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(54) Title: DETERGENT COMPOSITIONS

(57) Abstract: A laundry detergent composition containing surfactant and builder also contains a low level (0.5 to 5 wt%) of alkali metal persalt bleach, and from 0.05 to 5 wt% of iminodisuccinate (IDS) or hydroxyiminodisuccinate (HIDS). The composition provides improved stain removal, and reduced in-wash fading of chlorine-sensitive dyes, in wash liquors containing hypochlorite ions.

DETERGENT COMPOSITIONS

TECHNICAL FIELD

The present invention relates to laundry detergent compositions suitable for washing both white and coloured fabrics. The compositions exhibit improved stain removal, and reduced dye fading due to chlorine in wash water.

BACKGROUND

Chlorine (as alkali metal hypochlorite) is used in many parts of the world to purify water. To make sure that the water is safe, a small residual amount, typically about 0.5 ppm, of chlorine is left in the water. It has been found that even this small amount of chlorine can cause fading of chlorine-sensitive fabric dyes in the wash and in the rinse.

It is known that low levels of peroxy bleaches such as sodium perborate can be included in otherwise bleach-free laundry detergent compositions to act as chlorine scavengers.

It has now been discovered that laundry detergent compositions containing low levels of peroxy bleaches such as sodium perborate exhibit improved stain removal and better chlorine scavenging if iminodisuccinate (IDS) or hydroxyiminodisuccinate (HIDS) is present.

PRIOR ART

WO 91 17234A (Procter & Gamble) discloses low-pH granular laundry detergent compositions containing chlorine scavengers which minimise the fading of pH-sensitive and chlorine-sensitive fabric dyes during laundering. Among the many chlorine scavengers disclosed are peroxide bleaches, for example, perborate.

Iminodisuccinate (IDS) is known as a detergency builder and, in bleaching detergent compositions, as a stabiliser for peroxy bleach precursors.

US 3 697 453 (Pfizer) discloses detergent compositions having a pH of from 9 to 12, containing iminodisuccinate as a detergency builder, used together with detergent surfactant in a weight ratio of 0.25:1 to 10:1. IDS as a detergency builder is also disclosed in EP 757 094A (Bayer). IDS and hydroxyiminodisuccinate (HIDS) are disclosed in JP 09 110 813A (Nippon Shokubai) and JP 09 104 897A (Nippon Shokubai). HIDS as a detergency builder and complexing agent is disclosed in US 5 318 726 (Henkel KGaA).

EP 509 382A (W R Grace & Co/Hampshire Chemical Corporation) discloses a bleaching detergent composition comprising a bleaching agent and a bleach stabiliser of defined formula which includes IDS.

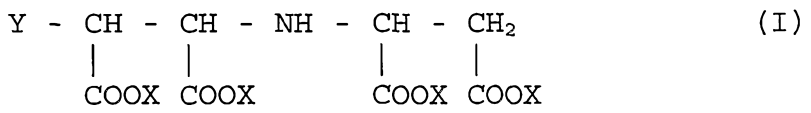
JP 09 249 895A (Lion) and JP 09 310 097A (Lion) disclose detergent compositions containing 3 to 20 wt% IDS or HIDS to

improve the stability or fabric substantivity of fluorescers (optical brighteners).

The use of IDS as a processing aid for detergent powders and detergent powder ingredients is disclosed in JP 09 100 497A (Lion) and JP 09 279 188A (Lion).

DEFINITION OF THE INVENTION

The present invention accordingly provides a laundry detergent composition comprising surfactant, builder, and optionally other non-bleach detergent ingredients, and also containing from 0.5 to 5 wt% of alkali metal persalt bleach and from 0.05 to 5 wt% of a compound of the formula (I):



(I)

wherein Y is H or OH and X is H or a solubilising cation.

A further subject of the invention is a method of removing stains from textile fabrics, which comprises laundering the fabrics by hand or machine in a wash liquor containing a detergent composition as defined above and also containing hypochlorite ions.

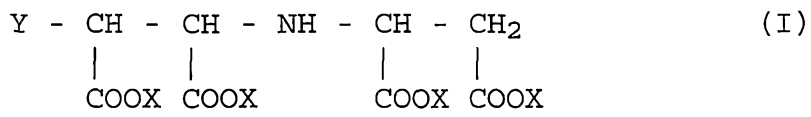
A further subject of the invention is the use of a compound of the formula I above, in an amount of from 0.05 to 5 wt%, in a laundry detergent composition containing from 0.5 to 5 wt% of alkali metal persalt bleach, to improve stain removal performance and as a chlorine scavenger to prevent

the fading of chlorine-sensitive dyes on coloured textile fabrics during laundering.

DETAILED DESCRIPTION OF THE INVENTION

The Compound of Formula I

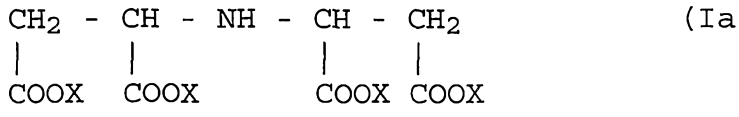
The detergent compositions of the invention contain, as an essential ingredient, a compound of the formula I:



(I)

wherein Y is H or OH; and X is H or a solubilising cation, preferably a sodium ion.

If Y is a hydrogen atom, the formula I represents iminodisuccinic acid or a water-soluble salt thereof. Iminodisuccinic acid, also known as N-(1,2-carboxyethyl)D,L-aspartic acid, has the formula (Ia) wherein X = H:

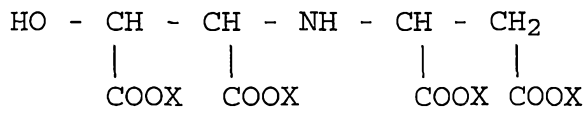


(Ia)

In the following description, the abbreviation "IDS" will be used to denote this material whether in acid or salt form. IDS is commercially available from Bayer AG, Leverkusen, Germany, and from Nippon Shokubai KK, Japan.

If Y is a hydroxyl group, the formula I represents hydroxyiminodisuccinic acid or a water-soluble salt thereof.

Hydroxyiminodisuccinic acid has the formula (Ib) wherein X = H:



(Ib)

In the following description, the abbreviation "HIDS" will be used to denote this material whether in acid or salt form. HIDS is commercially available from Nippon Shokubai KK, Japan.

For the purposes of the present invention, the IDS or HIDS may be, and preferably is, in the form of a salt, i.e. X in the formula I is a stable solubilising cation, preferably an alkali metal cation, more preferably sodium.

In the laundry detergent compositions of the invention, IDS or HIDS is present in an amount of from 0.05 to 5 wt%, more preferably from 0.05 to 2.5 wt%, most preferably from 0.2 to 2.5 wt%. The IDS or HIDS is preferably in sodium salt form.

The Alkali Metal Persalt Bleach

The alkali metal persalt bleach is present in an amount of from 0.5 to 5 wt%, preferably from 1 to 3 wt%. This amount

can be distinguished from the higher levels typically used in bleaching detergent compositions.

The alkali metal, preferably sodium, persalt bleach is preferably selected from perborates and percarbonate. The most preferred material is sodium perborate, in monohydrate or tetrahydrate form. Especially preferred is sodium perborate monohydrate.

The ratio of alkali metal persalt to IDS or HIDS is preferably within the range of from 3:1 to 1:3, more preferably from 2:1 to 1:2.

Detergent Compositions

The composition of the invention also contains other conventional detergent ingredients, other than bleaching ingredients. Essential ingredients are surfactants (detergent-active compounds) and detergency builders, and other non-bleach ingredients may optionally be present.

A preferred detergent composition according to the invention comprises:

(a) from 5 to 60 wt% of one or more detergent surfactants,

(b) from 10 to 80 wt% of one or more detergency builders,

(c) from 0.5 to 5 wt% of alkali metal persalt,

(d) from 0.05 to 5 wt% of IDS or HIDS,

(e) optionally other non-bleach detergent ingredients to 100 wt%.

The detergent compositions of the invention may be of any physical form.

Surfactants (detergent-active compounds)

The detergent compositions will contain, as essential ingredients, one or more detergent active compounds (surfactants) which may be chosen from soap and non-soap anionic, cationic, nonionic, amphoteric and zwitterionic detergent active compounds, and mixtures thereof.

Many suitable detergent active compounds are available and are fully described in the literature, for example, in "Surface-Active Agents and Detergents", Volumes I and II, by Schwartz, Perry and Berch.

The preferred detergent active compounds that can be used are soaps and synthetic non-soap anionic and nonionic compounds.

Anionic surfactants are well-known to those skilled in the art. Examples include alkylbenzene sulphonates, particularly linear alkylbenzene sulphonates having an alkyl chain length of C_8-C_{15}; primary and secondary alkylsulphates, particularly C_8-C_{15} primary alkyl sulphates; alkyl ether sulphates; olefin sulphonates; alkyl xylene sulphonates;

dialkyl sulphosuccinates; and fatty acid ester sulphonates. Sodium salts are generally preferred.

Nonionic surfactants that may be used include the primary and secondary alcohol ethoxylates, especially the C_8-C_{20} aliphatic alcohols ethoxylated with an average of from 1 to 20 moles of ethylene oxide per mole of alcohol, and more especially the C_{10}-C_{15} primary and secondary aliphatic alcohols ethoxylated with an average of from 1 to 10 moles of ethylene oxide per mole of alcohol. Non-ethoxylated nonionic surfactants include alkylpolyglycosides, glycerol monoethers, and polyhydroxyamides (glucamide).

Cationic surfactants that may be used include quaternary ammonium salts of the general formula $R_1R_2R_3R_4N^+ X^-$ wherein the R groups are long or short hydrocarbyl chains, typically alkyl, hydroxyalkyl or ethoxylated alkyl groups, and X is a solubilising cation (for example, compounds in which R_1 is a C_8-C_{22} alkyl group, preferably a C_8-C_{10} or C_{12}-C_{14} alkyl group, R_2 is a methyl group, and R_3 and R_4, which may be the same or different, are methyl or hydroxyethyl groups); and cationic esters (for example, choline esters).

In an especially preferred cationic surfactant of the general formula $R_1R_2R_3R_4N^+ X^-$, R_1 represents a C_8-C_{10} or C_{12}-C_{14} alkyl group, R_2 and R_3 represent methyl groups, and R_4 presents a hydroxyethyl group.

Amphoteric surfactants, for example, amine oxides, and zwitterionic surfactants, for example, betaines, may also be present.

Preferably, the quantity of anionic surfactant is in the range of from 5 to 50% by weight of the total composition. More preferably, the quantity of anionic surfactant is in the range of from 8 to 35% by weight.

Nonionic surfactant, if present, is preferably used in an amount within the range of from 1 to 20% by weight.

The total amount of surfactant present is preferably within the range of from 5 to 60 wt%.

Detergency Builders

The compositions may suitably contain from 10 to 80%, preferably from 15 to 70% by weight, of detergency builder. Preferably, the quantity of builder is in the range of from 15 to 50% by weight.

The detergent compositions may contain as builder a crystalline aluminosilicate, preferably an alkali metal aluminosilicate, more preferably a sodium aluminosilicate (zeolite).

The zeolite used as a builder may be the commercially available zeolite A (zeolite 4A) now widely used in laundry detergent powders. Alternatively, the zeolite may be maximum aluminium zeolite P (zeolite MAP) as described and

claimed in EP 384 070B (Unilever), and commercially available as Doucil (Trade Mark) A24 from Crosfield Chemicals Ltd, UK.

Zeolite MAP is defined as an alkali metal aluminosilicate of zeolite P type having a silicon to aluminium ratio not exceeding 1.33, preferably within the range of from 0.90 to 1.33, preferably within the range of from 0.90 to 1.20.

Especially preferred is zeolite MAP having a silicon to aluminium ratio not exceeding 1.07, more preferably about 1.00. The particle size of the zeolite is not critical. Zeolite A or zeolite MAP of any suitable particle size may be used.

Also preferred according to the present invention are phosphate builders, especially sodium tripolyphosphate. This may be used in combination with sodium orthophosphate, and/or sodium pyrophosphate.

Other inorganic builders that may be present additionally or alternatively include sodium carbonate, layered silicate, amorphous aluminosilicates.

Organic builders that may be present include polycarboxylate polymers such as polyacrylates and acrylic/maleic copolymers; polyaspartates; monomeric polycarboxylates such as citrates, gluconates, oxydisuccinates, glycerol mono-di- and trisuccinates, carboxymethyloxysuccinates, carboxy-methyloxymalonates, dipicolinates,

hydroxyethyliminodiacetates, alkyl- and alkenylmalonates and succinates; and sulphonated fatty acid salts.

Organic builders may be used in minor amounts as supplements to inorganic builders such as phosphates and zeolites. Especially preferred supplementary organic builders are citrates, suitably used in amounts of from 5 to 30 wt %, preferably from 10 to 25 wt %; and polymers, suitably used in amounts of from 0.5 to 15 wt %, preferably from 1 to 10 wt%. Suitable polymers include homo- and copolymers of acrylic acid and maleic acid, especially polyacrylates, acrylic/maleic copolymers, and copolymers of maleic acid and methyl vinyl ether.

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

Other Ingredients

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.

Preferred proteolytic enzymes (proteases) are catalytically active protein materials which degrade or alter protein types of stains when present as in fabric stains in a hydrolysis reaction. They may be of any suitable origin, such as vegetable, animal, bacterial or yeast origin.

Proteolytic enzymes or proteases of various qualities and origins and having activity in various pH ranges of from 4-12 are available. Proteases of both high and low isoelectric point are suitable.

Other enzymes that may suitably be present include lipases, amylases, and cellulases including high-activity cellulases such as "Carezyme").

In particulate 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.

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 32997A (Rhodia Chimie).

Other ingredients that may be present include solvents, hydrotropes, fluorescers, photobleaches, foam boosters or foam controllers (antifoams) as appropriate, sodium

carbonate, sodium bicarbonate, sodium silicate, sodium sulphate, calcium chloride, other inorganic salts, fabric conditioning compounds, and perfumes.

Product Form

As previously indicated, the compositions of the invention may be of any suitable physical form, for example, particulates (powders, granules, tablets), liquids, pastes, gels or bars.

According to one especially preferred embodiment of the invention, the detergent composition is in particulate form.

If necessary, the IDS may be incorporated in particulate compositions in the form of granules containing an inert carrier material.

Compositions in powder form may be of any bulk density and may be prepared by spray-drying, non-tower granulation, or any combination of these techniques.

The Chlorine Scavenging Benefit

The incorporation of IDS when low levels of alkali metal persalt are present has also been found to reduce the fading upon laundering of chlorine-sensitive dyes. This fading occurs due to the presence of sodium hypochlorite, which is routinely put into supply water for hygiene purposes: as indicated previously, residual levels of 0.5 ppm are typical. This causes fading of dyes of a wide range of

colours. The incorporation of IDS in accordance with the present invention can significantly reduce the amount of fading attributable to chlorine in the wash water.

The Stain Removal Benefit

A further benefit for the incorporation of IDS has also been observed: a significant improvement in the removal of certain highly coloured stains, for example, red wine.

EXAMPLES

The invention will now be illustrated in further detail by means of the following Examples, in which parts and percentages are by weight unless otherwise stated. Examples designated with a number illustrate the invention, while examples designated with a letter are comparative.

The IDS used in the Examples was tetrasodium iminodisuccinate ex Bayer. The HIDS used in the Examples was tetrasodium hydroxyiminodisuccinate ex Nippon Shokubai.

EXAMPLES 1 and 2, COMPARATIVE EXAMPLES A and B

Protection of Coloured Cotton Fabric Against Fading

Particulate laundry detergent compositions were prepared by conventional spray-drying and postdosing techniques to the following general formulation:

Component	wt%
Sodium linear alkylbenzene sulphonate (NaLAS)	23.71
Sodium silicate (anhydrous)	7.37
Sodium tripolyphosphate	18.77
Sodium carbonate	7.00
Sodium carboxymethyl cellulose	0.52
Polyacrylate polymer	0.54
Calcite	9.88
Sodium perborate monohydrate (if present)	0 or 2
IDS or HIDS (Na salt) (if present)	0 or 1
Sodium sulphate, fluorescer, zeolite, perfume, enzymes, water, impurities	to 100

Red and black cotton test cloths were prepared by dyeing white cotton cloths with red or black reactive dyes at a loading of 1 g/kg.

The test cloths were washed four times in tergotometers using the following wash conditions:

- Trace levels of metal ions: Fe = 2.5 ppm, Cu = 0.5 ppm, Zn = 5 ppm, Mn = 2.0ppm
- Trace level of NaOCl: 0.5 ppm
- Water hardness (wash and rinse): 26 °FH Ca
- Product dosage: 2.5 g/l
- Liquor to cloth ratio in the wash and rinse: 200 to 1
- Wash time: 20 minutes
- Number of rinses: 2
- Agitation: 75 rpm
- Wash temperature: 40°C.

The washed fabrics were then line-dried in the shade.

Fading was assessed by measuring reflectance changes at 530 nm for the red cloths and 600 nm for the black cloths. The results are shown in the table below: the lower the ΔR value, the lower the level of fading.

Example	IDS or HIDS	Na perborate	Red cotton ΔR530	Black cotton ΔR600
A	0	0	1.85	7.60
B	0	2%	2.52	9.55
1	1% IDS	2%	0.56	3.33
2	1% HIDS	2%	0.54	4.29

EXAMPLES 3 and 4, COMPARATIVE EXAMPLES C to F

Stain Removal

White cotton test cloths stained with red wine (EMPA 114) were washed in tergotometers using the same formulations and under the same conditions as described above, and line-dried in the shade.

Stain removal was assessed by measuring reflectance changes at 580 nm. An increase in reflectance indicates removal of the stain so the larger the figures, the better.

As indicated previously, the total wash duration was 20 minutes. Reflectance measurements were taken after 5 minutes, after 10 minutes and after 20 minutes.

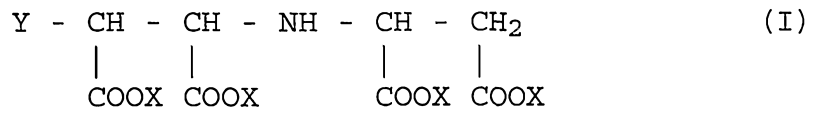
The results, shown as ΔΔR580 as compared with a control formulation containing no perborate and no IDS or HIDS, were as shown below.

Example	IDS	Na perborate monohydrate	ΔΔR 580		
			5 mins	10 mins	20 mins
C	1%	None	0.6	-0.5	1.84
D	None	2%	1.7	2.0	2.14
3	1%	2%	2.8	2.32	2.94

Example	HIDS	Na perborate monohydrate	ΔΔR 580		
			5 mins	10 mins	20 mins
E	1%	None	3.2	5.3	7.8
F	None	2%	1.5	2.1	2.1
4	1%	2%	4.4	6.7	9.1

CLAIMS

1. A laundry detergent composition comprising surfactant, builder, and optionally other detergent ingredients, characterised in that it further comprises from 0.5 to 5 wt% of alkali metal persalt bleach and from 0.05 to 5 wt% of a compound of the formula I:



(I)

wherein Y is H or OH, and X is H or a solubilising cation.

2. A detergent composition as claimed in claim 1, characterised in that it comprises:

(a) from 5 to 60 wt% of one or more detergent surfactants,

(b) from 10 to 80 wt% of one or more detergency builders,

(c) from 0.5 to 5 wt% of alkali metal persalt bleach,

(d) from 0.05 to 5 wt% of a compound of the formula I,

(e) optionally other non-bleach detergent ingredients to 100 wt%.

3. A detergent composition as claimed in claim 1 or claim 2, characterised in that it comprises from 0.2 to 2.5 wt% of the compound of the formula I.

4. A detergent composition as claimed in any preceding claim, characterised in that the compound of the formula I is iminodisuccinic acid or a salt thereof, preferably the sodium salt.

5. A detergent composition as claimed in any preceding claim, characterised in that the alkali metal persalt bleach is present in an amount of from 1 to 3 wt%.

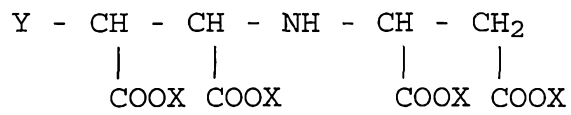
6. A detergent composition as claimed in any preceding claim, characterised in that the alkali metal persalt bleach is sodium perborate, preferably sodium perborate monohydrate.

7. A detergent composition as claimed in any preceding claim, characterised in that it is in particulate form.

8. A detergent composition as claimed in any preceding claim, characterised in that it comprises one or more non-bleach detergent ingredients selected from enzymes, antiredeposition polymers, soil release polymers, dye transfer inhibiting polymers, solvents, hydrotropes, fluorescers, photobleaches, foam boosters, foam controllers (antifoams), sodium carbonate, sodium bicarbonate, sodium silicate, sodium sulphate, calcium chloride, other inorganic salts, fabric conditioning compounds, and perfumes.

9. A method of removing stains from textile fabrics, characterised in that it comprises laundering the fabrics by hand or machine in a wash liquor containing a detergent composition as claimed in any one of claims 1 to 8 and also containing hypochlorite ions.

10. Use of a compound of the formula I:



(I)

wherein Y is H or OH, and X is H or a solubilising cation, in an amount of from 0.05 to 2.5 wt%, in a laundry detergent composition containing from 0.5 to 5 wt% of alkali metal persalt bleach, to improve the stain removal performance of the composition and as a chlorine scavenger to reduce the fading of chlorine-sensitive dyes in the presence of hypochlorite ions.