadly will range between a few seconds or ≥ 1 minute to ≤ 15 minutes, with ≥ 3 minutes to ≤ 10 minutes being more typical and most preferred is ≥ 2 minutes to ≤ 5 minutes.

The following examples are presented to help to illustrate the invention and should not be construed as limiting the invention.

Example

The following examples were carried out to illustrate the non-corrosive characteristic as well as the non-foaming activity of the neutralizing compositions according to the invention.

The following acidic composition were provided in a solid form:

All components of table 1 and 2 are mixed together and heated to temperature of about 60° C to about 75° C for about 10 minutes to about 30 minutes. Thereafter, the mixed slurry is casted and allows cooling to room temperature, whereby a casted acidic solid composition is formed.

Table 1

Solid acidic composition of the invention

Components	E1	E2	E3	E4	E5	E6	E7
	Wt.-%	Wt.-%	Wt.-%	Wt.-%	Wt.-%	Wt.-%	Wt.-%
Phosphoric acid (H_3PO_4)	10	15	25	27	30	35	40
Urea	5	9	12	15	18	22	25
o-Phenylphenol	0.5	0.5	-	0.5	-	0.5	0.5
Sulfamic acid	5	7	9	12	15	18	20
Citric Acid	20	25	30	35	40	45	50
Polyacrylic Acid	-	2.5	-	2.5	-	2.5	-
Water	Add. 100	Add. 100	Add. 100	Add. 100	Add. 100	Add. 100	Add. 100

Comparative Compositions V1 to V4

Table 2

The solid acidic comparative composition

Comparative Components	Wt.-%	Wt.-%	Wt.-%	Wt.-%
Concentrate V1				
Citric acid monohydrate	38.3			
Ready-to-use 0,1% V2 Citric acid monohydrate		0.0383		
Ready-to-use 0,3% V3 Citric acid monohydrate			0.1149	
Ready-to-use 0,5% V4 Citric acid monohydrate				0.1915
Water	Add. 100	Add. 100	Add. 100	Add. 100

Foam Formation Test

This test method provides a basis to assess the foam formation properties of the liquid acidic composition of the invention for neutralizing and removing alkaline residues.

Foam testing equipment

250 ml long-necked glass cylinder

Rubber stopper to close the long-necked glass cylinder

Test method

An aqueous acidic ready-to-use composition of the invention is formed, wherein 1.0 g of examples E1 to E7 are dissolved in 1000 ml of deionized water each. 100 ml of said aqueous acidic ready-to-use solution obtained from examples E1 to E7 are added to a graduated 250 ml long-necked glass cylinder. The long-necked glass cylinder was then turned up and down 20 x times in 20 seconds. Thereafter the glass cylinder was placed and the foam depth of each cylinder was scaled in ml to determine the foam formation. This test was carried out at a temperature of the cleaning solution at ambient temperature, 20° C and 55° C.

The foam hight of about ≥ 0 ml and about < 0.1 ml are considered to be excellent (++) and in line with the invention. The foam hight of about ≥ 0.1 ml to about ≤ 5 ml are considered to be good (+) and in line with the invention. The foam hight of about ≥ 5 ml are considered to be insufficient (–) thus not in line with the invention, i.e. non-inventive.

The table 3 shows the result of the foam formation caused by the acidic alkaline ready-to-use solution obtained from examples E1 to E7.

Table 3

Foam Formation Test-Results

Exampels	
E1	++
E2	++
E3	++
E4	++
E5	++
E6	++
E7	++

Material Compatibility Test

This test method provides a basis to assess the enhanced metal-surface-safeness of the liquid acidic composition of the invention for neutralizing and removing alkaline residues with respect to corrosion.

Corrosion testing equipment

350 ml wide-necked screw cap flasks for each test condition
V2A steel test plates of 100 mm x 50 mm x 1 mm
V4A steel test plates of 100 mm x 50 mm x 1 mm
Copper metal test plates of 100 mm x 50 mm x 1 mm

Brass metal test plates of 100 mm x 50 mm x 1 mm
Polycarbonate (PC) test plates of 100 mm x 50 mm x 4 mm
Plexiglas test plates of 100 mm x 50 mm x 4 mm
The metal test plates are cleaned with acetone before use
Clean paper toweling
Stop watch
Drying oven
Analytical balance capable of weighing to the 0.0001 place.

Test method

The solid acidic composition E4 were diluted with deionized water to a 10 wt.-% concentrated acidic composition E4-C and the so obtained concentrated acidic composition is further diluted with deionized water to a 0.5 wt.-% ready-to-use solution E4-R05. The plates were recorded and then placed in the center area of the bottom of a 350 ml wide-necked screw cap flask each. The test plates were completely submerged. Subsequently, each wide-necked screw cap flask was filed to the top with the 0.5 wt.-% ready-to-use solution E4-R05 obtained via a concentrated acidic solution E4-C from the solid acidic composition of E4 and with the 0.5 wt.-% solution of V4, having a temperature of 23° C. The wide-necked screw cap flasks were closed with the cap and allow staying for 7 days at a temperature of 23° C. Thereafter, the test plates were removed, rinsed with deionized water, placed on a clean paper towel and allowed to dry at a temperature of 23° C. The test plates were then weighted and the weight was taken to the fourth place. Subsequently the test plates were returned in there wide-necked screw cap flasks for another 7 days. Thereafter, the test plates were removed, rinsed with deionized water, placed on a clean paper towel and allowed to dry at a temperature of 23° C. The test plates were then weighted and the weight was taken to the fourth place. Subsequently the test plates were returned in there wide-necked screw cap flasks for another 7 days. The weight loss was calculated. Three tests were run for each test plate and the average weight loss was determined. The average weight loss for each test plates after treatment with said ready-to-use solution obtained from E4-R05 after two dissolution steps and V4 are shown in table 4 and table 5.

Table 4

Metal Material Compatibility Test

Material	Interval	0.5 wt.-% of E4-R05	0.5 wt.-% of V4
Copper	Start	45.0045	44.7704
	7 days	44.9642	44.7286
	14 days	44.9335	44.6855
	21 days	44.9045	44.6570
	loss	-0.0710	-0.0849

	loss in %	0.1578	0.1896
Material	Interval	0.5 wt.-% of E4-R05	0.5 wt.-% of V4
Brass	Start	43.5502	43.8973
	7 days	43.5088	43.855
	14 days	43.4662	43.8077
	21 days	43.4368	43.7725
	loss	-0.1134	-0.1248
	loss in %	0.2604	0.2843

Table 4 shows that the ready-to-use acidic composition of the invention E4-R05 has an improved metal compatibility compared with V4.

Table 5

Plastic Material Swelling Test

Material	Interval	0.5 wt.-% of E4-R05	0.5 wt.-% of V4
PC	Start	30.2311	30.1042
	7 days	30.2325	30.1527
	14 days	30.2358	30.1634
	21 days	30.2607	30.2046
	loss	0.0296	0.0592
	loss in %	0.0979	0.1967
Material	Interval	0.5 wt.-% of E4-R05	0.5 wt.-% of V4
Plexiglas	Start	18,1633	16,8084
	7 days	18,2783	16,891
	14 days	18,2609	16,9337
	21 days	18,2789	16,9365
	loss	0,1156	0,1281
	loss in %	0,6364	0,7621
	loss in %	0.0979	0.1967

Table 5 shows that the ready-to-use acidic composition of the invention E4-R05 causes a minor swell of the polymer material compared with V4.

Neutralization Test

Test method

The solid acidic cleaning compositions E4 diluted with deionized water to a 10 wt.-% acidic concentrated solution E4-C and said obtained acidic concentrated solution were further diluted with deionized water to a 0.1 wt.-% E4-R01 ready-to-use solution and to a 0.3 wt.-% E4-R03 ready-to-use solution.

An automatic instrument cleaning apparatus Miele G7836 CD, obtainable from the company Miele Cie KG, Germany, is used for cleaning medical instruments with an alkaline cleaner MetalClean, obtainable from the Company Ecolab, using the cleaning program DES-VAR-TD55. The cleaning program was stopped after the alkaline cleaning was pumped out and fresh water rinsing has been activated but before the neutralizing step has be started. The cleaning apparatus was opened and 2 x 500 ml distilled rinsing water and from a second run of the automatic instrument cleaning apparatus 2 x 500ml tape rinsing water was filled into four 600 ml beakers each and the pH was measured. Thereafter 0.5 ml and 1.5 ml of the ready-to-use acidic solutions E4-R01 and E4-R03 as well as of the comparison acidic solutions of V2 and V3 were added each to a 600 ml beaker and the pH was measured. The resulting pH-values are illustrated in table 6.

Table 6

	Distilled rinsing water	Distilled rinsing water	Tape rinsing water	Tape rinsing water
pH-value before neutralization	9.67	9.67	9.56	9.56
pH-value after neutralization				
500 ml rinsing solution + 0.5 ml of a 0.1 wt.-% acidic solution of V2	3.27	3.01	3.27	3.25
500 ml rinsing solution + 0.5 ml of a 0.1 wt.-% acidic ready-to-use solution E4-R01	3.96	4.05	4.15	4.20
500 ml rinsing solution + 1.5 ml of a 0.3 wt.-% acidic solution of V3	2.92	2.72	2.94	2.93
500 ml rinsing solution + 1.5 ml of a 0.3 wt.-% acidic ready-to-use solution E4-R03	3.22	3.22	3.27	3.27

It can be taken from table 6 that the acidic composition of the ready-to-use solution E4-R01 and E4-R03 of the invention have a clear neutralization activity and a higher pH compared to the comparative ready-to-use solutions V2 and V3.

Metal surfaces, ceramic surfaces and/or plastic surfaces in need of neutralizing are found in several locations. Exemplary locations include surgical instruments, medical instruments, and dental instruments, sinks, cookware, utensils, machine parts, vehicles, tanker trucks, vehicle wheels, work surfaces, tanks, immersion vessels, spray washers, and ultrasonic baths.

Metal surfaces that can be treated with a composition of the invention include iron-based metals such as iron, iron alloys, e. g. steel, tin, aluminum, copper, tungsten, titanium, molybdenum, etc., for example. The structure of the metal surface to be treated can vary widely. Thus, the metal surface, ceramic surface and/or plastic surface can be as a metal and/or plastic part of complex configuration, sheeting, coils, rolls, bars, rods, plates, disks, etc..

More preferred is the use of the acidic composition of the invention, in particular the ready-to-use-solution to neutralize or remove alkaline residues in the cleaning process of metal, ceramic and/or plastic articles, especially metal instruments, ceramic instruments, plastic instruments, instruments with a plastic surface, instruments with a ceramic surface and/or instruments with a metal surface.

Most preferred is the use of the acidic composition of the invention, in particular the ready-to-use-solution, to neutralize or remove alkaline residues in an automated instrument cleaning processing of metal, ceramic and/or plastic articles, especially metal instruments, ceramic instruments, plastic instruments, instruments with a plastic surface and/or instruments with a metal surface.

As used herein, the term "about" refers to variation in the numerical quantity that can occur, for example, through typical measuring and liquid handling procedures used for making concentrates or use solutions in the real world; through inadvertent error in these procedures; through differences in the manufacture, source, or purity of the ingredients used to make the compositions or carry out the methods; and the like. The term "about" also encompasses amounts that differ due to different equilibrium conditions for a composition resulting from a particular initial mixture. Whether or not modified by the term "about", the claims include equivalents to the quantities.

It should be noted that, 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. It should also be noted that the term “or” is generally employed in its sense including “and/or” unless the content clearly dictates otherwise. All publications and patent applications in this specification are indicative of the level of ordinary skill in the art to which this invention pertains. The invention has been described to various specific and preferred embodiments and techniques. However, it should be understood that many variations and modifications may be made while remaining within the spirit and scope of the invention.

What is claimed is:

1. An acidic solid composition for neutralizing alkaline solutions and/or alkaline residues comprising:
   a) urea;
   b) phosphoric acid;
   c) sulfamic acid;
   d) at least one weak organic acids; wherein the weight ratio of the phosphoric acid to sulfamic acid is in the range of about 1 : 0.05 to 1 : 1.

2. The acidic solid composition of claim 1 comprising:
   e) at least one polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids; and/or
   f) at least one preservative component.

3. The acidic solid composition of claim 1 or 2 comprising:
   a) about ≥ 5 wt.-% to about ≤ 25 wt.-%, preferably about ≥ 10 wt.-% to about ≤ 20 wt.-%, more preferred about ≥ 12 wt.-% to about ≤ 18 wt.-%, and most preferred about ≥ 15 wt.-% to about ≤ 16 wt.-% urea;
   b) about ≥ 10 wt.-% to about ≤ 40 wt.-%, preferably about ≥ 15 wt.-% to about ≤ 35 wt.-%, more preferred about ≥ 20 wt.-% to about ≤ 30 wt.-%, and most preferred about ≥ 25 wt.-% to about ≤ 28 wt.-% phosphoric acid;
   c) about ≥ 5 wt.-% to about ≤ 20 wt.-%, preferably about ≥ 7 wt.-% to about ≤ 18 wt.-%, more preferred about ≥ 9 wt.-% to about ≤ 15 wt.-%, and most preferred about ≥ 11 wt.-% to about ≤ 13 wt.-% sulfamic acid;
   d) about ≥ 20 wt.-% to about ≤ 50 wt.-%, preferably about ≥ 25 wt.-% to about ≤ 45 wt.-%, more preferred about ≥ 30 wt.-% to about ≤ 40 wt.-%, and most preferred about ≥ 34 wt.-% to about ≤ 36 wt.-% of at least one weak organic acid, preferably the weak organic acid is solid;
   e) about ≥ 0 wt.-% to about ≤ 5 wt.-%, preferably about ≥ 0.5 wt.-% to about ≤ 4 wt.-%, more preferred about ≥ 1 wt.-% to about ≤ 3.5 wt.-%, and most preferred about ≥ 2 wt.-% to about ≤ 3 wt.-% of at least one polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids;
   f) about ≥ 0 wt.-% to about ≤ 2 wt.-%, preferably about ≥ 0.2 wt.-% to about ≤ 1.5 wt.-%, more preferred about ≥ 0.4 wt.-% to about ≤ 1 wt.-%, and most preferred about ≥ 0.5 wt.-% to about ≤ 0.6 wt.-% of at least one preservative component; wherein the weight % of

the components are based on the total weight of the solid composition and the total weight of all components does not exceed 100 wt.-%.

4. The acidic solid composition of claims 1 to 3, wherein the weak organic acid has a pKs1 of about ≥ 2, preferably a pKs1 of about ≥ 2.5 and further preferred a pKs1 of about ≥ 3 to ≤ 4.

5. The acidic solid composition of claims 1 to 4, wherein the weak organic acid is selected from the group comprising citric acid, lactic acid, acetic acid, hydroxyacetic acid, glycolic acid, adipic acid, tartaric acid, succinic acid, propionic acid, maleic acid, alkane sulfonic acids, cycloalkane sulfonic acids, and most preferred is citric acid.

6. The acidic solid composition of claims 1 to 5, wherein the polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids is selected from the group comprising acrylic acid, methacrylic acid, polyitaconic acid, polymaleic acid, and mixtures thereof , most preferred is a polyacrylic acid.

7. The acidic solid composition of claims 1 to 6, wherein the preservative component is selected from the group comprising phenyl substituted compounds, preferably phenylphenol, o-phenylphenol, C_8-C_{18}-alkyldimethylbenzylammonium chloride, and/or phenoxy ethanol, sodium benzoate, 5-chloro-2 methyl-1,2 thiatol-3-one.

8. An acidic liquid composition for neutralizing alkaline residues comprising the components of claims 1 to 7 and a solvent.

9. The acidic liquid composition of claim 8, wherein the solid composition of claims 1 to 7 is dissolved in a solvent in a weight ratio of solid composition to solvent of about 1 : 10 to about 1 : 50000, preferably in a weight ratio of about 1 : 100 to about 1 : 10000, further preferred in a weight ratio of about 1 : 250 to about 1 : 7000, more preferred in a weight ratio of about 1 : 500 to about 1 : 3500, and more preferred in a weight ratio of about 1 : 1000 to about 1 : 2500.

10. The acidic liquid composition of claim 8 or 9, wherein the solvent is selected from the group comprising water, alcohols, glycols, glycol ethers and/or esters, most preferred is water.

11. The acidic liquid composition of claims 8 or 10, wherein the liquid composition is present in the form of a concentrated liquid composition for neutralizing alkaline residues or in the form of a ready-to-use liquid composition for neutralizing alkaline residues.

12. The acidic liquid composition of claims 8 to 11, wherein the concentrated liquid composition comprises:
    a) about ≥ 0.5 wt.-% to about ≤ 2.5 wt.-%, preferably about ≥ 0.75 wt.-% to about ≤ 2.25 wt.-%, more preferred about ≥ 1 wt.-% to about ≤ 2 wt.-%, and most preferred about ≥ 1.5 wt.-% to about ≤ 1.7 wt.-% urea;
    b) about ≥ 1 wt.-% to about ≤ 4 wt.-%, preferably about ≥ 1.5 wt.-% to about ≤ 3.5 wt.-%, more preferred about ≥ 2 wt.-% to about ≤ 3 wt.-%, and most preferred about ≥ 2.5 wt.-% to about ≤ 2.8 wt.-% phosphoric acid;
    c) about ≥ 0.1 wt.-% to about ≤ 2.5 wt.-%, preferably about ≥ 0.5 wt.-% to about ≤ 2 wt.-%, more preferred about ≥ 0.75 wt.-% to about ≤ 1.5 wt.-%, and most preferred about ≥ 1.0 wt.-% to about ≤ 1.25 wt.-% sulfamic acid;
    d) about ≥ 1 wt.-% to about ≤ 5 wt.-%, preferably about ≥ 1.5 wt.-% to about ≤ 4.5 wt.-%, more preferred about ≥ 2 wt.-% to about ≤ 4 wt.-%, and most preferred about ≥ 2.5 wt.-% to about ≤ 3.5 wt.-% of at least one weak organic acid, preferably the weak organic acid is solid;
    e) about ≥ 0 wt.-% to about ≤ 0.5 wt.-%, preferably about ≥ 0.05 wt.-% to about ≤ 0.4 wt.-%, more preferred about ≥ 0.1 wt.-% to about ≤ 0.3 wt.-%, and most preferred about ≥ 0.2 wt.-% to about ≤ 0.25 wt.-% of at least one polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids;
    f) about ≥ 0 wt.-% to about ≤ 0.2 wt.-%, preferably about ≥ 0.01 wt.-% to about ≤ 0.1 wt.-%, more preferred about ≥ 0.03 wt.-% to about ≤ 0.08 wt.-%, and most preferred about ≥ 0.05 wt.-% to about ≤ 0.06 wt.-% of at least one preservative component;
    g) about ≥ 80 wt.-% to about ≤ 95 wt.-%, preferably about ≥ 85 wt.-% to about ≤ 94 wt.-%, more preferred about ≥ 87 wt.-% to about ≤ 93 wt.-%, and most preferred about ≥ 90 wt.-% to about ≤ 92 wt.-% of at least one solvent; wherein the weight % of the components are based on the total weight of the concentrated liquid composition and the total weight of all components does not exceed 100 wt.-%.

13. The acidic liquid composition of claims 8 to 11, wherein the ready-to-use liquid composition comprises:
    a) about ≥ 0.0005 wt.-% to about ≤ 0.0075 wt.-%, preferably about ≥ 0.0008 wt.-% to about ≤ 0.007 wt.-%, more preferred about ≥ 0.0012 wt.-% to about ≤ 0.006 wt.-%, and most preferred about ≥ 0.0015 wt.-% to about ≤ 0.005 wt.-% urea;
    b) about ≥ 0.0001 wt.-% to about ≤ 0. 1 wt.-%, preferably about ≥ 0.0005 wt.-% to about ≤ 0.05 wt.-%, more preferred about ≥ 0.001 wt.-% to about ≤ 0.01 wt.-%, and most preferred about ≥ 0.0025 wt.-% to about ≤ 0.009 wt.-% phosphoric acid;

c) about ≥ 0.0001 wt.-% to about ≤ 0.01 wt.-%, preferably about ≥ 0.0004 wt.-% to about ≤ 0.008 wt.-%, more preferred about ≥ 0.0007 wt.-% to about ≤ 0.006 wt.-%, and most preferred about ≥ 0.001 wt.-% to about ≤ 0.004 wt.-% sulfamic acid;

d) about ≥ 0.0005 wt.-% to about ≤ 0.02 wt.-%, preferably about ≥ 0.001 wt.-% to about ≤ 0.017 wt.-%, more preferred about ≥ 0.0025 wt.-% to about ≤ 0.015 wt.-%, and most preferred about ≥ 0.0035 wt.-% to about ≤ 0.012 wt.-% of at least one weak organic acid, preferably the weak organic acid is solid;

e) about ≥ 0 wt.-% to about ≤ 0.05 wt.-%, preferably about ≥ 0.00005 wt.-% to about ≤ 0.03 wt.-%, more preferred about ≥ 0.0001 wt.-% to about ≤ 0.01 wt.-%, and most preferred about ≥ 0.00025 wt.-% to about ≤ 0.0075 wt.-% of at least one polymer of monomers of water-soluble monoethylenically unsaturated C_3 to C_8- carboxylic acids;

f) about ≥ 0 wt.-% to about ≤ 0.001 wt.-%, preferably about 0.0001 wt.-% to about ≤ 0.0005 wt.-%, more preferred about ≥ 0.0003 wt.-% to about ≤ 0.0003 wt.-%, and most preferred about ≥ 0.0005 wt.-% to about ≤ 0.00015 wt.-% of at least one preservative component;

g) about ≥ 99 wt.-% to about < 100 wt.-%, preferably about ≥ 99.9 wt.-%, more preferred about ≥ 99.99 wt.-%, and most preferred add. 100 wt.-% of at least one solvent, preferably water; wherein the weight % of the components are based on the total weight of the ready-to-use liquid composition and the total weight of all components does not exceed 100 wt.-%.

14. A method of neutralizing alkaline solutions and/or alkaline residues on an article, wherein an acidic composition of claims 1 to 13 is contacted with at least one surface of the article.

15. The method of claim 14, comprising the steps:

a) cleaning at least one surface of an article with an alkaline cleaning composition,

b) rinsing the cleaned article with a solvent, preferably water, to remove residues of the alkaline cleaning composition,

c) adding to the rinsing solvent of step b) an acidic composition of the invention for neutralizing the rinsing solvent of step b) and/or rinsing the so cleaned article with a liquid acidic composition of the invention for neutralizing alkaline residues that are remained on the surface of the article.

16. The method of claim 14 or 15, wherein the article is selected from the group comprising metal, ceramic and/or plastic articles, articles having a metal surface, ceramic surface and/or plastic surface, preferably metal instruments, ceramic instruments, plastic instruments, instruments with a metal surface, ceramic surface and/or instruments with a metal surface.

17. Use of the acidic liquid composition of claims 8 to 13 for neutralizing alkaline solutions and/or alkaline residues, preferably in an automated instrument processing , on metal, ceramic and/or plastic articles, articles having a metal surface, ceramic surface and/or plastic surface, preferably metal instruments, ceramic instruments, plastic instruments, instruments with a metal surface, ceramic surface and/or instruments with a metal surface.

18. The method of manufacture the acidic solid composition of claims 1 to 7 including the steps:
    - mixing the component of the acidic composition of claims 1 to 7 at elevated temperatures;
    - casting the mixed components into a form for forming a shaped article,
    - solidifying the cast components to said solid composition.

19. The method of manufacture an acidic ready-to-use solution of the solid composition according to claims 1 to 7 including the steps of:
    (i) Positioning in a product dissolving chamber that is connected to a solvent source an acidic solid composition for neutralizing alkaline residues,
    (ii) Obtaining an acidic concentrated solution by dissolving said acidic solid composition with sufficient solvent,
    (iii) Flushing-out said acidic concentrated solution, preferably step-wise,
    (iv) Dissolving said acidic concentrated solution by adding additional solvent to obtain an acidic ready-to-use solution for neutralizing alkaline residues,
    (v) Transmitting the acidic ready-to-use solution for neutralizing alkaline residues to the place of operation.

20. Apparatus for receiving an acidic solid composition of claims 1 to 7, comprising means for dissolving at least partly the acidic solid composition to an acidic liquid composition of claims 8 to 13.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/070536

A. CLASSIFICATION OF SUBJECT MATTER
INV. C11D7/08 C11D7/26 C11D7/32 C11D7/34
ADD.

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)
C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2009/059630 A1 (ECOLAB INC [US]; SAUTER JOACHIM [DE]; BURCZEK ANNA [DE]; GRUNWALD LUDG) 14 May 2009 (2009-05-14) page 1, lines 5-12; claims 3,4,6-10; example 1; tables 1-3 page 4, lines 12-17 page 10, lines 14-22 page 11, lines 11-15 page 17, lines 4-8,25-29 page 19, lines 12,13 -----	1-5,7-20
X	US 2009/249556 A1 (DERMEIK SALMAN [DE] ET AL) 8 October 2009 (2009-10-08) example 1 -----	8-11
X	GB 2 298 431 A (ECOLAB INC [US]) 4 September 1996 (1996-09-04) page 1, lines 5-19; examples 13,14,17,18 ----- -/--	1-5, 7-11,20

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search 14 September 2011	Date of mailing of the international search report 22/09/2011
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Klier, Erich

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

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