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(54) HEAVY DUTY LAUNDRY DETERGENT COMPOSITION FOR LOW TEMPERATURE WASHING

(57) The present invention relates to a heavy duty laundry detergent composition for use at low temperature comprising or consisting of a first component comprising a non-ionic surfactant system comprising or consisting of (a) > 2 wt.-% of at least one non-ionic low alkoxylated alcohol surfactant containing 2 to 6 ethylene oxide groups and at least one linear primary alcohol containing 12 to 15 carbon atoms, (b) > 8 wt.-% of at least one non-ionic higher alkoxylated alcohol surfactant containing more than 6 ethylene oxide groups and at least one linear or branched primary alcohol containing 12 to 15 carbon atoms, calculated on the total weight of the detergent composition, and a second component comprising a bleaching system comprising or consisting of (c) < 8 wt.-% of percarbonate, and (d) > 3 wt.-% of tetraacetylethylenediamine (TAED), calculated on the total weight amount of the detergent composition, characterized in that the ratio of (c) to (d) is less than 2 : 1 and the total amount of the bleaching system is at least 10 wt.-% calculated on the total weight of the detergent composition.

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a two-component heavy duty laundry detergent composition for use at low temperature comprising or consisting of a first component comprising a non-ionic surfactant system comprising or consisting of (a) > 2 wt.-% of at least one non-ionic low alkoxylated alcohol surfactant containing 2 to 6 ethylene oxide groups and at least one linear primary alcohol containing 12 to 15 carbon atoms, (b) > 8 wt.-% of at least one non-ionic higher alkoxylated alcohol surfactant containing more than 6 ethylene oxide groups and at least one linear or branched primary alcohol containing 12 to 15 carbon atoms, calculated on the total weight of the detergent composition, and a second component comprising a bleaching system comprising or consisting of (c) < 8 wt.-% of percarbonate, and (d) > 3 wt.-% of tetraacetylethylenediamine (TAED), calculated on the total weight amount of the detergent composition, characterized in that the ratio of (c) to (d) is less than 2 : 1 and the total amount of the bleaching system is at least 10 wt.-% calculated on the total weight of the detergent composition.

[0002] The present invention further relates to a method for preparing such two-component heavy duty laundry detergent composition and to the use of such heavy duty laundry detergent composition for cleaning laundry items, preferably at a temperature of 60 °C or less, more preferably at a temperature of 40 °C or less, most preferably at a temperature of 30 °C or less.

BACKGROUND OF THE INVENTION

[0003] Removing stains or soils, particularly hydrophobic soils, typically requires machine washing of laundry items at temperatures above 60° C, sometimes even at 95° C, so-called "boiling washes". Under these conditions, most stains or soils are removed without any problem. On the other hand, most washed materials do not support the conditions of a boiling wash. On the contrary, there is an increasing trend towards so-called low maintenance and functional laundry items, which can only be washed at washing temperatures of 30° C or 40° C at the most. At these temperatures, an efficient removal of stains or soils is not always satisfactorily guaranteed.

[0004] Accordingly, there exists a requirement for a washing agent which, when used even at low temperature wash cycles, leads to a sufficient removing of stains and/or soils but does not damage the laundry item material.

SUMMARY OF THE INVENTION

[0005] It is a main object of the present application to provide a laundry detergent composition which, when used even at low temperature wash cycles, leads to a sufficient removing of stains and/or soils but does not damage the laundry item material.

[0006] This object is solved by a two-component heavy duty laundry detergent composition for use at low temperature comprising or consisting of a first component comprising a non-ionic surfactant system comprising or consisting of (a) > 2 wt.-% of at least one non-ionic low alkoxylated alcohol surfactant containing 2 to 6 ethylene oxide groups and at least one linear primary alcohol containing 12 to 15 carbon atoms, (b) > 8 wt.-% of at least one non-ionic higher alkoxylated alcohol surfactant containing more than 6 ethylene oxide groups and at least one linear or branched primary alcohol containing 12 to 15 carbon atoms, calculated on the total weight of the detergent composition, and a second component comprising a bleaching system comprising or consisting of (c) < 8 wt.-% of percarbonate, and (d) > 3 wt.-% of tetraacetylethylenediamine (TAED), calculated on the total weight amount of the detergent composition, characterized in that the ratio of (c) to (d) is less than 2 : 1 and the total amount of the bleaching system is at least 10 wt.-% calculated on the total weight of the detergent composition.

[0007] The weight percent (wt.-%) is calculated on the total weight amount of the final detergent composition comprising or consisting of both a first and a second component. Further, the total weight amount of all components is selected such that it does not exceed 100 wt.-%. The ratio of components is parts by weight, if not otherwise stated.

[0008] The two-component heavy duty laundry detergent composition of the invention improves cleaning, in particular at temperatures below 60 °C.

[0009] Preferably, the two-component heavy duty laundry detergent composition of the invention is in the form of a powder or granulate. This facilitates the addition of the detergent composition into the washing machine.

[0010] Another object of the present invention is to provide a method for preparing a two-component heavy duty laundry detergent composition, which improves cleaning, in particular at temperatures below 60 °C.

[0011] The method for preparing a two-component heavy duty laundry detergent composition according to the present application comprises the steps of

- preparing a first component,

- optionally granulating the first component,
- preparing a second component,
- combining the first and second component to obtain a two-component heavy duty laundry detergent composition,
- optionally granulating the two-component heavy duty laundry detergent composition.

[0012] Another object of the present invention is to provide a method for removing stain or soil from a laundry item even at low washing temperatures.

[0013] According to the present application, the two-component heavy duty laundry detergent composition as defined above is used for cleaning laundry items. It is preferred that the cleaning is carried out at a temperature of 60 °C or less, more preferably at a temperature of 40 °C or less, most preferably at a temperature of 30 °C or less.

DETAILED DESCRIPTION OF THE INVENTION

[0014] As used herein, the phrase "low temperature" refers to a temperature of 60° C or less, preferably of 40 °C or less, more preferably of 30 °C or less. As used herein, the phrase "laundry item" or "washing" refers to an item made from or including textiles, woven fabrics, non-woven fabrics, or knitted fabrics. The laundry item can include natural or synthetic fibers such as silk fibers, linen fibers, cotton fibers, polyester fibers, polyamide fibers such as nylon, acrylic fibers, acetate fibers, and blends thereof including cotton and polyester blends. The fibers can be pretreated or untreated. Exemplary treated fibers include those treated for flame retardancy. It should be understood that the term "linen" is often used to describe certain types of laundry items including bed sheets, pillow cases, towels, table linen, table cloth, bar mops and uniforms.

[0015] The first component of the detergent composition of the invention may comprise additional ingredients such at least one builder and/or at least one complexing agent and/or at least one antifoaming agent and/or at least one pH-adjusting agent.

[0016] Also, the second component of the detergent composition of the invention may comprise additional ingredients such as at least one enzyme and/or at least one anionic surfactant and/or at least one optical brightener.

[0017] It should be understood that the addition of anionic surfactants is optional, thus the two-component heavy duty laundry detergent composition of the invention can be free of anionic surfactants.

[0018] The cleaning properties of the two-component heavy duty laundry detergent composition of the invention are predominantly determined by the bleaching system and by the nonionic surfactant system.

[0019] In order to optimize the cleaning properties of the detergent composition of the invention, the ratio of percarbonate (c) to tetraacetylethylenediamine (TAED) (d) in the bleaching system is less than 2 : 1 and the total amount of the bleaching system is at least 10 wt.-% calculated on the total weight of the detergent composition.

[0020] Further, non-ionic surfactant system comprises or consists of (a) > 2 wt.-% of at least one non-ionic low alkoxylated alcohol surfactant containing 2 to 6 ethylene oxide groups and at least one linear primary alcohol containing 12 to 15 carbon atoms and (b) > 8 wt.-% of at least one non-ionic higher alkoxylated alcohol surfactant containing more than 6 ethylene oxide groups and at least one linear or branched primary alcohol containing 12 to 15 carbon atoms calculated on the total weight of the detergent composition.

[0021] According to the present invention, it may be preferred that the ratio of (a) to (b) is less than 1 : 4.

[0022] As explained above, the two-component heavy duty laundry detergent composition of the invention comprises a non-ionic surfactant system comprising or consisting of (a) > 2 wt.-% of at least one non-ionic low alkoxylated alcohol surfactant containing 2 to 6 ethylene oxide groups and at least one linear primary alcohol containing 12 to 15 carbon atoms and (b) > 8 wt.-% of at least one non-ionic higher alkoxylated alcohol surfactant containing more than 6 ethylene oxide groups and at least one linear or branched primary alcohol containing 12 to 15 carbon atoms calculated on the total weight of the detergent composition.

Nonionic low alkoxylated alcohol surfactants

[0023] Exemplary nonionic low alkoxylated alcohol surfactants in the detergent composition according to the invention are alkoxylated alcohols from linear alcohols of natural origin with 12 to 15 carbon atoms containing 2 to 6 ethylene oxide groups (2-6 EO), preferably 2 ethylene oxide (2 EO) groups, or mixtures thereof.

[0024] Particularly preferred low ethoxylated alcohols of the detergent composition according to the invention are, however, alcohol ethoxylates from linear alcohols of natural origin with 12 to 15 carbon atoms containing 2 ethylene oxide groups (2EO) or mixtures thereof.

[0025] The degrees of ethoxylation from 2 EO to 6 EO, most preferred 2 EO, mentioned above are statistical mean values, which for a special product may be either a whole number or a fractional number. Preferred lower ethoxylated alcohols have a narrow homologues distribution (narrow range ethoxylates, NRE).

[0026] The nonionic low alkoxylated alcohol surfactant containing 2 to 6 alkylene oxide units is provided in the first

component of the detergent composition in an amount of > 2 wt.-%, preferably > 2 wt.-% to < 45 wt.-%, further preferred >2 wt.-% to <35 wt.-%, also preferred >2 wt.-% to <25 wt.-%, furthermore preferred >2 wt.-% to <20 wt.-%, in addition preferred >3 wt.-% to <15 wt.-%, more preferred >4 wt.-% to <10 wt.-% and most preferred >5 wt.-% to <8 wt.-% based on the total weight of the detergent composition.

Nonionic higher alkoxylated alcohol surfactants

[0027] Exemplary nonionic higher alkoxylated alcohol surfactants in the detergent composition according to the invention are alkoxylated alcohols from linear or branched alcohols of natural origin with 12 to 15 carbon atoms containing more than 6 ethylene oxide groups (6 EO), preferably 7 to 30 ethylene oxide groups (7-30 EO), further preferred 7 to 20 ethylene oxide groups (7-20 EO), more preferred 8 to 10 ethylene oxide groups (8-10 EO), and most preferred 8 ethylene oxide (8 EO) groups, or mixtures thereof.

[0028] However, most preferred is isotridecyl alcohol containing 7 EO to 14 EO, preferably 7 EO to 10 EO, and most preferred 8 EO, or mixtures thereof.

[0029] The degrees of ethoxylation of more than 7 EO, preferably 7 EO to 30 EO, further preferred 7 EO to 20 EO, more preferred 8 EO to 10 EO and most preferred 8 EO ethoxylation mentioned, are statistical mean values, which for a special product may be either a whole number or a fractional number. Preferred higher ethoxylated alcohols have a narrow homologues distribution (narrow range ethoxylates, NRE).

[0030] The nonionic higher alkoxylated alcohol surfactant containing more than 6 alkylene oxide units is provided in the first component of the detergent composition in an amount of > 8 wt.-%, preferably >8 wt.-% to <55 wt.-%, further preferred >8 wt.-% to <50 wt.-%, also preferred >8 wt.-% to <40 wt.-%, furthermore preferred >8 wt.-% to <30 wt.-%, in addition preferred >9 wt.- % to <25 wt.-%, and more preferred >11 wt.-% to <20 wt.-% based on the total weight of the detergent composition.

[0031] The two-component heavy-duty laundry detergent composition of the invention may include additional ingredients or forms of ingredients found in laundry detergents such as the following.

Additional Bleaching agent (PAP)

[0032] The detergent composition of the present invention comprises a bleaching system comprising or consisting of (c) < 8 wt.-% of percarbonate, and (d) > 3 wt.-% of tetraacetylethylenediamine (TAED), calculated on the total weight amount of the detergent composition, characterized in that the ratio of (c) to (d) is less than 2 : 1 and the total amount of the bleaching system is at least 10 wt.-% calculated on the total weight of the detergent composition.

[0033] However, the detergent composition of the present invention may also comprise additional bleaching agents. Suitable additional bleaching agent can be fatty acids such as sulfoperoxycarboxylic acids. The sulfoperoxycarboxylic acids are also useful as coupling agents. Further, bleaching fatty acid agents can be derived from non- petroleum based, renewable oils, e.g., castor, toll, soybean, canola, olive, peanut, tallow, rapeseed, and palm oils. As used herein, the term 'sulfoperoxycarboxylic acid' or 'sulfonated peroxycarboxylic acid' refers to the peroxycarboxylic acid form of a sulfonated carboxylic acid. In some embodiments, detergent compositions of the present invention can include one or more of the sulfoperoxycarboxylic acids in the second component.

[0034] Peroxycarboxylic (or percarboxylic) acids generally have the formula $R(C0_3H)_n$, where, for example, R is an alkyl, arylalkyl, cycloalkyl, aromatic, or heterocyclic group, and n is 1, 2, or 3, and named by prefixing the parent acid with peroxy. Percarboxylic acids can be made by the direct, acid catalyzed equilibrium action of hydrogen peroxide with the carboxylic acid, by autoxidation of aldehydes, or from acid chlorides, and hydrides, or carboxylic anhydrides with hydrogen or sodium peroxide. The R group can be saturated or unsaturated as well as substituted or unsubstituted.

[0035] Thus, the additional bleaching agent can be a sulfoperoxycarboxylic acid of Formula I:

$$R_1\text{-}CH(SO_3\text{-}X^+)R_2\text{-}COOOH \qquad \text{(Formula I)}$$

wherein R_1 is hydrogen, or a substituted or unsubstituted alkyl group; R_2 is a substituted or unsubstituted alkyl group; X is hydrogen, a cationic group, or an ester forming moiety; or salts or esters thereof.

[0036] In some embodiments, R_1 is a substituted or unsubstituted C_m alkyl group; X is hydrogen a cationic group, or an ester forming moiety; R_2 is a substituted or unsubstituted C_n alkyl group; m= 1 to 10; n = 1 to 10; and m+ n is less than 18, or salts, esters or mixtures thereof.

[0037] In some embodiments, R_1 is hydrogen. In other embodiments, R_1 is a substituted or unsubstituted alkyl group. In some embodiments, R_1 is a substituted or unsubstituted alkyl group that does not include a cyclic alkyl group. In some embodiments, R_1 is a substituted alkyl group. In some embodiments, R_1 is an unsubstituted C_1-C_9 alkyl group. In some embodiments, R_1 is an unsubstituted C_7 or C_8 alkyl.

[0038] In other embodiments, R_1 is a substituted C_8 - C_{10} alkyl group. In some embodiments, R_1 is a substituted C_8

- C_{10} alkyl group is substituted with at least 1, or at least 2 hydroxyl groups. In still yet other embodiments, R_1 is a substituted C_1-C_9 alkyl group. In some embodiments, R_1 is a C_1-C_9 alkyl group substituted with at least 1 SO_3H group.

[0039] In other embodiments, R_1 is a C_9-C_{10} substituted alkyl group. In some embodiments, R_1 is a substituted C_9-C_{10} alkyl group wherein at least two of the carbons on the carbon backbone form a heterocyclic group. In some embodiments, the heterocyclic group is an epoxide group.

[0040] In some embodiments, R_2 is a substituted C_1 to C_{10} alkyl group. In some embodiments, R_2 is a substituted C_8-C_{10} alkyl. In some embodiments, R_2 is an unsubstituted C_6-C_9 alkyl. In other embodiments, R_2 is a C_8 to C_{10} alkyl group substituted with at least one hydroxyl group. In some embodiments, R_2 is a C_{10} alkyl group substituted with at least two hydroxyl groups. In other embodiments, R_2 is a C_8 alkyl group substituted with at least one SO_3H group. In some embodiments, R_2 is a substituted C_9 group, wherein at least two of the carbons on the carbon backbone form a heterocyclic group. In some embodiments, the heterocyclic group is an epoxide group. In some embodiments, R_1 is C_8-C_9 substituted or unsubstituted alkyl, and R_2 is C_7- C_8 substituted or unsubstituted alkyl.

[0041] In some embodiments, the additional bleaching agent is selected from the group consisting of:

10-hydroxy-9-sulfooctadecaneperoxoic acid;
9,10-dihydroxy-8-sulfooctadecaneperoxoic acid;
9-sulfooctadecaneperoxoic acid;
11-sulfoundecaneperoxoic acid;
10,11-disulfoundecaneperoxoic acid;
8-(3-octyloxiran-2-yl)-8-sulfooctaneperoxoic acid;
9,10-dihydroxy-I 1-sulfooctadecaneperoxoic acid;
9-(1-sulfoheptyloxiran-2-yl)-9-nonaneperoxoic acid;
9-hydroxy-10-sulfooctadecaneperoxoic acid;
10-sulfooctadecaneperoxoic acid;
9,10-disulfooctadecaneperoxoic acid;
10-sulfoundecaneperoxoic acid;
9-(3-octyloxiran-2-yl)-9-sulfononaneperoxoic acid;
10,11-dihydroxy-9-sulfooctadecaneperoxoic acid;
8,9-dihydroxy-10-sulfooctadecaneperoxoic acid.

[0042] Sulfonated fatty acids suitable for use in forming bleaching compounds include, but are not limited to, 11-sulfoundecanoic acid, 10,11-disulfoundecanoic acid, sulfonated oleic acid, sulfonated linoleic acid, sulfonated palmitic acid and sulfonated stearic acid.

[0043] The sulfoperoxy acids can be formed using a variety of reaction mechanisms. For example, in some embodiments, the peracids are formed by the direct acid catalyzed equilibrium action of hydrogen peroxide with the bleaching materials. In some embodiments, the sulfonated carboxylic acids for use in forming the compounds of the present invention are not sulfonated at the alpha-position. It has been found that having the sulfonate group at the alpha position of the fatty acid prohibits the oxidation and/or perhydrolysis of the carboxylic acid group to form the corresponding peroxycarboxylic acid.

[0044] Preferred additional bleaching agents are phthalimidopercarboxylic acids, such as phthalimidoperoxyhexanoic acid (PAP).

Additional Surfactant Component

[0045] An additional surfactant component provides for enhancing the cleaning properties of the detergent composition. The surfactant component can be used to reduce surface tension and wet the soil particulate to allow penetration of the use solution and separation of the soil. The surfactant component can include anionic surfactants, nonionic surfactants other than the nonionic lower alkoxylated alcohol surfactants and the nonionic higher alkoxylated alcohol surfactants mentioned above, amphoteric surfactants and mixtures thereof.

Additional Nonionic Surfactant

[0046] Exemplary nonionic surfactants that can be used in the detergent composition according to the invention are alkoxylated, preferably ethoxylated or ethoxylated and propoxylated, fatty acid alkyl esters, preferably containing 1 to 4 carbon atoms in the alkyl chain. Particularly preferred are the fatty acid methyl esters.
Further surfactants include ethoxylated long chain fatty acid amides wherein the fatty acid has 8-20 carbon atoms and the amide group is ethoxylated with 1-20 ethylene oxide units.

[0047] A further class of nonionic surfactants, which can be used as ingredients of the detergent composition according

to the invention, is that of alkyl polyglycosides (APG). Suitable alkyl polyglycosides satisfy the general Formula RO(G)z where R is a linear or branched, saturated or unsaturated aliphatic radical containing 8 to 22 carbon atoms, preferably containing 12 to 18 carbon atoms, and G represents a glycose unit containing 5 or 6 carbon atoms. The degree of oligomerization z is a whole or fractional number between 1.0 and 4.0 and preferably is between 1.1 and 1.4.

[0048] Silicone containing nonionic surfactants, such as the commercially available ABIL B8852® or Silwet 7602®, can also be used. An exemplary silicone-containing surfactant is silicone polybutane.

[0049] Examples of amine oxide surfactants include: dimethyldodecylamine oxide, dimethyltetradecylamine oxide; ethylmethyltetradecylamine oxide, cetyldimethylamine oxide, dimethylstearylamine oxide, cetylethylpropylamine oxide, diethyldodecylamine oxide, diethyltetradecylamine oxide, dipropyldodecylamine oxide, lauryl dimethyl amine oxide, bis-(2-hydroxyethyl)dodecylamine oxide, bis-(2-hydroxyethyl)-3-dodecoxy-1 - hydroxypropylamine oxide, (2-hydroxypropyl)methyltetradecylamine oxide, dimethyloleyamine oxide, dimethyl-(2-hydroxydodecyl)amine oxide, and the corresponding decyl, hexadecyl and octadecyl homologues of the above compounds.

[0050] Additional nitrogen-containing surfactants include ethoxylated primary alkyl amines where the alkyl group has 10-20 carbon atoms and the amine is ethoxylated with 2-20 ethylene oxide units.

[0051] Additionally, non-ionic surfactants derived from the condensation of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylene diamine are also useful. For example, there are compounds containing from 40% to 80% of polyoxyethylene by weight and having a molecular weight from 5,000 to 11,000 resulting from the reaction of ethylene oxide groups with a hydrophobic base constituted of the reaction product from ethylene diamine and excess propylene oxide, wherein the base has a molecular weight of 2,500 to 3,000.

[0052] Suitable nonionic surfactants include the polyoxyethylene-polyoxypropylene condensates, which are sold by BASF under the trade name Pluronic®, polyoxy ethylene condensates of aliphatic alcohols/ethylene oxide condensates having from 1 to 30 moles of ethylene oxide per mole of coconut alcohol; ethoxylated long chain alcohols sold by Shell Chemical Co. under the trade name Neodol®, polyoxyethylene condensates of sorbitan fatty acids, alkanolamides, such as the monoalkoanolamides, dialkanolamides and the ethoxylated alkanolamides, for example coconut monoethanolamide, lauric isopropanolamide and lauric diethanolamide, and amine oxides, for example dodecyldimethylamine oxide.

[0053] Further exemplary non-ionic surfactants include alkylphenol alkoxylates and amine oxides such as alkyl dimethylamine oxide or bis (2-hydroxyethyl)alkylamine oxide. The additional nonionic surfactants can be provided in the first component of the detergent composition according to the invention in an amount of > 0 wt.-% to < 30 wt.-%, preferably > 1 wt.-% to < 25 wt.-%, further preferred > 5 wt.-% to < 20 wt.-%, and more preferred >10 wt.-% to <15 wt.-%, based on the total weight of the detergent composition.

Anionic Surfactant

[0054] The second component of the detergent composition according to the invention may comprise anionic surfactants.

[0055] Exemplary anionic surfactants that can be used include organic carboxylates, organic sulfonates, organic sulfates, organic phosphates, in particular linear alkylaryl sulfonates, alkylarylcarboxylates, and alkylarylphosphates.

[0056] The anionic surfactants can be provided in the second component of the detergent composition in an amount of > 0 wt.-% to < 30 wt.-%, preferably > 1 wt.-% to < 25 wt.-%, further preferred > 5 wt.-% to < 20 wt.-%, and more preferred >10 wt.-% to <15 wt.- %, based on the total weight of the detergent composition.

Cationic Surfactant

[0057] The presence of the nonionic surfactants enables the use of low levels of higher foaming cationic surfactants, while keeping the foaming at an acceptable level. In an aspect of the invention, the detergent composition of the invention may also comprise a cationic surfactant or an amphoteric surfactant, wherein the cationic or amphoteric surfactant is present in a concentration of > 1 wt.-% to < 20 wt.-%, preferably > 2 wt.-% to < 15 wt.-% and more preferably > 3 wt.-% to < 12% wt.-%>, based on the total weight of the detergent composition. Most preferred the detergent composition of the invention is free of cationic surfactants.

[0058] Suitable cationic surfactants include quaternary ammonium compounds having the formula of RR'R"R"'N^+X^+, where R, R', R" and R"' independently from another represent a C_1-C_{24} 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. Additional preferred cationic surfactants include ethoxylated and/or propoxylated alkyl amines, diamines, or triamines. 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. Any two of R, R', R" and R"' can form a cyclic group. Any one to three of R, R, R" and R"' can independently be hydrogen. X is a counter ion and preferably is a non-fluoride counter ion, more preferably selected form chloride, bromide, methosulfate, ethosulfate, sulfate, and phosphate.

[0059] In an aspect, the quaternary ammonium compound includes alkyl ethoxylated and/or propoxylated quaternary ammonium salts (or amines). In these alkyl ethoxylated and/or propoxylated quaternary ammonium salts (or amines), the alkyl group preferably contains between 6 and 22 carbon atoms and can be saturated and/or unsaturated. The degree of ethoxylation is preferably between 2 and 20, and/or the degree of propoxylation is preferably between 0 and 30. In an aspect, the quaternary ammonium compound includes an alkyl group with 6 to 22 carbon atoms and a degree of ethoxylation between 2 and 20. A preferred cationic surfactant is commercially available under the name Berol 563® from Akzo-Nobel.

Amphoteric Surfactant

[0060] Examples of suitable amphoteric surfactants that can be contained in the detergent composition according to the invention include capryloamphopropionate, disodium lauryl B-iminodipropionate, cocoamphocarboxypropionate and disodium octylimino dipropionate.

[0061] The amphoteric surfactants can be provided in the composition in an amount of > 0 wt.-% to < 30 wt.-%, preferably > 1 wt.-% to < 25 wt.-%, further preferred > 5 wt.-% to < 20 wt.-%, and more preferred >10 wt.-% to <15 wt.-%, based on the total weight of the detergent composition. The detergent composition according to the invention is preferably free of amphoteric surfactants.

Alkaline Source

[0062] The detergent composition may further comprise at least one source of alkalinity. The at least one source of alkalinity can be any source of alkalinity that is compatible with the other components of the detergent composition. Exemplary sources of alkalinity include alkali metal hydroxides, alkali metal salts, phosphates, amines, and mixtures thereof.

[0063] The detergent composition according to the invention can be adjusted by adding the at least one source of alkalinity so that a pH-value of > 8 and < 10, preferably of > 8.2 and < 9.8, more preferably of > 8.3 and < 9.7, even more preferably of > 8.4 and < 9.6, further preferred of > 8.6 and < 9.5, most preferred of > 8.8 and < 9.3 is achieved.

[0064] Exemplary alkali metal hydroxides include sodium hydroxide, potassium hydroxide, and lithium hydroxide. However, most preferred is sodium hydroxide. Exemplary alkali metal salts include sodium carbonate, lithium carbonate, potassium carbonate, and mixtures thereof. Exemplary phosphates include sodium pyrophosphate, potassium pyrophosphate, and mixtures thereof. Exemplary amines include alkanolamines, preferably selected from the group consisting of triethanolamine, monoethanolamine, diethanolamine, and mixtures thereof.

[0065] The source of alkalinity, preferably an alkali metal hydroxide, may be added to the composition in a variety of forms, including for example in the form of solid beads or dissolved in an aqueous solution.

Zeolite

[0066] The detergent composition of the present invention can comprise zeolites. The amount of zeolites can be > 2 wt.-% to < 40 wt.-%, preferably > 10 wt.-% to < 35 wt.-%, further preferred > 15 wt.-% to < 30 wt.-%, and more preferred > 20 wt.-% to < 25 wt.-%, based on the total weight of the detergent composition.

[0067] Zeolite A and/or P are preferred. A particularly preferred zeolite P is zeolite MAP®(a commercial product of Crosfield). However, zeolites X as well as mixtures of A, X and/or P are also suitable. Commercially available and preferred in the context of the present invention is, for example, a co-crystallizate of zeolite X and zeolite A (ca. 80 wt. % zeolite X), which is marketed under the name of VEGOBOND AX® by Condea Augusta S.p.A.

[0068] Suitable zeolites have a mean particle size of less than 10 μm(volume distribution, as measured by the Coulter Counter Method) and preferably comprise >18% to <22% by weight of bound water.

Corrosion Inhibitor

[0069] The detergent composition according to the invention may comprises a corrosion inhibitor selected from the group consisting of silicate, calcium acetate, calcium chloride, calcium gluconate, calcium phosphate, calcium borate, calcium carbonate, calcium citrate, calcium lactate, calcium sulfate, calcium tartrate, benzotriazole, 1,2,3-benzotriazole and mixtures thereof. Exemplary silicates include sodium metasilicates, sesquisilicates, orthosilicates, potassium silicates, and mixtures thereof. However, most preferred is sodium silicate.

[0070] The amount of corrosion inhibitor, when present, is > 1 wt.-% to < 20 wt.-%, preferably > 2 wt.-% to < 18 wt.-%, further preferred > 4 wt.-% to < 15 wt.-%, and more preferred > 6 wt.-% to < 10 wt.-%, based on the total weight of the detergent composition.

[0071] Additional corrosion inhibitors which may optionally be added to the composition of this invention include metal

salts of magnesium and/or zinc. Preferably, the metal ions are provided in water-soluble form. Examples of useful water-soluble forms of magnesium and zinc ions are the chlorides, nitrates and sulfates of the respective metals.

[0072] In order to maintain the dispersibility of the magnesium and/or zinc metal corrosion inhibitors in the presence of agents which would otherwise cause precipitation of the zinc or magnesium ions, e. g. , carbonates, phosphates, etc. , it might be advantageous to include a carboxylated polymer to the detergent composition. Useful carboxylated polymers may generically be categorized as water-soluble carboxylic acid polymers such as polyacrylic and polymethacrylic acids or vinyl addition polymers. Of the vinyl addition polymers contemplated, maleic anhydride copolymers with vinyl acetate, styrene, ethylene, isobutylene, acrylic acid and vinyl ethers are useful examples.

[0073] The molecular weight of these polymers may vary over a broad range although it is preferred to use polymers having an average molecular weight from 1,000 up to 1,000, 000, more preferably from 1,000 up to 100,000, most preferably from 1,000 up to 10,000.

Hydrotrope Component

[0074] It should be understood that a hydrotrope component is optional in the detergent composition according to the invention and can be omitted if it is not needed for stabilizing the surfactant component. Thus, the detergent according to the invention is preferably free of a hydrotrope component. However, a hydrotrope component can be used to stabilize the surfactant(s).

[0075] Examples of suitable hydrotropes include the sodium, potassium, ammonium and alkanol ammonium salts of xylene, toluene, ethylbenzoate, isopropylbenzene, naphthalene, alkyl naphthalene sulfonates, phosphate esters of alkoxylated alkyl phenols, phosphate esters of alkoxylated alcohols, short chain (C_1 to C_8) alkyl polyglycosides, sodium, potassium and ammonium salts of the alkyl sarcosinates, salts of cumene sulfonates, amino propionates, diphenyl oxides, and disulfonates. The hydrotropes are useful in maintaining the organic materials including the surfactant(s) readily dispersed in the aqueous cleaning solution.

[0076] The hydrotrope component can be provided in combination with the corrosion inhibitor in an amount sufficient to stabilize the surfactant component. When a hydrotrope component is used, it can be provided in an amount of > 1 wt.-% to < 20 wt.-%, preferably > 2 wt.-% to < 15 wt.-%, further preferred > 4 wt.-% to < 10 wt.-%, and more preferred > 6 wt.-% to < 8 wt.-%, based on the weight of the corrosion inhibitor of the detergent composition according to the present invention.

Chelant Component

[0077] The detergent composition according to the invention is preferably free of chelant component. However, the detergent composition of the invention can comprise a chelant that exhibits soil removal properties when used at alkaline conditions. The chelant component is provided for tying up metals in the soil to assist in cleaning and detergency. The chelant component can be provided in the composition in an amount of > 0 wt.-% to < 30 wt.-%, preferably > 2 wt.-% to < 20 wt.-%, further preferred > 4 wt.-% to < 10 wt.-%, and more preferred > 6 wt.-% to < 8 wt.-%, based on the total weight of the composition. It should be understood that the chelant component can include mixtures of different chelants.

[0078] Exemplary chelants that can be used according to the invention include phosphonates, sodium gluconate, pentasodium salt of diethylenetriamine pentaacetic acid (available under the name Versenex 80^0), sodium glucoheptonate, ethylene diamine tetraacetic acid (EDTA), salts of ethylene diamine tetraacetic acid, hydroxyethyl ethylene diamine triacetic acid (HEDTA), salts of hydroxyethyl ethylene diamine triacetic acid, nitrilotriacetic acid (NT A), salts of nitrilotriacetic acid, diethanolglycine sodium salt (DEG), ethanoldiglycine disodium salt (EDG), tetrasodium N,N-bis(carboxylatomethyl)-L-glutamate (GLDA), and mixtures thereof. Exemplary salts of ethylene diamine tetraacetic acid include disodium salts, tetrasodium salts, diammonium salts, and trisodium salts. An exemplary salt of hydroxyethyl ethylene diamine triacetic acid is the trisodium salt. Suitable hydroxymonocarboxylic acid compounds include, but are not limited to, citric acid; propionic acid; gluconic acid; glycolic acid; glucoheptanoic acid; succinic acid; lactic acid; methyllactic acid; 2-hydroxybutanoic acid; mandelic acid; atrolactic acid; phenyllactic acid; glyeric acid; 2,3, 4-trihydroxybutanoic acid; alpha hydro xylauric acid; benzillic acid; isocitric acid; citramalic acid; agaricic acid; quinic acid; uronic acids, including glucuronic acid, glucuronolactonic acid, galaturonic acid, and galacturonolactonic acid; hydroxypyruvic acid; ascorbic acid; and tropic acid. Preferred hydroxymonocarboxylic acid compounds include citric acid; propionic acid; gluconic acid; glycolic acid; glucoheptanoic acid; and succinic acid. Suitable hydroxydicarboxylic acid compounds include, but are not limited to, tartronic acid ; malic acid; tartaric acid; arabiraric acid; ribaric acid; xylaric acid; lyxaric acid; glucaric acid; galactaric acid; mannaric acid; gularic acid; allaric acid; altraric acid; idaric acid; and talaric acid. Preferred hydroxydicarboxylic acid compounds include tartaric acid as well as ethylene diamine tetraacetic acid.

Foam Inhibitor

[0079] The detergent composition according to the invention may comprise foam inhibitors. Suitable non-surface-active foam inhibitors are, for example, organopolysiloxanes and mixtures thereof with microfine, optionally silanised silica and also paraffins, waxes, micro crystalline waxes and mixtures thereof with silanised silica or bis-fatty acid alkylenediamides such as bis-stearyl ethylenediamide. Mixtures of various foam inhibitors, for example mixtures of silicones, paraffins or waxes, may also be used.

[0080] The amount of foam inhibitors can be > 1 wt.-% to < 10 wt.-%, preferably > 2 wt.-% to < 9 wt.-%, further preferred > 3 wt.-% to < 6 wt.-%, and more preferred > 4 wt.-% to < 5 wt.-%, based on the total weight of the detergent composition.

Dispersion Agent

[0081] The detergent composition according to the invention may comprise dispersion agents. A dispersion agent can be provided in the composition in an amount of > 1 wt.-% to < 20 wt.- %, preferably > 2 wt.-% to < 15 wt.-%, further preferred > 4 wt.-% to < 10 wt.-%, and more preferred > 6 wt.-% to < 8 wt.-%, based on the total weight of the detergent composition. It should be understood that the dispersion agent can include mixtures of different dispersion agent.

[0082] Suitable dispersion agents are polycarboxylic acids, particularly malic acid, tartaric acid, citric acid and sugar acids, monomeric and polymeric aminopolycarboxylic acids, particularly methylglycinediacetic acid, nitrilotriacetic acid and ethylenediaminetetraacetic acid as well as polyaspartic acid, polyphosphonic acids, particularly aminotris(methylenephosphonic acid), ethylenediaminetetrakis(methylenephosphonic acid), hydroxyethylidene diposphoric acid and 1-hydroxyethane-1,1-diphosphonic acid, polymeric hydroxyl compounds such as dextrin as well as (poly)-carboxylic acids, particularly those polycarboxylates obtained from the oxidation of polysaccharides or dextrins, polymeric acrylic acids, methacrylic acids, maleic acids and mixed polymers thereof, which can comprise small amounts of copolymerized polymerizable substances exempt from carboxylic acid functionality.

[0083] The average molecular weight of the homopolymers of unsaturated carboxylic acids is generally between 5,000 and 200,000 and that of the copolymers between 2,000 and 200,000, preferably 50,000 to 120,000, each based on the free acid. Particularly preferred is an acrylic acid-maleic acid copolymer having an average molecular weight of 50,000 to 100,000.

[0084] Suitable, yet less preferred dispersion agents of this class are copolymers of acrylic acid or methacrylic acid with vinyl ethers, such as vinyl methyl ethers, vinyl esters, ethylene, propylene and styrene, in which the content of the acid is at least 50 wt. %. Terpolymers, which comprise two unsaturated acids and/or their salts as monomers as well as vinyl alcohol and/or an esterified vinyl alcohol or a carbohydrate, can also be used as water-soluble organic builders. The first acid monomer or its salt is derived from a monoethylenically unsaturated C_3- C_8-carboxylic acid and preferably from a C_3-C_4-monocarboxylic acid, particularly from (meth)acrylic acid. The second monomer or its salt can be a derivative of a C_4-C_8-dicarboxylic acid, maleic acid being particularly preferred, and/or a derivative of an allyl sulfonic acid, which is substituted in the 2-position with an alkyl or aryl radical. These types of polymers generally have an average molecular weight between 1000 and 200,000. Further preferred copolymers are those, which have acrolein and acrylic acid/acrylic acid salts or vinyl acetate as monomers. Polyaspartic acids are particularly preferred.

Other Additives

[0085] The detergent composition according to the invention is preferably free of other additives. However, other additives may be included in the composition according to the present invention if considered necessary.

[0086] Exemplary additional agents include anti-redeposition agents, optical brighteners, sequestrates, builders, water conditioning agents, oil and water repellant agents, color fastness agents, starch/sizing agents, fabric softening agents, souring agents, iron controlling agents, antimicrobials, fungicides, UV absorbers and/or fragrances, and the like.

[0087] The detergent composition according to the invention may also comprise an enzyme material. The enzyme material can be selected from proteases, amylases, lipases, cellulases, peroxidases, and mixtures thereof. The enzyme material can be present in said composition in a concentration of from 0.001 wt.-% to 3 wt.-%, based on the total weight of the detergent composition.

Dye/Odorant

[0088] 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, Direct Blue 86® (Miles), Fastusol 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.

[0089] 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.

[0090] For laundry cleaning or sanitizing compositions, preferred dyes and odorants include one or more blue dyes, which can be employed at concentrations up to 1 wt-%.

Anti-Redeposition Agent

[0091] Anti-redeposition agents can be used to facilitate sustaining a suspension of soils in solution and reduce the tendency of the soils to be redeposited onto a substrate from which they have been removed.

[0092] Exemplary anti-redeposition agents include fatty acid amides, fluorocarbon surfactants, complex phosphate esters, styrene maleic anhydride copolymers, and cellulosic derivatives such as carboxymethyl cellulose, hydroxyethyl cellulose, hydroxypropyl cellulose, and the like. Specific exemplary anti-redeposition agents include styrene maleic anhydride copolymers, sodium tripolyphosphate, sodium carboxymethyl cellulose, polyvinylpyrrolidone, acrylic acid polymers, and maleic/olefmic copolymers.

[0093] The amount of anti-redeposition agents can be > 0.1 wt.-% to < 10 wt.-%, preferably > 0.2 wt.-% to < 5 wt.-%, further preferred > 0.3 wt.-% to < 1 wt.-%, and more preferred > 0.4 wt.-% to < 0.5 wt.-%, based on the total weight of the composition.

Optical Brightener

[0094] Optical brighteners, referred to as fluorescent whitening agents or fluorescent brightening agents, provide optical compensation for the yellow cast in fabric substrates. With optical brighteners, yellowing is replaced by light emitted from optical brighteners present in the area commensurate in scope with yellow color. The violet to blue light supplied by the optical brighteners combines with other light reflected from the location to provide a substantially complete or enhanced bright white appearance. The brightener produces this additional light through fluorescence. Optical brighteners can absorb light in the ultraviolet range (e.g. 275-400 nm) and can emit light in the ultraviolet blue spectrum (e.g. 400-500 nm).

[0095] Fluorescent compounds belonging to the optical brightener family are typically aromatic or aromatic heterocyclic materials often containing condensed ring systems. An important feature of these compounds is the presence of an uninterrupted chain of conjugated double bonds associated with an aromatic ring. The number of such conjugated double bonds is dependent on substituents as well as the planarity of the fluorescent part of the molecule.

[0096] Most brightener compounds are derivatives of stilbene or 4,4'-diamino stilbene, biphenyl, five-membered heterocycles (triazoles, oxazoles, imidazoles, etc.) or six-membered heterocycles (cumarins, naphthalamides, triazines, etc.).

[0097] The choice of optical brighteners for use in a detergent composition will depend upon a number of factors, such as the type of detergent, the nature of other components present in the detergent composition, the temperature of the wash water, the degree of agitation, and the ratio of the material washed to the tub size. The brightener selection is also dependent upon the type of material to be cleaned, e.g. cottons, synthetics, etc.. Since most laundry detergent products are used to clean a variety of fabrics, the detergent composition may contain a mixture of brighteners, which are effective for a variety of fabrics. It is of course necessary that the individual components of such a brightener mixture be compatible.

[0098] Commercial optical brighteners which may be useful in a detergent composition according to the present invention can be classified into subgroups, which include, but are not necessarily limited to, derivatives of stilbene, pyrazoline, coumarin, carboxylic acid, methinecyanines, dibenzothiophene-5,5-dioxide, azoles, 5- and 6-membered-ring heterocycles and other miscellaneous agents. Examples of these types of brighteners are disclosed in "The Production and Application of Fluorescent Brightening Agents" by M. Zahradnik, published by John Wiley & Sons, New York (1982).

[0099] Stilbene derivatives which may be useful in the present invention include, but are not necessarily limited to, derivatives of bis(triazinyl)amino-stilbene; bisacylamino derivatives of stilbene; triazole derivatives of stilbene; oxadiazole derivatives of stilbene; oxazole derivatives of stilbene; and styryl derivatives of stilbene. Preferred optical brighteners include stilbene derivatives.

[0100] Optical brighteners that can suitably be used are 4,4'-bis-(2-sulostyryl)biphenyl (CBS- X) and/or 4,4'-bis-[(4,6-di-anilino-s-triazin-2-yl)-amino]-2,2'-stilbenedisulfonate (DMS-X). The amount of optical brighteners can be > 0.1 wt.-% to < 2 wt.-%, and more preferred > 0.2 wt.-% to < 1 wt.-%, based on the total weight of the detergent composition.

Sequestrant/ Builder

[0101] The detergent composition for low temperature washing of the invention can include a sequestrant. In general, a sequestrant is a molecule capable of coordinating (i.e., binding) the metal ions commonly found in natural water to

prevent the metal ions from interfering with the action of the other detersive ingredients of a cleaning composition. Some chelating/sequestering agents can also function as a threshold agent when included in an effective amount. For a further discussion of chelating agents/sequestrants, see Kirk-Othmer, "Encyclopedia of Chemical Technology", Third Edition, volume 5, pages 339-366 and volume 23, pages 319-320. A variety of sequestrants can be used including, for example, organic phosphonate, aminocarboxylic acid, condensed phosphate, inorganic builder, polymeric polycarboxylate, and mixtures thereof. Such sequestrants and builders are commercially available.

[0102] Suitable condensed phosphates include sodium and potassium orthophosphate, sodium and potassium pyrophosphate, sodium and potassium tripolyphosphate, sodium hexametaphosphate, preferably of tripolyphosphate.

[0103] In an aspect, the composition of the invention includes as sequestrant or builder condensed phosphate and polyacrylate, or sodium tripolyphosphate and polyacrylate. Sodium salts of condensed phosphates are preferred to the corresponding potassium salts.

[0104] The builder can include an organic phosphonate, such as an organic-phosphonic acid and alkali metal salts thereof. The sequestrant can be or include an aminocarboxylic acid type sequestrant. 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; hydro xyethylenediaminetetraacetic acid, nitrilotriacetic acid (NTA); methylglycinediacetic acid (MGDA); 2-hydroxyethyliminodiacetic acid (HEIDA); ethylenediaminetetraacetic acid (EDTA); N-hydroxyethyl-ethylenediaminetriacetic acid (HEDTA); diethylenetriammepentaacetic acid (DTPA); and alanine-N,N-diacetic acid; and mixtures thereof. Preferred amino carboxylates include the sodium salt of EDTA, MGDA, and HEIDA.

[0105] An exemplary sequestrant or builder that can be used includes iminodisuccinic acid (IDS) and salts of iminodisuccinic acid. Such sequestrants are desirable because they are generally considered to be more environmentally friendly compared with other sequestrants.

[0106] It should be understood that the sequestrant and/or builder are optional components. When the composition of the invention includes a sequestrant and/or builder, the sequestrant and/or builder can be provided in an amount of > 0 wt.-% to < 30 wt.- %, preferably > 2 wt.-% to < 20 wt.-%, further preferred > 4 wt.-% to < 10 wt.-%, and more preferred > 6 wt.-% to < 8 wt.-%, based on the weight of the detergent composition.

Color Fastness Agent

[0107] Exemplary color fastness agents that can be used include polyvinyl pyrrolidone and quaternary amines. It should be understood that the color fastness agents are optional, but when they are used, they can be used in the detergent composition of the invention in amounts of > 0.1 wt.-% to < 10 wt.-%, preferably > 0.2 wt.-% to < 5 wt.-%, further preferred > 0.3 wt.-% to < 3 wt.-%, and more preferred > 0.5 wt.-% to < 1 wt.-%, based on the total weight of the detergent composition.

Softening Agent

[0108] The detergent composition of the invention can include softening agents. Exemplary softening agents include quaternary ammonium compounds such as alkylated quaternary ammonium compounds, cyclic quaternary ammonium compounds, aromatic quaternary ammonium compounds, diquaternary ammonium compounds, alkoxylated quaternary ammonium compounds, amidoamine quaternary ammonium compounds, ester quaternary ammonium compounds, and mixtures thereof.

[0109] Exemplary alkylated quaternary ammonium compounds include ammonium compounds having an alkyl group containing between 6 and 24 carbon atoms.

[0110] Exemplary alkylated quaternary ammonium compounds include monoalkyl trimethyl quaternary ammonium compounds, monomethyl trialkyl quaternary ammonium compounds, and dialkyl dimethyl quaternary ammonium compounds.

[0111] Examples of alkylated quaternary ammonium compounds that are commercially available are Adogen®, Arosurf®, Variquat®, and Varisoft®. The alkyl group can be a C_8- C_{22} group or a C_8-C_{18} group or a C_{12}-C_{22} group that is aliphatic and saturated or unsaturated or straight or branched, a benzyl group, an alkyl ether propyl group, a stearyl group, or a palmityl group.

[0112] Exemplary cyclic quaternary ammonium compounds include imidazolinium quaternary ammonium compounds and are commercially available under the name Varisoft®.

[0113] Exemplary aromatic quaternary ammonium compounds include dimethyl alkyl benzyl quaternary ammonium compounds, monomethyl dialkyl benzyl quaternary ammonium compounds, trimethyl benzyl quaternary ammonium compounds, and trialkyl benzyl quaternary ammonium compounds. The alkyl group can contain between 6 and 24 carbon atoms, preferably between 10 and 18 carbon atoms, and can be a stearyl group or a hydrogenated tallow group.

[0114] Exemplary aromatic quaternary ammonium compounds are available under the names Variquat® and Varisoft®. The aromatic quaternary ammonium compounds can include multiple benzyl groups. Diquaternary ammonium com-

pounds include those compounds that have at least two quaternary ammonium groups. An exemplary diquaternary ammonium compound is N-tallow pentamethyl propane diammonium dichloride and is available under the name Adogen 477®. Exemplary alkoxylated quaternary ammonium compounds include methyldialkoxy alkyl quaternary ammonium compounds, trialkoxy alkyl quaternary ammonium compounds, trialkoxy methyl quaternary ammonium compounds, dimethyl alkoxy alkyl quaternary ammonium compounds, and trimethyl alkoxy quaternary ammonium compounds. Exemplary alkoxylated quaternary ammonium compounds are available under the names Varstat® and Variquat®.

[0115] Exemplary amido amine quaternary ammonium compounds include diamidoamine quaternary ammonium compounds. Exemplary diamidoamine quaternary ammonium compounds are available under the name Varisoft®. Exemplary amido amine quaternary ammonium compounds that can be used according to the invention are methyl-bis(tallow amidoethyl)-2-hydroxyethyl ammonium methyl sulfate, and methyl bis (oleylamidoethyl)-2-hydroxyethyl ammonium methyl sulfate. Exemplary ester quaternary compounds are available under the name Stephantex®.

[0116] The quaternary ammonium compounds can include any counter ion that allows the component to be used in a manner that imparts fabric-softening properties. Exemplary counter ions include chloride, methyl sulfate, ethyl sulfate, and sulfate.

[0117] It should be understood that the softening agents are optional components and need not be present in the detergent composition according to the invention. When fabric softening agents are incorporated into the composition of the invention, they can be included in amounts of > 1 wt.-% to < 20 wt.-%, preferably > 2 wt.-% to < 18 wt.-%, further preferred > 4 wt.-% to < 15 wt.-%, and more preferred > 5 wt.-% to < 10 wt.-%, based on the total weight of the detergent composition.

pH Adjusting Agent

[0118] The pH value of the detergent composition according to the invention can be adjusted by adding a pH adjusting agent and/or can be provided as a result of a carryover effect, if present, from a prior washing process step. In addition, the pH of the detergent composition according to the invention can be provided as a result of components in the first and second component of the detergent composition.

[0119] The detergent composition according to the invention can be provided with a pH that favors cleaning. The pH of the first and second component can be adjusted by the introduction of a pH adjusting agent that can be an acid or a base.

[0120] 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 have already been mentioned above and referred to as "source of alkalinity".

[0121] 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.

[0122] Exemplary inorganic acids that can be used include mineral acids such as sulfuric 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.

[0123] 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, $-(EO)_x$, $-(PO)_x$,$-NH_2$, and $-NO_2$ wherein R is a C_1 to C_{10} alkyl group. Exemplary aromatic carboxylic acids include benzoic carboxylic acid and salicylic carboxylic acid. Additional exemplary organic acids include oxalic acid, phthlaic acid, sebacic acid, adipic acid, citric acid, maleic acid, and modified forms thereof containing side groups including halogen, -OH, -R, -OR, $-(EO)_x$, $-(PO)_x$, $-NH_2$, and $-NO_2$ wherein R is a C_1 to C_{10} alkyl group. It should be understood that the subscript "x" refers to repeating units.

[0124] 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, C_3-C_{26} fatty acids that may be saturated or unsaturated, and sulfonated forms of fatty acids. An exemplary aromatic fatty acid includes phenylstearic acid.

[0125] 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.

[0126] 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 composition of first and/or second component.

[0127] It is preferred that the detergent composition according to the invention is free of phosphates and/or ethylenediamine tetraacetate (EDTA) and/or alkylbenzenesulfonate and/or nitromusks and/or polycyclic musks.

[0128] A particularly preferred detergent composition according to the present invention consists of the following ingredients:

ingredient	component	wt.-%
modified sodium aluminiumsilicate	1	23,8
sodium hydroxide	1	0,22
phosphonates	1	0,41
builder	1	4,03
alcohol, C12-15, branched and linear, 7-9 EO	1	8,85
sodium sulphate	1	38,76
alcohol, C12-15, linear, 2-6 EO	1	2,03
starch/sizing agent	1	0,02
foam inhibitor	1	0,17
sodium carbonate peroxyhydrate	2	7,3
tetraacetylethylenediamine	2	4,0
enzyme	2	0,4
sulfuric acid, mono-C12-18 alkylester, sodium salt	2	4,8
perfume	2	0,05
Optical brighthener	1	0,15
water	-	ad 100
total:		***100,0***

Preparation Process

[0129] The two-component heavy duty laundry detergent composition for use at low temperature according to the present application can be prepared by a process comprising the steps of

- preparing the first component as defined above,
- optionally granulating the first component,
- preparing the second component as defined above,
- combining the first and second component to obtain a two-component heavy duty laundry detergent composition according to the invention,
- optionally granulating the two-component heavy duty laundry detergent composition two-component heavy duty laundry detergent composition.

[0130] In a preferred aspect of the present invention, the two-component heavy duty laundry detergent composition is in the form of a powder or granulate.

Laundry Cleaning Process

[0131] Another object of the present invention is to provide a method for removing soil from a laundry item, in particular at low temperatures. Laundry cleaning processes can include processes such as flushing, sudsing, draining, rinsing, extracting, repetitions thereof, or combinations thereof.

[0132] Flushing can include contacting the laundry item with a flushing composition. In an aspect, flushing is the initial wetting step in the machine that carries out the washing procedure. A method of cleaning laundry can include flushing one, two, or more times. Conventional flushing compositions are water (e.g., soft or tap water). In conventional systems, flushing can separate loose soil from and wet a laundry item, but little more.

[0133] Flushing can be referred to as presoaking, preflushing, or prewashing. According to the present invention, flushing includes or can be contacting the laundry item with a penetrant composition. Preferably, contacting with a penetrant composition precedes contact of the laundry item with any composition other than water.

[0134] Sudsing can be referred to as "washing", includes cleaning the laundry item with the detergent composition of the invention. The detergent composition of the invention can herein be referred to as "cleaning composition". Sudsing can follow flushing. According to the present invention, sudsing and other cleaning processes follow contacting with the

penetrant composition. In an aspect, contacting with the penetrant composition can occur during the sudsing cycle, but before addition of the cleaning composition. In an aspect, sudsing includes contacting a penetrant-treated laundry item with a cleaning composition.

[0135] Draining includes removing a cleaning, flushing, or other composition from the laundry item, for example, by gravity and/or centrifugal force. Draining can follow sudsing. Draining can occur between repeats of flushing.

[0136] Rinsing can include contacting the laundry item with a rinse composition suitable for removing remaining cleaning (sudsing and/or bleach) composition. The rinse composition can, for example, be water (e.g., soft or tap water), a sour rinse, or a rinse including a softener. A method of cleaning laundry can include one, two, three, or more rinses. Rinsing can follow sudsing.

[0137] Extracting can include removing a rinse composition from the laundry item, typically with centrifugal force. Extracting can follow one or more rinsing cycles.

[0138] The laundry item can be processed in a laundry washing machine like a washer extractor or a tunnel washer. A washer extractor that can be used includes a drum having an interior for holding laundry, a motor constructed and arranged for rotating the drum, a water inlet for introducing water into the drum interior, a chemical inlet for introducing chemicals into the drum interior, a drain for allowing fluid to drain from the drum interior, and a processing unit constructed for operating the washer extractor.

[0139] A tunnel washer consists of several compartments that are arranged in a tunnel-like construction. The laundry remains in each compartment for a certain time and then is transported to the next compartment by top-transfer or bottom-transfer. Each compartment can be connected to a dosing unit that allows the addition of one or more detergent components. In this way, the first component and the second component, as well as other chemicals for the treatment of the laundry, can be added independently into various compartments of the tunnel washer.

[0140] The method for treating laundry can be provided for a commercial and/or industrial laundry washing apparatus and can be provided in a residential and/or home laundry washing machine. A tunnel washer, also called a continuous batch washer, is an industrial laundry machine designed specifically to handle heavy loads. Exemplary commercial and/or industrial laundry washing facilities include those cleaning textiles for the rental, health care, and hospitality industries. In addition, the method for treating laundry can occur as part of an operation the steps of washing, rinsing, finishing, and extracting. In addition, it should be understood that the step of treating laundry can include, as part of the step, additional activities such as, for example, washing and finishing.

[0141] It is expected that many commercial and industrial laundry washing machines are capable of handling the method for treating laundry according to the invention. Many commercial and industrial laundry washing machines are computer programmable, and computer programs can be provided to operate the machines according to the invention. In addition, it is expected that machines can be made available to treat laundry according to the invention, and that these machines can be used in both industrial and commercial applications and in home and residential applications. In addition, the detergent composition of the invention can be formulated so that it can be used in commercial and industrial laundry washing machines and residential laundry washing machines that are in common use, that are not computer programmable, and without modification. That is, it is expected that conventional laundry washing machines can be used to treat laundry according to the invention.

[0142] The length of time sufficient to provide a desired level of cleaning of the detergent composition of the invention often depends on the laundry washing machine that is being used. In general, it is expected that sufficient cleaning can occur at a time of > 1 minute and < 60 minutes, at a time of t > 5 minutes and < 40 minutes, and a time of > 10 minutes and < 30 minutes. Of course, the amount of time often depends on the temperature of the cleaning process. The temperature of the cleaning can be provided at > 20 °C to < 60 °C, preferably at > 30 °C to < 40 °C.

[0143] The present invention may be better understood with reference to the following examples. These examples are intended to be representative of specific aspects of the invention, and are not intended as limiting the scope of the invention.

EXAMPLES

1. INTRODUCTION

[0144] A Heavy Duty Laundry Detergent Composition according to the invention was tested at 30 °C cotton-program without pre-wash during 15 wash cycles according to the test program "Revised EU Ecolabel Performance Test for Laundry Detergents - Final Draft - Version 10/02/2011".

[0145] The following products were tested:

	product	batch-No.	No. and type of package	filling quantity	dosage per wash cycle	wash temperature
A	IEC-base detergent type A* basic powder + Sodium percarbonate + TAED	237-970 257-819 26746203	1 x PP-bucket 1 x PP-box 1 x PP-box	5,0 kg 1,0 kg 0,5 kg	70 g + 12,5 g + 2,5 g	 30 °C
C	Taxat Clean HDD Powder	10.01.2012	1 x neutral PE-bucket	3,46 kg	76,5 g	30 °C

[0146] The IEC-reference detergent type A* basic powder; Sodium percarbonate and bleach activator TAED were supplied by wfk Testgewebe GmbH.

[0147] The two-component heavy-duty laundry detergent composition according to the invention C had the following ingredients:

ingredient	component	wt.-%
modified sodium aluminiumsilicate	1	23,8
sodium hydroxide	1	0,22
phosphonates	1	0,41
builder	1	4,03
alcohol, C12-15, branched and linear, 7-9 EO	1	8,85
sodium sulphate	1	38,76
alcohol, C12-15, linear, 2-6 EO	1	2,03
starch/sizing agent	1	0,02
foam inhibitor	1	0,17
sodium carbonate peroxyhydrate	2	7,3
tetraacetylethylenediamine	2	4,0
enzyme	2	0,4
sulfuric acid, mono-C12-18 alkylester, sodium salt	2	4,8
perfume	2	0,05
Optical brighthener	1	0,15
water	-	ad 100
total:		***100,0***

[0148] The following criteria of washing performance of the products were tested:

- Stain removal at standardized and circular stains
- Greying (Basic Degree of Whiteness) after 15 wash cycles on standard cotton fabric wfk 11 A

2. TESTING CONDITIONS

[0149] The washing trials were carried out in three washing machines Miele Novotronic W 527 under the following conditions:

product	efficient at	wash program test product	wash program reference product	water inlet temperature test product	water inlet temperature reference product	heaters machine test product disconnected
HDD	30 °C	30 °C normal cotton program, 1200 rpm	30 °C normal cotton program, 1200 rpm	(20 +/-2) °C	(20+/-2) °C	no

[0150] The trials were carried out at a water-hardness of (2,5 +/- 0,2) mmol/L (i.e. 14 +/-0,5 °dH). The total load was (4,5 +/- 0,1) kg. The composition of the load during the 15 wash cycles is given in the **Table 1**.

Table 1 Composition of the load during 15 wash cycles

wash cycle no.	textile items
1 - 5 and 12 - 15	14 huckaback towels 12 pillow cases 4 soil ballast fabrics wfk SBL 2 standard cotton fabrics (20 cm x 20 cm)
6 - 11	12 huckaback towels 12 pillow cases 4 soil ballast fabrics wfk SBL 2 standard cotton fabrics (20 cm x 20 cm) 2 x 14 stains

2.1 Preparation of Standard Cotton Fabric

[0151] Before starting the 15 test cycles the standard cotton fabrics for all products (2 pieces per product) were added to new huckaback towels, which are not used in the test to a (4,0 ± 0,5) kg load. Three washes at 60 °C cotton program without pre-wash with "water-plus-button" in the Miele Novotronic W 527 machines were carried out. For the basic powder of ECE standard detergent for colour fastness tests (phosphate containing, free of optical brighteners, 1 x 1,5 kg; batch 217-563) a dosage of 85,0 g per 4,0 kg load is used. Only after the 3rd wash the standard cotton fabrics were ironed (adjustment: 2 points without steam). Per product each of the 2 pre-washed standard cotton fabrics were added to the washes 1 to 15.

2.2 Determination of Stain Removal

[0152] For determination of stain removal standardized stains (12 x 12) cm^2 and circular stains (5 x 5) cm^2 are applied from the 6^{th} to the 11^{th} wash cycle using two new sets of test fabrics for each wash cycle. The following test fabrics, which are fixed on four huckaback towels, are used for:

Stain	Supplier
Tea	wfk 10J
Coffee	wfk 10K
Red Wine	wfk 10LIU
Chocolate	wfk 10Z
Blood	wfk 10PBU
Make up	wfk 10MU
Fruit Juice	CFT CS-15

(continued)

Stain	Supplier
motor oil, unused	EMPA106
Grass	EMPA164
Tomato Puree	Equest
Carrot Baby Food	Equest
French Sqeezy Mustard	Equest
Grass/Mud	Equest
Frying Fat(Hamburger Grease)	Equest

[0153] The swatches are washed in a single wash cycle (single wash assessment). After each wash cycle the stains are ironed two times (adjustment: 2 points without steam) at a Miele Professional HM16-83 household mangle.

[0154] Cleaning performance was quantified through reflectancy measurement using an automatic reflectometer (Datacolor Spectraflash SF 600, 10 ° observer, D 65, without gloss, with UV-filter at 420 nm) measuring the Y-value. Each standardized stain was measured 4 times, the circular stains were measured 2 times. For each standardized stain mean and standard deviation of 48 measurements and for each circular stain mean and standard deviation of 24 measurements were calculated.

2.3 Determination of Greying (Basic Degree of Whiteness)

[0155] For determination of greying two pieces of standard cotton fabric wfk 11A were applied during 15 wash cycles.

[0156] After 15 wash cycles wash cycle the standard cotton fabrics were ironed two times (adjustment: 2 points without steam) at a Miele Professional HM16-83 household mangle. The samples have to be measured at minimum fourfold. Averages are calculated out of 8 single measurements per standard cotton fabric (8 measurements) with standard deviation. The measurement of the Basic Degree of Whiteness (Y-value) excludes the influence of UV-light, which is excluded by an appropriate filter.

2.4 Minimum Requirements

[0157] In **Table 2** the minimum requirements for Heavy Duty detergent powders are given:

Table 2 Minimum Requirements for Powder Heavy Duty Detergents

Test criteria	Monitors	Powder Heavy Duty Detergents
Stain Removal	14 stains	All the stains must be evaluated separately (Y final) and referred to the reference: DY = (AVERAGE REFERENCE - σ) - (AVERAGE PRODUCT + σ) DY $\leq$ 10 pass DY > 10 fail 3 failures are allowed.
Greying (Basic Degree of Whiteness)	2 standard cotton fabrics	ΔY = AVERAGE REFERENCE - AVERAGE PRODUCT ΔY < 2.0 pass

3. RESULTS

3.1 Determination Stain Removal

[0158] The results of Stain Removal during 6 wash cycles at 30 °C cotton program without pre wash with "water-plus-button" are given in **Table 3.**

Table 3 Stain Removal during six wash cycles (arithmetical mean of 24 respectively 48 values)

stains	product C = test product 30 °C cotton program AVE. + σ	product A = Reference /30 °C cotton program AVE. - σ	DT + (AVERAGE reference - σ) - (AVERAGE test product + σ)
Tea	63,3	64,5	1,2
Coffee	75,6	76,6	1,0
Red wine	68,2	69,5	1,3
Chocolate	66,9	65,3	1,6
Blood	81,7	62,6	0,9
Make up	71,3	69,1	-2,2
Fruit juice	67,6	71,8	4,2
Motor oil, unused	37,7	36,0	-1,7
Grass	62,8	62,4	-0,4
Tomato puree	77,8	78,6	0,8
Carrot Baby food	80,7	79,2	-1,5
French squeezy mustard	72,9	76,3	3,4
Grass/Mud	45,8	41,4	-4,4
Frying fat	25,5	24,3	-1,2

3.2 Determination of Greying (Basic Degree of Whiteness)

[0159] The results of Greying (Basic Degree of Whiteness) after 15 washes at 30 °C cotton program without pre wash with "water-plus-button" are given in **Table 4.**

Table 4 Greying (Basic Degree of Whiteness) - Results after 15 wash cycles on standard cotton cloth wfk 11A

Product	1st cloth	2nd cloth	Average	reference - test product
A = Reference	88,6	88,6	88,6	
C = Test Product	86,9	86.9	86,9	1,7

Claims

1. A two-component heavy duty laundry detergent composition for use at low temperature comprising or consisting of a first component comprising a non-ionic surfactant system comprising or consisting of

(a) > 2 wt.-% of at least one non-ionic low alkoxylated alcohol surfactant containing 2 to 6 ethylene oxide groups and at least one linear primary alcohol containing 12 to 15 carbon atoms,
(b) > 8 wt.-% of at least one non-ionic higher alkoxylated alcohol surfactant containing more than 6 ethylene oxide groups and at least one linear or branched primary alcohol containing 12 to 15 carbon atoms,

calculated on the total weight of the detergent composition, and
a second component comprising a bleaching system comprising or consisting of

(c) < 8 wt.-% of percarbonate, and
(d) > 3 wt.-% of tetraacetylethylenediamine (TAED),

calculated on the total weight amount of the detergent composition,
characterized in that the ratio of (c) to (d) is less than 2 : 1 and the total amount of the bleaching system is at least 10 wt.-% calculated on the total weight of the detergent composition.

2. The detergent composition of claim 1, wherein the ratio of (a) to (b) is less than 1 : 4.

3. The detergent composition of any of claims 1 to 2, wherein the first component further comprises at least one compound selected from the group consisting of builders, complexing agents, antifoaming agents, pH-adjusting agent and combinations of one or compounds thereof.

4. The detergent composition of claim 3, wherein the first component further comprises > 0 wt.-% and <1 wt.-% of phosphonate as complexing agent.

5. The detergent composition of any of claims 1 to 4, wherein the second component further comprises at least one compound selected from the group consisting of enzymes, anionic surfactants, optical brighteners and combinations of one or more compounds thereof.

6. The detergent composition of claim 5, wherein the second component comprises > 0.1 wt.-% and <1 wt.-% of 4,4'-bis-(2-sulfostyryl)biphenyl disodium salt as optical brightener.

7. The detergent composition of any of claims 1 to 6, wherein the composition is free of phosphates and/or ethylenediamine tatraacetate (EDTA) and/or alkylbenzenesulfonates and/or nitromusks and/or polycyclic musks.

8. The detergent composition of any of claims 1 to 7, wherein the composition has a pH-value between 8 and 10, preferably between 8.2 and 9.8, further preferred between 8.3 and 9.7, also preferred between 8.4 and 9.6, more preferred between 8.6 and 9.5, and most preferred between 8.8 and 9.3.

9. The detergent composition of any of claims 1 to 8, wherein the composition is in the form of a powder or granulate.

10. The detergent composition of any of claims 1 to 9, wherein the composition consists of the following components:

ingredient	**component**	**wt.-%**
modified sodium aluminiumsilicate	1	23,8
sodium hydroxide	1	0,22
phosphonates	1	0,41
builder	1	4,03
alcohol, C12-15, branched and linear, 7-9 EO	1	8,85
sodium sulphate	1	38,76
alcohol, C12-15, linear, 2-6 EO	1	2,03
starch/sizing agent	1	0,02
foam inhibitor	1	0,17
sodium carbonate peroxyhydrate	2	7,3
tetraacetylethylenediamine	2	4,0
enzyme	2	0,4
sulfuric acid, mono-C12-18 alkylester, sodium salt	2	4,8
perfume	2	0,05
Optical brighthener	1	0,15
water	-	ad 100
total:		***100,0***

11. Method for preparing a two-component heavy duty laundry detergent composition according to any of claims 1 to 10, comprising the steps of

- preparing the first component,
- optionally granulating the first component,
- preparing the second component,
- combining the first and second component to obtain a two-component heavy duty laundry detergent composition,
- optionally granulating the two-component heavy duty laundry detergent composition.

12. Use of the two-component heavy duty laundry detergent composition according to any of claims 1 to 11 for cleaning laundry items.

13. The use according to claim 12, wherein the cleaning is carried out at a temperature of 60 °C or less, preferably at a temperature of 40 °C or less, most preferably at a temperature of 30 °C or less.

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EUROPEAN SEARCH REPORT

Application Number
EP 17 16 1303

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	US 6 103 685 A (HALL ROBIN GIBSON [GB]) 15 August 2000 (2000-08-15) * column 10, lines 10-18 * * column 23, line 32 - column 24, line 6 * * column 25, lines 44-55 * * column 28, lines 37-41 * * claims; examples 2,7 *	1-13	
A	US 6 187 739 B1 (MERZ THOMAS [DE] ET AL) 13 February 2001 (2001-02-13) * column 6, line 58 - column 7, line 24 * * column 8, line 59 - column 9, line 10 * * claims; examples 6-8 *	1-13	TECHNICAL FIELDS SEARCHED (IPC) C11D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 May 2017	Péntek, Eric

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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