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(54) NON-ENZYMATIC CLEANER FOR REPROCESSING SURGICAL INSTRUMENTS AND FLEXIBLE ENDOSCOPES

NICHTENZYMATISCHER REINIGER ZUR WIEDERAUFBEREITUNG CHIRURGISCHER INSTRUMENTE UND FLEXIBLER ENDOSKOPPE

AGENT DE NETTOYAGE NON ENZYMATIQUE POUR LE RETRAITEMENT D'INSTRUMENTS CHIRURGICAUX ET D'ENDOSCOPES SOUPLES

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Description**Field of the Invention**

5 **[0001]** The disclosure pertains to non-enzymatic compositions useful for cleaning surgical, medical and dental instruments and flexible endoscopes prior to reuse. In particular, the disclosure pertains to liquid concentrate non-enzymatic compositions useful for cleaning such instruments prior to a disinfection process, as well as to methods for use of the non-enzymatic compositions in such treatments.

10 **Background of the Invention**

[0002] Effective cleaning, sterilization and disinfection of articles are of the utmost importance in many industries, such as healthcare, the food industry, etc. For example, reusable medical instruments, such as surgical instruments or probes, including flexible endoscopes, are typically contaminated with blood and other body matter and potentially with infectious microorganisms during use and require cleaning and sterilization / disinfection after each use to ensure that the risks of cross infection from patient-to-patient as well as from patient-to-health care personnel are minimized.

[0003] Surgical instruments including flexible endoscopes are normally pre-cleaned prior to automatic cleaning and disinfection. Manual pre-cleaning with the help of brushing serves to remove macroscopic soil rests and to free any present clogging sites which may not be successfully cleaned in the machine.

20 **[0004]** A typical cycle for automatic cleaning of medical instruments consists of a number of consecutive stages: pre-wash, wash, rinses (usually two) and drying. The pre-wash stage is primarily used to dissolve blood on the instruments and may be run with a suitable wash solution. The wash part of the cycle is run with a wash solution which typically contains or more surfactants. Both the pre-wash and wash solutions may additionally contain one or more enzymes. Wash time, water temperature, surfactant selection, and wash solution concentration levels can vary depending upon the particular nature of the instrument and/or soil to be cleaned therefrom. The purpose of the rinse stage(s) is primarily to remove soil dissolved in the pre-wash and /or wash stage(s) as well as to remove any remaining surfactant-containing wash solution.

[0005] Medical instruments that are thermally stable, such as scissors, knives or scalpels, may be sterilized by processing at a high temperature.

30 **[0006]** However, many articles including surgical, medical or dental instruments or probes such as flexible endoscopes are temperature sensitive, particularly at relatively high temperatures, and therefore must be cleaned and disinfected at lower temperatures either manually or in a machine.

[0007] The process of cleaning, sterilizing and disinfecting instruments which are temperature sensitive is especially complicated where blood or other matter has been allowed to dry on the instruments. Body fluids, such as blood, lipids and synovial fluids from joints can adhere to the instruments during use in a surgical procedure, and as such fluids dry, the adhesion becomes stronger and the adhered body-fluid based matter becomes harder to dissolve using ordinary cleaning methods. Blood in particular becomes more difficult to remove once it has dried. Therefore, any cleaning composition to be used in these situations must be able to clean a range of body fluids effectively from a variety of different substrate surfaces such as are found on such as surgical instruments or probes, including flexible endoscopes.

40 **[0008]** In the past it was thought that there was a risk that the instruments having strongly adhered matter could remain soiled after cleaning with conventional detergent-based cleaning compositions. Such soil retention would pose a health risk if the instrument was re-used immediately following cleaning. However, an increased risk is potentially posed if an instrument having retained soil is stored for a period following cleaning because during the storage period bacterial growth is possible, which could affect not only the soiled instrument, but also its surrounding environment. To obviate the risks associated with ineffective removal of adhered body matter, improved cleansing compositions which included one or more enzymes were developed in order to break-down both the chemical structure of the adhered body-fluid based matter, as well as the physical/adhesive bond between matter and the instrument via hydrolysis. Compositions containing one or more enzymes are disclosed in WO 2009/095827A1 are able to deliver effective cleaning at neutral (6.5) pH levels.

50 **[0009]** Whilst the cleaning power of enzymes is undoubted, their increased use has led to concerns in relation to potential health issues, and issues associated with the spread of enzymes in reprocessing areas. These concerns are of sufficient magnitude that some countries are considering whether enzymes should be incorporated in cleaning compositions in the future. Therefore, there is a need for new non-enzyme based cleaning compositions which are capable of removing strongly adhered matter at levels consistent with those provided by current enzyme-including cleaning compositions.

55 **[0010]** Currently cleaning compositions which do not contain one or more enzymes are generally formulated at alkaline pH levels. The use of extreme pH levels in cleaning compositions, whether highly acidic or highly alkaline can introduce additional contamination risks in the medical, surgical and dental fields due to material incompatibility effects.

[0011] US 2014/311529 discloses a detergent composition for endoscope washers, including a non-ionic surfactant represented by the formula $R-O-[(EO)_m/(PO)_n]-H$, a branched-chain fatty acid having not less than 6 and not more than 10 carbon atoms or a salt thereof, a defoaming agent and water.

[0012] WO 2006/086875 discloses a method for cleaning dental and medical instruments, in which a cleaning solution including a low-residue corrosion inhibitor is used not only in a wash stage of the cleaning cycle, but also in at least one subsequent cycle. The cleaning solution has a neutral to alkaline pH and comprises a low foaming surfactant and a corrosion inhibitor selected from the group of C4 - C16 alkyl pyrrolidones and C1 - C18 alkylamines.

[0013] Typical non-enzyme containing cleaning compositions as are known in the art are aggressive and often use moderately or even highly alkaline conditions to provide a high cleaning performance.

[0014] As will be readily appreciated many articles including surgical, medical or dental instruments or probes such as flexible endoscopes which require routine re-cleaning prior to re-use comprise metallic components, and even moderately alkaline cleaning compositions such are typical in the art are often highly aggressive towards metals and metal alloys, such as steel, stainless steel, copper, zinc, brass, aluminum, and anodized aluminum, for example. However for aluminum and zinc in particular, exposure to moderate to highly alkaline pH conditions inhibits passivation.

[0015] Given the requirement for repeated use, cleaning and re-use of such articles, over time the impact of cleaning using aggressive, alkaline formulations increases the risk of corrosion of the metallic surfaces of such articles, either in whole or in part i.e. localized corrosion concentration such as pitting or cracking. Whilst an impact of metal corrosion is degradation of intrinsic properties such as strength, with associated risk of breakage or fracture, a particular risk for articles for use in the surgical, medical and dental fields is the risk that the surface becomes less impermeable to body fluids. Therefore, there is a need for new non-enzyme based cleaning compositions which are capable of removing strongly adhered matter from metal surfaces and which have desirable material compatibility.

[0016] An indication that the surface properties of metal articles, or metal containing articles have been compromised via repeated cleaning with aggressive, alkaline formulations is discoloration of the articles, either in whole or in part. A metal surface which has been compromised, via corrosion or other degradation processes may include cracks or pits which are potential additional sites for bacterial colonies to be established. Once corroded, such articles may require repair to re-establish the integrity of the metal surface, such as via coating processes, or even replacement of the entire instrument. Therefore, there is a need for new non-enzyme based cleaning compositions which are capable of removing strongly adhered matter from metal surfaces and which have reduced risk of post-cleaning soil retention.

[0017] During the cleaning process current highly alkaline non-enzyme cleaning compositions can tend to generate levels of foam which either obscure the wash solution in this the articles are immersed, or which cling to the article being cleansed when removed from the solution thereby leading to a longer and less efficient cleaning process. When utilized in manual cleaning of articles, some of these compositions can also provide cloudy or milky solutions in which it is difficult to clearly see the article to be cleansed when immersed in said solution, and therefore to effectively cleanse any adhered soil thereon. Therefore, there is a need for new non-enzyme based cleaning compositions which are capable of removing strongly adhered matter from metal surfaces at neutral or mildly alkaline pH levels and which provide clearer wash solutions and/or reduced levels of foaming during the cleaning process.

Summary of the Invention

[0018] Novel non-enzymatic cleaning compositions are provided that are particularly suitable for manual cleaning of articles, and in particular surgical, medical or dental instruments including probes and flexible endoscopes.

[0019] The novel liquid concentrate non-enzymatic cleaning compositions provide desirable cleaning performance levels in comparison to neutral enzyme-including compositions. The novel liquid concentrate non-enzymatic cleaning compositions provide desirable cleaning performance levels across a broad range of in use concentrations in comparison to neutral enzyme-including compositions.

[0020] The novel liquid concentrate non-enzymatic cleaning compositions have improved material compatibility in comparison to conventional highly alkaline non-enzyme containing compositions.

[0021] The novel liquid concentrate non-enzymatic cleaning compositions: are low or no foaming at in use concentration levels; provide low foaming in use (dilute) solutions across a broad range of concentration levels, from 0.2% to 2.0%; provide a cleaning or wash solution which at in use concentration levels is not cloudy at temperatures of up to and including 45°C; are stable across a range of storage conditions in concentrated (undiluted) form; are stable across a range of hardness conditions at in aqueous solutions at in use concentration levels, such as for example up to and including 23 degrees of hardness, on the German hardness scale (°dH DE); demonstrate good material compatibility.

[0022] The present liquid concentrate non-enzymatic cleaning compositions are defined in the appended claims.

[0023] The low foaming surfactant system comprising at least one nonionic surfactant may comprise from about 1 to about 15 weight % of at least one nonionic surfactant which is a PO/EO/PO block copolymer and/or an ethoxylated amine block copolymer.

[0024] The at least one complexing agent may comprise one or more super-complexing agents and optionally one or

more complexing agents as defined hereinafter. In one aspect the at least one complexing agent comprises one or more small molecule organic super-complexing agents and especially methylglycine diacetic acid (MGDA) and acid or alkali metal salts thereof.

[0025] The at least one source of alkalinity may comprise one or more amines. In one aspect the at least one source of alkalinity comprises an alkanolamine independently selected from: triethanolamine (TEA); TEA 99%; monoethanolamine (MEA); diethanolamine (DEA); and combinations or mixtures thereof.

[0026] The moderately alkaline pH level may comprise a pH in the range of from 7 to 12; from 8 to 10; from 8.5 to 9.5, about 9.5.

[0027] The at least one anti-corrosion agent may comprise one or more phosphoric acid esters, and/or one or more phosphonic acid esters. In one aspect the at least one corrosion inhibitor is a phosphate ester independently selected from phosphoric acid, 2-ethylhexyl ester, commercially available from Clariant as Hordaphos® MDAH, or phosphoric acid, mixed esters with butyl alcohol and ethylene glycol, commercially available as Hordaphos® MDGB.

[0028] A non-enzymatic cleaning composition is provided that can comprise a low foaming surfactant system comprising at least one nonionic surfactant, at least one complexing agent, optionally at least one anti-corrosion agent, at least one source of alkali and a moderately alkaline pH level.

[0029] Typically, the cleaning composition has a pH of about 9.5.

[0030] In some aspects, the low foaming surfactant system comprising at least one nonionic surfactant is present in the cleaning composition in an amount ranging from about 0.1 to 15.0 weight %, the at least one complexing agent is present in an amount ranging from about 0.1 to 10.0 weight %, the at least one source of alkalinity is present in an amount ranging from about 0.1 to 10.0 weight %, optionally, the at least one anti-corrosion agent is present in an amount ranging from about 0 to 5 weight %, and the cleaning composition has a pH of about 9.5.

[0031] In certain aspects, the low foaming surfactant system comprising at least one nonionic surfactant is present in the cleaning composition in an amount ranging from about 2.0 to 10.0 weight % the at least one complexing agent is present in an amount ranging from about 2.0 to 8.0 weight %, the at least one source of alkalinity is present in an amount ranging from about 3.0 to 8.0 weight % and the cleaning composition has a pH of: from 8 to 10; from 8.5 to 9.5; or about 9.5.

[0032] According to one aspect the non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes comprises:

- (a) 0.1 to 15.0 weight % of a low-foaming surfactant system comprising at least one nonionic surfactant;
- (b) 0.1 to 10.0 weight % of at least one complexing agent;
- (c) 0.1 to 10.0 weight % of at least one source of alkalinity;
- (d) 0 to 5.0 weight % of at least one anti-corrosion agent;
- (e) 60 to 99.7 weight % of an aqueous solvent

and wherein the pH of the composition is: between 7 and 12; between 8 and 10; from 8.5 to 9.5; or about 9.5.

[0033] According to a further aspect the non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes comprises:

- (a) 0.1 to 15.0 weight % of a low-foaming surfactant system comprising at least one nonionic surfactant;
- (b) 0.1 to 5.0 weight % of at least one complexing agent;
- (c) 0.1 to 10.0 weight % of at least one source of alkalinity;
- (d) 0 to 5.0 weight % of at least one anti-corrosion agent;
- (e) 65 to 99.7 weight % of an aqueous solvent

and wherein the pH of the composition is: between 8 and 10; from 8.5 to 9.5; or about 9.5.

[0034] According to a yet further aspect the non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes comprises:

- (a) 0.1 to 10.0 weight % of a low-foaming surfactant system comprising at least one nonionic surfactant;
- (b) 0.1 to 5.0 weight % of at least one complexing agent;
- (c) 0.1 to 10.0 weight % of at least one source of alkalinity;
- (d) 0.1 to 5.0 weight % of at least one anti-corrosion agent;
- (e) 70 to 99.6 weight % of an aqueous solvent

and wherein the pH of the composition is: between 8 and 10; from 8.5 to 9.5; or about 9.5.

[0035] Methods of cleaning articles using the novel non-enzymatic cleaning compositions for the delivery of effective cleaning whilst limiting alkaline-pH associated corrosion or degradation of the metallic surfaces of the articles by the cleaning composition are also provided. Typically, the articles to be cleaned are metal articles and the step of cleaning

the article with the novel non-enzymatic cleaning composition is carried out manually. The methods can include the steps of providing an article to be cleaned and directly applying an effective amount of the novel non-enzymatic cleaning composition to the article, either in diluted form or as a concentrated solution, and cleaning of the article therewith, followed by at least one rinsing step, and optionally at least one further cleaning and washing cycle. The methods can include the steps of providing an article to be cleaned, providing an effective amount of the novel non-enzymatic cleaning composition in an aqueous solution and cleaning the article with/in the dilute aqueous solution containing the novel non-enzymatic cleaning composition.

[0036] Typically, the novel non-enzymatic cleaning composition is at least partially diluted to form a concentrated or a dilute aqueous solution prior to use.

[0037] In some aspects, the step of cleaning the article with the novel non-enzymatic cleaning composition is carried out automatically.

[0038] An effective amount of the novel non-enzymatic cleaning composition is preferably such that desirable foam levels, solution clarity (turbidity), cleaning efficacy (particularly cleaning of blood and/or blood-based soils are provided using the composition after dilution to provide an aqueous solution of the composition prior to use.

[0039] In a further aspect an effective amount of the novel non-enzymatic cleaning composition is preferably such that desirable foam levels, solution clarity (turbidity), cleaning efficacy (blood / blood-based soil cleaning), and material compatibility (anti-corrosive effects) are provided using the composition after dilution to provide an aqueous solution of the composition prior to use.

[0040] For example, in an embodiment of the invention, an effective amount of the novel non-enzymatic cleaning composition is such that the amount of the low foam surfactant system comprising at least one nonionic surfactant ranges from about 0.1 to 15.0 weight %, the amount of the at least one complexing agent is present in an amount ranging from about 0.1 to 10.0 weight %, and the amount of the at least one source of alkalinity is present in an amount ranging from about 0.1 to 10.0 weight % and the cleaning composition is then diluted with water to between 10% original concentration to 0.1% original concentration.

[0041] For example, for use in cleaning surgical, medical and dental instruments and flexible endoscopes as defined herein prior to their re-use, the concentrated non-enzymatic cleaning composition may be diluted with a suitable aqueous solvent to 10%, 5%, 2%, 1%, 0.5% or preferably 0.2% of the original composition concentration prior to use i.e. a 10% aqueous solution of the composition. The choice of dilution for any particular in-use aqueous cleaning solution will be dependent upon the level or soil, the type of soil, the time the soil has been left on the surface, as well as the hardness of the water used to dilute the composition.

[0042] For the avoidance of doubt, and unless specified to the contrary, where the relative amounts of any particular component in the compositions herein are expressed in terms of % weight this means the amount of the component relative to the total amount of the composition. For example, 6% of a source of alkalinity in a cleaning composition herein means that 100g (100%) of the composition contains 6g (6%) of said source of alkalinity.

[0043] The foregoing has outlined rather broadly the features and technical advantages of the present disclosure in order that the detailed description of the invention that follows may be better understood. Additional features and advantages of the disclosure will be described hereinafter that form the subject of the claims. It should be appreciated by those skilled in the art that the conception and the specific embodiments disclosed may be readily utilized as a basis for modifying or designing other embodiments for carrying out the same purposes of the present disclosure. It should also be realized by those skilled in the art that such equivalent embodiments do not depart from the spirit or scope of the disclosure as set forth in the appended claims.

Detailed Description of Preferred Embodiments

[0044] The present disclosure provides non-enzymatic compositions useful for cleaning surgical, medical and dental instruments and flexible endoscopes prior to reuse. In particular, the disclosure provides liquid concentrate non-enzymatic compositions useful for cleaning such instruments prior to disinfection, as well as to methods for use of the non-enzymatic compositions in such cleaning treatments.

[0045] For the avoidance of doubt, the liquid concentrate compositions herein may be applied directly to an article to be cleaned without dilution, or may be applied as concentrated solutions to an article to be cleaned, or may be diluted to form aqueous in use solutions into which articles to be cleaned may be immersed and cleaned.

[0046] The terms cleaning as used herein in terms of liquid concentrate, or in-use solutions thereof, means suitable for use in cleaning wherein cleaning as defined herein means the removal of soils, marks, stains, dirt or other material from the surface of an item.

[0047] The present compositions are formulated to have at least a moderately alkaline pH level both on manufacture of a finished liquid concentrate, and when in-use as a diluted solution. A moderately alkaline pH level as defined herein is a pH of from about pH 7 to about pH 10.5. According to an aspect the non-enzymatic compositions herein have a finished pH of: at least 7.5; from about 7.5 to about 10; from about 7.7 to about 9.8; from about 8.0 to about 9.7; from

about 8.5 to about 9.5; and about 9.5.

[0048] Accordingly non-enzymatic cleaning compositions are provided which additionally are formulated to have a finished pH of: at least 7.5; from about 7.5 to about 10; from about 7.7 to about 9.8; from about 8.0 to about 9.7; from about 8.5 to about 9.5; and about 9.5.

[0049] For the avoidance of doubt, the finished pH of a liquid concentrate composition as detailed herein is the final pH of the composition following pH adjustment with acid or base as necessary to bring the pH into line with the desired levels of from about 7.5 to about 10.5, and preferably about pH 9.5.

[0050] As will be readily appreciated the pH of an in-use solution where the liquid concentrate has been diluted with water will substantially correspond to the pH of the original liquid concentrate and ideally be within 0.1 to 1, or 0.5 to 1 pH unit of the finished pH level. Any suitable form of water may be used to provide an in-use solution, de-ionized (DI), or tap water. Typically tap water will be used, in which case the water will have a defined hardness level (the degree of hardness).

[0051] The cleaning performance of certain aspects is particularly effective in the removal of dried body fluids, and especially of dried blood.

[0052] The present compositions provide low, or no foaming use solutions at temperatures of up to and including 45°C. A low foaming or no foaming use solution as defined herein is a solution having an initial foam height of less than about 5cm, and reducing to 0cm between about 10 seconds and 1 minute as measured in accordance with the manual shaking methodology detailed in the Experimental Methods section herein.

[0053] The present compositions provide crystal clear use solutions at temperatures of up to and including 45°C and at water hardness levels of up to and including 23 degrees of Hardness (23° dH) on the German water hardness scale. A crystal clear use solution as defined herein is a solution having which is clear to the naked eye both on initial formulation, and after pH finishing.

[0054] As demonstrated in the Experimental Results section hereinafter the present compositions provide desirable cleaning performance when compared to enzymatic cleansers. As further demonstrated in the Experimental Results section, the efficacious cleaning abilities of the present compositions are especially effective in the removal of blood based soils.

[0055] Surprisingly, the present moderately alkaline non-enzymatic cleaning compositions have been demonstrated to provided material compatibilities consistent with neutral pH multi-enzyme containing cleaning compositions, and improved material compatibility (reduced corrosive potential) versus baseline (standard) alkaline pH non-enzyme containing compositions. These results are especially surprising because it is widely known that increasing the pH in cleaning compositions carries an increased risk of material incompatibility in some metal substrates.

[0056] Even more surprisingly the present non-enzymatic cleaning compositions have been demonstrated to provide performance levels, and especially blood soil removal performance levels which are consistent with multi-enzyme containing cleaning compositions. As discussed in the Experimental Results hereinafter the present compositions show faster soil removal performance versus enzyme containing cleaning compositions. These faster cleaning results are particularly surprising because to date, enzymes have been considered to be the "gold-standard" for blood soil removal.

[0057] As demonstrated hereinafter the present compositions provide desirable cleaning and anti-corrosive performance levels, and are particularly effective in the removal of dried body fluids, and especially of dried blood and in the inhibition of corrosion of anodized aluminum.

Surfactants

[0058] The present invention can be a liquid concentrate composition comprising based on the whole composition from about 0.1 to about 15 wt. %, from about 0.1 to about 10 wt. %, from about 0.1 to about 6 wt. %, from about 0.1 to about 4 wt. %, from about 1 to about 6 wt. %, from about 1 to about 4 wt. % of a low-foam surfactant system comprising at least one nonionic surfactant.

[0059] According to an aspect the compositions comprise from 1 to 15% of at least one nonionic surfactant which is a PO/EO/PO block copolymer and/or an ethoxylated amine block copolymer.

[0060] According to a further aspect the composition includes at least two nonionic surfactants selected from one or more PO/EO/PO block copolymers and one or more ethoxylated amine block copolymers.

[0061] According to an aspect the compositions comprise from 1 to 15% of at least one nonionic surfactant which is a PO/EO/PO block copolymer and/or an ethoxylated amine block copolymer, and optionally further surfactants wherein said further surfactants preferably comprise one or more additional non-ionic surfactants.

[0062] Suitable PO/EO/PO block copolymers for use herein include compounds of general formula A: $\text{HO}(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x(\text{CH}_2\text{CH}_2\text{O})_y(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x\text{H}$ wherein the relative weight ratio of EO : PO is independently selected from EO : PO ranges of : from about 10 : 90 to about 90 : 10; from about 20 : 80 to about 80 : 20; from about 30 : 70 to about 70 : 30; from about 40 : 60 to from about 60 : 40; about 40 : 60. As will be readily appreciated the corresponding values of x and y will be dependent upon the particular EO : PO range for any particular block copolymer.

For example, a PO : EO : PO block copolymer having a weight ratio of total EO to total PO of 40 : 60 and a molecular weight of 2650 will have values of x and y of about 24 for y and about 13 to 14 for x.

[0063] Exemplary PO/EO/PO block copolymers of formula suitable for use herein include the Pluronic and reverse Pluronic nonionic surfactant ranges from (BASF), and in particular the Pluronic RPE range including Pluronic® RPE 1720, Pluronic® RPE 1740, Pluronic® RPE 2035, Pluronic® RPE 2520, Pluronic® RPE 2525, Pluronic® RPE 3110 and mixtures and combinations thereof.

[0064] The following Pluronics are suitable for use herein: RPE 1720, having a molecular weight of 2150; RPE 1740 having a molecular weight of 2650; RPE 2035 having a molecular weight of 4100; RPE 2520 having a molecular weight of 3100; RPE 2525 having a molecular weight of 2000; RPE 3110 having a molecular weight of 3500. For the avoidance of doubt all of these Pluronic RPE materials are considered to be at 100% active.

[0065] According to a further aspect the invention provides a non-enzymatic liquid concentrate cleaning composition as defined herein wherein the nonionic surfactant is present at a level of from about 0.1 weight % to about 15 weight % and includes at least one PO/EO/PO block copolymer of formula $\text{HO}(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x-(\text{CH}_2\text{CH}_2\text{O})_y-(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x\text{H}$ wherein the relative weight ratio of EO : PO is independently selected from EO : PO ranges of : from about 10 : 90 to about 90 : 10; from about 20 : 80 to about 80 : 20; from about 30 : 70 to about 70 : 30; from about 40 : 60 to from about 60 : 40; about 40 : 60 and wherein the copolymer has a molecular weight in the range of from: about 2000 to about 4500; about 2500 to about 3500; about 2650.

[0066] According to a further aspect the invention provides a non-enzymatic liquid concentrate cleaning composition as defined herein wherein the nonionic surfactant is present at a level which is independently selected from : about 0.1 weight % to about 10 weight %; from about 0.1 weight % to about 6%; from about 0.1 weight % to about 4 weight %, and includes at least one PO/EO/PO block copolymer of formula $\text{HO}(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x-(\text{CH}_2\text{CH}_2\text{O})_y-(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x\text{H}$ wherein the relative weight ratio of EO : PO is independently selected from EO : PO ranges of : from about 10 : 90 to about 90 : 10; from about 20 : 80 to about 80 : 20; from about 30 : 70 to about 70 : 30; from about 40 : 60 to from about 60 : 40; about 40 : 60 and wherein the copolymer has a molecular weight in the range of from: about 2000 to about 4500; about 2500 to about 3500; about 2650.

[0067] The present invention provides a non-enzymatic liquid concentrate cleaning composition as defined herein wherein the nonionic surfactant is present at a level which is independently selected from : about 0.1 weight % to about 10 weight %; from about 0.1 weight % to about 6%; from about 0.1 weight % to about 4 weight %, and is an PO/EO/PO block copolymer of formula $\text{HO}(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x-(\text{CH}_2\text{CH}_2\text{O})_y-(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x\text{H}$ wherein the relative weight ratio of EO : PO is independently selected from EO : PO ranges of : from about 10 : 90 to about 90 : 10; from about 20 : 80 to about 80 : 20; from about 30 : 70 to about 70 : 30; from about 40 : 60 to from about 60 : 40; about 40 : 60 and wherein the copolymer has a molecular weight in the range of from: about 2000 to about 4500; about 2500 to about 3500; about 2650.

[0068] According to a further aspect the present invention provides a non-enzymatic liquid concentrate cleaning composition as defined herein wherein the nonionic surfactant is a PO/EO/PO block copolymer having an EO : PO weight ratio of 40 : 60 and a molecular weight of 2650. An exemplary PO/EO/PO PO block copolymer having an EO : PO weight ratio of 40 : 60 and a molecular weight of 2650 is PL1740. Thus in accordance with a further aspect the present invention provides a non-enzymatic liquid concentrate cleaning composition wherein the nonionic surfactant is PL1740.

[0069] Suitable ethoxylated amine block copolymers for use herein include alkoxyated ethylene diamines. Exemplary alkoxyated ethylene diamines for use herein are the Synperonic T series which are commercially available from Croda, Genapol ED 3030 and Genapol ED 3060 which are available from Clariant. Particular Synperonics for use herein include: SYNPERONIC T/304, alkoxyated ethylene diamine having a molecular weight of 1650; SYNPERONIC T/701, alkoxyated ethylene diamine having a molecular weight of 3600; SYNPERONIC T/707, alkoxyated ethylene diamine having a molecular weight of 25000; SYNPERONIC T/904, alkoxyated ethylene diamine having a molecular weight of 7500; and SYNPERONIC T/908, alkoxyated ethylene diamine having a molecular weight of 25000.

[0070] According to a further aspect the invention provides a non-enzymatic liquid concentrate cleaning composition as defined herein wherein the nonionic surfactant is present at a level independently selected from: about 0.1 weight % to about 15 weight %; from about 0.1 weight % to about 10%; from about 0.1 weight % to about 6 weight %; from about 0.1 weight % to about 4 weight %, and includes at least one ethoxylated amine block copolymer having a molecular weight in the range of from: about 1500 to about 25000; about 1500 to about 8000; about 1600 to about 7500; about 1650.

[0071] The present invention provides a non-enzymatic liquid concentrate cleaning composition as defined herein wherein the nonionic surfactant is present at a level which is independently selected from about 0.1 weight % to about 15 weight %; from about 0.1 weight % to about 10%; from about 0.1 weight % to about 6 weight %; from about 0.1 weight % to about 4 weight %, and is an alkoxyated ethylene diamine.

[0072] According to a further aspect the present invention provides a non-enzymatic liquid concentrate cleaning composition as defined herein wherein the nonionic surfactant is an alkoxyated ethylene diamine having a molecular weight of 1650. An exemplary alkoxyated ethylene diamine having a molecular weight of 1650 is Synperonic T/304, available from Croda. Thus in accordance with a further aspect the present invention provides a non-enzymatic liquid concentrate

cleaning composition wherein the nonionic surfactant is Synperonic T/304.

[0073] For the avoidance of doubt, where a material is described herein in terms of its general composition i.e. an alkoxylated ethylene diamine, with specific properties i.e. molecular weight of 1650, and an exemplary commercially available form is provided it will be readily appreciated that any alternative commercially available material having the same composition will also be suitable for use herein.

[0074] In one embodiment the at least one low foam nonionic comprises Synperonic® T/304.

[0075] According to a further aspect the invention provides a non-enzymatic liquid concentrate cleaning composition as defined herein wherein the nonionic surfactant includes at least one PO/EO/PO block of formula $\text{HO}(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x-(\text{CH}_2\text{CH}_2\text{O})_y-(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x\text{H}$ wherein the relative weight ratio of EO : PO is independently selected from EO : PO ranges of : from about 10 : 90 to about 90 : 10; from about 20 : 80 to about 80 : 20; from about 30 : 70 to about 70 : 30; from about 40 : 60 to from about 60 : 40; about 40 : 60 and wherein the copolymer has a molecular weight in the range of from: about 2000 to about 4500; about 2500 to about 3500; about 2650, and at least one ethoxylated amine block copolymer having a molecular weight in the range of from: about 1500 to about 25000: about 1500 to about 8000; about 1600 to about 7500; about 1650.

[0076] In one embodiment the at least one low foam nonionic comprises a combination of a Pluronic RPE and a Synperonic T, and in particular Pluronics® RPE 1740 and Synperonic® T/304 wherein the total level of low foam nonionic is from about 0.1 weight % to about 15 weight %; from about 0.1 weight % to about 10%; from about 0.1 weight % to about 6 weight %; from about 0.1 weight % to about 4 weight %.

[0077] The present invention is particularly useful for manual and ultrasonic cleaning of surgical instruments and endoscopes where visual inspection is helpful. As detailed hereinafter, compositions according to the invention have been demonstrated to show low foaming at in use concentration and gives a solution which in use concentration is not cloudy at a temperature in the range from 0 to 45°C.

[0078] Further, in use liquid compositions according to the present invention have been demonstrated to provide good cleaning efficacy.

[0079] Suitable additional nonionic surfactants for use herein include the Dehydol, Lankropol, Genapol and Hoesch ranges of surfactants. Exemplary additional non-ionic surfactants for use herein include: fatty alcohol ethoxylate C₁₀ - C₁₆ with 1.2 moles PO and 6.4 moles EO commercially available as Dehydol® 980, from BASF; fatty acid sulphonate commercially available as Lankropol OPA, from AkzoNobel; C₁₂/C₁₅ oxo alcohol PO-EO adduct commercially available from Clariant as Genapol EP 2552; and C₁₂-C₁₄ fatty alcohol alkoxylate 2EO/4PO copolymer commercially available as Hoesch FA 42 LF, from Julius Hoesch; and combinations and mixtures thereof.

[0080] According to an aspect there is provided a non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes comprises:

- (a) 0.1 to 10.0 weight % of a low-foaming surfactant system comprising at least one nonionic surfactant;
- (b) 0.1 to 5.0 weight % of at least one complexing agent;
- (c) 0.1 to 10.0 weight % of at least one source of alkalinity;
- (d) 0.1 to 5.0 weight % of at least one anti-corrosion agent;
- (d) 70 to 99.6 weight % of an aqueous solvent

wherein the pH of the composition is: between 8 and 10; from 8.5 to 9.5; or about 9.5, and wherein the weight ratio of low foaming surfactant to complexing agent is in the range of from about 2 : 1 to about 2 : 3.

[0081] According to a further aspect there is provided a non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes wherein the weight ratio of low foaming surfactant to complexing agent is in the range of from about 2 : 1 to about 2 : 3 and wherein the surfactant is independently selected from: at least one PO/EO/PO block of formula $\text{HO}(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x-(\text{CH}_2\text{CH}_2\text{O})_y-(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x\text{H}$ wherein the relative weight ratio of EO : PO is from about 10 : 90 to about 90 : 10, from about 20 : 80 to about 80 : 20, from about 30 : 70 to about 70 : 30, from about 40 : 60 to from about 60 : 40, or about 40 : 60 and wherein the copolymer has a molecular weight in the range of from about 2000 to about 4500, from about 2500 to about 3500, or about 2650; at least one ethoxylated amine block copolymer having a molecular weight in the range of from: about 1500 to about 25000: about 1500 to about 8000; about 1600 to about 7500; about 1650; and mixtures of said PO/EO/PO and ethoxylated amine block copolymers.

[0082] According to a further aspect there is provided a non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes wherein the weight ratio of low foaming surfactant to complexing agent is in the range of from about 2 : 1 to about 2 : 3, wherein the surfactant is present at a level of from about 0.1% to about 10%, from about 2% to about 8%, from about 3 weight % to about 7 weight %, or about 6 weight %, and especially wherein the surfactant is independently selected from: Pluronic 1740 at a level of from about 3 weight % to about 7 weight %, or about 6 weight %; Synperonic T/304 at a level of from about 1 weight % to about 10 weight %.

[0083] According to an aspect there is provided a non-enzymatic liquid concentrate composition for cleaning surgical,

medical and dental instruments and flexible endoscopes comprises:

- (a) 0.1 to 10.0 weight % of a low-foaming surfactant system comprising at least one nonionic surfactant;
- (b) 0.1 to 5.0 weight % of at least one complexing agent;
- (c) 0.1 to 10.0 weight % of at least one source of alkalinity;
- (d) 0.1 to 5.0 weight % of at least one anti-corrosion agent;
- (d) 70 to 99.6 weight % of an aqueous solvent

wherein the pH of the composition is: between 8 and 10; from 8.5 to 9.5; or about 9.5, and wherein the weight ratio of complexing agent: anti-corrosion agent: source of alkalinity is in of from about 4 : 1 : 4 to about 6 : 1 : 6.

[0084] According to a yet further aspect there is provided a non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes wherein the weight ratio of low foaming surfactant to complexing agent is in the range of from about 2 : 1 to about 2 : 3 and wherein the weight ratio of complexing agent : anti-corrosion agent: source of alkalinity is in of from about 4 : 1 : 4 to about 6 : 1 : 6.

[0085] The invention additionally provides a non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes wherein level of low foam surfactant is from about 2 weight % to about 8 weight %, from about 3 weight % to about 7 weight %, or about 6 weight % and wherein the weight ratio of low foaming surfactant to complexing agent is in the range of from about 2 : 1 to about 2 : 3 and wherein the weight ratio of complexing agent : anti-corrosion agent : source of alkalinity is in the range of from about 4 : 1 : 4 to about 6 : 1 : 6, from about 5 : 1 : 5 to about 5.5 : 1 : 5.5, or from about 5.2 : 1 : 5.2 to about 5.3 : 1 : 5.3.

Complexing Agent

[0086] The compositions herein include one or more complexing agents at a level of from 0.1 weight % to about 10 weight %, from about 0.5 weight % to about 8 weight %, from about 1 weight % to about 6 weight %, from about 2 weight % to about 5 weight %.

[0087] In general, a complexing agent or a sequestrant, is a molecule capable of coordinating (i.e., binding) the metal ions commonly found in natural water to prevent those metal ions from interfering with the action of other deterative ingredients such as surfactants in a cleaning composition. Some complexing agents can also function as threshold agents when included in an effective amount. For a further discussion of complexing agents, see Kirk-Othmer, Encyclopedia of Chemical Technology, Third Edition, volume 5, pages 339-366 and volume 23, pages 319-320.

[0088] The term complexing agent as generally defined herein is one or more agents which are capable of coordinating with metal ions in the wash water, when the compositions are used either as concentrated or diluted aqueous solutions, in order to form stable or transiently stable metal-complexes. Without wishing to be bound to any particular theory, a stable metal complex as defined herein is a complex which binds the metal ions in such a manner that they cannot interfere with the cleaning process, and in some instances such complexes may advantageously precipitate out of solution during the washing process and be simply rinsed away.

[0089] Advantageously some complexing agents, so-called super complexing agents as particularly defined herein, are not only capable of coordinating with metal ions in natural or wash water as discussed herein but are also capable of binding with metallic components within a body soil to be removed during the cleaning process. Without wishing to be bound to any particular theory it is proposed herein that, for example in relation to blood-based soils, certain complexing agents may additionally be capable of binding to Ca-bridges within the protein-based elements of such soil and by such action enhance soil break-down and removal during the cleaning process.

[0090] According to an aspect, the one or more super-complexing agents for use herein includes at least one complexing agents which is capable of coordinating with metal ions in natural or wash water and is capable of binding with metallic components within a body soil to be removed during the cleaning process.

[0091] Super-complexing agents for use herein include one or more small molecule organic complexing agents including aminocarboxylic acid type sequestrants. Suitable aminocarboxylic acid type sequestrants include the acids or alkali metal salts thereof, e.g., amino acetates and salts thereof. Some examples include N-hydroxyethylaminodiacetic acid; hydroxyethylenediaminetetraacetic acid, nitrilotriacetic acid (NTA); methylglycine diacetic acid (MGDA); 2-hydroxyethyliminodiacetic acid (HEIDA); ethylenediamine tetraacetic acid (EDTA); N-hydroxyethyl-ethylenediaminetriacetic acid (HEDTA); diethylenetriammepentaacetic acid (DTPA); ethyloenediamine-tetrapropionic acid triethyltetraamine-hexaacetic acid (TTHSA), and alanine-N,N-diacetic acid; N,N-diacetic acid (GLDA), methylglycinediacetic acid (MGDA), iminodisuccinate (IDS) and the like; and the respective alkali metal ammonium and substituted ammonium salts thereof; and combinations or mixtures thereof.

[0092] Preferred herein as small molecule organic super-complexing agents are materials which when utilised in liquid concentrate compositions provide desirable cleaning performance, particularly versus blood / blood-based soils.

[0093] Preferred small molecule organic super-complexing agents for use herein include: methylglycinediacetic acid

(MGDA), and salts thereof, and especially the tri-sodium salt, commercially available from BASF as Trilon® M Liquid, and particularly where utilized as a 40% aqueous solution. Other examples of Trilon M grades include: Trilon® M Compactate, Trilon® M Granules SG, Trilon® M Granules, Trilon® M Liquid, Trilon® M Powder

[0094] In one embodiment the at least one super complexing agent comprises MGDA.

[0095] In one embodiment the at least one super complexing agent comprises GLDA. Examples of commercially available sources of GLDA suitable for use herein are: GLDA- Na_4 , N,N-diacetic acid tetra sodium salts, also known as L-glutamic acid tetra sodium salt of tetrasodium N,N-bis(carboxymethyl)-L-glutamate, available as Dissolvine GL-47-S (47% liquid), Dissolvine-PD-S (micro-granular) and Dissolvine-38 (38% liquid) from Akzo Nobel.

[0096] According to an aspect the liquid concentrate composition herein includes one or more complexing agents wherein at least one complexing agent is a small molecule organic super-complexing agent.

[0097] According to an aspect the liquid concentrate composition herein includes one or more complexing agents wherein at least one complexing agent is an aminocarboxylic acid or an acid or alkali metal salt thereof, and particularly wherein at least one complexing agent is methylglycinediacetic acid (MGDA), or an acid or alkali salt thereof.

[0098] According to a further aspect the invention provides a non-enzymatic liquid concentrate cleaning composition as defined herein wherein the nonionic surfactant includes at least one PO/EO/PO block of formula $\text{HO}(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x(\text{CH}_2\text{CH}_2\text{O})_y(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x\text{H}$ wherein the relative weight ratio of EO : PO is independently selected from EO : PO ranges of : from about 10 : 90 to about 90 : 10; from about 20 : 80 to about 80 : 20; from about 30 : 70 to about 70 : 30; from about 40 : 60 to from about 60 : 40; about 40 : 60 and wherein the copolymer has a molecular weight in the range of from: about 2000 to about 4500; about 2500 to about 3500; about 2650, and/or at least one ethoxylated amine block copolymer having a molecular weight in the range of from: about 1500 to about 25000; about 1500 to about 8000; about 1600 to about 7500; about 1650, wherein the total level of low foam nonionic is from about 0.1 weight % to about 15 weight %; from about 0.1 weight % to about 10%; from about 0.1 weight % to about 6 weight %; from about 0.1 weight % to about 4 weight %, and wherein the composition includes one or more complexing agents at a level of from at a level of from 0.1 weight % to about 10 weight %, from about 0.5 weight % to about 8 weight %, from about 1 weight % to about 6 weight %, or from about 2 weight % to about 5 weight % and wherein at least one complexing agent is an aminocarboxylic acid or an acid or alkali metal salt thereof.

[0099] In one embodiment the at least one low foam nonionic comprises a Pluronic RPE and/or Synperonic T nonionic surfactant, and in particular Pluronic® RPE1740 and/or Synperonic® T/304 wherein the level of low foam nonionic is from about 0.1 weight % to about 15 weight %; from about 0.1 weight % to about 10%; from about 0.1 weight % to about 6 weight %; from about 0.1 weight % to about 4 weight %, and wherein the, and particularly wherein at least one complexing agent is methylglycinediacetic acid (MGDA), or an acid or alkali salt thereof present at a level of from 0.1 weight % to about 10 weight %, from about 0.5 weight % to about 8 weight %, from about 1 weight % to about 6 weight %, or from about 2 weight % to about 5 weight %.

[0100] Additional, optional complexing agents for use in addition to the super-complexing agents can be included. Where one or more of such optional additional complexing agents is used the total level of such agents is from 0.01 weight % to about 1 weight %. Suitable additional optional complexing agents for use herein are not limited to organic chelating compounds which sequester metal ions in solution, particularly transition metal ions. A variety of suitable additional optional complexing agents can be used in the liquid concentrate cleaning compositions herein including, for example, organic amino- or hydroxy-polyphosphonic acid complexing agents (either in acid or soluble salt forms), carboxylic acids (e.g. polymeric polycarbonate), hydroxycarboxylic acids, aminocarboxylic acids, or heterocyclic carboxylic acids e.g. , pyridine-2-6-dicarboxylic acid (dipicolinic acid), condensed phosphates, inorganic builders, polymeric polycarboxylates, and the like, and combinations or mixtures thereof. Such complexing agents are commercially available.

[0101] Suitable condensed phosphates for use as additional complexing agents herein include sodium and potassium orthophosphate, sodium and potassium pyrophosphate, sodium and potassium tripolyphosphate, sodium hexameta-phosphate.

[0102] Exemplary commercially available additional complexing agents include: phosphonates sold under the trade name DEQUEST® from Thermos or Cublen® from Zschimmer & Schwarz or Briquest® from Rhodia including, for example, 1-hydroxyethylidene-1,1-diphosphonic acid ($\text{CH}_3\text{C}(\text{PO}_3\text{H}_2)_2\text{OH}$) (HEDP) DEQUEST® 2010; amino(tri(methylenephosphonic acid)), ($\text{N}[\text{CH}_2\text{PO}_3\text{H}_2]_3$), available as DEQUEST® 2000, or as Cublen® AP5 from Zschimmer & Schwarz, or as Briquest® 301-50A from Rhodia; ethylenediamine[tetra (methylenephosphonic acid)], available from Thermphos as DEQUEST® 2041; diethylene triamine penta(methylene phosphonic acid), available from Thermphos as DEQUEST® 2066, or as Cublen® D 3217S from Zschimmer & Schwarz; 2-phosphonobutane-1,2-tricarboxylic acid available from Lanxess as Bayhibit® AM; additional commercially available complexing agents include: iminodisuccinate sodium salt, available from Lanxess as Baypure® CX 100/34; sodium gluconate (e.g. granular) and sodium triphosphate (available from Innphos); Versene® 100, Low NTA Versene®, Versene® powder, and Versene® 120 all available from Dow; Dissolvine® D-40 and GL-38 available from Akzo; sodium citrate; and combinations and mixtures thereof.

[0103] In view of the increasing complexity of the regulatory requirements relating to the use of phosphates, the present compositions preferably contain 0.5 wt. % or less of phosphate.

[0104] According to a further aspect there is provided a non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes wherein the weight ratio of low foaming surfactant to complexing agent is in the range of from about 2 : 1 to about 2 : 3 and wherein the complexing agent is independently selected from: methylglycinediacetic acid (MGDA) and/or and salts thereof, and especially the tri-sodium salt; glutamic acid, N,N-diacetic acid (GLDA) and/or and salts thereof, and especially the tetrasodium salt; and mixtures and combinations thereof.

[0105] According to a yet further aspect there is provided a non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes wherein the weight ratio of low foaming surfactant to complexing agent is in the range of from about 2 : 1 to about 2 : 3, wherein the weight ratio of complexing agent: anti-corrosion agent : source of alkalinity is in of from about 4 : 1 : 4 to about 6 : 1 : 6 and wherein the complexing agent is a small molecule organic super-complexing agent as defined herein, and particularly wherein the complexing agent is independently selected from: methylglycinediacetic acid (MGDA) and/or and salts thereof, and especially the tri-sodium salt; glutamic acid, N,N-diacetic acid (GLDA) and/or and salts thereof, and especially the tetrasodium salt; and mixtures and combinations thereof.

[0106] The invention additionally provides a non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes wherein level of low foam surfactant is from about 2 weight % to about 8 weight %, from about 3 weight % to about 7 weight %, or about 6 weight % and wherein ratio of low foaming surfactant to complexing agent is in the range of from about 2 : 1 to about 2 : 3 and wherein the weight ratio of complexing agent : anti-corrosion agent : source of alkalinity is in the range of from about 4 : 1 : 4 to about 6 : 1 : 6, from about 5 : 1 : 5 to about 5.5 : 1 : 5.5, or from about 5.2 : 1 : 5.2 to about 5.3 : 1 : 5.3.

[0107] The one or more additional complexing agents can include one or more organic phosphonates, such as an organic-phosphonic acid and alkali metal salts thereof. Exemplary suitable organic phosphonates for use herein include: 1-hydroxyethane-1,1-diphosphonic acid, $\text{CH}_3\text{C}(\text{OH})[\text{PO}(\text{OH})_2]_2$; aminotri(methylenephosphonic acid): $\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_3$; aminotri(methylenephosphonate), sodium salt; 2-hydroxyethyliminobis (methylenephosphonic acid), $\text{HOCH}_2\text{CH}_2\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2$; ethylenetriaminepenta(methylene phosphonic acid), $(\text{HO})_2\text{POCH}_2\text{N}[\text{CH}_2\text{CH}_2\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2]_2$; diethylenetriaminepenta(methylene-phosphonate), sodium salt, $\text{C}_9\text{H}_{(28-x)}\text{N}_3\text{Na}_x\text{O}_{15}\text{P}_5$ where $x=7$; hexamethylenediamine(tetramethylene phosphonate), potassium salt, $\text{C}_{10}\text{H}_{(28-x)}\text{N}_2\text{K}_x\text{O}_{12}\text{P}_4$ where $x=6$; bis(hexamethylene)triamine (pentamethylenephosphonic acid), $(\text{HO})_2\text{POCH}_2\text{N}[\text{CH}_2]_6\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2$; and phosphorus acid H_3PO_3 ; and other similar organic phosphonates, and mixtures thereof; 2-hydroxyethyliminobis(methylenephosphonic acid), $\text{HOCH}_2\text{CH}_2\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2$; diethylenetriaminepenta(methylenephosphonic acid), $(\text{HO})_2\text{POCH}_2\text{N}[\text{CH}_2\text{CH}_2\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2]_2$; diethylenetriaminepenta(methylenephosphonate), sodium salt, $\text{C}_9\text{H}_{(28-x)}\text{N}_3\text{Na}_x\text{O}_{15}\text{P}_5$ where $x=7$; hexamethylenediamine(tetramethylenephosphonate), potassium salt, $\text{C}_{10}\text{H}_{(28-x)}\text{N}_2\text{K}_x\text{O}_{12}\text{P}_4$ where $x=6$; bis(hexamethylene)triamine(pentamethylenephosphonic acid), $(\text{HO})_2\text{POCH}_2\text{N}[\text{CH}_2]_6\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2$, or salts thereof, such as the alkali metal salts, ammonium salts, or alkylol amine salts, such as mono-, di-, or tetra-ethanolamine salts, picolinic acid or di-picolinic acid salts or mixtures thereof.

Anti-Corrosion Agent / Corrosion inhibitor

[0108] As used herein, the terms anti-corrosion agent or corrosion inhibitor is intended to refer to at least one of, or any combination of, the disclosed corrosion inhibitors, corrosion inhibitor intermediates, and corrosion inhibitor product formulations. A corrosion inhibitor as defined herein is an agent which either acts with or impacts upon another component in the cleaning composition such that the risk of surface damage (to the article to be cleaned) is reduced.

[0109] As used herein, "an effective amount" is intended to refer to an amount by which the referred to component is present to perform its intended function. For example, an effective amount of a corrosion inhibitor is an amount of that component necessary to inhibit corrosion.

[0110] It is vital in many industries that the articles or instruments used in those industries are clean and/or sterilized / disinfected. For example, in the healthcare industry, it is crucial that surgical instruments are cleaned and sterilized / disinfected after every use to ensure that the risk of contamination and infection are minimized. Many of these articles are metallic, and these metallic articles may suffer from corrosion if cleaned with an aggressive cleaning composition. As will be readily appreciated, in the surgical field in particular, patient safety is of paramount importance, and as such ensuring articles are cleaned as thoroughly as possible, will generally take precedence over the desire to ensure equipment longevity by reducing or prevention of corrosion. As such, and as referred to in the background herein, it has become a generally accepted trade-off that the need to use higher alkaline pH levels in non-enzymatic cleaning compositions to deliver a high quality of cleaning, brings an increased risk of article corrosion over time.

[0111] Therefore, it would be advantageous to provide a non-enzymatic alkaline cleaning composition that inhibits the corrosion of articles to be cleaned without inhibiting the cleaning action of the cleaning composition.

[0112] In a further aspect novel liquid concentrate non-enzymatic cleaning compositions for cleaning surgical, medical and dental instruments and flexible endoscopes are provided comprising:

- (a) 0.1 to 15.0 weight % of a low-foam surfactant system comprising at least one nonionic surfactant;
- (b) 0.1 to 5.0 weight % of at least one complexing agent;
- (c) 0.1 to 10.0 weight % of at least one source of alkalinity;
- (d) optionally 0.1 to 10.0 weight % of at least one additional surfactant;
- (e) 0.1 to 5.0 weight % of at least one anti-corrosion agent;
- (f) 55.0 to 99.69 weight % of an aqueous solvent

and wherein the pH of the composition is at least 7.5; from about 7.5 to about 10; from about 7.7 to about 9.8; from about 8.0 to about 9.7; from about 8.5 to about 9.5; and about 9.5.

[0113] According to an aspect there is provided a liquid concentrate non-enzymatic cleaning composition as detailed hereinbefore comprising from 0.1 wt % to 5.0 wt. % of at least one anti-corrosion agent selected from one or more phosphoric acid esters, and/or one or more phosphonic acid esters.

[0114] Suitable for use herein as anti-corrosion agents are alkyl esters of phosphoric acid, particularly mono or di-alkyl esters, phosphonic acids and esters thereof and combinations and mixtures thereof.

[0115] Exemplary phosphate esters for use herein include: Hordaphos® MDAH, phosphoric acid, 2-ethylhexyl ester available from Clariant; Hordaphos® MDGB phosphoric acid, mixed esters with butyl alcohol and ethylene glycol available from Clariant; and combinations and mixtures thereof.

[0116] According to a further aspect the non-enzymatic liquid concentrate compositions as defined according to any aspect herein include at least one anti-corrosion agent at a level of: from about 0.1 wt % to about 5.0 wt. %; from about 0.2 wt % to about 4 wt %; from about 0.5 wt % to about 5 wt %; about 0.95 wt %. For the avoidance of doubt where one or more anti-corrosion agents are present the total level is within the levels defined hereinbefore and within 0.1 wt % to 5 wt %.

[0117] In one embodiment the at least one anti-corrosion agent comprises Hordaphos® MDAH at a level of: from about 0.1 wt % to about 5.0 wt. %; from about 0.2 wt % to about 4 wt %; from about 0.5 wt % to about 5 wt %; about 0.95 wt. %.

[0118] In one embodiment the at least one anti-corrosion agent comprises Hordaphos® MDGB at a level of: from about 0.1 wt % to about 5.0 wt. %; from about 0.2 wt % to about 4 wt %; from about 0.5 wt % to about 5 wt %; about 0.95 wt. %.

[0119] According to an aspect the present invention provides a non-enzymatic liquid concentrate cleaning composition as defined herein wherein the nonionic surfactant includes at least one PO/EO/PO block of formula $\text{HO}(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x(\text{CH}_2\text{CH}_2\text{O})_y(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x\text{H}$ wherein the relative weight ratio of EO : PO is independently selected from EO : PO ranges of : from about 10 : 90 to about 90 : 10; from about 20 : 80 to about 80 : 20; from about 30 : 70 to about 70 : 30; from about 40 : 60 to from about 60 : 40; about 40 : 60 and wherein the copolymer has a molecular weight in the range of from: about 2000 to about 4500; about 2500 to about 3500; about 2650, and at least one ethoxylated amine block copolymer having a molecular weight in the range of from: about 1500 to about 25000: about 1500 to about 8000; about 1600 to about 7500; about 1650 and at least one anti-corrosion agent at a level of: from about 0.1 wt % to about 5.0 wt. %; from about 0.2 wt % to about 4 wt %; from about 0.5 wt % to about 5 wt %; about 0.95 wt % and wherein the anti-corrosion agent is an alkyl ester of phosphoric acid, particularly a mono or di-alkyl ester.

[0120] In one embodiment the at least one low foam nonionic is a Pluronic RPE and/or a Synperonic T, and in particular Pluronic® RPE1740 and/or Synperonic® T/304 wherein the total level of low foam nonionic is from about 0.1 weight % to about 15 weight %; from about 0.1 weight % to about 10%; from about 0.1 weight % to about 6 weight %; from about 0.1 weight % to about 4 weight % and wherein the anti-corrosion agent is independently selected from: Hordaphos® MDGB; Hordaphos® MDAH and mixtures and combinations thereof.

[0121] According to a yet further aspect there is provided a non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes wherein the weight ratio of low foaming surfactant to complexing agent is in the range of from about 2 : 1 to about 2 : 3, wherein the weight ratio of complexing agent: anti-corrosion agent : source of alkalinity is in of from about 4 : 1 : 4 to about 6 : 1 : 6 wherein the complexing agent is a small molecule organic super-complexing agent, and wherein the anti-corrosion agent is one or more alkyl esters of phosphoric acid.

[0122] The invention additionally provides a non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes wherein level of low foam surfactant is from about 2 weight % to about 8 weight %, from about 3 weight % to about 7 weight %, or about 6 weight % and wherein ratio of low foaming surfactant to complexing agent is in the range of from about 2 : 1 to about 2 : 3, wherein the weight ratio of complexing agent: anti-corrosion agent: source of alkalinity is in the range of from about 4 : 1 : 4 to about 6 : 1 : 6, from about 5 : 1 : 5 to about 5.5 : 1 : 5.5, or from about 5.2 : 1 : 5.2 to about 5.3 : 1 : 5.3 and wherein the anti-corrosion agent is independently selected from Hordaphos® MDAH; Hordaphos® MDGB.

[0123] Suitable optional, additional anti-corrosion agents for use herein include phosphonic acids and phosphonic acid esters also known as phosphonates thereof for use as corrosion inhibitors herein are include organic phosphonates, condensed phosphonates, or the like, and mixtures and combinations thereof.

[0124] The at least one phosphonic acid may include a plurality of phosphonic acid or phosphonates including, for

example, organic phosphonates, condensed phosphonates, mixtures thereof, or the like. Suitable condensed phosphonates include sodium and potassium orthophosphonates, sodium and potassium pyrophosphonate, sodium and potassium tripolyphosphonate, sodium hexametaphosphonate.

[0125] Some examples of suitable organic phosphonic acids including their corresponding phosphonates include: Alkyl (C_1 - C_{20}) phosphonic acid: $R[PO(OH)_2]$, where R is C_1 - C_{20} ; 2-carboxy phosphonic acid: $COOH[PO(OH)_2]$; 2-carboxyalkyl (C_1 - C_{20}) phosphonic acid: $COOHR[PO(OH)_2]$, where R is C_1 - C_{20} ; 1-hydroxyethane-1,1-diphosphonic acid: $CH_3C(OH)[PO(OH)_2]_2$; aminotri(methylenephosphonic acid): $N[CH_2PO(OH)_2]_3$; aminotri(methylenephosphonate), sodium salt; 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(methylenephosphonate), sodium salt, $C_9H_{(28-x)}N_3Na_xO_{15}P_5$ ($x=7$); hexamethylenediamine (tetramethylenephosphonate), potassium salt, $C_{10}H_{(28-x)}N_2K_xO_{12}P_4$ ($x=6$); bis(hexamethylene)triamine(pentamethylenephosphonic acid), $(HO)_2POCH_2N[(CH_2)_6N[CH_2PO(OH)_2]_2]_2$; phosphorus acid H_3PO_3 ; and other similar organic phosphonates, and mixtures thereof.

[0126] Further examples include: 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 phosphonate), sodium salt, hexamethylenediamine(tetramethylenephosphonate), potassium salt, $C_{10}H_{(28-x)}N_2K_xO_{12}P_4$ ($x=6$); bis(hexamethylene)triamine(pentamethylenephosphonic acid), $(HO)_2POCH_2N[(CH_2)_6N[CH_2PO(OH)_2]_2]_2$.

Alkaline Source

[0127] The source of alkalinity can be any source of alkalinity that is compatible with the other components of the liquid concentrate non-enzymatic cleaning composition. Exemplary sources of alkalinity include alkali metal hydroxides, alkali metal salts, phosphates, amines, and mixtures thereof.

[0128] The alkalinity of a liquid concentrate composition as defined herein can be adjusted to provide a finished liquid concentrate composition having a desirable pH by adding the source of alkalinity until a pH-value of: at least 7.5; from about 7.5 to about 12; from about 7.5 to about 10.5; from about 7.5 to about 10; from about 7.7 to about 9.8; from about 8.0 to about 9.7; from about 8.5 to about 9.5; and especially about 9.5 is achieved.

[0129] According to an aspect the source of alkalinity is one or more amines. Exemplary amines include alkanolamines selected from the group comprising triethanolamine (TEA), TEA 99%, monoethanolamine (MEA), diethanolamine (DEA), and mixtures thereof. TEA is a preferred amine for use herein.

[0130] Exemplary alkali metal hydroxides include sodium hydroxide, potassium hydroxide, and lithium hydroxide. Alkali metal hydroxides are commercially available as pellets or beads having a mix of particle sizes ranging from 12-100 U.S. mesh, or as an aqueous solution, such as for example, as an about 45 wt.%, as an about 50 wt.%, or as an about 73 wt.% solution. A preferred form of sodium hydroxide is a 50% aqueous solution (caustic soda).

[0131] Exemplary alkali metal salts include sodium carbonate, trisodium phosphate, potassium carbonate, and mixtures thereof. Exemplary phosphates include sodium pyrophosphate, potassium pyrophosphate, and mixtures thereof.

[0132] According to a yet further aspect there is provided a non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes wherein the weight ratio of low foaming surfactant to complexing agent is in the range of from about 2 : 1 to about 2 : 3, wherein the weight ratio of complexing agent: anti-corrosion agent : source of alkalinity is in of from about 4 : 1 : 4 to about 6 : 1 : 6 wherein the complexing agent is a small molecule organic super-complexing agent, wherein the anti-corrosion agent is one or more alkyl esters of phosphoric acid, and wherein the source of alkalinity is one or more amines, and especially one or more alkanolamines.

[0133] The invention additionally provides a non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes wherein level of low foam surfactant is from about 2 weight % to about 8 weight %, from about 3 weight % to about 7 weight %, or about 6 weight % and wherein ratio of low foaming surfactant to complexing agent is in the range of from about 2 : 1 to about 2 : 3, wherein the weight ratio of complexing agent: anti-corrosion agent: source of alkalinity is in the range of from about 4 : 1 : 4 to about 6 : 1 : 6, from about 5 : 1 : 5 to about 5.5 : 1 : 5.5, or from about 5.2 : 1 : 5.2 to about 5.3 : 1 : 5.3 and wherein the source of alkalinity is an alkanolamine, particularly TEA.

[0134] The source of alkalinity, particularly the one or more amines, may be added to the composition in a variety of forms, including for example in the form of liquids (for amines), or as solid beads, dissolved in an aqueous solution or as a combination thereof (for alkali metal hydroxides).

[0135] The source of alkalinity may comprises one or more different sources of alkalinity with the provision that the total level of the source of alkalinity in the present composition is from about 1 wt. % to about 10 wt. %, from about 2 wt. % to about 8 wt. %, from about 3 wt. % to about 6 wt. %, about 5 wt. % of the liquid concentrate non-enzymatic cleaning composition.

Hydrotrope Component

[0136] The liquid detergent concentrate composition may optionally additionally include from 1 weight % to 20 weight % in total of one or more hydrotrope components. It is anticipated, that where present, the one or more hydrotrope components will provide added stability to the liquid concentrate cleaning compositions, primarily by stabilizing the nonionic surfactant component.

[0137] Examples of the hydrotropes include the sodium, potassium, ammonium and alkanol ammonium salts of xylene, toluene, ethylbenzoate, isopropylbenzene, naphthalene, alkyl naphthalene sulfonates, phosphate esters of alkoxyated alkyl phenols, phosphate esters of alkoxyated alcohols, short chain (C8 or less) alkyl polyglycoside, sodium, potassium and ammonium salts of the allcyl sarcosinates, salts of cumene sulfonates, amino propionates, diphenyl oxides, and disulfonates.

[0138] According to an aspect one or more hydrotropes are present in the liquid concentrate cleaning compositions wherein the total level of hydrotrope is provided in an amount of about 1 weight % to about 20 weight %, preferably about 3 weight % to about 15 weight %, further preferred about 5 weight % to about 15 weight %, based on the weight of the liquid concentrate cleaning composition.

[0139] According to an aspect the hydrotrope is a 40% aqueous solution of sodium cumene sulfonate (SCS). According to an aspect the hydrotrope is a 40% aqueous solution of sodium cumene sulfonate (SCS) present at a level of from 5 weight % to about 15 weight %, and preferably about 10 weight %.

Additional components

[0140] The non-enzymatic cleaning compositions may include such additional ingredients or forms of ingredients such as are typically found in manual cleaning compositions such as one or more additional surfactants, one or more dyes, one or more perfumes or odorants, one or more preservatives or antimicrobial agents, one or more hydrotropes, one or more pH adjusting agents, one or more corrosion inhibitors, one or more anti-foaming agents, one or more viscosity adjusting or formulation stabilising agents such as thickening agents.

Additional Surfactant

[0141] The liquid concentrate non-enzymatic cleaning compositions herein may comprise additional surfactants such as one or more cationic surfactants, one or more anionic surfactants, e.g., phosphate ester, alkyl amine oxide, one or more amphoteric so-called zwitterionic surfactants and combinations and mixtures thereof. Where present the total level of additional surfactants is from 0.1 to 10 weight %.

[0142] According to an aspect the non-enzymatic cleaning compositions herein are free of cationic surfactants. According to another aspect the non-enzymatic cleaning compositions herein are free of both cationic surfactants and amphoteric surfactants. According to one aspect the non-enzymatic liquid concentrate cleaning compositions additionally comprise from 1 to 10 weight % of one or more anionic surfactants, and optionally from 0.1 to 2 weight % of one or more anti-foaming agents.

Anionic Surfactants

[0143] As discussed hereinbefore, the non-enzymatic liquid concentrate cleaning composition can include from 1 to 10 weight % of one or more anionic surfactants, and optionally from 0.1 to 2 weight % of one or more anti-foaming agents. Exemplary anionic surfactants that can be used include organic carboxylates, organic sulfonates, organic sulfates, organic phosphates and the like, particularly linear alkylaryl sulfonates, such as alkylarylcarboxylates, alkylarylsulfonates, alkylarylphosphates, and the like. These classes of anionic surfactants are known within the surfactant art as linear alkyl benzyl sulfonates (LABS), alpha olefin sulfonates (AOS), alkyl sulfates, and secondary alkane sulfonates.

[0144] The anionic surfactants can be provided in the composition in an amount of from: 0 to about 10 weight%; from about 1 weight % to about 10 weight %; from about 2 weight % to about 9 weight %; from about 3 weight % to about 8 weight %; or about 5 weight %, based on the weight of the total non-enzymatic liquid concentrate cleaning composition, as defined hereinbefore.

Cationic Surfactants

[0145] The non-enzymatic liquid concentrate cleaning compositions herein can include from 0.1 to 1 weight % of one or more cationic surfactants. Where the composition includes one or more anionic surfactants no cationic surfactant is present.

[0146] Suitable cationic surfactants include quaternary ammonium compounds having the formula of $RR'R''R'''N^+X^-$,

where R, R', R'' and R''' are each a C₁-C₂₄ alkyl, aryl or arylalkyl group that can optionally contain one or more P, O, S or N heteroatoms, and X is F, Cl, Br, I or an alkyl sulfate.

[0147] Each of R, R', R'' and R''' can independently include, individually or in combination, substituents including 6 to 24 carbon atoms, preferably 14 to 24 carbon atoms, and more preferably, 16 to 24 carbon atoms. Each of R, R', R'' and R''' can independently be linear, cyclic, branched, saturated, or unsaturated, and can include heteroatoms such as oxygen, phosphorous, sulfur, or nitrogen. Any two of R, R', R'' and R''' can form a cyclic group. Any one of three of R, R', R'' and R''' can independently be hydrogen. X is preferably a counter ion and preferably a non-fluoride counter ion. Exemplary counter ions include chloride, bromide, methosulfate, ethosulfate, sulfate, and phosphate.

[0148] The quaternary ammonium compound includes alkyl ethoxylated and/or propoxylated quaternary ammonium salts (or amines).

[0149] Preferred alkyl groups contain between about 6 and about 22 carbon atoms and can be saturated and/or unsaturated. The degree of ethoxylation is preferably between about 2 and about 20, and/or the degree of propoxylation is preferably between about 0 and about 30. In an embodiment, the quaternary ammonium compound includes an alkyl group with about 6 to about 22 carbon atoms and a degree of ethoxylation between about 2 and about 20. An exemplary cationic surfactant is commercially available under the name Berol 563 from Akzo-Nobel.

[0150] Additional cationic surfactants suitable for use include ethoxylated and/or propoxylated alkyl amines, diamines, or triamines.

Amphoteric Surfactants

[0151] The non-enzymatic liquid concentrate cleaning compositions herein can include from 0.1 to 5 weight % of one or more amphoteric surfactants. Examples of suitable amphoteric surfactants include capryloamphopropionate, disodium lauryl B-iminodipropionate, cocoamphocarboxypropionate, and disodium octylimino dipropionate.

[0152] The amphoteric surfactants can be provided in the composition in an amount of about 0 weight % to about 5 weight %; from 0.1 to 5 weight %, 1 to 5 weight %; 2 to 5 weight %, based on the weight of the total liquid concentrate composition.

pH Adjusting Agent

[0153] The pH value of the non-enzymatic liquid concentrate cleaning composition herein can be adjusted by adding an acidic or basic pH adjusting agent. The selection of any particular agent will be dependent upon the starting pH of the liquid concentrate cleaning composition, or in use solution to be adjusted, and desired pH to be achieved. Typically, the pH adjusting agent is provided as part of the liquid concentrate cleaning composition.

[0154] The pH adjusting agent can be provided in a form that allows it to take effect at a certain point in time during the manual or automatic washing process i.e. during use. For example, the pH adjusting agent can be coated in a manner that provides for release of the pH adjusting agent after a length of time. In addition, the pH-adjusting agent can be a component that is generated as a result of a reaction.

[0155] Accordingly, the pH-adjusting agent can provide the desired pH shift to a second pH after the composition has been provided at the first pH for a desired length of time.

[0156] When the pH adjusting agent is used to increase the pH, it can be referred to as an alkaline agent. Exemplary alkaline agents that can be used has been already mentioned above and referred to as "source of alkalinity". Triethylamine (TEA) and particularly 99% TEA is a preferred source of alkalinity herein.

[0157] When the pH adjusting agent is used to lower the pH, it can be referred to as an acidifying agent. Exemplary acidifying agents include inorganic acids, organic acids, and mixtures of inorganic acids and organic acids. Exemplary inorganic acids that can be used include mineral acids such as sulphuric acid, nitric acid, hydrochloric acid, and phosphoric acid. Exemplary organic acids that can be used include carboxylic acids including monocarboxylic acids and polycarboxylic acids such as dicarboxylic acids. Exemplary carboxylic acids include aliphatic and aromatic carboxylic acids. Exemplary aliphatic carboxylic acids include acetic acid, formic acid, halogen-containing carboxylic acids such as chloroacetic carboxylic acid, and modified carboxylic acids containing side groups such as -OH, -R, -OR, -(EO)_x, -(PO)_x, -NH₂, and -NO₂ wherein R is a C₁ to C₁₀ alkyl group. Exemplary aromatic carboxylic acids include benzoic carboxylic acid, salicylic carboxylic acid, and aromatic carboxylic acid modified to include as a side group at least one of halogen, -OH, -R, -OR, -(EO)_x, -(PO)_x, -NH₂, and -NO₂ wherein R is a C₁ to C₁₀ alkyl group. Additional exemplary organic acids include oxalic acid, phthalic acid, sebacic acid, adipic acid, citric acid, maleic acid, and modified forms thereof containing side groups including halogen, -OH, -R, -OR, -(EO)_x, -(PO)_x, -NH₂, and -NO₂ wherein R is a C₁ to C₁₀ alkyl group. It should be understood that the subscript X refers to repeating units. Additional exemplary organic acids include fatty acids such as aliphatic fatty acids and aromatic fatty acids. Exemplary aliphatic fatty acids include oleic acid, palmitic acid, stearic acid, and C₃-C₂₆ fatty acids that may be saturated or unsaturated, and sulfonated forms of fatty acids. An exemplary aromatic fatty acid includes phenylstearic acid. Additional acids that can be used include

peroxycarboxylic acid such as peroxyacetic acid, and phthalimidopercarboxylic acids. Additional acidic pH adjusting agents include carbon dioxide and ozone.

[0158] According to an aspect the pH adjusting agent is an acidifying agent, more particularly an organic acid, and especially citric acid.

[0159] According to an aspect the pH adjusting agent is an acidifying agent, more particularly an organic acid, and especially citric acid and the source of alkalinity is an amine, more particularly triethylamine (TEA).

[0160] The pH can be adjusted by adding the pH adjusting agent and/or by allowing the pH adjusting agent to cause a pH shift. For example, the pH adjusting agent can be formed *in situ* by reaction and/or the pH adjusting agent can be coated and, once the coating is degraded, the pH adjusting agent can become exposed to the liquid concentrate cleaning composition.

Preservative

[0161] One or more preservatives also known as antimicrobial agents or biocides are typically included in the non-enzymatic liquid concentrate cleaning compositions herein at a total preservative level of from 0.01 weight % to 2 weight %.

[0162] Any suitable preservative can be used. Exemplary preservatives for use include: phenoxyethanol, and 1,2-Benzisothiazol-3(2H)-on (BIT) commercially available within the Nuosept® product range from Ashland.

[0163] According to an aspect the non-enzymatic liquid concentrate cleaning compositions include one or more preservatives at a total level of from 0.05 weight % to 1.0 weight %, from 0.1 weight % to 1 weight %.

Dyes/Odorants

[0164] Various dyes, odorants including perfumes, and other aesthetic enhancing agents may also be included in the composition. Dyes may be included to alter the appearance of the composition, as for example, Patent Blue V, 4-[4,4',-Bis-diethylamino- α -hydroxy-benzhydryl]-6-hydroxy-benzol-1,3-disulfoacid, also known as iso-sulphan blue available from Sigma-Aldrich, Direct Blue 86 (Miles), Fastsol Blue (Mobay Chemical Corp.), Acid Orange 7 (American Cyanamid), Basic Violet 10 (Sandoz), Acid Yellow 23 (GAF), Acid Yellow 17 (Sigma Chemical), Sap Green (Keyston Analine and Chemical), Metanil Yellow (Keystone Analine and Chemical), Acid Blue 9 (Hilton Davis), Sandolan Blue/ Acid Blue 182 (Sandoz), Hisol Fast Red (Capitol Color and Chemical), Fluorescein (Capitol Color and Chemical), Acid Green 25 (Ciba-Geigy), and the like.

[0165] Fragrances or perfumes that may be included in the compositions include, for example, terpenoids such as citronellol, aldehydes such as amyl cinnamaldehyde, a jasmine such as CIS-jasmine or jasmal, vanillin, and the like.

[0166] For liquid concentrate cleaning compositions the total level at which one or more dyes, or one or more perfumes or odorants may be independently included is from about 0.0001 to about 0.2 weight %.

[0167] As will be readily appreciated the novel non-enzymatic cleaning compositions provided herein are suitable for cleaning a wide variety of articles including: surgical, medical or dental instruments; surgical probes including flexible endoscopes; ware including food plates or platters, food containers or cutlery; beverage containers including bottles, glasses, jugs, cups or mugs.

[0168] Such cleaning can be carried out manually or automatically in accordance with the methods detailed herein wherein the selection of the cleaning route will be dependent upon the nature of the article to be cleansed. As previously described and as exemplified hereinafter surgical, medical or dental instruments; surgical probes including flexible endoscopes are preferably cleansed using manual methods.

[0169] As detailed hereinbefore, cleaning solutions comprising the novel non-enzymatic compositions herein are substantially non-corrosive to metals such as stainless steel, anodized aluminium, aluminium, copper and brass which are often at risk of damages when soaked in previously available alkaline cleaning products.

[0170] The cleaning solution provided by the invention can be used for any suitable purpose.

[0171] Preferably, it is employed as a soak cleaner for medical and surgical instruments, dental hand piece, and the like, for both human and veterinary practice. When used as a soak cleaner, it is applied before the instruments are disinfected. It can also be readily used as a concentrate to be added to ultrasonic baths and to automatic washers, for cleaning more elaborate medical equipment.

[0172] As detailed previously herein, when employed in automatic washing systems, it is important that the surfactant, or detergent, component has low foam characteristics to avoid machine malfunction due to excessive foam formation. The cleaning and detergent solutions comprising an aqueous solution of the non-enzymatic cleaning compositions as defined herein are readily employed at elevated temperatures, as high as about 45°C.

[0173] Foreign matter to be cleaned or removed includes, for example, biological substances, e.g., tissue and blood. Foreign matter also includes other materials such as lubricant, diagnostic and therapeutic compositions, materials for pathology testing, medical or veterinary research, and the like, remaining on instruments after these are employed for their intended use. Foreign matter also includes pathogens including bacteria, viruses, and prions. For the avoidance

of doubt, the term "instrument" as used herein is intended to be defined broadly, to include any articles, items, objects, implements or devices for which the gentle removal of organic or biological substances, such as protein, fats, carbohydrates and similar material is desirable. Simply by way of example and without limitation, instruments are implements employed in patient or client contact (human or veterinary) during the practice of surgery, medicine, dentistry, podiatry, pathology for e.g., therapeutic, diagnostic and/ or research purposes. Examples include, surgical instruments, e.g., scalpels, probes, clamps, etc., endoscopes, operating room or dental hand-pieces, ventilation tubes, and the like. Surgical instruments and equipment inevitably pick up amounts of bio-burden on them after being employed in operations on humans or animals.

[0174] Surgical instruments include for example rigid and flexible probes and scopes, and specifically including flexible endoscopes, laparoscopic instruments, trays and anything that gets soiled with body fluids which result in them having varying amounts of bio-burden on them after being so used.

[0175] Other articles that may be cleansed with solutions of the novel non-enzymatic compositions as detailed herein also include miscellaneous other instruments and/or implements employed in cosmetic and beauty applications. These applications include hair cutting, nail care, body art, skin piercing, collection of body fluids, e.g., blood, and blood separation and fractionation equipment, and similar such applications, that are too numerous to mention. The novel non-enzymatic compositions are also contemplated for use in cleaning implements and items employed in the food processing and pharmaceutical industries.

Experimental Methods

Method of Preparation of Cleaning Compositions

[0176] Cleaning compositions as defined hereinbefore can be made in accordance with the following method.

Method of Preparation of a Use Solution

[0177] A use solution of a test composition is prepared by diluting the composition with water at room temperature (RT). For the avoidance of doubt, and unless specifically defined to the contrary, RT as defined herein is a temperature in the range of from 20°C to about 23°C, and especially about 20°C. The concentration of the test composition in water, the so-called "use solution" can be varied according to the nature of the particular assessment to be undertaken. Typically use solutions having test composition aqueous concentration levels of 10%, 5%, 1%, 0.5%, 0.3% or 0.2% can be tested using in the methods detailed herein.

Test for Efficacy of Cleaning Compositions [Blood Cleaning Efficacy]

[0178] The purpose of this test is to enable to measurement of the efficiency of blood cleaning performance of different cleaning compositions. To ensure consistency in the trends in cleaning efficacy observed between different test compositions, and different test runs it is important to ensure that the test compositions are exposed to blood coupons for the same contact time. In the present test methodologies as detailed in the results section herein contact times of 5 minutes and 2 minutes have been used, although shorter or longer contact time periods may be used depending upon the nature of the substrate (metal coupon) or soil (blood etc) being tested. Furthermore, it is recommended that where it is intended to make comparisons between the results obtained for different test compositions against a particular soil on a particular coupon, that soiled coupons from a common batch are used for each test compositions in order to minimize batch-to-batch inconsistencies.

[0179] A batch of coupons is prepared as follows: Stainless steel coupons (5x5x0.1 cm) are cleaned and degreased with acetone for preparation. The coupons were dried prior to soiling by placing them on a bench for 30min. Typically 3 coupons were tested for each concentration of a particular formula. The combined weight of all the coupons is then measured and recorded. 0.2 g of reactivated sheep blood (commercially available from for example from Fiebig-Nährstofftechnik) is weighed out and delivered onto each coupon and spread across the coupon surface. For ease of handling and to avoid contamination of the test area it can be useful to leave a small frame, typically around 3mm around the outside of each coupon thereby providing a soil-free (clean) handling area. The soiled coupons are then dried in a drying cabinet for 1 hour at 45°C. After cooling down to room temperature the combined weight of all the dried, soiled coupons is measured and recorded.

[0180] 400ml of an aqueous use solution of a test Composition at the desired aqueous concentration level of: 0.2%, 0.5% and/or 1% is prepared in the required water (de-ionised, tap / 14°C dH DE, or Hard / 23°C dH DE as detailed hereinbefore, but at a temperature of 20°C to 23°C and added into a standard 500ml beaker. The test coupons (one coupon per beaker, 3 coupons per formula) were immersed in the test solution and left for 5 minutes without agitation, in an environment where the external temperature is from 20°C to 23°C RT. At the end of this 5 minute test solution

contact time, the coupons were removed and immersed in clean water for rinsing. Then the test coupons were dried at ambient temperature (20 to 23°C) overnight.

[0181] The level of soil removal is evaluated both visually and gravimetrically. The total starting weight of the coupons with dried blood (i.e. the pre-immersion weight) minus the total weight of the clean coupons (i.e. the pre-soiling weight) is equal to the blood load. The total weight of the cleaned coupons (i.e. the post-immersion and drying weight) minus the weight of the clean coupons (i.e. the pre-soiling weight) is equal to the blood load after cleaning, namely the remaining blood load.

[0182] Using this approach the cleaning efficacy can be calculated. The result in form of the cleaning efficacy is given in percent. The tests were repeated a minimum of three times and average results (in percent) are reported.

Test for Foam Performance [Foam Height - manual tilting/shaking method]

[0183] A use solution of a composition to be tested in water is prepared at room temperature (RT). For the avoidance of doubt, and unless specifically defined to the contrary, RT as defined herein is a temperature in the range of from 20°C to about 23°C. The concentration of test composition in water can be varied according to the nature of the particular assessment to be undertaken. Typically use solutions having test composition aqueous concentration levels of 10%, 5%, 1% or 0.5% are tested using this method.

[0184] A sample of the use solution to be tested (100 ml) is poured, placed or otherwise filled into a 250 ml measuring cylinder (height: 30.5cm, width: 3.7cm). The cylinder is closed with a polyethylene (PE) plug. Any suitable PE plug which effectively seals the cylinder and prevents or substantially limits the escape of test solution can be used. The so-closed cylinder is then tilted 20 times from a substantially upright position to a substantially upended / upside down position. The resultant foam height in the cylinder is measured as soon as practicably possible following the removal of the plug. This measurement provides a baseline, 0 minute foam height. The foam height is then measured at further pre-defined time points, of 1 and 5 minutes thereafter. The foam height in the measuring cylinder is measured with a ruler and documented in millimetres (mm).

[0185] This test is repeated minimum three times.

[0186] Before the test the measuring cylinder is cleaned and rinsed with ethanol for degreasing; followed by rinsing with demineralized water.

Test for Cleaning Solution Clarity [Turbidity / Cloud point]

[0187] As defined hereinbefore the cloud point is the temperature where a liquid product becomes cloudy. To determine the cloud point of a test composition a use solution is prepared and an assessment of its clarity is made using the naked eye. As detailed hereinbefore a use solution is a solution of a composition to be tested in water. The concentration of the use solution of a test composition can be varied according to the nature of the particular assessment to be undertaken. Typically use solutions having test composition aqueous concentration levels of 10%, 5%, 1%, 0.5%, 0.3% or 0.2% can be tested using this method. For the avoidance of doubt where a solution is described as being "clear" in the results section herein this means that to the naked eye the solution is crystal clear, whilst a solution which is described as "turbid" is non-clear or cloudy.

[0188] The relative stability of test compositions in different water conditions can be measured by recording the cloud points of use solutions prepared from water of different degrees of (°dH).

[0189] The use solution at the desired concentration level is filled into a 150 ml beaker at room temperature (RT). The temperature is raised slowly and monitored with a thermometer. To ensure consistency between the results for different test samples, the means for increasing the temperature includes any suitable graduated heating method which can be pre-set or pre-programmed. The temperature at which the test composition use solution shows the first signs of cloudiness, as observed by the naked eye, during heating is documented. The heating is stopped and the solution is allowed to cool naturally. Both the solution and the temperature are observed during this cooling period. The temperature is documented when the solution first becomes clear again.

[0190] Using this method cloud points are determined with an accuracy of 0.5°C. Typically the test is repeated at least twice to ensure consistency of results.

Test for Material Compatibility

[0191] In-use solutions of the compositions to be tested at the desired concentration level are prepared as indicated hereinbefore. The test solutions can be prepared in de-ionised (DI) or tap water as desired. Tap water is a more likely real-life scenario, whilst DI water provides a worst-case, stress test scenario. The metal materials to be assessed for compatibility with the test composition solutions are provided as metal plates, such as for example Steel or Aluminium plates. Whilst the size of the plates can vary it is important that the same size and material of plates are used for each

test solution within any group of tests. Typically plates of (12cm by 6cm by 0.1cm) are used.

[0192] The weight of each plate is measured in its dry state prior to testing, and again post-immersion. In each case, the testing is carried out at room temperature and each test plate is fully immersed in an in-use solution of 500ml of the test composition at the desired aqueous concentration, for example 0.5%, in a suitable container, such as for example in a beaker (600ml).

[0193] After one week each of the test plates was rinsed off with DI water, dried and the weight was re-measured. On the following day the plates were immersed again (in freshly prepared test solutions) and the procedure was repeated twice more. The results obtained from this test can be provided either as raw data set or as an average data set of the average % weight loss.

[0194] All of the compositions and methods disclosed and claimed herein can be made and executed without undue experimentation in light of the present disclosure. While this invention may be embodied in many different forms, there are described in detail herein specific preferred embodiments of the invention. The present disclosure is an exemplification of the principles of the invention and is not intended to limit the invention to the particular embodiments illustrated. In addition, unless expressly stated to the contrary, use of the term "a" is intended to include "at least one" or "one or more." For example, "a nonionic surfactant" is intended to include "at least one nonionic surfactant" or "one or more nonionic surfactant."

[0195] Any ranges given either in absolute terms or in approximate terms are intended to encompass both, and any definitions used herein are intended to be clarifying and not limiting. Notwithstanding that the numerical ranges and parameters setting forth the broad scope of the invention are approximations, the numerical values set forth in the specific examples are reported as precisely as possible. Any numerical value, however, inherently contains certain errors necessarily resulting from the standard deviation found in their respective testing measurements. Moreover, all ranges disclosed herein are to be understood to encompass any and all sub ranges (including all fractional and whole values) subsumed therein.

[0196] Furthermore, the invention encompasses any and all possible combinations of some or all of the various embodiments described herein. It should also be understood that various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the invention and without diminishing its intended advantages. It is therefore intended that such changes and modifications be covered by the appended claims.

[0197] The following experimental results are based on various compositions. The function, chemical and trade names of the components used in these compositions are as follows:

Component	Chemical Name	Trade Name
Solvent	Water	Aqua purificata
Solvent	1,2 Dihydroxy propane	Propylene glycol
Solvent	Ethanol azeotrope 96%	Ethanol azeotrope 96%
Corrosion inhibitor	Benzotriazole	Preventol BZT
Hydrotrope	sodium cumene sulphonate	Na cumene sulphonate, 40%
Super-complexing agent	Glutamic acid, N,N-diacetic acid, tetrasodium salt, 38% solution(GLDA)	Dissolvine GL-38
Nonionic surfactant	Fatty alcohol alkoxylate	Genapol EP 0244
wetting, dispersing, and emulsifying agent.	Octyl sulphate	Texapon 842
Nonionic surfactant	Block copolymer (PO-EO-PO)	Pluronic RPE 1720
polyfunctional surfactant	Sodium-N-lauryl-β-iminodipropionate	Deriphat 160 C
Nonionic surfactant	Block copolymer (PO-EO-PO)	Pluronic RPE 1740
Enzyme	Protease	Purafect Prime 4000L
Preservative	2-Methyl-2H-Isotiazol-3-One (MIT) and 1,2-Benzisotiazol-3(2H)-on (BIT)	Nuosept BM 22
Preservative	Phenoxyethanol	Protectol PE
Alkalinity	Triethanolamine 99%	Triethanolamine 99%

(continued)

Component	Chemical Name	Trade Name
Wetting agent	Propan-1,2,3-triol	Glycerin
pH adjust	Citric acid monohydrate	Citric Acid monohydrate
pH adjust	Sodium hydroxide, 50% solution	Sodium Hydroxide 50%
Nonionic surfactant	Alcohols, C10-16, ethoxylated, propoxylated	Dehydol 980
Anti-corrosion agent / corrosion inhibitor	Phosphoric acid ester	Hordaphos MDGB
Nonionic Surfactant	Alkoxylated ethylene diamine	Synperonic T/304
Anti-corrosion agent /c corrosion Inhibitor	Phosphoric acid, 2-ethylhexyl ester	Hordaphos MDAH
Super-complexing agent	Methylglycine diacetic acid, tri sodium salt, 40% solution (MGDA)	Trilon M Liquid
Dye	4-[4,4'-bis-diethylamino- α -hydroxy benzhydryl]-6-hydroxy-benzol-1,3-disulfoacid	Patentblue 85 E 131; Food Blue 5 CI 42051 DRM

Experimental Results

1. Foam Height, pH and Clarity of Compositions

[0198] The purpose of this experiment was to determine whether a series of test formulations, Compositions E, F, G which contained varying levels of at least PL1740 as a nonionic surfactant and 10% GLDA as a super-complexing agent could provide desirable foam heights in combination with clarity across conditions and retain elevated (alkaline) pH. The foam height, clarity and pH retention of Compositions E, F, G were compared to an enzyme containing formulation, Sekusept Multienzyme, Composition J, and two further comparator formulations, Compositions H and I based on alternative nonionic surfactants at a total level of 4%, and each containing GLDA at 10%, and again formulated at elevated pH.

[0199] The formulation details of Compositions E to J as well as physical properties (pH and visual appearance) of formulations E to I and multi-enzyme formulation J is also provided in Table 1. The relative composition of the components in formulations E to I are shown as weight percentages, wt. %, out of a total composition level of 100.00.

[0200] Table 1 additionally provides data relating to foam height, as well as clarity and pH data for each formulation, at the point of manufacture, after 24 hours (at room temperature), and in 1% use solutions in de-ionised water and in tap water (14°dH DE).

[0201] As can be seen from the results in Table 1, test Composition E which contained PL1740-alone was clear at the point of manufacture but became cloudy after 24 hours. Test Compositions F and G provided desirable clarity under all conditions and demonstrated improved foam height results both initially and after 1 minute in 1% solutions in both de-ionised and tap water.

[0202] Again, the initial pH and pH in de-ionised water were maintained at desirable elevated levels, whilst in tap water solution the pH level fell below the pH 9.5 target.

[0203] The foam heights were determined using the methodology as detailed in the Experimental Methods section herein. For the avoidance of doubt, the faster the foam dissipates the more desirable the foam performance.

[0204] None of the test or comparator formulations was able to provide foam performance at the levels provided by the multi-enzyme formulation I.

TABLE 1

Component	Trade Name	E	F	G	H	I	J
Solvent	Aqua purificata	75.25	75.25	75.25	75.25	75.25	N/A
Corrosion inhibitor	Preventol BZT	0.20	0.20	0.20	0.20	0.20	N/A
Hydrotrope	Na cumene sulphonate	-	-	-	-	-	N/A

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(continued)

Component	Trade Name	E	F	G	H	I	J
Super Complexing agent	Dissolvine GL-38	10.00	10.00	10.00	10.00	10.00	N/A
Nonionic surfactant	Dehydol 980	-	-	-	-	2.00	N/A
Nonionic surfactant	Pluronic RPE 1740	4.00	3.00	2.00	-	-	N/A
polyfunctional surfactant	Deriphat 160 C	-	1.00	2.00	4.00	2.00	N/A
Preservative	Nuosept BM 22	0.20	0.20	0.20	0.20	0.2	N/A
Alkalinity	Triethanolamine 99%	10.00	10.00	10.00	10.00	10.00	N/A
pH adjust	Citric Acid monohydrate	0.35	0.35	0.35	0.35	0.35	N/A
TOTAL		100.0	100.0	100.0	100.0	100.0	N/A
Appearance		clear	clear	clear	clear	clear	clear, blue
Appearance > 24 hours		turbid	clear	clear	clear	clear	clear, blue
pH		10.8/9.5	10.3 / 9.5	10.0/9.5	10.0/9.5	10.1 / 9.5	8.6
pH in deionised		10.10	10.00	10.00	10.00	9.90	8.3
Appearance in 1% (deionised solution)		-	clear	clear	clear	clear	clear, bluish
pH 1% in Tap water (14°dH DE)		-	8.60	8.60	8.60	8.60	7.90
Appearance in 1% Tap water solution		-	clear	clear	clear	clear	clear, bluish
Foam test/Tap water (min. / cm)		-	0/5 1 / 0	0/5 1 / 1	0/7 1 / 5	0/7 1 / 6.5	0/2 10sec / 0
Foam test / de-ionised water (min. / cm)		-	0/5 1 / 0.7	0/6 1 / 3	0/6 1 / 5	0/8 1 / 7	0/2 10sec/ 0

[0205] As can be seen from the results in Table 1, test Compositions F and G provide desirable clarity under all conditions.

2.1 Core Stability, Foam Height, pH and Clarity of Compositions

[0206] A series of experiments was designed to explore the stability of the core system: the nonionic, the super-complexing agent and the source of alkalinity. Two test formulations were prepared, Composition K and Composition L, and the cores for stability were assessed via selective removal of one or more elements and observation of whether a stable formulation could be prepared. For the avoidance of doubt a stable formulation is an emulsified formulation and an unstable formulation is a formulation which separates.

[0207] The relative composition of the components in formulations K and L are shown as weight percents, wt. %, out of a total composition level of 100.00 in Table 2.

[0208] Table 2 additionally provides information as to the method of preparation of test Compositions K and L.

TABLE 2

Component	Trade Name	K	Order	L	Order
Solvent	Aqua purificata	72.37	1	78.37	1
Nonionic surfactant	Pluronic RPE 1740	6.00	2	-	-
Nonionic Surfactant	Synperonic T/304	-	-	10.00	2
Hydrotrope	Na cumene sulphonate	10.00	3	-	-
Super-complexing agent	Trilon M Liquid	5.00	4	5.00	3
Alkalinity	Triethanolamine 99%	5.00	5	5.00	4
Corrosion Inhibitor	Hordaphos MDAH	0.95	6	0.95	5
Preservative	Protectol PE	0.5	7		
Preservative	Nuosept BM 22	-	-	0.5	6
Dye	Patent Blue 85 E 131	0.0015	8	0.0015	7
pH adjust	Citric acid monohydrate	0.18	9	0.18	8
TOTAL		100.00	100.00	100.00	100.00
pH		9.5		9.5	

[0209] The results obtained from examination of the stability of a series of sub-formulations based on Compositions K and L confirmed that for Composition K, only the dye and citric acid could be removed without a detrimental impact on stability, whilst for Composition L, the dye, citric acid, preservative and corrosion inhibitor can all be removed without detrimental effect to the stability of the core of the emulsion composition.

2.2 Core Stability, Foam Height, pH and Clarity of Compositions

[0210] A series of experiments was designed to explore the impact of varying the MGDA level in further test formulations similar to Composition L as discussed herein before. Three test formulations were prepared, Compositions M, N, and O. Surprisingly all three compositions provided excellent foam height data as well as desirable emulsion clarity in tap water-based and hard-water based, in use solutions. This is unexpected because normally increased levels of stabilizing agents would be required to provide these levels of emulsion stability (clarity) in very hard water conditions.

[0211] The relative composition of the components in formulations M, N and O are shown as weight percents, wt. %, out of a total composition level of 100.00 in Table 3.

[0212] Table 3 additionally provides information as to the method of preparation of test Compositions M, N and O.

TABLE 3

Component	Trade Name	M	N	O	Order
Solvent	Aqua purificata	75.30	77.21	68.37	1
Nonionic surfactant	Synperonic T/304	-	-	10.00	2
Super-complexing agent	Trilon M Liquid	5.00	2.50	10.00	3
Alkalinity	Triethanolamine 99%	15.00	15.00	15.00	4
pH adjust	Citric acid monohydrate	1.50	2.09	3.48	5
Preservative	Protectol PE	0.5	-	-	6
Preservative	Nuosept BM 22	-	0.20	0.20	6
TOTAL		100.00	100.00	100.00	
pH		9.5	9.5	9.5	

(continued)

Component	Trade Name	M	N	O	Order
Appearance, 24h in 1% solution, tap water at 14°dH DE		Clear	Clear	Clear	
Appearance, 24h in 1% solution, hard water at 32°dH DE		Clear	Clear	Clear	
Foam test / Tap water (min. / cm)		0/5 20s / 0	0/5 20s / 0	0/5 20s / 0	

2.3 Core Stability, Foam Height, pH and Clarity of Compositions

[0213] A further series of five formulations, Compositions P, Q, R, S, T was prepared which included combination of a super complexing agent, MGDA with TEA as the source of alkalinity (at the same level in each formulation) in combination with either T304 or PL1740 (nonionics), and either Hordaphos MDAH or MDGB (corrosion inhibitors). The results presented in Table 4 illustrate the impact of varying the nonionic/corrosion inhibitor combinations.

[0214] Comparisons between P and Q show that reducing the pH leads to initially turbid concentrates, whilst comparing R, S and T shows that increasing the pH (to 12.1) does not affect initial clarity. The final pHs of the concentrates were all -9.5. The foam test results indicate that PL1740 is a better nonionic for the provision of low foaming, than T304.

[0215] These results also confirm, in the T304-based compositions, that varying the type or level of the corrosion inhibitors does not adversely impact upon the stability of the formulations.

[0216] Formulation Q was prepared at a below target pH level (pH 8.62), and was found to be turbid on initial formulation, this confirms the value of maintaining the target pH level of pH 9.5 or above.

[0217] Surprisingly the results demonstrate that compositions according to the invention, Compositions R, S and T provide clear compositions with acceptable foam performance (although not as low as for P or Q) in the absence of propylene glycol.

[0218] The relative composition of the components in formulations P to T are shown as weight percents, wt. %, out of a total composition level of 100.00 in Table 4. Table 4 additionally provides information as to the order of addition for preparation.

TABLE 4

Function	Trade Name	P	Q	R	S	T	Order
solvent	Aqua purificata	59.90	59.30	82.5	81.5	81.8	1,9
solvent	Propylene Glycol	10.00	10.00	-	-	-	-
Nonionic surfactant	Synperonic T/304	-	-	6.00	6.00	6.00	2
Nonionic surfactant	Pluronic RPE 1740	6.00	6.00	-	-	-	2
hydrotrope	Na cumene sulphonate	10.00	10.00	-	-	-	
Complexing agent	Trilon M Liquid	5.00	5.00	5.00	5.00	5.00	3
Alkalinity source	Triethanolamine 99%	5.00	5.00	5.00	5.00	5.00	4
pH adjusting	NaOH 50%	0.27	0.94	-	-	0.34	8
pH adjusting	Citric Acid monohydrate	0.2	0.2	0.2	0.2	0.2	8
Corrosion inhibitor	Hordaphos MDAH	1.0	-	-	1.0	-	6
Corrosion inhibitor	Hordaphos MDGB	-	1.0	-	-	1.0	6
preservative	Protectol PE	0.5	0.5	0.5	0.5	0.5	5
preservative	Nuosept BM22	0.2	0.2	0.2	0.2	0.2	7
	TOTAL	100.00	100.00	100.00	100.00	100.00	
	pH (< adjustment)	9.61	8.62	12.1	9.85	9.34	
	Finished pH	9.5	9.5	9.52	9.51	9.52	
	Appearance, on preparation	Clear	turbid	Clear	Clear	Clear	

(continued)

Function	Trade Name	P	Q	R	S	T	Order
	Foam test/ Tap water, 14°dH (min./ cm)	0/3 2/0	0/3 5/0.6	0/5 1/0	0/3 1/0	0/5 1/0	

2.4 Core Stability, Foam Height, pH and Clarity of Compositions

[0219] Test formulations, Compositions U and V, were prepared which were similar to compositions P and Q in Table 4, but with different water contents and without propylene glycol. The purpose of this experiment was to confirm that desirable clarity and foam performance could be provided by PL1740 nonionic formulations without PG.

[0220] The results presented in Table 5 show that desirable clarity and foam performance are provided by PL1740 / Trilon M / TEA core formulations having differing corrosion inhibitors and no PG. In particular the foam test results demonstrate that formulation U had significantly improved foam reduction time.

[0221] The relative composition of the components in formulations U and V are shown as weight percents, wt. %, out of a total composition level of 100.00 in Table 5. Table 5 additionally provides information as to the order of addition for preparation as well as formulation W, which was tested versus compositions Ua for cleaning efficacy as discussed hereinafter.

TABLE 5

Function	Trade Name	U	V	Order	W	Ua	Order
solvent	Aqua purificata	71.8	72.1	1,9	77.77	71.84	1,9
Nonionic surfactant	Synperonic T/304	-	-	-	10.00	-	-
Nonionic surfactant	Pluronic RPE 1740	6.00	6.00	2	-	6.00	2
hydrotrope	Na cumene sulphonate	10.00	10.00	3	-	10.00	3
Complexing agent	Trilon M Liquid	5.00	5.00	3	5.00	5.00	4
Alkalinity	Triethanolamine 99%	5.00	5.00	4	5.00	5.00	5
pH-adjuster	NaOH 50%	0.46	0.20	8	-	0.46	10
pH-adjuster	Citric Acid monohydrate	-	-	-	0.53	-	10
preservative	Nuosept BM 22	0.2	0.2	7	0.2	0.2	8
Corrosion inhibitor	Hordaphos MDAH	1.0	-	6	1.0	1.0	6
Corrosion inhibitor	Hordaphos MDGB	-	1.0	6	-	-	
preservative	Protectol PE	0.5	0.5	5	0.5	0.5	7
dye	Patent blue V	-	-	-	0.0015	0.0015	9
	TOTAL	100	100		100	100	
	pH (< adjustment)	9.64	9.02		9.83	9.71	
	Finished pH	9.5	9.49		9.51	9.5	
	Appearance, on preparation	Clear	Clear initially		Clear	Clear	

2.4 Core Stability, pH and Clarity of Compositions

[0222] Composition L2 which corresponds to Composition L (see Table 2), but with a lower level of MDAH was prepared. The purpose of this experiment was to determine the impact of MDAH level and whether use of a pre-mix of water / TEA / MDAH impacted on the initial formulation stability.

[0223] Testing of Composition L2 demonstrated that at this reduced MDAH level (0.1%), versus 0.95% in Composition L, the formulation became cloudy (turbid) during manufacture as soon as the corrosion inhibitor was introduced. Additionally this could not be revised by modified addition of the MDAH in combination with the TEA and the water components. This confirms that to ensure desirable concentrate clarity and Composition stability, a level of corrosion inhibitor of greater than about 0.1% is required.

[0224] Formulation L2 did achieve a target finished (adjusted) pH level of 9.5.

[0225] The relative composition of the components in formulations L and L2 are shown as weight percents, wt. %, out of a total composition level of 100.00 in Table 6. Table 6 additionally provides information as to the order of addition for preparation as well as pH and clarity data. For the avoidance of doubt the data for Composition L is extracted from Table 2 hereinbefore.

TABLE 6

Function	Trade Name	L	L2	Order for L2
solvent	Aqua purificata	78.67	79.52	1,4
Nonionic Surfactant	Synperonic T304	10.00	10.00	2
Complexing agent	Trilon M Liquid	5.00	5.00	3
Alkalinity	Triethanolamine 99%	5.00	5.00	4
pH-adjuster	Citric Acid monohydrate	0.18	0.18	8
preservative	Nuosept BM 22	0.20	0.2	6
Corrosion inhibitor	Hordaphos MDAH	0.95	0.10	5
Dye	Patentblue V	0.0015	0.0015	7
TOTAL		100	100	
Finished pH		9.5	9.5	

3.1.1 Cleaning Efficacy [Blood Removall of Compositions after 2 minutes

[0226] The cleaning efficacy of compositions in accordance with the invention was tested versus a number of commercially available enzyme-containing compositions. These tests confirmed the desirable performance levels of present compositions versus these commercial compositions at both 2 and 5 minute soak times. A number of these results are illustrated and discussed hereinafter.

[0227] Test solutions of compositions K and L (from Table 3) were prepared and diluted solutions thereof at 0.5%, in deionised (DI) water were assessed for cleaning efficacy against blood soil for 2 minutes soak time versus correspondingly diluted solutions of a commercial multi-enzyme comparator formulations Endozyme AW Plus (from Ruhof), and a commercial multi-enzymatic comparator formulation Aniosyme DD1 (from Anios).

[0228] The testing was carried out in accordance with the method described hereinbefore and three sets of results were obtained for each composition. In each instance the plates were weighed before soiling, after soiling (with blood) and after cleaning. The percentage removal was calculated for each, as well as the average percentage removal.

	empty plate	plate blood	after cleaning	% removal
Test product K, 0.5% 2 Min DI-Water	15.5387	15.5730	15.5396	97.3761
	15.5884	15.6274	15.5904	94.8718
	15.7839	15.8330	15.7866	94.5010
Test product L, 0.5% 2 Min DI-Water	15.5692	15.6161	15.5700	98.2942
	15.5263	15.5573	15.5272	97.0968
	15.7335	15.7667	15.7345	96.9880
Aniosyme DD1, 0.5% 2 Min DI-Water	15.5134	15.5460	15.5149	95.3988
	15.5983	15.6341	15.6044	82.9609
	15.8322	15.8718	15.8348	93.4343
Endozyme AW Plus, 0.5% 2 Min DI-Water	15.7974	15.8342	15.8033	83.9674
	15.4351	15.4783	15.4373	94.9074
	15.4866	15.5330	15.4905	91.5948

	% blood removed
Test product K, 0.5%, 2 Min DI water	95.5830
Test product L, 0.5%, 2 Min DI water	97.4597
Aniosyme DD1, 0.5%, 2 Min DI water	90.5980
Endozyme AW Plus, 0.5%, 2 Min DI water	90.1565

[0229] The average results obtained from these three tests clearly illustrates that compositions K and L of the present invention deliver superior cleaning performance in terms of percentage blood removal after 2 minutes versus enzymatic comparator compositions. These results are very surprising because enzyme formulations are generally accepted to provide the gold standard in cleaning performance.

[0230] Compositions of the invention have been demonstrated to deliver improved soil removal after 2 minutes versus comparator compositions.

3.1.2 Cleaning Efficacy [Blood Removal] of Compositions after 5 minutes

[0231] The tests of 3.1.1 were repeated but with a 5 minute soak time. The average results obtained from these three tests clearly illustrates that compositions K and L of the present invention deliver superior cleaning performance in terms of percentage blood removal after 2 minutes versus both enzymatic comparator compositions. These results are very surprising because enzyme formulations are generally accepted to provide the gold standard in cleaning performance.

[0232] Compositions of the invention have been demonstrated to deliver improved soil removal after 2 minutes versus comparator compositions.

	empty plate	plate blood	after cleaning	% removal
Test product K, 0.5%	15.5259	15.5599	15.5292	90.2941
5 Min DI-Water	15.4183	15.4601	15.4205	94.7368
	15.7329	15.7768	15.7340	97.4943
Test product L, 0.5%	15.5685	15.605	15.5783	73.1507
5 Min DI-Water	15.7972	15.8376	15.8026	86.6337
	15.8296	15.8743	15.8331	92.1700
Aniosyme DD1, 0.5%	15.5384	15.5738	15.5403	94.6328
5 Min DI-Water	15.5978	15.6415	15.5997	95.6522
	15.8317	15.8805	15.8351	93.0328
Endozyme AW Plus, 0.5%	15.7838	15.8422	15.7854	97.2603
5 Min DI-Water	15.4397	15.4846	15.4407	97.7728
	15.5126	15.5470	15.5145	94.4767
			% blood removed	
Test product K, 0.5%, 5 Min DI water			94.1751	
Test product L, 0.5%, 5 Min DI water			83.9848	
Aniosyme DD1, 0.5%, 5 Min DI water			94.4392	
Endozyme AW Plus, 0.5%, 5 Min DI water			96.5033	

3.2 Cleaning Efficacy [Blood Removal] of Compositions

[0233] Test solutions of compositions A1, A2, A3 and A1-a (illustrated in Table 7) were prepared and diluted solutions thereof at 0.5%, 1%, in deionised (DI) water were assessed for cleaning efficacy versus correspondingly diluted solutions of a commercial multi-enzyme comparator formulation Sekusept from Ecolab.

TABLE 7

Function	Trade Name	A1	A2	A3	A1-a	B1	B2	B3	B1-a
	Aqua purificata	75.50	73.50	75.50	74.55	85.82	83.82	85.82	84.87
Nonionic Surfactant	Synperonic T/304	-	-	-	-	4.00	6.00	4.00	4.00
Nonionic surfactant	Pluronic PL1740	4.00	6.00	4.00	4.00	-	-	-	-
hydrotrope	Na cumene sulphonate	10.00	10.00	10.00	10.00-	-	-	-	-
Complexing agent	Trilon M Liquid	5.00	5.00	-	5.00	5.00	5.00	-	5.00
Complexing agent	Dissolvine GL-38	-	-	5.00	-	-	-	5.00	-
Alkalinity	Triethanolamine 99%	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Corrosion inhibitor	Hordaphos MDAH	-	-	-	0.95	-	-	-	0.95
preservative	Protectol PE	0.5	0.5	0.50	0.5	-	-	-	-
pH-adjuster	Citric Acid monohydrate	-	-	-	-	0.18	0.18	0.18	0.18
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	pH before adjustment	11.77	11.52	11.45	9.82	12.00	12.00	11.90	9.90
	Finished pH	9.52	9.52	9.5	9.53	9.5	9.5	9.5	9.5

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[0234] The test was carried out in accordance with the method described hereinbefore and three sets of results were obtained for each composition. In each instance the plates were weighed before soiling, after soiling (with blood) and after cleaning. The percentage removal was calculated for each.

5		empty plate	plate blood	after cleaning	% removal
	Sekusept				
	Multienzyme 0.5%	15.2616	15.2921	15.2667	83.2787
	2 Min in DI-H ₂ O	15.5983	15.6384	15.6049	83.5411
10		15.7780	15.8164	15.7814	91.1458
	A1 0.5%	15.7979	15.8275	15.8065	70.9459
	2 Min in DI-H ₂ O	15.7929	15.8368	15.7982	87.9271
		15.8334	15.8617	15.8359	91.1661
15					
	A2 0.5%	15.8028	15.8314	15.8074	83.9161
	2 Min in DI-H ₂ O	15.8302	15.8652	15.8361	83.1429
		15.7676	15.8071	15.7707	92.1519
20					
	A3 0.5%	15.5263	15.5670	15.5287	94.1032
	2 Min in DI-H ₂ O	15.4881	15.5189	15.4926	85.3896
		15.5948	15.6285	15.5985	89.0208
25					
	A1-a 0.5%	15.7339	15.7792	15.7431	79.6909
	2 Min in DI-H ₂ O	15.8266	15.8620	15.8299	90.6780
		15.8328	15.8632	15.8361	89.1447

[0235] Surprisingly the average results obtained from these three tests clearly illustrate that compositions of the present invention deliver cleaning performance at similar levels to that of the comparator enzyme containing composition. These results are surprising because enzyme formulations are generally accepted to provide the gold standard in cleaning performance.

35		% blood removed
	Enzymatic Cleaner, 2 Min DI-H ₂ O	85.9886
	A1, 2 Min DI-H ₂ O	83.3464
	A2, 2 Min DI-H ₂ O	86.4036
40	A3, 2 Min DI-H ₂ O	89.5045
	A1-a, 2 Min DI-H ₂ O	86.5046

4.3 Cleaning Efficacy [Blood Removal] of Compositions

[0236] Test solutions of compositions B1, B2, B3 and B1-a (from Table 8) were prepared and diluted solutions thereof at 0.5%, 1%, in DI water were assessed for cleaning efficacy versus correspondingly diluted solutions of a commercial multi-enzyme comparator formulation (Sekusept) and a non-enzymatic commercially available formulation Aniosyme DD1. The test was carried out in accordance with the method described hereinbefore and three sets of results were obtained for each composition. In each instance the plates were weighed before soiling, after soiling (with blood) and after cleaning. The percentage removal was calculated for each.

		empty plate	plate blood	after cleaning	% removal
55	Sekusept				
	Multienzyme 0.5%	15.7705	15.8044	15.7752	86.1357
	2 Min in DI-H ₂ O	15.6371	15.6720	15.6416	87.1060
		15.8033	15.8438	15.8078	88.8889

(continued)

		empty plate	plate blood	after cleaning	% removal
5	Sekusept				
	B1 0.5%	15.4515	15.4864	15.4555	88.5387
	2 Min in DI-H ₂ O	15.5054	15.5434	15.5101	87.6316
		15.5486	15.5846	15.5536	86.1111
	B2 0.5%	15.8099	15.8376	15.8102	98.9170
10	2 Min in DI-H ₂ O	15.6575	15.8585	15.6644	96.5672
		15.7038	15.7446	15.709	87.2549
	B3 0.5%	15.7446	15.7807	15.7489	88.0886
	2 Min in DI-H ₂ O	15.7665	15.7983	15.7709	86.1635
		15.7749	15.8095	15.7783	90.1734
15	B1-a 0.5%	15.7337	15.7722	15.7376	89.8701
	2 Min in DI-H ₂ O	15.7965	15.8296	15.8008	87.0091
		15.7265	15.7596	15.7306	87.6133
	Aniosyme DD1				
20	0.5%	15.8023	15.843	15.8091	83.2924
	2 Min in DI-H ₂ O	15.7506	15.7892	15.7572	82.9016
		15.6780	15.706	15.6813	88.2143

[0237] As clearly illustrated the average results obtained from these three tests clearly illustrate that compositions of the present invention deliver cleaning performance at similar levels to that of the comparator enzyme containing composition, and that composition B2 delivers improved cleaning. All of the test compositions and the enzyme comparator formulation outperformed the non-enzymatic comparator formulation. These results are surprising because enzyme formulations are generally accepted to provide the gold standard in cleaning performance.

		% blood removed
30	Sekusept Multienzyme, 2 Min DI-H ₂ O	87.3769
	B1, 2 Min DI-H ₂ O	87.4271
	B2, 2 Min DI-H ₂ O	94.2463
35	B3, 2 Min DI-H ₂ O	88.1419
	B1-a, 2 Min DI-H ₂ O	88.1642
	Aniosyme DD1, 2 Min DI-H ₂ O	84.8027

5.1. Material Compatibility

[0238] Material compatibility testing was carried out for compositions A1 to B1-a as illustrated in Table 8 and also for a comparator enzymatic composition (Sekusept Multienzyme). The method was carried out in accordance with the procedure detailed hereinbefore, and in each test case, the plates were immersed an in-use solution of the test composition at 0,5% aqueous concentration in deionised (DI) water, in a beaker (600ml).

[0239] After a week the plates were rinsed off with DI water, dried and the weight was measured. On the following day the plates were immersed again (in freshly prepared test solutions) and the whole procedure was repeated twice more.

[0240] The results are illustrated in Table 8.

[0241] These results illustrate that even when tested in DI water, there was substantially no weight loss shown for compositions of the invention when tested against Steel for up to 3 weeks. As it is known that alkaline compositions can have a negative impact on compatibility with Steel these results are unprecedented.

[0242] In addition the results demonstrate very low weight losses in DI water for a range of metals at up to 3 weeks of immersion. Whilst not wishing to be bound to any particular theory it is proposed herein that the increased weight losses observed for the present compositions with blue and red Al, versus Al-alone are pigment-associated effects.

[0243] Given that, in reality surgical instruments are only likely to be soaked for a matter of minutes at a time, and in tap water, as opposed to the weeks of immersion in DI water in these stress condition tests, these results indicate that the present compositions are likely to compare favourably to enzymatic compositions during use.

TABLE 8

Formula Material	weight loss (%) after 3 week immersion period at RT								enzymatic cleaner
	A1	A2	A3	A1-a	B1	B2	B3	B1-a	
Anodized Al blue	0.063	0.052	0.054	0.066	0.110	0.096	0.127	0.105	-0.003
Anodized Al Red	0.069	0.051	0.065	0.055	0.081	0.095	0.098	0.082	-0.002
Aluminium	0.028	-0.015	0.030	0.038	0.024	0.050	0.022	0.030	0.008
Steel (V4A)	0.004	0.003	0.000	-0.005	-0.003	-0.001	-0.001	-0.006	-0.001

4.2. Material Compatibility

[0244] Material compatibility testing was carried out for compositions K and L (as illustrated in Table 2). The method was carried out in accordance with the procedure detailed hereinbefore, and in each test case, the Anodized Aluminium plates were immersed in an in-use solution of the test composition at 0.5% aqueous concentration in TAP water (water hardness 14 °dH), in a beaker (600ml). The results for Composition K are shown in Table 9 and the results for Composition L are shown in Table 10.

TABLE 9

test piece	Weight loss (%)		
	1 week	2 weeks	3 weeks
Red Plate	0,0051	-0,0028	-0,0020
Blue Plate	0,0057	-0,0033	-0,0005

TABLE 10

test piece	Weight loss (%)		
	1 week	2 weeks	3 weeks
Red Plate	0,0065	-0,0028	-0,0008
Blue Plate	0,0057	-0,0027	-0,0016

[0245] These results demonstrate that both compositions K and L show negligible weight losses in these stress test conditions. Compositions of the invention have been demonstrated to show highly desirable material compatibility when tested with both red and blue Anodized Aluminum.

Claims

1. A non-enzymatic liquid concentrate composition for cleaning surgical, medical and dental instruments and flexible endoscopes comprising: a low-foam surfactant system comprising a nonionic surfactant; a complexing agent; a source of alkalinity; and an aqueous solvent, wherein the composition or a use solution of the composition has a pH in the range of from pH 7 to pH 12; wherein the composition is free of an enzyme, wherein the surfactant system comprises an ethoxylated amine block copolymer, a PO/EO/PO block copolymer, or a mixture thereof, and wherein

the PO/EO/PO block copolymer has a formula $\text{HO}(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x-(\text{CH}_2\text{CH}_2\text{O})_y-(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x\text{H}$ and a molecular weight in the range of from about 2000 to about 4500, wherein the relative weight ratio of EO:PO is from about 10:90 to about 90:10.

2. A cleaning composition according to claim 1 comprising:
 - (a) 0.1 to 15.0 weight % of the low-foaming surfactant system;
 - (b) 0.1 to 10.0 weight % of the complexing agent;
 - (c) 0.1 to 10.0 weight % of the source of alkalinity;
 - (d) 0 to 5.0 weight % of an anti-corrosion agent; and
 - (e) 60 to 99.7 weight % of the aqueous solvent.
3. A cleaning composition according to claim 1 or 2, wherein the surfactant system comprises from 0.1 weight % to about 10 weight % of the cleaning composition comprising the PO/EO/PO block co-polymer.
4. A cleaning composition according to any one of claims 1-3, wherein the ethoxylated amine block copolymer has a molecular weight in the range of from about 1500 to about 25000.
5. A cleaning composition according to any one of claims 1-4, wherein the complexing agent comprises a small molecular organic complexing agent.
6. A cleaning composition according to any one of claims 1-4, wherein the complexing agent comprises a small molecular organic complexing agent independently selected from: sodium methylglycine diacetate (MGDA); N,N-di-acetic acid (GLDA); and combinations thereof.
7. A cleaning composition according to any one of claims 2-6, wherein the anti-corrosion agent is present at a level of from about 0.1 wt % to about 5.0 wt. %, from about 0.2 wt % to about 4 wt %; from about 0.5 wt % to about 5 wt %; or about 0.95 wt %, and wherein the anti-corrosion agent is a phosphate ester.
8. A cleaning composition according to any one of claims 2-7, comprising:
 - (a) 0.1 to 10.0 weight % of the low-foaming surfactant system comprising at least one nonionic surfactant;
 - (b) 0.1 to 10.0 weight % of the complexing agent;
 - (c) 0.1 to 10.0 weight % of the source of alkalinity;
 - (d) 0.1 to 5.0 weight % of the anti-corrosion agent; and
 - (e) 65 to 99.6 weight % of the aqueous solvent.
9. A cleaning composition according to any one of claims 1-8, wherein the source of alkalinity comprises triethanolamine (TEA).
10. A cleaning composition according to any one of claims 1-9, wherein the cleaning composition the use solution of the composition has a pH of between 7.5 and 10.5, between 8 and 10, between 8.5 and 9.5, or about 9.5.
11. A cleaning composition according to any one of claims 1-10, wherein a weight ratio of the low foaming surfactant to the complexing agent is in the range of from about 2 : 1 to about 2 : 3.
12. A cleaning composition according to any one of claims 1-11, wherein a weight ratio of the complexing agent: the anti-corrosion agent: the source of alkalinity is in the range of from about 4 : 1 : 4 to about 6 : 1 : 6.
13. A cleaning composition according to any one of claims 1-12, wherein the low foam surfactant system is from about 0.1 weight % to about 10 weight %, from about 2 weight % to about 8 weight %, from about 3 weight % to about 7 weight %, or about 6 weight % and wherein the ratio of the low foaming surfactant system to the complexing agent is in the range of from about 2 : 1 to about 2 : 3 and wherein the weight ratio of complexing agent: anti-corrosion agent: source of alkalinity is in the range of from about 4 : 1 : 4 to about 6 : 1 : 6, from about 5 : 1 : 5 to about 5.5 : 1 : 5.5, or from about 5.2 : 1 : 5.2 to about 5.3 : 1 : 5.3.
14. A cleaning composition according to any one of claims 1-13, wherein the low foam surfactant system is present in an amount ranging from about 2.0 to 10.0 weight %, the complexing agent is present in an amount ranging from

about 2.0 to 10.0 weight %, the anti-corrosion agent is present in an amount ranging from about 0.5 weight % to about 3.0 weight %, and the source of alkalinity is present in an amount ranging from about 3.0 to 8.0 weight %.

15. A method of cleaning articles comprising the steps:

- (a) providing a metal article to be cleaned;
- (b) providing the non-enzymatic cleaning composition according to any one of claims 1-14;
- (c) applying the composition to the said article, or diluting the composition to provide an aqueous use solution;
- (d) cleaning said article with the composition or with said aqueous use solution.

Patentansprüche

1. Nichtenzymatische flüssige Konzentratzusammensetzung zum Reinigen von chirurgischen, medizinischen und zahnmedizinischen Instrumenten und flexiblen Endoskopen, umfassend:

ein schaumarmes Tensidsystem, umfassend ein nichtionisches Tensid;
 einen Komplexbildner;
 eine Alkalinitätsquelle; und
 ein wässriges Lösungsmittel, wobei die Zusammensetzung oder eine Gebrauchslösung der Zusammensetzung einen pH-Wert im Bereich von pH 7 bis pH 12 aufweist;
 wobei die Zusammensetzung frei von einem Enzym ist, wobei das Tensidsystem ein ethoxyliertes Amin-Blockcopolymer, ein PO/EO/PO-Blockcopolymer oder eine Mischung davon umfasst, und wobei das PO/EO/PO-Blockcopolymer eine Formel $\text{HO}(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x(\text{CH}_2\text{CH}_2\text{O})_y(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x\text{H}$ und ein Molekulargewicht im Bereich von etwa 2000 bis etwa 4500 aufweist, wobei das relative Gewichtsverhältnis von EO:PO etwa 10:90 bis etwa 90:10 beträgt.

2. Reinigungszusammensetzung nach Anspruch 1, umfassend:

- (a) 0,1 bis 15,0 Gew.-% des schaumarmen Tensidsystems;
- (b) 0,1 bis 10,0 Gew.-% des Komplexbildners;
- (c) 0,1 bis 10,0 Gew.-% der Alkalinitätsquelle;
- (d) 0 bis 5,0 Gew.-% eines Korrosionsschutzmittels; und
- (e) 60 bis 99,7 Gew.-% des wässrigen Lösungsmittels.

3. Reinigungszusammensetzung nach Anspruch 1 oder 2, wobei das Tensidsystem 0,1 Gew.-% bis etwa 10 Gew.-% der Reinigungszusammensetzung umfasst, die das PO/EO/PO-Blockcopolymer umfasst.

4. Reinigungszusammensetzung nach einem der Ansprüche 1-3, wobei das ethoxylierte Amin-Blockcopolymer ein Molekulargewicht im Bereich von etwa 1500 bis etwa 25000 aufweist.

5. Reinigungszusammensetzung nach einem der Ansprüche 1-4, wobei der Komplexbildner einen niedermolekularen organischen Komplexbildner umfasst.

6. Reinigungszusammensetzung nach einem der Ansprüche 1-4, wobei der Komplexbildner einen niedermolekularen organischen Komplexbildner umfasst, der unabhängig ausgewählt ist aus:

Natriummethylglycindiäacetat (MGDA);
 N,N-Diacetsäure (GLDA); und
 Kombinationen davon.

7. Reinigungszusammensetzung nach einem der Ansprüche 2-6, wobei das Korrosionsschutzmittel in einer Menge von etwa 0,1 Gew.-% bis etwa 5,0 Gew.-%, von etwa 0,2 Gew.-% bis etwa 4 Gew.-%;

von etwa 0,5 Gew.-% bis etwa 5 Gew.-%; oder
 etwa 0,95 Gew.-% vorliegt und wobei das Korrosionsschutzmittel ein Phosphatester ist.

8. Reinigungszusammensetzung nach einem der Ansprüche 2-7, umfassend:

- (a) 0,1 bis 10,0 Gew.-% des schaumarmen Tensidsystems, umfassend mindestens ein nichtionisches Tensid;
- (b) 0,1 bis 10,0 Gew.-% des Komplexbildners;
- (c) 0,1 bis 10,0 Gew.-% der Alkalinitätsquelle;
- (d) 0,1 bis 5,0 Gew.-% des Korrosionsschutzmittels; und
- (e) 65 bis 99,6 Gew.-% des wässrigen Lösungsmittels.

9. Reinigungszusammensetzung nach einem der Ansprüche 1-8, wobei die Alkalinitätsquelle Triethanolamin (TEA) umfasst.

10. Reinigungszusammensetzung nach einem der Ansprüche 1-9, wobei die Reinigungszusammensetzung die Gebrauchslösung der Zusammensetzung einen pH-Wert zwischen 7,5 und 10,5, zwischen 8 und 10, zwischen 8,5 und 9,5 oder etwa 9,5 aufweist.

11. Reinigungszusammensetzung nach einem der Ansprüche 1-10, wobei ein Gewichtsverhältnis des schaumarmen Tensids zu dem Komplexbildner im Bereich von etwa 2:1 bis etwa 2:3 liegt.

12. Reinigungszusammensetzung nach einem der Ansprüche 1-11, wobei ein Gewichtsverhältnis von Komplexbildner: Korrosionsschutzmittel: Alkalinitätsquelle im Bereich von etwa 4:1:4 bis etwa 6:1:6 liegt.

13. Reinigungszusammensetzung nach einem der Ansprüche 1-12, wobei das schaumarme Tensidsystem von etwa 0,1 Gew.-% bis etwa 10 Gew.-%, von etwa 2 Gew.-% bis etwa 8 Gew.-%, von etwa 3 Gew.-% bis etwa 7 Gew.-% oder etwa 6 Gew.-% beträgt und wobei das Verhältnis des schaumarmen Tensidsystems zum Komplexbildner im Bereich von etwa 2:1 bis etwa 2:3 liegt und wobei das Gewichtsverhältnis von Komplexbildner: Korrosionsschutzmittel: Alkalinitätsquelle im Bereich von etwa 4:1:4 bis etwa 6:1:6, von etwa 5:1:5 bis etwa 5,5:1:5,5 oder von etwa 5,2:1:5,2 bis etwa 5,3:1:5,3 liegt.

14. Reinigungszusammensetzung nach einem der Ansprüche 1-13, wobei das schaumarme Tensidsystem in einer Menge, die von etwa 2,0 bis 10,0 Gew.-% reicht, vorliegt, der Komplexbildner in einer Menge, die von etwa 2,0 bis 10,0 Gew.-% reicht, vorliegt, das Korrosionsschutzmittel in einer Menge, die von etwa 0,5 Gew.-% bis etwa 3,0 Gew.-% reicht, vorliegt und die Alkalinitätsquelle in einer Menge, die von etwa 3,0 bis 8,0 Gew.-% reicht, vorliegt.

15. Verfahren zum Reinigen von Gegenständen, das die folgenden Schritte umfasst:

- (a) Bereitstellen eines zu reinigenden Metallgegenstands;
- (b) Bereitstellen der nichtenzymatischen Reinigungszusammensetzung nach einem der Ansprüche 1-14;
- (c) Auftragen der Zusammensetzung auf den Gegenstand oder Verdünnen der Zusammensetzung, um eine wässrige Gebrauchslösung bereitzustellen;
- (d) Reinigen des Gegenstands mit der Zusammensetzung oder mit der wässrigen Gebrauchslösung.

Revendications

1. Composition de concentré liquide non enzymatique pour le nettoyage d'instruments chirurgicaux, médicaux et dentaires et d'endoscopes souples, comprenant : un système tensioactif peu moussant comprenant un tensioactif non ionique ; un agent complexant ; une source d'alcalinité ; et un solvant aqueux, la composition ou une solution d'utilisation de la composition ayant un pH dans la plage allant de pH 7 à pH 12 ; la composition étant dépourvue d'enzyme, le système tensioactif comprenant un copolymère séquencé d'amine éthoxylée, un copolymère séquencé PO/OE/PO, ou un mélange de ceux-ci, et le copolymère séquencé PO/OE/PO répondant à la formule $\text{HO}(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x-(\text{CH}_2\text{CH}_2\text{O})_y-(\text{CH}(\text{CH}_3)\text{CH}_2\text{O})_x\text{H}$ et ayant un poids moléculaire dans la plage allant d'environ 2000 à environ 4500, le rapport en poids relatif de EO:PO étant d'environ 10:90 à environ 90:10.

2. Composition de nettoyage selon la revendication 1, comprenant :

- (a) 0,1 à 15,0 % en poids du système tensioactif peu moussant ;
- (b) 0,1 à 10,0 % en poids de l'agent complexant ;
- (c) 0,1 à 10,0 % en poids de la source d'alcalinité ;

(d) 0 à 5,0 % en poids d'un agent anticorrosion ; et

(e) 60 à 99,7 % en poids du solvant aqueux.

3. Composition de nettoyage selon la revendication 1 ou 2, dans laquelle le système tensioactif comprend 0,1 à environ 10 % en poids de la composition de nettoyage comprenant le copolymère séquencé PO/OE/PO.

4. Composition de nettoyage selon l'une quelconque des revendications 1 à 3, dans laquelle le copolymère séquencé d'amine éthoxylée a un poids moléculaire dans la plage allant d'environ 1500 à environ 25000.

5. Composition de nettoyage selon l'une quelconque des revendications 1 à 4, dans laquelle l'agent complexant comprend un agent complexant organique de faible taille moléculaire.

6. Composition de nettoyage selon l'une quelconque des revendications 1 à 4, dans laquelle l'agent complexant comprend un agent complexant organique de faible taille moléculaire choisi indépendamment parmi : la méthylglycine diacétique de sodium (MGDA) ; l'acide N,N-diacétique (GLDA) ; et leurs combinaisons.

7. Composition de nettoyage selon l'une quelconque des revendications 2 à 6, dans laquelle l'agent anticorrosion est présent en une quantité d'environ 0,1 à environ 5,0 % en poids, d'environ 0,2 à environ 4 % en poids ; d'environ 0,5 à environ 5 % en poids ; ou d'environ 0,95 % en poids, et dans laquelle l'agent anticorrosion est un ester de phosphate.

8. Composition de nettoyage selon l'une quelconque des revendications 2 à 7, comprenant :

(a) 0,1 à 10,0 % en poids du système tensioactif peu moussant comprenant au moins un tensioactif non ionique ;

(b) 0,1 à 10,0 % en poids de l'agent complexant ;

(c) 0,1 à 10,0 % en poids de la source d'alcalinité ;

(d) 0,1 à 5,0 % en poids de l'agent anticorrosion ; et

(e) 65 à 99,6 % en poids du solvant aqueux.

9. Composition de nettoyage selon l'une quelconque des revendications 1 à 8, dans laquelle la source d'alcalinité comprend de la triéthanolamine (TEA).

10. Composition de nettoyage selon l'une quelconque des revendications 1 à 9, dans laquelle la composition de nettoyage ou la solution d'utilisation de la composition a un pH compris entre 7,5 et 10,5, entre 8 et 10, entre 8,5 et 9,5, ou d'environ 9,5.

11. Composition de nettoyage selon l'une quelconque des revendications 1 à 10, dans laquelle un rapport en poids du tensioactif peu moussant à l'agent complexant est dans la plage allant d'environ 2:1 à environ 2:3.

12. Composition de nettoyage selon l'une quelconque des revendications 1 à 11, dans laquelle un rapport en poids de l'agent complexant à l'agent anticorrosion à la source d'alcalinité est dans la plage allant d'environ 4:1:4 à environ 6:1:6.

13. Composition de nettoyage selon l'une quelconque des revendications 1 à 12, dans laquelle le système tensioactif peu moussant est d'environ 0,1 à environ 10 % en poids, d'environ 2 à environ 8 % en poids, d'environ 3 à environ 7 % en poids, ou d'environ 6 % en poids et dans laquelle le rapport du système tensioactif peu moussant à l'agent complexant est dans la plage allant d'environ 2:1 à environ 2:3, et dans laquelle le rapport en poids de l'agent complexant à l'agent anticorrosion à la source d'alcalinité est dans la plage allant d'environ 4:1:4 à environ 6:1:6, d'environ 5:1:5 à environ 5,5:1:5,5, ou d'environ 5,2:1:5,2 à environ 5,3:1:5,3.

14. Composition de nettoyage selon l'une quelconque des revendications 1 à 13, dans laquelle le système tensioactif peu moussant est présent en une quantité dans la plage allant d'environ 2,0 à 10,0 % en poids, l'agent complexant est présent en une quantité dans la plage allant d'environ 2,0 à 10,0 % en poids, l'agent anticorrosion est présent en une quantité dans la plage allant d'environ 0,5 à environ 3,0 % en poids, et la source d'alcalinité est présente en une quantité dans la plage allant d'environ 3,0 à 8,0 % en poids.

15. Procédé de nettoyage d'articles, comprenant les étapes de :

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- (a) la fourniture d'un article métallique à nettoyer ;
- (b) la fourniture de la composition de nettoyage non enzymatique selon l'une quelconque des revendications 1 à 14 ;
- (c) l'application de la composition sur ledit article ou la dilution de la composition pour fournir une solution d'utilisation aqueuse ;
- (d) le nettoyage dudit article avec la composition ou avec ladite solution d'utilisation aqueuse.

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REFERENCES CITED IN THE DESCRIPTION

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