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(54) Foam composition comprising surfactants

(57) The present invention provides a foam composition for cleaning and conditioning textile fabrics comprising cationic surfactant and at least 15% by weight of nonionic surfactant wherein the cationic surfactant and nonionic surfactant is in a ratio of at least 1:5.

The invention also relates to a packaged product containing a propellant and the composition of the invention.

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Description

[0001] The present invention relates to foam compositions for cleaning textile fabrics.

[0002] The process of cleaning and conditioning textile fabrics has been carried out by various means for many centuries. Recently many improvements and refinements have been made to give more efficient processes for cleaning and conditioning textile fabrics. Modern-day processes basically involve a system to deliver active cleaning or conditioning materials to the fibre surface. Typically these processes involve the dissolution of either a powder or a liquid into water into order to provide a wash liquor which is then used to soak the textile fabrics. However some products in the form of a foam have also been suggested.

[0003] US-A-3 781 212, issued on 25th December, 1973 discloses compositions comprising 10-60% by weight of nonionic surfactant as well as optional cationic surfactant. If used, the cationic surfactant should comprise less than 15% by weight of the surfactant system. The composition is designed to stabilise enzymes and is disclosed for fabric cleaning.

[0004] US-A-4 242 377, issued on 30th December, 1980 discloses compositions comprising cationic surfactant as well as 0.5-15% foaming agent, such as nonionic surfactant in combination. This composition is intended for use in a dryer for the purpose of imparting softness to the fabrics (i.e. fabric conditioning).

[0005] EP-A-0 765 932, published on 2nd April 1997 discloses compositions comprising softening clay. This composition is intended in a wash process for the dual purpose of fabric cleaning and fabric softening at the same time.

[0006] However there is no disclosure in the prior art of detergent foams which provide dual purpose of fabric cleaning and fabric conditioning without relying upon softening clay for the fabric conditioning benefits.

[0007] The object of the present invention is to provide a foam composition for cleaning and conditioning textile fabrics comprising cationic surfactant and at least 15% by weight of nonionic surfactant.

Summary of the Invention

[0008] This object is achieved by means of a composition comprising cationic surfactant and nonionic surfactant in a ratio of at least 1:5. Preferably the composition comprises less than 3% by weight of anionic surfactant, and more preferably it is free of anionic surfactant.

[0009] In a further aspect the invention also provides a packaged product comprising

(i) a foaming composition comprising a surfactant system;
(ii) a propellant; and
(iii) a container;
wherein the surfactant system comprises cationic surfactant and at least 15% by weight of nonionic surfactant, and wherein the weight ratio of cationic surfactant to nonionic surfactant is at least 1:5. In a preferred embodiment of the invention the propellant is a gas such as carbon dioxide or nitrous oxide.

Detailed Description of the Invention

[0010] Textile fabrics are any materials made from cloth, including garments such as shirts, blouses, socks, skirts, trousers, jackets, underwear, and also including tablecloths, towels, curtains. The definition of textile fabrics as used herein does not include carpets and similar floor coverings.

[0011] Textile fabrics which are to be used in the present invention are commonly made by weaving or knitting. Many different fibres may be used to produce woven, knitted or other types of textile fabric including synthetic fibres (such as polyester, polyamide, etc.) and natural fibres from plants (such as cotton, hemp) and from animals (such as wool, angora, silk). Blends of different fibres are also commonly used.

[0012] Foam is a coarse dispersion of gas in a relatively small amount of liquid. The foams of the present invention are a continuous liquid phase comprising a detergent composition, and a dispersed phase comprising a gas. The gas "bubbles" of the dispersed phase can vary in size from 50 micrometers to several millimetres.

[0013] In general, the quality of the foam is determined by assessing various foam quality attributes, such as: 1) the appearance of the foam as it is determined by the uniformity of the bubble size distribution, as well as by the actual bubble sizes, wherein small and uniformly sized bubbles are generally preferred; 2) the thickness of the foam as it is determined by the apparent foam viscosity, wherein a greater apparent foam viscosity is generally preferred; 3) the density of the foam which is preferably less than 350g/l, more preferably less than 200 g/l, and most preferably less than 100 g/l; and 4) the drainage of the liquid from the foam upon standing on a solid surface, wherein lack of drainage of the liquid is generally preferred.

[0014] Preferred components of the detergent foam will now be described in more detail.

[0015] Water-soluble nonionic surfactants are also useful as surfactants in the compositions of the invention. Indeed, preferred processes use cationic/nonionic blends. Such nonionic materials include compounds produced by the condensation of alkylene oxide groups (hydrophilic in nature) with an organic hydrophobic compound, which may be aliphatic or alkyl aromatic in nature. The length of the polyoxyalkylene group which is condensed with any particular hydrophobic group can be readily adjusted to yield a water-soluble compound having the desired degree of balance between hydrophilic and hydrophobic elements.

[0016] Suitable nonionic surfactants include the polyethylene oxide condensates of alkyl phenols, e.g., the condensation products of alkyl phenols having an alkyl group containing from about 6 to 16 carbon atoms, in either a straight chain or branched chain configuration, with from about 4 to 25 moles of ethylene oxide per mole of alkyl phenol.

[0017] Preferred nonionics are the water-soluble condensation products of aliphatic alcohols containing from 8 to 22 carbon atoms, in either straight chain or branched configuration, with from 1 to 25 moles of ethylene oxide per mole of alcohol, especially 2 to 7 moles of ethylene oxide per mole of alcohol. Particularly preferred are the condensation products of alcohols having an alkyl group containing from about 9 to 15 carbon atoms; and condensation products of propylene glycol with ethylene oxide.

[0018] Other preferred nonionics are polyhydroxy fatty acid amides which may be prepared by reacting a fatty acid ester and an N-alkyl polyhydroxy amine. The preferred amine for use in the present invention is N-(R1)-CH2(CH2OH)4-CH2-OH and the preferred ester is a C12-C20 fatty acid methyl ester. Most preferred is the reaction product of N-methyl glucamine (which may be derived from glucose) with C12-C20 fatty acid methyl ester.

[0019] Methods of manufacturing polyhydroxy fatty acid amides have been described in WO 9206073, published on 16th April, 1992. This application describes the preparation of polyhydroxy fatty acid amides in the presence of solvents. In a highly preferred embodiment of the invention N-methyl glucamine is reacted with a C12-C20 methyl ester.

[0020] Other surfactants that may be used in the compositions of the present invention include C10-C18 glycerol ethers, C10-18 alkyl polyglycoside and their corresponding sulphated polyglycosides, alkyl ester sulphonates, and oleoyl sarcosinate.

[0021] Semi-polar nonionic surfactants include water-soluble amine oxides containing one alkyl moiety of from about 10 to 18 carbon atoms and 2 moieties selected from the group consisting of alkyl groups and hydroxyalkyl groups containing from 1 to about 3 carbon atoms; water-soluble phosphine oxides containing one alkyl moiety of about 10 to 18 carbon atoms and 2 moieties selected from the group consisting of alkyl groups and hydroxyalkyl groups containing from about 1 to 3 carbon atoms; and water-soluble sulfoxides containing one alkyl moiety of from about 10 to 18 carbon atoms and a moiety selected from the group consisting of alkyl and hydroxyalkyl moieties of from about 1 to 3 carbon atoms.

[0022] Nonionic surfactants are used in the compositions of the present invention at levels of at least 15% by weight. Preferably nonionic surfactants are used at levels of from 20% to 50%, and more preferably from 20% to 30%.

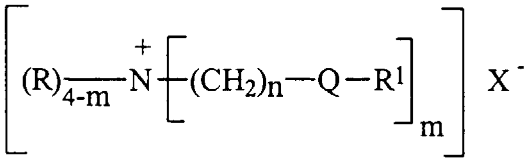
[0023] Ampholytic surfactants include derivatives of aliphatic or aliphatic derivatives of heterocyclic secondary and tertiary amines in which the aliphatic moiety can be either straight or branched chain and wherein one of the aliphatic substituents contains from about 8 to 18 carbon atoms and at least one aliphatic substituent contains an anionic water-solubilizing group.

[0024] Zwitterionic surfactants include derivatives of aliphatic quaternary ammonium phosphonium, and sulfonium compounds in which one of the aliphatic substituents contains from about 8 to 18 carbon atoms.

[0025] Anionic surfactants may also be usesd, but preferably in minor amounts. It is preferred that the compositions comprise less than 3% by weight of anionic surfactant, and even more preferably that the compositions are substantially free of anionic surfactant.

[0026] The cationic surfactants for use in the present invention include quarternary ammonium compounds.

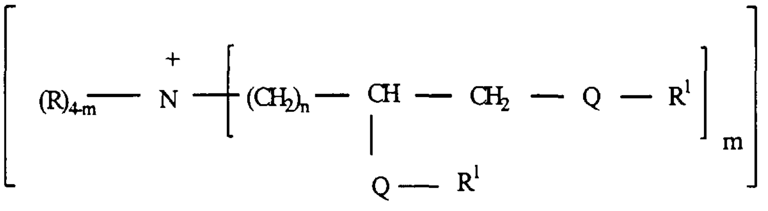
Preferred quaternary ammonium compound have the formula



$$\left[(R)_{4-m}-\overset{+}{N}\left[(CH_2)_n-Q-R^1\right]_m\right]X^- \quad (1)$$

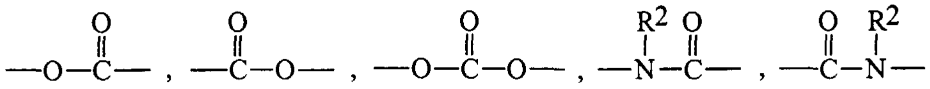
(1)

or the formula:



$$\left[(R)_{4-m} - \overset{+}{N} - \left[(CH_2)_n - \underset{\displaystyle Q - R^1}{\underset{|}{CH}} - CH_2 - Q - R^1 \right]_m \right] X \qquad (2)$$

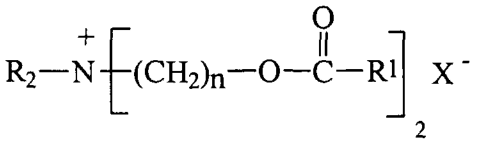
wherein Q is a functional unit having the formula:



$$-O-\overset{\overset{\displaystyle O}{\|}}{C}- \; , \; -\overset{\overset{\displaystyle O}{\|}}{C}-O- \; , \; -O-\overset{\overset{\displaystyle O}{\|}}{C}-O- \; , \; -\overset{\overset{\displaystyle R2}{|}}{N}-\overset{\overset{\displaystyle O}{\|}}{C}- \; , \; -\overset{\overset{\displaystyle O}{\|}}{C}-\overset{\overset{\displaystyle R2}{|}}{N}-$$

each R unit is independently hydrogen, C_1-C_6 alkyl, C_1-C_6 hydroxyalkyl, and mixtures thereof, preferably methyl or hydroxy alkyl; each R^1 unit is independently linear or branched C_{11}-C_{22} alkyl, linear or branched C_{11}-C_{22} alkenyl, and mixtures thereof, R^2 is hydrogen, C_1-C_4 alkyl, C_1-C_4 hydroxyalkyl, and mixtures thereof; X is an anion which is compatible with compounds and adjunct ingredients; the index m is from 1 to 4, preferably 2; the index n is from 1 to 4, preferably 2.

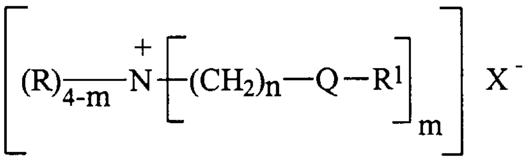
[0027] An example of a preferred compound is a mixture of quaternized amines having the formula:



$$R_2-\overset{+}{N}-\left[(CH_2)_n-O-\overset{\overset{\displaystyle O}{\|}}{C}-R^1 \right]_2 X^-$$

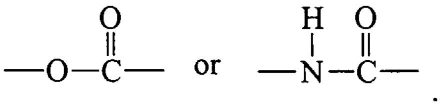
wherein R_2 is preferably methyl; R^1 is a linear or branched alkyl or alkenyl chain comprising at least 11 atoms, preferably at least 15 atoms. In the above fabric softener example, the unit $-R^1$ represents a fatty alkyl or alkenyl unit which is typically derived from a triglyceride source. The triglyceride source is preferably derived from tallow, partially hydrogenated tallow, lard, partially hydrogenated lard, vegetable oils and/or partially hydrogenated vegetable oils, such as, canola oil, safflower oil, peanut oil, sunflower oil, corn oil, soybean oil, tall oil, rice bran oil, etc. and mixtures of these oils.

[0028] The preferred compound of the present invention are the Diester and/or Diamide Quaternary Ammonium (DEQA) compounds, the diesters and diamides having the formula:



$$\left[(R)_{4-m}-\overset{+}{N}-\left[(CH_2)_n-Q-R^1 \right]_m \right] X^-$$

wherein R, R^1, X, and n are the same as defined herein above for formulas (1) and (2), and Q has the formula:



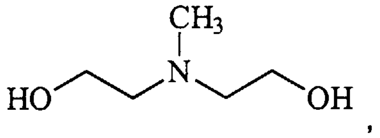
$$-O-\overset{\overset{\displaystyle O}{\|}}{C}- \quad \text{or} \quad -\overset{\overset{\displaystyle H}{|}}{N}-\overset{\overset{\displaystyle O}{\|}}{C}- .$$

[0029] These preferred compounds are formed from the reaction of an amine with a fatty acyl unit to form an amine intermediate having the formula:

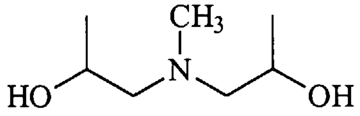
$$R\text{—}N\left[(CH_2)_n\text{—}Q\text{—}R^1\right]_2$$

wherein R is preferably methyl, Q and R^1 are as defined herein before; followed by quaternization to the final softener active.

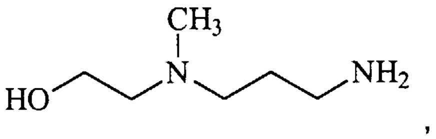
[0030] Non-limiting examples of preferred amines which are used to form the DEQA compounds according to the present invention include methyl bis(2-hydroxyethyl)amine having the formula:



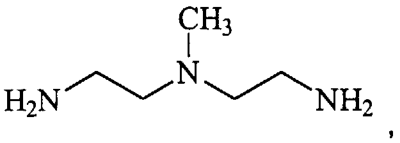
methyl bis(2-hydroxypropyl)amine having the formula:



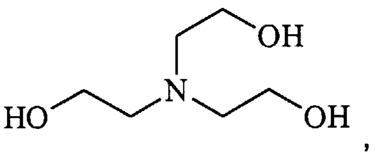
methyl (3-aminopropyl) (2-hydroxyethyl)amine having the formula:



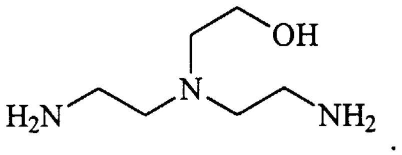
methyl bis(2-aminoethyl)amine having the formula:



triethanol amine having the formula:



di(2-aminoethyl) ethanolamine having the formula:



[0031] The counterion, $X^{(-)}$ above, can be any softener-compatible anion, preferably the anion of a strong acid, for example, chloride, bromide, methylsulfate, ethylsulfate, sulfate, nitrate and the like, more preferably chloride or methyl sulfate. The anion can also, but less preferably, carry a double charge in which case $X^{(-)}$ represents half a group.

[0032] Tallow and canola oil are convenient and inexpensive sources of fatty acyl units which are suitable for use in the present invention as R^1 units. The following are non-limiting examples of quaternary ammonium compounds suitable for use in the compositions of the present invention. The term "tallowyl" as used herein below indicates the R^1 unit is derived from a tallow triglyceride source and is a mixture of fatty alkyl or alkenyl units. Likewise, the use of the term canolyl refers to a mixture of fatty alkyl or alkenyl units derived from canola oil.

Table II

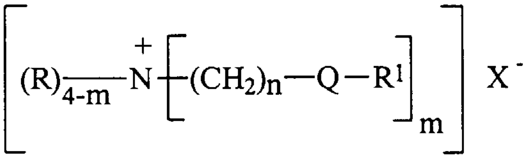
Fabric Softener Actives
N,N-di(tallowyl-oxy-2-oxo-ethyl)-N-methyl, N-(2-hydroxyethyl) ammonium chloride;
N,N-di(canolyl-oxy-2-oxo-ethyl)-N-methyl, N-(2-hydroxyethyl) ammonium chloride;
N,N-di(tallowyloxy-2-oxo-ethyl)-N,N-dimethyl ammonium chloride;
N,N-di(canolyloxy-2-oxo-ethyl)-N,N-dimethyl ammonium chloride
N,N,N-tri(tallowyl-oxy-2-oxo-ethyl)-N-methyl ammonium chloride;
N,N,N-tri(canolyl-oxy-2-oxo-ethyl)-N-methyl ammonium chloride;
N-(tallowyloxy-2-oxo-ethyl)-N-(tallowyl)-N,N-dimethyl ammonium chloride;
N-(canolyloxy-2-oxo-ethyl)-N-(canolyl)-N,N-dimethyl ammonium chloride;
1,2-di(tallowyloxy-oxo)-3-N,N,N-trimethylammoniopropane chloride; and
1,2-di(canolyloxy-oxo)-3-N,N,N-trimethylammoniopropane chloride;
N-(canoyloxy-2-oxo-ethyl), N-methyl, N,N-di(2-hydroxyethyl) ammonium chloride
N-(tallowyloxy-2-oxo-ethyl), N-methyl, N,N-di(2-hydroxyethyl) ammonium chloride
and mixtures of the above actives.

[0033] Other examples of quaternay ammoniun compounds are methylbis(tallowamidoethyl)(2-hydroxyethyl)ammonium methylsulfate and methylbis(hydrogenated tallowamidoethyl)(2-hydroxyethyl)ammonium methylsulfate; these materials are available from Witco Chemical Company under the trade names Varisoft® 222 and Varisoft® 110, respectively.

[0034] Particularly preferred is N,N-di(canolyl-oxy-2-oxo-ethyl)-N-methyl, N-(2-hydroxyethyl) ammonium chloride.

[0035] The level of unsaturation contained within the tallow, canola, or other fatty acyl unit chain can be measured by the Iodine Value (IV) of the corresponding fatty acid, which in the present case should preferably be in the range of from 5 to 100 with two categories of compounds being distinguished, having a IV below or above 25.

[0036] Indeed, for compounds having the formula:



$$\left[(R)_{4-m}-\overset{+}{N}-\left[(CH_2)_n-Q-R^1\right]_m\right] X^-$$

derived from tallow fatty acids, when the Iodine Value is from 5 to 25, preferably 15 to 20, it has been found that a *cis/trans* isomer weight ratio greater than about 30/70, preferably greater than about 50/50 and more preferably greater than about 70/30 provides optimal concentrability.

For compounds of this type made from tallow fatty acids having a Iodine Value of above 25, the ratio of *cis* to *trans* isomers has been found to be less critical unless very high concentrations are needed.

Other suitable examples of compounds are derived from fatty acyl groups wherein the terms "tallowyl" and canolyl" in the above examples are replaced by the terms "cocoyl, palmyl, lauryl, oleyl, ricinoleyl, stearyl, palmityl," which correspond to the triglyceride source from which the fatty acyl units are derived. These alternative fatty acyl sources can comprise either fully saturated, or preferably at least partly unsaturated chains.

[0037] As described herein before, R units are preferably methyl, however, suitable compounds are described by replacing the term "methyl" in the above examples in Table II with the units "ethyl, ethoxy, propyl, propoxy, isopropyl, butyl, isobutyl and t-butyl.

[0038] The counter ion, X, in the examples of Table II can be suitably replaced by bromide, methylsulfate, formate, sulfate, nitrate, and mixtures thereof. In fact, the anion, X, is merely present as a counterion of the positively charged quaternary ammonium compounds. The scope of this invention is not considered limited to any particular anion.

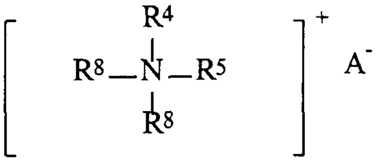
[0039] Examples of suitable acids include the inorganic mineral acids, carboxylic acids, in particular the low molecular weight (C_1-C_5) carboxylic acids, and alkylsulfonic acids. Suitable inorganic acids include HCl, H_2SO_4, HNO_3 and H_3PO_4. Suitable organic acids include formic, acetic, citric, methylsulfonic and ethylsulfonic acid. Preferred acids are citric, hydrochloric, phosphoric, formic, methylsulfonic acid, and benzoic acids.

[0040] As used herein, when the diester is specified, it will include the monoester that is normally present in manufacture.

[0041] Mixtures of actives of formula (1) and (2) may also be prepared.

[0042] 2)-Still other suitable quaternary ammonium compounds for use herein are cationic nitrogenous salts having two or more long chain acyclic aliphatic C_8-C_{22} hydrocarbon groups or one said group and an arylalkyl group which can be used either alone or as part of a mixture are selected from the group consisting of:

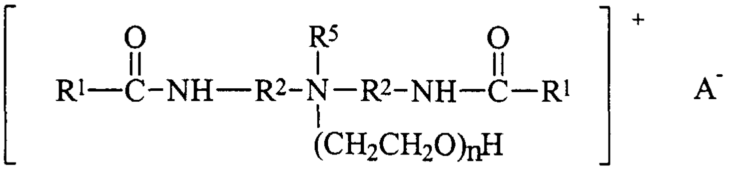
(i) acyclic quaternary ammonium salts having the formula:



$$\left[R^8-\overset{R^4}{\underset{R^8}{N}}-R^5\right]^+ A^-$$

wherein R^4 is an acyclic aliphatic C_8-C_{22} hydrocarbon group, R^5 is a C_1-C_4 saturated alkyl or hydroxyalkyl group, R^8 is selected from the group consisting of R^4 and R^5 groups, and A- is an anion defined as above;

(ii) diamino alkoxylated quaternary ammonium salts having the formula:



$$\left[R^1-\overset{O}{\overset{\|}{C}}-NH-R^2-\overset{R^5}{\underset{(CH_2CH_2O)_nH}{N}}-R^2-NH-\overset{O}{\overset{\|}{C}}-R^1\right]^+ A^-$$

wherein n is equal to 1 to about 5, and R^1, R^2, R^5 and A^- are as defined above;

(iii) mixtures thereof.

[0043] Examples of the above class cationic nitrogenous salts are the well-known dialkyldi methylammonium salts such as ditallowdimethylammonium chloride, ditallowdimethylammonium methylsulfate, di(hydrogenatedtallow)dimethylammonium chloride, distearyldimethylammonium chloride, dibehenyldimethylammonium chloride. Di(hydrogenatedtallow)di methylammonium chloride and ditallowdimethylammonium chloride are preferred. Examples of commercially available dialkyldimethyl ammonium salts usable in the present invention are di(hydrogenatedtallow)dimethylammonium chloride (trade name Adogen® 442), ditallowdimethylammonium chloride (trade name Adogen® 470, Praepagen® 3445), distearyl dimethylammonium chloride (trade name Arosurf® TA-100), all available from Witco Chemical Company. Dibehenyldimethylammonium chloride is sold under the trade name Kemamine Q-2802C by Humko Chemical Division of Witco Chemical Corporation.
Dimethylstearylbenzyl ammonium chloride is sold under the trade names Varisoft® SDC by Witco Chemical Company and Ammonyx® 490 by Onyx Chemical Company.

[0044] Cationic surfactants are used in the compositions of the present invention in levels of at least 3% by weight. Preferably cationic surfactant are used at levels of between 5% and 50%, and more preferably at levels of between 8% and 20%. The weight ratio of cationic surfactant to nonionic surfactant is at least 1:5, and preferably at least 1:3.

[0045] The foam of the present invention can contain neutral or alkaline salts which have a pH in solution of seven or greater, and can be either organic or inorganic in nature. While some of the salts are inert, many of them also function as detergency builder materials in the laundering solution.

[0046] Examples of neutral water-soluble salts include the alkali metal, ethanolamine, ammonium or substituted ammonium chlorides, fluorides and sulfates. The sodium, ethanolamine and ammonium salts of the above are preferred. Citric acid and, in general, any other organic or inorganic acid may be incorporated into the present invention.

[0047] Other useful water-soluble salts include the compounds commonly known as detergent builder materials. Builders are generally selected from the various water-soluble, alkali metal, ethanolamine, ammonium or substituted ammonium phosphates, polyphosphates, phosphonates, polyphosphonates, carbonates, silicates, borates, and polyhyroxysulfonates. Preferred are the sodium, ethanolamine and ammonium salts of the above.

[0048] Specific examples of inorganic phosphate builders are sodium and potassium tripolyphosphate, pyrophosphate, polymeric metaphosphate having a degree of polymerization of from about 6 to 21, and orthophosphate. Examples of polyphosphonate builders are the salts of ethylene diphosphonic acid, the salts of ethane 1-hydroxy-1,1-diphosphonic acid and the salts of ethane, 1,1,2-triphosphonic acid. Other phosphorus builder compounds are disclosed in U.S. Pat. Nos. 3,159,581; 3,213,030; 3,422,021; 3,422,137; 3,400,176 and 3,400,148, incorporated herein by reference. In general, however, phosphates are preferably avoided for environmental reasons.

[0049] Examples of nonphosphorus, inorganic builders are sodium and potassium carbonate, bicarbonate, sesquicarbonate, tetraborate decahydrate, and silicate having a molar ratio of SiO_2 to alkali metal oxide of from about 0.5 to about 4.0, preferably from about 1.0 to about 2.4.

[0050] Enzymes can be included in the formulations herein for a wide variety of fabric laundering purposes, including removal of protein-based, carbohydrate-based, or triglyceride-based stains, for example, and for the prevention of refugee dye transfer, and for fabric restoration. The enzymes to be incorporated include proteases, amylases, lipases, cellulases, and peroxidases, as well as mixtures thereof. Other types of enzymes may also be included. They may be of any suitable origin, such as vegetable, animal, bacterial, fungal and yeast origin. However, their choice is governed by several factors such as pH-activity and/or stability optima, thermostability, stability versus active detergents, builders and so on. In this respect bacterial or fungal enzymes are preferred, such as bacterial amylases and proteases, and fungal cellulases.

[0051] Enzymes are normally incorporated at levels sufficient to provide up to about 5 mg by weight, more typically about 0.01 mg to about 3 mg, of active enzyme per gram of the composition. Stated otherwise, the compositions herein will typically comprise from about 0.001% to about 5%, preferably 0.01%-1% by weight of a commercial enzyme preparation. Protease enzymes are usually present in such commercial preparations at levels sufficient to provide from 0.005 to 0.1 Anson units (AU) of activity per gram of composition.

[0052] Suitable examples of proteases are the subtilisins which are obtained from particular strains of B. subtilis and B. licheniforms. Another suitable protease is obtained from a strain of Bacillus, having maximum activity throughout the pH range of 8-12, developed and sold by Novo Industries A/S under the registered trade name ESPERASE. The preparation of this enzyme and analogous enzymes is described in British Patent Specification No. 1,243,784 of Novo. Proteolytic enzymes suitable for removing protein-based stains that are commercially available include those sold under the tradenames ALCALASE and SAVINASE by Novo Industries A/S (Denmark) and MAXATASE by International Bio-Synthetics, Inc. (The Netherlands). Other proteases include Protease A (see European Patent Application 130,756, published January 9, 1985) and Protease B (see European Patent Application Serial No. 87303761.8, filed April 28, 1987, and European Patent Application 130,756, Bott et al, published January 9, 1985).

[0053] Amylases include, for example, α-amylases described in British Patent Specification No. 1,296,839 (Novo), RAPIDASE, International Bio-Synthetics, Inc. and TERMAMYL, Novo Industries.

[0054] The cellulase usable in the present invention include both bacterial or fungal cellulase. Preferably, they will have a pH optimum of between 5 and 9.5. Suitable cellulases are disclosed in U.S. Patent 4,435,307, Barbesgoard et al, issued March 6, 1984, which discloses fungal cellulase produced from Humicola insolens and Humicola strain DSM1800 or a cellulase 212-producing fungus belonging to the genus Aeromonas, and cellulase extracted from the hepatopancreas of a marine mollusk (Dolabella Auricula Solander). suitable cellulases are also disclosed in GB-A-2.075.028; GB-A-2.095.275 and DE-OS-2.247.832. CAREZYME (Novo) is especially useful.

[0055] Suitable lipase enzymes for detergent usage include those produced by microorganisms of the Pseudomonas group, such as Pseudomonas stutzeri ATCC 19.154, as disclosed in British Patent 1,372,034. See also lipases in Japanese Patent Application 53,20487, laid open to public inspection on February 24, 1978. This lipase is available from Amano Pharmaceutical Co. Ltd., Nagoya, Japan, under the trade name Lipase P "Amano," hereinafter referred to as "Amano-P." Other commercial lipases include Amano-CES, lipases ex Chromobacter viscosum, e.g. Chromobacter viscosum var. lipolyticum NRRLB 3673, commercially available from Toyo Jozo Co., Tagata, Japan; and further Chromobacter viscosum lipases from U.S. Biochemical Corp., U.S.A. and Disoynth Co., The Netherlands, and lipases ex Pseudomonas gladioli. The LIPOLASE enzyme derived from Humicola lanuginosa and commercially available from Novo (see also EPO 341,947) is a preferred lipase for use herein.

[0056] Peroxidase enzymes are used in combination with oxygen sources, e.g., percarbonate, perborate, persulfate, hydrogen peroxide, etc. They are used for "solution bleaching," i.e. to prevent transfer of dyes or pigments removed from substrates during wash operations to other substrates in the wash solution. Peroxidase enzymes are known in the art, and include, for example, horseradish peroxidase, ligninase, and haloperoxidase such as chloro- and bromo-peroxidase. Peroxidase-containing detergent compositions are disclosed, for example, in PCT International Application WO 89/099813, published October 19, 1989, by O. Kirk, assigned to Novo Industries A/S.

[0057] A wide range of enzyme materials and means for their incorporation into synthetic detergent compositions are also disclosed in U.S. Patent 3,553,139, issued January 5, 1971 to McCarty et al. Enzymes are further disclosed in U.S. Patent 4,101,457, Place et al, issued July 18, 1978, and in U.S. Patent 4,507,219, Hughes, issued March 26, 1985, both. Enzyme materials useful for liquid detergent formulations, and their incorporation into such formulations, are disclosed in U.S. Patent 4,261,868, Hora et al, issued April 14, 1981. Enzymes for use in detergents can be stabilized by various techniques. Enzyme stabilization techniques are disclosed and exemplified in U.S. Patent 3,600,319, issued August 17, 1971 to Gedge, et al, and European Patent Application Publication No. 0 199 405, Application No. 86200586.5, published October 29, 1986, Venegas. Enzyme stabilization systems are also described, for example, in U.S. Patent 3,519,570.

[0058] It is important to distinguish between the foam of the present invention and the suds which are commonly encountered in everyday washing process. The foam of the present invention is much more concentrated and comprises less water than conventional suds. Foam comprises less than 90%, preferably less than 75%, more preferably less than 50%, even more preferably less than 30%, and most preferably less than 15% by weight of water. The foam of the present invention comprises at least 18% by weight, and preferably at least 25% by weight of a surface active agent.

[0059] On the other hand, suds, which are formed in conventional washing process when detergents are diluted prior to washing, are formed from quite dilute solutions typically 100g of product in 10 litres of water. The result is a wash liquor which comprises about 99% by weight of water. A layer of suds may form on the surface of the wash liquor, the composition of the suds being similar to that of the wash liquor itself. The surfactant content of the suds will normally be much less than 1%, typically less than 0.3%. Consequently the difference between the foam of the present invention and the suds of a conventional washing process will be understood.

[0060] It will also be recognised by the man skilled in the art that suds are often considered undesirable in the washing process and antisuds agents are often employed to reduce or control them. In a washing process in which the solution of detergent active agents is the medium of transport of the actives to the fibre surface, the presence of suds can diminish washing performance. This is because the detergent actives which are in the suds are no longer dissolved in the washing liquor itself, and are not therefore efficiently transported to the fibre surface.

[0061] The packaged product of the present invention comprises a sealed container, such as an essentially cylindrical bottle, having a dispensing means such as a nozzle. The container contains the composition and propellant. Suitable containers may be made from any material, especially aluminium, tin-plate, plastics including PET, OPP, PE or polyamide and including mixtures, laminates or other combinations of these. Foam is dispensed when the nozzle is activated and the detergent is released together with the propellant gas. The propellant gas expands to form many "bubbles" within the composition thereby creating the foam. Preferred propellants are hydrofluorocarbons, chlorofluorocarbons, alkanes including propane and butane, carbon dioxide, nitrous oxide, nitrogen, air or mixtures thereof. Most preferred are carbon dioxide and nitrous oxide, or mixtures thereof.

[0062] Various ways to pressurise the propellant gas are known in the art. For example the gas may be pressurised at the time of packing. The product may be physically separated from a compressed gas by a membrane such as rubber under tension. Alternatively a means for pressurising the gas subsequently by mechanical action may be provided (so-called "pump and spray" systems).

[0063] Various apparatus for delivering foams are described in US-A 5 364 031 issued on 15th November 1994 entitled "Foam Dispensing Nozzles and Dispensers Employing Said Nozzles".

[0064] Any nozzle or nozzle / valve assembly which provides a means for releasing the mixture of detergent ingredients from the container and provides a foam is suitable for use in the present invention. The Precision Valve Company (Valve Précision in France) supplies a range of nozzle assemblies for various applications including shaving foams and carpet cleaners under various trade names including City®, Montego®, Power Jet®, Vulcan® and Visco®. Nozzles which disperse the foam both horizontally and vertically (when the container is held upright) are available. Metering nozzles which dispense a predetermined amount of foam are also available and useful in the present invention. Metering valves are disclosed in WO9108965 (Precision Valve Co) and EP-A 616953 (3M Co). In order for the apparatus to be effective in the method of the present invention it should deliver the foam at a rate of at least 3g per second of foam from the sealed container, more preferably at a rate of at least 10 g per second.

Methods of Cleaning

Handwash

[0065] The method of the present invention may be used to wash textile fabrics by hand (referred to herein as "handwash"). The foam is dispensed onto or around the textile fabrics to be washed, and then the foam is thoroughly distributed over the textile fabrics, if necessary, by agitating the textile fabrics and foam by hand. It is believed that the high surface area of the foam enables the active ingredients to be well-distributed over the surface of the textile fabrics. Furthermore it is believed that the intimate proximity of the active, non-diluted foam to the textile fabrics promotes excellent cleaning.

[0066] The textile fabrics may be left to soak in the foam for anything up to several days, or even weeks. However it is preferred that the soaking time is between 1 minute and 24 hours, preferably between 5 minutes and 4 hours.

[0067] If desired any foam residue may subsequently be removed from the textile fabrics. For example the residue may be rinsed out using clean water or it may be removed from the textile fabrics by applying a vacuum.

[0068] The method of the present invention is particularly well-suited to hand washing of delicate textile fabrics. In particular textile fabrics comprising high levels of wool or silk may be advantageously treated in this way. One particular benefit is a marked reduction in local fabric damage which may occur when conventional laundry processes are used. In conventional laundry processes the detergent composition, the soiled textile fabrics and water are all brought together in a suitable container. At the beginning of the process there are very high local concentrations of active ingredients as they begin to dissolve in the water, but before they have been homogeneously distributed in the water. Such high local concentrations in solution, if they happen to be present on or close to the fabric can cause local fabric damage. This is especially true in the case of high local concentrations of bleaching agents and optical brighteners in solution. This type of local fabric damage is avoided according to the method of the present invention. Because all of the active ingredients are uniformly distributed throughout the large volume of the foam there are no local concentrations of active materials which might cause fabric damage.

[0069] A typical handwash composition will comprise some or all of the following components : surfactants (anionic, nonionic, cationic, amphoteric, zwitterionic), detergent builders and chelating agents, soil release polymers, optical brightener, dye transfer inhibition polymer, perfume, enzymes, colorants. Surfactants are preferably present at a level of from 18% to 90% by weight of the composition, preferably 20% to 80% of the composition, more preferably from 25% to 50% of the composition and most preferably about 30% by weight of the composition.

Detergent builders such as fatty acids, citric acid, succinic acid, phosphate, zeolite are preferably present at a level of from 10% to 90% by weight of the composition, preferably 10% to 50% of the composition, more preferably from 12% to 20% by weight of the composition.

Cheating agent such as phosphonate are preferably present at a level of from 0% to 5%, more preferably from 0.1% to 3% by weight of the composition.

Machine wash

[0070] The method of the present invention may be used to wash textile fabrics in a conventional washing machine or, alternatively, if no added water is required, in a conventional drying machine (both cases referred to herein as "machine wash"). The foam of the present invention is simply dispensed into the drum of the machine either before or after the soiled textile fabrics have been loaded.

[0071] Most commercially available washing machines have automatic washing cycles, and many of these cycles start by the addition of water into the machine drum. However, to fall within the scope of the present invention it is necessary for the concentrated foam to be thoroughly dispersed over the textile fabrics without being dissolved in solution. Preferably this is achieved using a washing machine with a washing cycle in which the drum is rotated several times (thereby distributing the foam) before any water is added. However, this does not exclude the step of presoaking the textile fabrics prior to the treatment with the foam from the present invention.

[0072] If water is added at a later part of the cycle most of the foam components will be dissolved or dispersed in the water, probably resulting in a layer of suds in the machine. As noted above, these suds which have a high water content and a low surfactant content should not be considered as foam within the meaning of the present invention.

[0073] The wash cycle may be completed by any combination of washing, rinsing, conditioning and/or drying steps, during any one of which additional wash or rinse additives may be introduced into the machine drum.

[0074] The compositions suitable for machine wash foams are similar to those described above for handwash foams.

Examples

[0075]

Foaming Detergent Composition :	Ex 1	Ex. 2	Ex. 3	Ex.4	Ex. 5	A	B
Alkyl benzenesulfonate	-	-	1.0	-	-	-	-
Alkyl sulfate	-	-	-	-	-	7	8.8
Alkyl ether sulfate	-	-	-	-	-	6.7	7.5
Nonionic E07	30	20	29	30	25	15.7	12.6
C12-18 glucose amide	-	10	-	-	-	-	4.8
Cationic surfactant A	15	10	15	-	15	-	-
Cationic surfactant B	-		-	10	-	-	-
Ethanol	2.5	2.5	2.5	2.5	2.5	0.9	0.9
PEG 200	8.8	8.8	8.8	8.8	30	30	30
Propylene glycol	20	20	20	20	10	9.5	9.5
Hexylene glycol	1.3	0.9	1.3	0.9	1.3	-	-
Monoethanolamine	2.3	2.3	2.3	2.3	2.3	8.8	8.8
Citric Acid	2.5	2.5	2.5	2.5	-	-	-
Fatty acid	-	-	-	-	-	11.4	11.4
Boric acid	2.0	2.0	2.0	2.0	2.0	3.6	3.6
Enzymes	0.5	0.5	0.5	0.5	0.6	0.6	0.6
Tetraethylene pentamine 15 ethyloxylated	1.3	1.3	1.3	1.3	-	0.3	-
Ethylenediamine disuccinate	1.3	1.3	1.3	-	-	1.0	-
Minors (perfume/colorant/etc.)	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Water	balance						
Cationic surfactant A is N,N-di(canolyl-oxy-2-oxo-ethyl)-N-methyl, N-(2-hydroxyethyl) ammonium chloride; Cationic surfactant B is N-(canoyloxy-2-oxo-ethyl), N-methyl, N, N-di(2-hydroxyethyl) ammonium chloride.							

[0076] In each of the examples the foaming detergent composition was packaged into a conventional aerosol can with a foam dispensing nozzle and valve together with carbon dioxide.

Claims

1. A foam composition for cleaning textile fabrics comprising cationic surfactant and at least 15% by weight of nonionic surfactant, wherein the weight ratio of cationic surfactant to nonionic surfactant is at least 1:5.

2. A foam composition according to claim 1 further comprising less than 3% by weight of anionic surfactant.

3. A foam composition according to claim 2 which is substantially free of anionic surfactant.

4. A foam composition according to any of claims 1 to 3 further comprising non-surfactant detergent components selected from the list consisting of detergent builders, sequestrants, polymers, enzymes, perfumes and mixtures thereof.

5. A packaged product comprising

   (i) a foaming composition comprising a surfactant system;
   (ii) a propellant; and
   (iii) a container;
   characterised in that the surfactant system comprises cationic surfactant and at least 15% by weight of nonionic surfactant, wherein the weight ratio of cationic surfactant to nonionic surfactant is at least 1:5.

6. A packaged product according to claim 5 wherein the propellant essentially comprises a non-liquifiable gas is selected from carbon dioxide or nitrous oxide, or mixtures thereof.

7. A packaged product according to either of claims 5 or 6 wherein the foaming composition comprises less than 25% by weight, preferably less than 15% by weight, of water

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 20 0532

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Place of search	Date of completion of the search	Examiner
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