EUROPEAN PATENT SPECIFICATION

LAUNDRY DETERGENT COMPOSITION
WASCHMITTELZUSAMMENSETZUNG
COMPOSITION DE DÉTERGENT DE BLANCHISserie

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References cited:
EP-A- 0 388 389
US-A- 4 863 636

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The present invention relates to the use of hydroxamic acid and its corresponding salts in laundry detergent compositions with low levels of zeolite and phosphate builder, leading to improved detergency and stain removal.

Improvement of stain removal is one of the constant goals of the detergents industry, as this may lead to savings on the use of chemicals in detergent compositions, or may lead to washing at lower temperature, and/or for shorter times, and therewith saving energy. Therefore there is still an interest to improve the detergency effect, especially the primary detergency effect of laundry detergent compositions on textile stains, for example particulate stains, such as stains comprising soils or clay, or plant based stains, such as grass. Especially particulate stains are difficult to remove during the laundering process.

Hydroxamic acids are a class of chemical compounds in which a hydroxylamine is inserted into a carboxylic acid. The general structure of a hydroxamic acid is the following:

![Formula 1](formula1.png)

in which R^1 is an organic residue, for example alkyl or alkylen group. The hydroxamic acid may be present as its corresponding alkali metal salt, or hydroxamate.

The hydroxamates may conveniently be formed from the corresponding hydroxamic acid by substitution of the acid hydrogen atom by a cation:

![Formula 2](formula2.png)

L^+ is a monovalent cation such as for example the alkali metals (e.g. potassium, sodium), or ammonium or a substituted ammonium.

Hydroxamic acids and hydroxamates are known to be useful as metal chelators. They have also been used in detergent compositions in order to improve bleaching performance, as well as use as a builder substance.

EP 388 389 A2 discloses bleach free under built liquid detergent compositions containing hydroxamic acids and their derivatives which assist in the removal of bleachable wine stains from fabrics during laundering. Hydroxamic acids as in formula 1 are disclosed, wherein R^1 represents an optionally substituted straight- or branched chain C_5-C_21 alkyl or C_5-C_21 alkenyl group or an optionally-substituted phenyl group, and R^2 represents hydrogen, or an optionally substituted C_1-C_6 alkyl group, or an optionally-substituted phenyl group. One of the examples shows an improved bleaching performance when a hydroxamate is used in a detergent composition in hard water (20° German hardness, which is about 143 milligram calcium per litre). The examples use C_12 linear, C_12 branched, C_13 branched and C_18 hydroxamates in detergent formulations comprising mixtures of anionic surfactant and nonionic surfactant. In examples I, II and IV there is an excess of nonionic surfactant of at least 1.25 to 1 and in example III there is 100% anionic surfactant. The liquids also contain at least 6 wt% ethanol, which assists in solubilising the long chain hydroxamates.

US 4,863,636 discloses liquid detergent compositions comprising one or more detersive surfactants and one or more of N-hydroxyimide or carboxy hydroxamic acid detergent additives. These compounds serve as active metal ion chelating agents, leading to improved stain removal.
WO 97/48786 discloses a multicomponent system for use with detergent substances, containing an oxidation catalyst, a suitable oxidant, at least one mediator that has been selected from the group of, among others, hydroxamic acids and hydroxamic acid derivatives, a co-mediator, and optionally a low quantity of at least one free amine of each mediator. This system leads to improved bleach function of the detergent, and less consumption of a mediator.

GB 1317445 discloses detergent compositions comprising an alkali-metal salt of a hydroxamic acid. The function of this salt is to prevent the corrosion of copper and copper alloys that is utilised in the construction of the washing machines.

We have now surprisingly found that the primary detergency effect, especially on red clay particulate soil, can be improved by incorporating specific hydroxamic acids and/or hydroxamates in specific laundry detergent compositions.

Laundry detergents need to be able to remove everyday dirt and stains that are commonly found in a wash load. Two particular stains that are problematic, especially when children’s wear or sport’s wear is being washed, are clay soil stains and grass stains. One type of clay that is particularly resistant to removal by surfactants alone is red clay, such as red pottery clay or Red Georgia clay. This is a particulate soil stain.

Accordingly, the present invention provides a laundry detergent composition according to claim 1.

It should be understood that references to a number of carbon atoms include mixed chain length materials provided that some of the hydroxamate material falls within the ranges specified and the ratios and amounts are determined by excluding any material falling outside of the specified range.

Soap is not included in the calculation of anionic surfactant amounts and ratios.

Due to the relatively high levels of hydroxamate that are present in the formulation, if a high level of surfactant is present, it is necessary to seek alternative hydrotrope systems. We prefer a hydrotrope system comprising propylene glycol and glycerol at levels of at least 6 wt%, more preferably at least 10 wt%. By using high levels of hydroxamate and surfactant in the composition, it is possible to use less composition per wash, which has consequential benefits for the storage and transportation of the resulting concentrated formulation. Such concentrated formulations comprise at least 20 wt% of the detersive surfactant system, preferably at least 30 wt% and more preferably over 40 wt%.

The preferred hydroxamates are those where R² is Hydrogen and R¹ is C₈ to C₁₄ alkyl, preferably normal alkyl, most preferably saturated.

The detergent composition is preferably used in an aqueous wash liquor, but may comprise one or more solvents suitable for use for domestic laundry purposes. Preferably, the improved stain removal occurs during the main wash of the laundry process, i.e. preferably the laundry detergent composition in which the hydroxamates are used is a main wash product. The wash liquor is preferably free of formate salts. Furthermore, it is preferably free from bleach, especially peroxygen bleach.

The composition may comprise from 1 to 15 wt% soap. The preferred soaps are made from saturated fatty acids.

Especially preferred compositions comprise at least 0.5 wt% of soil release polymer. This improves the multiwash performance of the detergent system for the removal of the clay. Inclusion of at least 0.5 wt% anti redeposition polymer is also beneficial due to the very high efficiency of primary detergency soil removal meaning that there is an increased level of soil in the wash liquor, which must then be prevented from redeposition onto the same or a different piece of fabric.

The preferred ratio of hydroxamate to detersive surfactant system for optimum particulate red clay soil removal lies in the range 1:7 to 1:13. An even more preferred range of ratios being 1:9 to 1:11 parts by weight.

The preferred ratio of anionic to nonionic surfactant for particulate red clay soil removal is at least 1:1, more preferably at least 3:2. Preferably, it is at most 9:1. So a most preferred range is 1:1 to 9:1, or 3:2 to 9:1.

The compositions are particularly suitable for use on particulate stains such as soils and clays, especially red clay, and also surprisingly grass.

The invention also extends to the use of 0.5 to 20 wt% hydroxamic acid or its corresponding hydroxamate of the structure:

![Chemical structure](image)

wherein R¹ is a C₈ normal alkyl group, and R² is a hydrogen atom, in a laundry detergent composition, for improving the particulate soils stain removal from a textile substrate, wherein the composition further comprises a detersive surfactant system comprising anionic surfactant and nonionic surfactant at a concentration from 3 to 80 wt%; and optionally

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[0011] [0012] [0013] [0014] [0015] [0016] [0017] [0018] [0019] [0020] [0021] [0022] [0023] [0024] [0025] [0026]

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3
other ingredients to 100 wt%.

**[0027]** The hydroxamate may be incorporated within the laundry detergent compositions in any suitable fashion within the knowledge of a person of ordinary skill in the art.

**Detailed Description of the Invention**

**[0028]** Whenever either the term 'hydroxamic acid' or 'hydroxamate' is used in this specification, this encompasses both hydroxamic acid and the corresponding hydroxamate (salt of hydroxamic acid), unless indicated otherwise.

**[0029]** All percentages mentioned herein are by weight calculated on the total composition, unless specified otherwise. The abbreviation 'wt%' is to be understood as % by weight of the total composition.

**[0030]** The stained fabric is treated with the laundry detergent composition comprising hydroxamate according to the invention and the primary detergency is the measured stain removal by the laundry composition on the stain. This is a separate process to so-called soil release using a polymer, which is treatment of fabric with a polymer (through a wash or other such treatment), with subsequent staining of the fabric, the soil release polymer having the effect of the easier removal of the stain.

**[0031]** The following definitions pertain to chemical structures, molecular segments and substituents:

Molecular weights of monomers and polymers are expressed as weight average molecular weights, except where otherwise specified.

**[0032]** The textile/fabric substrates used can be any typical textile/fabric substrate, such as cotton (woven, knitted & denim), polyester (woven, knitted & micro fibre), nylon, silk, polycotton (polyester/cotton blends), polyester elastane, cotton elastane, viscose rayon, acrylic or wool. Particularly suitable textile/fabric substrates are cotton, polycotton and polyester substrates.

Particulate stains are stains comprising for example dirt, soil, clay, mud or soot. They are predominately solid in nature and come into contact with fabrics in the course of their regular use.

**Hydroxamic acid and derivatives**

**[0033]** The general structure of a hydroxamic acid in the context of the present invention has been indicated in formula 3, and R1, is as defined above. R1 is chosen from the group consisting of C4, C5, C6, C7, C8, C9, C10, C11, or C12 or C14 normal alkyl group, most preferably R1 is at least a C8-14 normal alkyl group. When the C8 material is used this is called octyl hydroxamic acid. The potassium salt is particularly useful.

\[
\text{H}_2\text{N}=\text{C}(\text{OH})\text{R}^1
\]

**octanohydroxamic acid K salt**

**[0034]** Without wishing to be bound by theory, we believe that the hydroxamate acts by binding to metal ions that are present in the soil on the fabric. This binding action, which is, in effect, the known sequestrant property of the hydroxamate is not, in itself, of any use to remove the soil from the fabric. The key is the "tail" of the hydroxamate i.e. the group R1 minus any branching that folds back onto the amate Nitrogen via group R2. The tail is selected to have an affinity for the surfactant system. This means that the soil removal ability of an already optimised surfactant system is further enhanced by the use of the hydroxamate as it, in effect, labels the difficult to remove particulate material (clay) as "soil" for removal by the surfactant system acting on the hydroxamate molecules now fixed to the particulates via their binding to the metal ions embedded in the clay type particulates. The detergents will adhere to the hydroxamate, leading overall to more surfactants interacting with the fabric, leading to better soil release. Therewith the hydroxamic acids act as a linker molecule facilitating the removal and suspension of the particulate soil from the fabric into a wash liquor and thus boosting the primary detergency.

**[0035]** This enhancing of the primary detergency of surfactant systems is especially relevant when using concentrated liquid detergent compositions, as the pH during the laundering process is relatively low (pH 7.5-8) as compared to traditional laundering processes with particulate detergent compositions (pH 9-10.5). The lower pH during the laundering process with liquid detergent compositions may lead to reduced soil release, as the surface charges of the soils are less negative as compared to the higher pH during the conventional well built and buffered laundering processes, achieved with conventional zeolite or phosphate built powder products. This surface charge of the soil may lead to increased repellence of the surfactants by the soil, possibly leading to reduced release of the soil. Hence, in a preferred embodiment, the hydroxamates are used in liquid detergent compositions, and more preferred the detergents surfactant concentration.
in said liquid detergent compositions is from 20 to 80 wt%.

**Surfactants**

**[0037]** The laundry detergent composition in which the hydroxamate is used comprises a detersive surfactant system at a concentration from 3 to 80 wt%. By a detersive surfactant system, we mean that the surfactants therein provide a detersive, i.e. cleaning effect to textile fabrics treated as part of a laundering process. Other surfactants, which are not detersive surfactants, can be used as part of the composition.

**[0038]** Preferably, the detersive surfactant is present at a level of from 5 to 60 wt%, more preferably from 10 to 50 wt%. Even more preferably, the detersive surfactant system comprises at least 20, or 30 or even 40 wt% of the composition.

**[0039]** In general, any surfactant may be used as detersive surfactants, including anionic, nonionic, cationic, and amphoteric or zwitterionic surfactants, or combinations of these, provided that there is anionic and nonionic surfactant present in the range of ratios specified above.

**[0040]** Cationic surfactant may optionally be present as part of the detersive surfactant.

**[0041]** Anionic surfactant is present at a level of from 0.1 to 50 wt%, preferably from 1 to 40 wt%, more preferably from 1.5 to 25 wt%. Nonionic surfactant is incorporated at a level of from 0.1 to 50 wt%, preferably from 1 to 40 wt%, more preferably from 1.5 to 25 wt%. The ratio of anionic surfactant to nonionic surfactant is from 19:1 to 1:1.1, more preferably from 9:1 to 1:1.


**Nonionic surfactant**

**[0043]** For the purposes of this disclosure, 'nonionic surfactant' shall be defined as amphiphilic molecules with a molecular weight of less than about 10,000, unless otherwise noted, which are substantially free of any functional groups that exhibit a net charge at the normal wash pH of 6-11.

**[0044]** Any type of nonionic surfactant may be used, although preferred materials are further discussed below. Highly preferred are fatty acid ethoxylates, especially ethoxylates, having an alkyl chain of from C₆-C₂₆, preferably C₈-C₃₀, more preferably C₁₀-C₁₂₆, especially C₁₀-C₁₈ carbon atoms, for example, the Neodol range from Shell (The Hague, The Netherlands); ethylene oxide/propylene oxide oxide block polymers which may have molecular weight from 1,000 to 30,000, for example, Pluronic (trademark) from BASF (Ludwigshafen, Germany); and alkylphenol ethoxylates, for example Triton X-100, available from Dow Chemical (Midland, Mich., USA).

**[0045]** Other nonionic surfactants should also be considered within the scope of this invention. These include condensates of alkanolamines with fatty acids, such as cocamide DEA, polyol-fatty acid esters, such as the Span series available from Uniqema (Gouda, The Netherlands), ethoxylated polyol-fatty acid esters, such as the Tween series available from Uniqema (Gouda, The Netherlands), alkylpolyglucosides, such as the APG line available from Cognis (Düsseldorf, Germany) and n-alkylpyrrolidones, such as the Surfadone series of products marketed by ISP (Wayne, N.J., USA). Furthermore, nonionic surfactants not specifically mentioned above, but within the definition, may also be used.

**[0046]** The more preferred nonionic surfactants are the fatty acid ethoxylates with an average degree of ethoxylation of 7, alkoxylates with one propylene oxide and multiple ethylene oxide units, seed oil based surfactant, such as Ecosurf SA7 or SA9 available from Dow Chemical, APGs, and branched alcohol Guerbet nonionics.

**Anionic surfactant**

**[0047]** 'Anionic surfactants' are defined herein as amphiphilic molecules comprising one or more functional groups that exhibit a net anionic charge when in aqueous solution at the normal wash pH of between 6 and 11.

**[0048]** Preferred anionic surfactants are the alkali metal salts of organic sulphur reaction products having in their molecular structure an alkyl radical containing from about 6 to 24 carbon atoms and a radical selected from the group consisting of sulphonic and sulphuric acid ester radicals.

**[0049]** Although any anionic surfactant hereinafter described can be used, such as alkyl ether sulphates, soaps, fatty acid ester sulphonates, alkyl benzene sulphonates, sulphonesuccinate esters, primary alkyl sulphates, olefin sulphonates,
paraffin sulphonates and organic phosphate; preferred anionic surfactants are the alkali and alkaline earth metal salts of fatty acid carboxylates, fatty alcohol sulphates, preferably primary alkyl sulfates, more preferably they are ethoxylated, for example alkyl ether sulphates; alkylbenzene sulphonates, alkyl ester fatty acid sulphonates, especially methyl ester fatty acid sulphonates and mixtures thereof.

Cationic, amphoteric surfactants and/or zwitterionic surfactants

[0050] Also cationic, amphoteric surfactants and/or zwitterionic surfactants may be present in the laundry detergent compositions in which the hydroxamate is used as cosurfactant according to the invention.

[0051] Preferred cationic surfactants are quaternary ammonium salts of the general formula \( R_1R_2R_3R_4N^+X^- \), for example where \( R_1 \) is a \( C_{12-14} \) alkyl group, \( R_2 \) and \( R_3 \) are methyl groups, \( R_4 \) is a 2-hydroxyethyl group, and \( X^- \) is a chloride ion. This material is available commercially as Praepagen (Trade Mark) HY from Clariant GmbH, in the form of a 40% by weight aqueous solution.

[0052] In a preferred embodiment the laundry detergent composition in which the hydroxamate is used according to the invention further comprises an amphoteric or zwitterionic surfactant. Amphoteric surfactants are molecules that contain both acidic and basic groups and will exist as zwitterions at the normal wash pH of between 6 and 11. Preferably an amphoteric or zwitterionic surfactant is present at a level of from 0.1 to 20% by weight, more preferably from 0.25 to 15% by weight, even more preferably from 0.5 to 10% by weight.

[0053] Suitable zwitterionic surfactants are exemplified as those which can be broadly described as derivatives of aliphatic quaternary ammonium, sulphonium and phosphonium compounds with one long chain group having about 8 to about 18 carbon atoms and at least one water solubilizing radical selected from the group consisting of sulfate, sulfonate, carboxylate, phosphate or phosphonate. A general formula for these compounds is:

\[
R_1(R_2)_xY^+R_3Z^-
\]

wherein \( R_1 \) contains an alkyl, alkenyl or hydroxyalkyl group with 8 to 18 carbon atoms; \( Y \) is a nitrogen, sulphur or phosphorous atom; \( R_2 \) is an alkyl or hydroxyalkyl group with 1 to 3 carbon atoms; \( x \) is 1 when \( Y \) is a sulphur atom and 2 when \( Y \) is a nitrogen or phosphorous atom; \( R_3 \) is an alkyl or hydroxyalkyl group with 1 to 5 carbon atoms and \( Z \) is radical selected from the group consisting of sulfate, sulfonate, carboxylate, phosphate or phosphonate.

[0054] Preferred amphoteric surfactants are amine oxides, for example coco dimethyl amine oxide.

[0055] Preferred zwitterionic surfactants are betaines, and especially amidobetaines. Preferred betaines are \( C_8 \) to \( C_{18} \) alkyl amidoalkyl betaines, for example coco amido betaine. These may be included as co-surfactants, preferably present in an amount of from 0 to 10 wt %, more preferably 1 to 5 wt %, based on the weight of the total composition. Other betaines that may be employed are sulfatobetaines, such as 3-(dodecyl(dimethylammonium)-1-propane sulfonate; and 2-(coco(dimethylammonium)-1-ethane sulfate. Sulfo betaines, such as: 3-(dodecyl(dimethyl-ammonium)-2-hydroxy-1-propane sulfonate; 3-(tetradecyl(dimethylammonium)-1-propane sulfonate; 3-(C12-C14 alkyl-amidopropyl(dimethylammonium)-2-hydroxy-1-propane sulfonate; and 3-(coco(dimethylammonium)-1-propane sulfonate. Carboxy betaines, such as (dodecyl(dimethylammonium) acetate (also known as lauryl betaine); (tetradecyl(dimethylammonium) acetate (also known as myristyl betaine); (coco(dimethylammonium) acetate (also known as coconut betaine); (oleyl(dimethylammonium) acetate (also known as oleyl betaine); (dodecyloxyethyl(dimethylammonium) acetate; and (cocoamido-propyl(dimethylammonium) acetate (also known as cocoamido-propyl betaine or CAPB).

[0056] The sulphonium betaines, such as: (dodecyl(dimethylsulphonium) acetate; and 3-(coco(dimethyl-sulphonium)-1-propane sulfonate.

The phosphonium betaines, such as 4-(trimethylyphosphonium)-1-hexadecane sulfonate; 3-(dodecyl(dimethylphosphonium)-1-propanesulfonate; and 2-(dodecyl(dimethylphosphonium)-1-ethane sulfonate.

The laundry detergent compositions preferably comprise carboxy betaines or sulphonbetaines as amphoteric or zwitterionic surfactants, or mixtures thereof. Especially preferred is lauryl betaine. The betaines and hydroxamates may provide even further enhanced particulate soil removal when used together in the compositions according to the invention.

Detergency builders

[0057] The laundry detergent compositions in which the hydroxamate is used preferably comprise low levels of detergency builder, based on the weight of the total composition. The amounts of the inorganic builders zeolite and phosphate are less than 5 wt%. These builders are considered to be harmful to the environment when used in large quantities. Furthermore they need to be used at high levels to have a significant building effect and this is inconsistent with the modern concentrated highly weight efficient laundry detergent formulations.

[0058] Preferably the builder is selected from the group of alkali and alkaline earth metal carbonates (e.g. sodium
carbonate), silicates (e.g. layered silicate), and organic builders such as citrates (e.g. sodium citrate), succinates, sulphanamates and malonates, and any combination of these. The organic builders are preferred. They may be used at levels of 1 wt% or more, up to, say, 50 wt%.

[0059] Organic builders that may be present include polycarboxylate polymers such as polyacrylates and acrylic/maleic copolymers; polyaspartates; monomeric polycarboxylates such as citrates, gluconates, oxydissuccinates, glycerol mono-di- and trisuccinates, carboxymethylxysuccinates, carboxy-methyloxymalonates, dipicolinates, hydroxyethyliminodiacetates, alkyl- and alkenyImalonates and succinates; and sulphonated fatty acid salts.

[0060] Organic builders may be used in minor amounts. Especially preferred organic builders are citrates, suitably used in amounts of from 1 to 30 wt%, preferably from 1.5 to 10 wt%; and acrylic polymers, more especially acrylic/maleic copolymers, suitably used in amounts of from 0.5 to 15 wt%, preferably from 1 to 10 wt%.

[0061] Builders, both inorganic and organic, are preferably present in alkali metal salt, especially sodium salt, form.

Other optional ingredients

[0062] In addition to the essential components detailed in the claims, the formulation may include one or more optional ingredients to enhance performance and properties. While it is not necessary for these elements to be present in order to practice this invention, the use of such materials is often very helpful in rendering the formulation acceptable for consumer use.

[0063] Examples of optional components include, but are not limited to: hydrotropes, fluorescent whitening agents, photobleaches, fibre lubricants, reducing agents, enzymes, enzyme stabilising agents (such as borates and polyols), powder finishing agents, defoamers, bleaches, bleach catalysts, soil release agents, especially, soil release polymers for cotton or polyester or both, antiredeposition agents, especially antiredeposition polymers, dye transfer inhibitors, buffers, colorants, fragrances, pro-fragrances, rheology modifiers, anti-ashing polymers, preservatives, insect repellents, soil repellents, water-resistance agents, suspending agents, aesthetic agents, structuring agents, sanitisers, solvents, including aqueous and non-aqueous solvents, fabric finishing agents, dye fixatives, wrinkle-reducing agents, fabric conditioning agents and deodorizers.

[0064] These optional ingredients may include, but are not limited to, any one or more of the following: soap, peroxyacid and perssalt bleaches, bleach activators, sequestants, cellulose ethers and esters, other antiredeposition agents, sodium sulphate, sodium silicate, sodium chloride, calcium chloride, sodium bicarbonate, other inorganic salts, fluocerscens, photobleaches, polyvinyl pyrrolidone, other dye transfer inhibiting polymers, foam controllers, foam boosters, acrylic and acrylic/maleic polymers, proteases, lipases, cellulases, amylases, other detergent enzymes, citric acid, soil release polymers, fabric conditioning compounds, coloured speckles, and perfume.

[0065] The laundry detergent composition may suitably contain a bleach system based on peroxy bleach compounds, for example, inorganic persalts or organic peroxyacids, capable of yielding hydrogen peroxide in aqueous solution.

Suitable peroxy bleach compounds include organic peroxides such as urea peroxide, and inorganic persalts such as the alkali metal perborates, percarbonates, perphosphates, persilicates and persulphates. Preferred inorganic persalts are sodium perborate monohydrate and tetrahydrate, and sodium percarbonate. Especially preferred is sodium percarbonate having a protective coating against destabilisation by moisture. Sodium percarbonate having a protective coating comprising sodium metaborate and sodium silicate is disclosed in GB 2 123 044B (Kao).

[0066] The peroxy bleach compound is suitably present in an amount of from 5 to 35% by weight, preferably from 10 to 25% by weight.

[0067] The peroxy bleach compound may be used in conjunction with a bleach activator (bleach precursor) to improve bleaching action at low wash temperatures. The bleach precursor is suitably present in an amount of from 1 to 8% by weight, preferably from 2 to 5% by weight.

[0068] Preferred bleach precursors are peroxycarboxylic acid precursors, more especially peracetic acid precursors and peroxybenzoic acid precursors; and peroxyrocarbonic acid precursors. An especially preferred bleach precursor suitable for use in the present invention is N,N,N',N'-tetracetyl ethylenediamine (TAED). Also of interest are peroxybenzoic acid precursors, in particular, N,N,N-trimethylammonium toluoyloxy benzene sulphonate.

[0069] A bleach stabiliser (heavy metal sequestrant) may also be present. Suitable bleach stabilisers include ethylenediamine tetracetate (EDTA) and the polyphosphonates such as Dequest (Trade Mark), EDTMP. However, notwithstanding the above it is preferred for the composition to contain no bleach and to rely on the improved clay stain removal derived from the novel hydroxamate and surfactant combination. This is particularly the case for liquid compositions.

[0070] The detergent compositions may also contain one or more enzymes. Suitable enzymes include the proteases, amylases, cellulases, oxidases, peroxidases and lipases usable for incorporation in detergent compositions.

[0071] In particular detergent compositions, detergency enzymes are commonly employed in granular form in amounts of from about 0.1 to about 3.0 wt%. However, any suitable physical form of enzyme may be used in any effective amount.

[0072] Antiredeposition agents, for example cellulose esters and ethers, for example sodium carboxymethyl cellulose,
may also be present.

The compositions may also contain soil release polymers, for example sulphonated and unsulphonated PET/POET polymers, both end-capped and non-end-capped, and polyethylene glycol/polyvinyl alcohol graft copolymers such as Sokolan (Trade Mark) HP22. Especially preferred soil release polymers are the sulphonated non-end-capped polyesters described and claimed in WO 95 32997 A (Rhodia Chimie).

**Product form and preparation**

A product according to the invention may take any suitable form, such as a solid, liquid or paste composition, for example as particulates (powders, granules), tablets or bars.

Preferably, the product is in a concentrated liquid with a surfactant concentration of at least 30wt%. Such compositions require the presence of hydroxopropylcellulose to solubilise the ingredients. Ethanol is preferably avoided. Preferred hydroxopropylcellulose are propylene glycol and glycerol. Based on this teaching the skilled person will be able to select other hydroxopropylcellulose that avoid the use of highly volatile solvents like ethanol without the need for inventive activity.

According to a second embodiment of the invention, the detergent composition is in particulate form. The ratio of anionic to nonionic surfactant in the detergent surfactant system is then preferably at least 3:2, preferably at least 7:2.

Powders of low to moderate bulk density may be prepared by spray-drying slurry, and optionally post dosing (dry-mixing) further ingredients. Routes available for powder manufacture include spray drying, drum drying, fluid bed drying, and scraped film drying devices such as the wiped film evaporator. A preferred form of scraped film device is a wiped film evaporator. One such suitable wiped film evaporator is the Dryex system based on a wiped film evaporator available from Ballestra S.p.A.. Alternative equipment would be the Chemithon the Turbo Tube dryer system wherein a high active surfactant paste is heated and metering to a multi tube, steam-jacketed drying vessel.

'Concentrated' or 'compact' powders may be prepared by mixing and granulating processes, for example, using a high-speed mixer/granulator, or other non-tower processes.

Tablets may be prepared by compacting powders, especially 'concentrated' powders.

The invention will now be further described with reference to the following non-limiting examples.

**EXAMPLES**

**Measurement of Soil Release Index (SRI)**

SRI is a measure of how much of a stain on textile is removed during a washing process. The intensity of any stain can be measured by means of a reflectometer in terms of the difference between the stain and a clean cloth giving $\Delta E^*$ for each stain. It is defined as $\Delta E^*$ and is calculated as:

$$
\Delta E^* = \sqrt{\left(L_{stain\-before}^* - L_{clean\-cloth}^*\right)^2 + \left(a_{stain\-before}^* - a_{clean\-cloth}^*\right)^2 + \left(b_{stain\-before}^* - b_{clean\-cloth}^*\right)^2}
$$

$L^*$, $a^*$, and $b^*$ are the coordinates of the CIE 1976 ($L^*$, $a^*$, $b^*$) colour space, determined using a standard reflectometer. $\Delta E^*$ can be measured before and after the stain is washed, to give $\Delta E^*_{bw}$ (before wash) and $\Delta E^*_{aw}$ (after wash). SRI is then defined as:

$$
\text{SRI} = 100 - \Delta E^*_{aw}
$$

A SRI of 100 means complete removal of a stain.

$\Delta E$ after wash is the difference in $L$ a b colour space between the clean (unwashed) fabric and the stain after wash. So a $\Delta E$ after wash of zero means a stain that is completely removed. Therefore, a SRI$_{aw}$ of 100 is a completely removed stain. The clean (or virgin) fabric is an "absolute standard" which is not washed. For each experiment, it refers to an identical piece of fabric to that which the stain is applied. Therefore, its point in L a b colour space stays constant.

Example 1: Preparation of octyl hydroxamate (potassium salt)

The potassium salt of octyl hydroxamate was prepared by the method disclosed by Raghavan and Fuerstenau (Journal of Colloid and Interface Science, 1975, Vol. 50, p. 319-330).
Example 2: Removal of red clay stains on knitted polyester (2:1)

A wash liquor was formulated, containing as surfactants primary alkyl sulfate (PAS, anionic, ex Kao Emal PH10) and alcohol ethoxylate (nonionic C_{12}-7EO, Neodol 25-7 ex Shell), as shown in table 1 at the indicated concentrations. Additionally the wash liquor contained NaCl at a concentration of 5 mM. Water hardness was 6°FH (soft water, about 24 milligram calcium per litre), and water temperature was 30°C. No builder or sequestrants were added to the composition, as these ingredients were not required due to the soft water used.

Table 1 Concentrations of surfactants and hydroxamate in wash liquors.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Formulation 1</th>
<th>Formulation 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>primary alcohol sulfate</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>alcohol ethoxylate (C_{12}-7EO)</td>
<td>0.16</td>
<td>0.16</td>
</tr>
<tr>
<td>octyl hydroxamate (potassium salt) prepared in example 1</td>
<td>0.00</td>
<td>0.05</td>
</tr>
</tbody>
</table>

The following results were obtained for the removal of red clay stains from knitted polyester cloth, as measured in the following standard protocol, called the soft water Tergotometer wash protocol, using a Tergotometer washing machine. The red clay used is a form of pottery clay.

Soft water Tergotometer wash protocol:

1. Measurement of the colour of the stain on the textile cloth
2. Set Tergotometer to 25°C.
3. Add water and formulation stock solutions to each pot, agitate for 1 minute.
4. Add stain cloths and ballast, switch on Tergotometer.
5. Leave to wash for 12 minutes
6. Rinse cloths in 6° French hard water for 1 minute, repeat rinse.
7. Dry cloths overnight.
8. Measurement of the colour of the stain on the textile cloth

Table 2 Stain removal index (SRI) for red clay stains on knitted polyester

<table>
<thead>
<tr>
<th>Formulation</th>
<th>SRI red clay stains on knitted polyester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (comparative)</td>
<td>88.0</td>
</tr>
<tr>
<td>2</td>
<td>97.2</td>
</tr>
</tbody>
</table>

This experiment shows that the formulation comprising octyl hydroxamate leads to substantially better removal of red clay stains from knitted polyester in soft water. As this is an experiment in soft water, the mechanism by which the hydroxamic acid acts is not as a builder, therefore the builder effect is excluded as a mechanism of action for improvement of the detergency effect.

Example 3: Removal of Georgia clay stains from knitted polyester and grass stains from woven cotton

Two liquid detergents were formulated. The surfactants used were sodium alkyl benzene sulphonate (Na LAS, anionic), alcohol ethoxylate (nonionic C_{12}-7EO, Neodol 25-7 ex Shell) and a neutralised saturated soap (coco fatty acid (Prifac 5908 ex Uniqema)) as shown in table 3 at the indicated concentrations. Also used were standard compounds of a laundry liquid detergent (builder (sodium citrate), hydrotrope (5% glycerol and 9% propylene glycol), buffer and sequestrant (Dequest 2086 phosphonate), enzyme (Savinase Ultra 16L protease). Two wash liquors were prepared using formulations 3 and 4, respectively, as outlined in table 3, to give surfactant and hydroxamate levels as shown in table 4. The water hardness in the liquors was 26°FH (median water, about 104 milligram calcium per litre), and water temperature was 40°C. The pH was buffered to between 7 and 8.
The following results were obtained for the removal of Georgia clay stains from knitted polyester cloth and the removal of grass stains from woven cotton, as measured in the following standard protocol, called the Linitest™ wash protocol, using a Linitest™ washing machine.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Formulation 3</th>
<th>Formulation 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na LAS</td>
<td>27.6</td>
<td>27.6</td>
</tr>
<tr>
<td>alcohol ethoxylate (C_{12} 7EO)</td>
<td>12.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Na soap</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>octyl hydroxamate (potassium salt) prepared in example 1</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Dequest 2066</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>sodium citrate</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>triethanol amine</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>hydrotropes, enzymes &amp; minors</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>water</td>
<td>32.2</td>
<td></td>
</tr>
</tbody>
</table>

Table 4 Concentrations of surfactants and hydroxamates in wash liquors based on the formulations in table 3.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Formulation 3</th>
<th>Formulation 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na LAS</td>
<td>0.72</td>
<td>0.72</td>
</tr>
<tr>
<td>alcohol ethoxylate (C_{12} 7EO)</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>Na soap</td>
<td>0.24</td>
<td>0.24</td>
</tr>
<tr>
<td>octyl hydroxamate (potassium salt) prepared in example 1</td>
<td>0.00</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Table 5 Stain removal index (SRI) for Georgia clay stains on knitted polyester and woven cotton and grass on knitted polyester

<table>
<thead>
<tr>
<th>Formulation</th>
<th>SRI Georgia clay on knitted polyester</th>
<th>SRI Grass on knitted polyester</th>
<th>SRI Georgia clay on woven cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 (comparative)</td>
<td>79.4</td>
<td>90.1</td>
<td>66.4</td>
</tr>
<tr>
<td>4</td>
<td>89.1</td>
<td>92.1</td>
<td>70.7</td>
</tr>
</tbody>
</table>

[0089] The following results were obtained for the removal of Georgia clay stains from knitted polyester cloth and the removal of grass stains from woven cotton, as measured in the following standard protocol, called the Linitest™ wash protocol, using a Linitest™ washing machine.

[0090] Linitest™ wash protocol

1. Read before wash stains.
2. Switch on Linitester™ and leave to heat to 40°C.
3. Dose product into pots, add water to pots.
4. Place stains, ballast and 50 ball bearings in pots.
5. Start Linitester™ and leave to wash for 30 minutes.
6. Rinse ballast and cloths for 5 minutes.
7. Repeat rinse.
8. Dry stains overnight.
9. Read after wash stains.
This experiment shows that the use of the hydroxamate acid leads to better removal of Georgia clay as well as grass on knitted polyester and improved removal of Georgia clay from woven cotton.

Although Savinase is present in the detergent composition, which improves grass stain removal, grass stain removal is further improved by the addition of the hydroxamate.

Example 4. Typical examples of detergent compositions

Some typical detergent compositions according to the present invention are given in table 6.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Powder Formulation (concentration in final product [weight %])</th>
<th>Liquid Detergent Formulation (concentration in final product [weight %])</th>
<th>Concentrated Liquid Detergent (concentration in final product [weight %])</th>
</tr>
</thead>
<tbody>
<tr>
<td>linear alkyl benzene sulphonate</td>
<td>15</td>
<td>16</td>
<td>24</td>
</tr>
<tr>
<td>alcohol ethoxylate</td>
<td>5</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Sodium sulphate</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium carbonate</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>enzymes</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>whitening agent</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>hydroxamate</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>sodium citrate</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>sodium chloride</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>sodium hydroxide</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>dispersant</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>perfume, foam control &amp; other minors</td>
<td>balance</td>
<td>balance</td>
<td>balance</td>
</tr>
</tbody>
</table>

Example 5 Hydroxamates with various alky chain lengths

The following results were obtained for the removal of Georgia Clay stains from woven cotton cloth, as measured in the following standard protocol, called the Tergotometer hard water wash protocol, using a Tergotometer washing machine. Different hydroxamates were used according to table 7.

Tergotometer hard water wash protocol:

Add water and formulation stock solutions to each pot, agitate for 1 minute.
Add stain cloths and ballast, switch on Tergotometer.
Leave to wash for 12 minutes
Rinse cloths in 26° French hard water for 1 minute, repeat rinse.
Dry cloths overnight.

Measurement of the colour of the stain on the textile cloth

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Formulation 5</th>
<th>Formulation 6</th>
<th>Formulation 7</th>
<th>Formulation 8</th>
<th>Formulation 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na LAS</td>
<td>14.3</td>
<td>14.3</td>
<td>14.3</td>
<td>14.3</td>
<td>14.3</td>
</tr>
</tbody>
</table>
Tables 8 and 9 summarise the results on the different cloths.

**Example 6: Effect of Anionic Nonionic ratio**

Table 8

<table>
<thead>
<tr>
<th>Formulation</th>
<th>Dose of Formulation in wash (g/L)</th>
<th>SR_{law} Georgia Clay from Woven Cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (control)</td>
<td>1.42</td>
<td>69.4</td>
</tr>
<tr>
<td>6 (hexyl hydroxamate, potassium salt)</td>
<td>1.42</td>
<td>71.0</td>
</tr>
<tr>
<td>7 (Octyl hydroxamate, potassium salt)</td>
<td>1.42</td>
<td>72.7</td>
</tr>
</tbody>
</table>

Table 9

<table>
<thead>
<tr>
<th>Formulation</th>
<th>Dose of Formulation in wash (g/L)</th>
<th>SR_{law} Georgia Clay from knitted polyester</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (control)</td>
<td>2.72</td>
<td>71.4</td>
</tr>
<tr>
<td>7 (Octyl hydroxamate, potassium salt)</td>
<td>2.72</td>
<td>72.7</td>
</tr>
<tr>
<td>8 (Decyl Hydroxamate, potassium salt)</td>
<td>2.72</td>
<td>81.9</td>
</tr>
<tr>
<td>9 (Dodecyl Hydroxamate, potassium salt)</td>
<td>2.72</td>
<td>79.5</td>
</tr>
</tbody>
</table>

Tables 8 and 9 summarise the results on the different cloths.

**Table 10** Formulations A to F (Comparative - without Octyl Hydroxamate)

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>NaLAS</td>
<td>1</td>
<td>0.8</td>
<td>0.67</td>
<td>0.5</td>
<td>0.25</td>
<td>0</td>
</tr>
<tr>
<td>Neodol 25-7 (nonionic surfactant Ex Shell)</td>
<td>0</td>
<td>0.2</td>
<td>0.33</td>
<td>0.5</td>
<td>0.75</td>
<td>1</td>
</tr>
</tbody>
</table>
This example shows the effect of varying the ratio of anionic to nonionic surfactant for the removal of Georgia Clay stains from knitted polyester, as measured in the Tergotometer hard wash protocol described above. The formulations are given in table 11 and the comparative formulations without the hydroxamate are given in table 10.

The results are summarised in table 12. Formulations A-OH, E-OH and F-OH are comparative.

### Example 7: Higher Anionic to Nonionic ratios (Georgia Clay removal from woven cotton)

A number of Anionic/Nonionic formulations were made where the anionic to nonionic surfactant ratio was at least 4:1. A set of comparative formulations without hydroxamate was first made up as per table 13. Then a set of corresponding formulations comprising 5 wt% of octyl hydroxamate was made up as per table 14.
The soap used was Prifac 5908. The hydrotropes were glycerol and propylene glycol.

The following results were obtained for the removal of Georgia Clay stains from woven cotton, as measured using the standard hard water Tergotometer wash protocol described above and with an In wash formulation concentration of 2.6 g/L for each of the formulations in tables 13 and 14. The results are given in table 15. Example J-OH is comparative.

**Table 14**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>G_OH</th>
<th>H_OH</th>
<th>I_OH</th>
<th>J_OH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na LAS</td>
<td>32.9</td>
<td>37.0</td>
<td>39.0</td>
<td>41.1</td>
</tr>
<tr>
<td>alcohol ethoxylate (C₁₂ 7EO)</td>
<td>8.2</td>
<td>4.1</td>
<td>2.1</td>
<td>0</td>
</tr>
<tr>
<td>Na soap</td>
<td>8.02</td>
<td>8.02</td>
<td>8.02</td>
<td>8.02</td>
</tr>
<tr>
<td>Sodium Citrate</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Triethanolamine</td>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Sequestrant (Dequest 2066)</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Octyl hydroxamate (potassium salt)</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Hydrotropes, enzymes and minors</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Water</td>
<td>Balance</td>
<td>Balance</td>
<td>Balance</td>
<td>Balance</td>
</tr>
</tbody>
</table>

The following results were obtained for the removal of Georgia Clay stains from woven cotton, as measured using the standard hard water Tergotometer wash protocol described above and with an In wash formulation concentration of 2.6 g/L for each of the formulations in tables 13 and 14. The results are given in table 15. Example J-OH is comparative.

**Table 15**

<table>
<thead>
<tr>
<th>Formulations</th>
<th>Anionic:nonionic</th>
<th>SRIₘₜ (no hydroxamate)</th>
<th>SRIₘₜ (with hydroxamate)</th>
<th>% increase SRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>G / G_OH</td>
<td>4 to 1</td>
<td>67</td>
<td>72.9</td>
<td>8.81</td>
</tr>
<tr>
<td>H / H_OH</td>
<td>9 to 1</td>
<td>68.2</td>
<td>70.6</td>
<td>3.52</td>
</tr>
<tr>
<td>I / I_OH</td>
<td>19 to 1</td>
<td>67.2</td>
<td>68.6</td>
<td>2.08</td>
</tr>
<tr>
<td>J / J_OH</td>
<td>1 to 0</td>
<td>68.8</td>
<td>68.6</td>
<td>-0.29</td>
</tr>
</tbody>
</table>

**Example 8: Alternative Anionic: Primary Alkyl sulphate**

**Table 16 (comparative formulations)**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Alkyl Sulphate</td>
<td>0</td>
<td>27.5</td>
<td>32.9</td>
<td>41.1</td>
<td>20.55</td>
<td>10.3</td>
</tr>
<tr>
<td>Alcohol ethoxylate (C₁₂ 7EO)</td>
<td>41.1</td>
<td>13.6</td>
<td>8.2</td>
<td>0</td>
<td>20.55</td>
<td>30.8</td>
</tr>
<tr>
<td>Na soap</td>
<td>8.02</td>
<td>8.02</td>
<td>8.02</td>
<td>8.02</td>
<td>8.02</td>
<td>8.02</td>
</tr>
<tr>
<td>Sodium Citrate</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Triethanolamine</td>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Sequestrant (Dequest 2066)</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Hydrotropes, enzymes and minors</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
</tbody>
</table>
The following results in table 18 were obtained for the removal of Georgia Clay stains from knitted polyester, as measured using the hard water Tergotometer wash protocol using 2.6 g/L formulation in wash. The comparative formulations without hydroxamate are given in table 16 and the hydroxamate containing formulations are given in table 17. The hydrotrope system, as usual, comprised 5 wt% glycerol and 9 wt% propylene glycol. Compositions N-OH and P-OH are comparative as the ratio of anionic to nonionic is outside of the claimed range.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Balance</td>
<td>Balance</td>
<td>Balance</td>
<td>Balance</td>
<td>Balance</td>
<td>Balance</td>
</tr>
</tbody>
</table>

Table 17 (formulations with hydroxamate)

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>K_OH</th>
<th>L_OH</th>
<th>M_OH</th>
<th>N_OH</th>
<th>O_OH</th>
<th>P_OH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Alkyl Sulphate</td>
<td>0</td>
<td>27.5</td>
<td>32.9</td>
<td>41.1</td>
<td>20.55</td>
<td>10.3</td>
</tr>
<tr>
<td>Alcohol ethoxylate (C\textsubscript{12} 7EO)</td>
<td>41.1</td>
<td>13.6</td>
<td>8.2</td>
<td>0</td>
<td>20.55</td>
<td>30.8</td>
</tr>
<tr>
<td>Na soap</td>
<td>8.02</td>
<td>8.02</td>
<td>8.02</td>
<td>8.02</td>
<td>8.02</td>
<td>8.02</td>
</tr>
<tr>
<td>Sodium Citrate</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Triethanolamine</td>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Sequestrant (Dequest 2066)</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Octylhydroxamate (potassium salt)</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Hydrotropes, enzymes and minors</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Water</td>
<td>Balance</td>
<td>Balance</td>
<td>Balance</td>
<td>Balance</td>
<td>Balance</td>
<td>Balance</td>
</tr>
</tbody>
</table>

Table 18

<table>
<thead>
<tr>
<th>Formulation</th>
<th>Anionic:nonionic</th>
<th>SRI\textsubscript{aw} (no hydroxamate)</th>
<th>SRI\textsubscript{aw} (with hydroxamate)</th>
<th>% increase SRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>K / K_OH</td>
<td>0 to 1</td>
<td>73.6</td>
<td>75.4</td>
<td>2.45</td>
</tr>
<tr>
<td>P / P_OH</td>
<td>1 to 3</td>
<td>74.0</td>
<td>73.4</td>
<td>-0.81</td>
</tr>
<tr>
<td>O / O_OH</td>
<td>1 to 1</td>
<td>74.1</td>
<td>75.6</td>
<td>2.02</td>
</tr>
<tr>
<td>L / L_OH</td>
<td>2 to 1</td>
<td>73.4</td>
<td>77.2</td>
<td>5.18</td>
</tr>
<tr>
<td>M / M_OH</td>
<td>4 to 1</td>
<td>73.9</td>
<td>77.7</td>
<td>5.14</td>
</tr>
<tr>
<td>N / N_OH</td>
<td>1 to 0</td>
<td>73</td>
<td>74.7</td>
<td>2.33</td>
</tr>
</tbody>
</table>

Claims

1. A laundry detergent composition comprising

   a) 0.5 to 20, preferably 6, wt% hydroxamic acid or its corresponding hydroxamate of the structure:
wherein \( R^1 \) is chosen from the group consisting of \( C_4, C_5, C_6, C_7, C_8, C_9, C_{10}, C_{11}, C_{12} \) or \( C_{14} \) alkyl group and \( R^2 \) is hydrogen,

b) 3 to 80 wt% of detersive surfactant system comprising

(i) anionic surfactant; and
(ii) nonionic surfactant

wherein the weight ratio of (i) to (ii) lies in the range 1:1.1 to 19:1, and the weight ratio a) to b) lies in the range 1:5 to 1:15

c) optionally, other ingredients to 100 wt% provided that zeolite and phosphate builders are present at less than 5 wt% and ethanol is present at a level of less than 5 wt%, whereby soap is not included in the calculation of anionic surfactant amounts and ratios.

2. Composition according to claim 1, wherein \( R^1 \) is a \( C_{8-14} \) normal alkyl group.

3. A composition according to any of claims 1 to 2, wherein the composition comprises detergency builder at a concentration from 1 to 50 wt%.

4. A composition according to any preceding claim which comprises at least 20 wt% of the detersive surfactant system, preferably at least 30 wt% and more preferably over 40 wt%.

5. A composition according to any preceding claim which comprises from 1 to 15 wt% soap, preferably made from saturated fatty acids.

6. A composition according to any preceding claim comprising at least 0.5 wt% of soil release polymer.

7. A composition according to any preceding claim comprising at least 0.5 wt% anti redeposition polymer.

8. A composition according to any preceding claim wherein the ratio of hydroxamate to detersive surfactant system lies in the range 1:7 to 1:13, preferably 1:9 to 1:11 parts by weight.

9. A composition according to any preceding claim in which the ratio of anionic to nonionic surfactant is at least 1:1, preferably at least 3:2.

10. A composition according to claim 9 in which the ratio of anionic to nonionic surfactant is 1:1 to 9:1, preferably 3:2 to 9:1.

11. A composition according to any preceding claim in which the composition is a liquid composition.

12. A composition according to claim 11 comprising a hydrotrope system comprising propylene glycol and glycerol at levels of at least 6 wt%.

13. A composition according to claim 11 or 12, which is a liquid composition, comprising detersive surfactant at a concentration from 20 to 80% by weight of the total composition.

**Patentansprüche**

1. Waschmittelzusammensetzung, umfassend

   a) 0,5 bis 20 Gew.-%, vorzugsweise 6 Gew.-% Hydroxamsäure oder deren korrespondierendes Hydroxamat der Struktur
worin R¹ aus der Gruppe ausgewählt ist, die aus einer C₄-, C₅-, C₆-, C₇-, C₈-, C₉-, C₁₀-, C₁₁-, C₁₂- oder C₁₄-Alkylgruppe besteht, und R² Wasserstoff ist,

b) 3 bis 80 Gew.-% Waschtensidsystem, umfassend
   (i) anionisches Tensid und
   (ii) nichtionisches Tensid,

wobei das Gewichtsverhältnis von (i) zu (ii) in dem Bereich von 1:1,1 bis 19:1 liegt und das Gewichtsverhältnis
a) zu b) in dem Bereich von 1:5 bis 1:15 liegt,
c) optional andere Bestandteile bis zu 100 Gew.-%, dies mit der Maßgabe, dass Zeolith- und Phosphat-Builder
mit weniger als 5 Gew.-% vorliegen und Ethanol in einer Konzentration von weniger als 5 Gew.-% vorliegt,

wobei die Seife in die Berechnung der Mengen und Verhältnisse des anionischen Tensids nicht einbezogen ist.

2. Zusammensetzung nach Anspruch 1, wobei R¹ eine übliche C₈-₁₄-Alkylgruppe darstellt.

3. Zusammensetzung nach irgendeinem der Ansprüche 1 bis 2, wobei die Zusammensetzung Waschmittelbuilder in
   einer Konzentration von 1 bis 50 Gew.-% umfasst.

4. Zusammensetzung nach irgendeinem vorhergehenden Anspruch, welche mindestens 20 Gew.-% Waschtensid-
   system, vorzugsweise mindestens 30 Gew.-% und bevorzugter über 40 Gew.-% umfasst.

5. Zusammensetzung nach irgendeinem vorhergehenden Anspruch, welche von 1 bis 15 Gew.-% Seife umfasst,
   vorzugsweise aus gesättigten Fettsäuren hergestellt.

6. Zusammensetzung nach irgendeinem vorhergehenden Anspruch, umfassend mindestens 0,5 Gew.-% Soil-Re-
   lease-Polymer.

7. Zusammensetzung nach irgendeinem vorhergehenden Anspruch, umfassend mindestens 0,5 Gew.-% Antiwieder-
   ablagerungspolymer.

8. Zusammensetzung nach irgendeinem vorhergehenden Anspruch, wobei das Verhältnis von Hydroxamat zu Wasch-

9. Zusammensetzung nach irgendeinem vorhergehenden Anspruch, in welchem das Verhältnis von anionischem zu
   nichtionischem Tensid mindestens 1:1, vorzugsweise mindestens 3:2, beträgt.

10. Zusammensetzung nach Anspruch 9, in welcher das Verhältnis von anionischem zu nichtionischem Tensid 1:1 bis
    9:1, vorzugsweise 3:2 bis 9:1, beträgt.

11. Zusammensetzung nach irgendeinem vorhergehenden Anspruch, in welcher die Zusammensetzung eine flüssige
    Zusammensetzung ist.

12. Zusammensetzung nach Anspruch 11, umfassend ein hydrotropes System, umfassend Propylenglykol und Glycerin
    in Konzentrationen von mindestens 6 Gew.-%.

13. Zusammensetzung nach Anspruch 11 oder 12, welche eine flüssige Zusammensetzung darstellt, umfassend Wasch-
Revendications

1. Composition de détergent de lessive comprenant

   a) de 0,5 à 20, de préférence 6, % en masse d’acide hydroxamique ou de son hydroxamate correspondant de
   la structure :

   ![Image]

   où R₁ est choisi dans le groupe consistant en un groupe alkyle en C₄, C₅, C₆, C₇, C₈, C₉, C₁₀, C₁₁, C₁₂ ou C₁₄
   et R₂ est l’hydrogène,

   b) de 3 à 80 % en masse d’un système de tensioactif détérsif comprenant

   (i) un tensioactif anionique ; et
   (ii) un tensioactif non ionique

   dans laquelle le rapport massique de (i) à (ii) se trouve dans l’intervalle de 1:1,1 à 19:1, et le rapport massique
   a) b) se trouve dans l’intervalle de 1:5 à 1:15

   c) éventuellement, d’autres ingrédients par rapport à 100 % en masse à condition que des adjuvants de zéolite
   et de phosphate soient présents à moins de 5 % en masse et de l’éthanol soit présent à une teneur inférieure
   à 5 % en masse, sur quoi du savon n’est pas inclus dans le calcul des quantités et rapports de tensioactif
   anionique.

2. Composition selon la revendication 1, dans laquelle R₁ est un groupe alkyle normal en C₈-1₄.

3. Composition selon l’une quelconque des revendications 1 à 2, dans laquelle la composition comprend un adjuvant
détergent à une concentration de 1 à 50 % en masse.

4. Composition selon l’une quelconque des revendications précédentes qui comprend au moins 20 % en masse du
   système de tensioactif détérsif, de préférence au moins 30 % en masse et encore mieux plus de 40 % en masse.

5. Composition selon l’une quelconque des revendications précédentes qui comprend de 1 à 15 % en masse de savon,
de préférence constitué d’acides gras saturés.

6. Composition selon l’une quelconque des revendications précédentes comprenant au moins 0,5 % en masse d’un
   polymère de libération des salissures.

7. Composition selon l’une quelconque des revendications précédentes comprenant au moins 0,5 % en masse de
   polymère anti-redéposition.

8. Composition selon l’une quelconque des revendications précédentes, dans laquelle le rapport d’hydroxamate à
   système de tensioactif détérsif se trouve dans l’intervalle de 1:7 à 1:13, de préférence de 1:9 à 1:11 parties en masse.

9. Composition selon l’une quelconque des revendications précédentes, dans laquelle le rapport de tensioactif anio-
nique à non ionique est d’au moins 1:1, de préférence d’au moins 3:2.

10. Composition selon la revendication 9, dans laquelle le rapport de tensioactif anionique à non ionique est de 1:1 à
    9:1, de préférence de 3:2 à 9:1.
11. Composition selon l'une quelconque des revendications précédentes, dans laquelle la composition est une composition liquide.

12. Composition selon la revendication 11 comprenant un système d'hydro trope comprenant du propylène glycol et du glycérol à des teneurs d'au moins 6 % en masse.

13. Composition selon la revendication 11 ou 12, laquelle est une composition liquide, comprenant un tensioactif détersif à une concentration de 20 à 80 % en masse de la composition totale.
REFERENCES CITED IN THE DESCRIPTION

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