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(54) **Enzyme-bleach catalyst cogranulate suitable for detergent compositions**

(57) The present invention refers to a granulate particle comprising a core and a coating, wherein the core comprises at least one metal containing bleach catalyst and at least one enzyme and the coating comprises at least one water soluble coating compound, wherein within the core the metal containing bleach catalyst is either

in intimate mixture with the enzyme(s) or an inner core or layer comprising the metal containing bleach catalyst is coated with the enzyme(s), further the invention refers to the use of said enzyme(s) for stabilizing metal containing bleach catalyst(s), and the use of a cleaning composition comprising said granulate particle for dishwashing.

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Description

5 [0001] The present invention refers to a granulate particle comprising a core and a coating, wherein the core comprises at least one metal containing bleach catalyst and at least one enzyme and the coating comprises at least one water soluble coating compound, wherein within the core the metal containing bleach catalyst is either in intimate mixture with the enzyme(s) or an inner core or layer comprising the metal containing bleach catalyst is coated with the enzyme(s), further the invention refers to the use of said enzyme(s) for stabilizing metal containing bleach catalyst(s), and the use of a cleaning composition comprising said granulate particle for dishwashing.

10 [0002] Modern dishwashing detergents are expected to remove a broad variety of soils and stains from the surface of tableware, dishes and cutlery. Over the last couple of decades, automatic dishwashing detergents were developed to perform improved cleaning at eco-friendly, sustainable and user-friendly conditions, such as cleaning performance at lower temperatures and lower alkaline content while reducing water consumption and time for each cleaning cycle.

15 [0003] For this purpose, nowadays domestic automatic dishwasher detergents commonly contain bleach catalysts for an improved cleaning performance. These bleach catalysts often contain a transition metal. Thus, said transition metal bleach catalysts can range from transition metal salts, including but not limited to those of iron, manganese, copper, cobalt and ruthenium; see for example U.S. Patent 3,398,096 simple water-soluble salts of iron and manganese such as the divalent, trivalent, tetravalent and quadrivalent salts; to more sophisticated catalysts such as those of the following references:

20 [0004] One group of usually used catalysts are those comprising manganese, as this metal is less toxic than for example cobalt. Such compounds are well known in the art and include, for example, the manganese-based catalysts disclosed in U.S. Pat. 5,246,621, U.S. Pat. 5,244,594; U.S. Pat. 5,194,416; U.S. Pat. 5,114,606; and EP-A 549 271, EP-A 549 272, EP-A 544 440, and EP-A 544 490. Other metal-based bleach catalysts include those disclosed in U.S. Pat. 4,430,243 and U.S. Pat. 5,114,611. The use of manganese with various complex ligands to enhance bleaching is also reported in the following United States Patents: 4,728,455; 5,284,944; 5,246,612; 5,256,779; 5,280,117; 5,274,147; 25 5,153,161; and 5,227,084.

[0005] The bleach catalysts useful in machine dishwashing compositions and concentrated powder detergent compositions may also be selected as appropriate for the present invention. For examples of suitable bleach catalysts see U.S. Pat. 4,246,612 and U.S. Pat. 5,227,084.

30 [0006] Moreover, WO 97/22681 discloses automatic dishwashing detergent (ADD) compositions as compact granular, phosphate-free or phosphate-containing and chlorine bleach-free types incorporating metal-containing bleach catalysts, preferably catalysts containing manganese and/or selected cobalt/ammonia catalysts, as well as fully-formulated automatic dishwashing detergent compositions with enzymes.

[0007] Additionally, WO 97/22680 discloses composite particles comprising a bleach catalyst plus one or more enzymes suitable for incorporation into detergent compositions.

35 [0008] Although being very effective in promoting cleaning properties of automatic dishwashing detergent compositions, enzymes have to be protected from oxidation caused by the components of an oxygen bleach system, namely the source of hydrogen peroxide and an activator. Therefore, WO 98/55577 discloses the physical separation of components of the bleach system and an enzyme-containing core by a barrier layer. Said enzyme containing core may further include a bleach catalyst system.

40 [0009] A major disadvantages of the cited prior art is that it is solely focused on improving the dishwashing performance of automatic dishwashing detergent compositions by increasing stability of incorporated enzymes. Attention has never been drawn to the stability of the metal containing bleach catalyst in such automatic dishwashing compositions.

45 [0010] It has been found that the storage, especially the long-term storage, of metal containing bleach catalysts in dishwashing compositions is difficult as cleaning performance decreases significantly upon storage over a few weeks. Therefore, it would be highly desirable to stabilize metal containing bleach catalysts, specifically designed to be compatible in ADD formulations, even for a long-term storage.

[0011] It was an object of the present invention to provide a granulate particle comprising at least one metal containing bleach catalyst that is suitable for long-term storage without forfeiting its good cleaning performance.

50 [0012] This object is met by a granulate particle comprising a core and a coating, wherein the core comprises at least one metal containing bleach catalyst and at least one enzyme and the coating comprises at least one water soluble coating compound, wherein within the core the metal containing bleach catalyst is either in intimate mixture with the enzyme(s) or an inner core or layer comprising the metal containing bleach catalyst is coated with the enzyme(s), wherein at least 2 wt.-% of the ingredients of the core are represented by the metal containing bleach catalyst and the enzyme(s).

55 [0013] According to this invention surprisingly it was found that the use of a cleaning composition comprising said above mentioned granulate particles results in a stable cleaning performance even upon a storage period of 12 weeks. With "stable cleaning performance" it is meant that the cleaning performance of a cleaning composition comprising said granulate particles does significantly slower forfeit cleaning performance quality in comparison to cleaning compositions comprising the bleach activator and the enzyme not in form of said granulate particle. It was found that a good cleaning

performance of a cleaning composition comprising said granulate particles is retained over a long-term storage in comparison to cleaning compositions not comprising said granulate particle. Furthermore, with "stable cleaning performance" it is meant that the forfeit in cleaning quality is less than 5 % after a storage time of 4 weeks, less than 10 % after a storage time of 12 weeks and less than 15 % after a storage time of 26 weeks, based on the maximum cleaning quality directly after formulation/production of the cleaning composition.

[0014] As depicted in Example 1 the cleaning performance of a granulate particle according to claim 1 is significantly improved and stable over a time period of at least 12 weeks in comparison to a cleaning composition comprising separated enzyme(s) and bleach catalyst. Thus, a granulate particle according to this invention overcomes the limitations of the prior art and provides an excellent combination of tea stain removal, good dish-care, and good overall cleaning performance as a result from greater stability of the metal containing bleach catalyst.

[0015] In its broadest aspect the invention relates to granulate particles comprising a core and a coating, wherein the core comprises at least one metal containing bleach catalyst and said metal containing bleach catalyst is protected from detrimental influence to maintain excellent cleaning performance during storage by using at least one enzyme(s).

[0016] In terms of the present invention the term "core" refers to the central portion of the granulate particle, which is completely surrounded by a coating. The "core" comprises the bleach catalyst and the enzyme and is either represented by an intimate mixture of at least one metal containing bleach catalyst and at least one enzyme or the core comprises an inner core comprising or consisting of at least one metal containing bleach catalyst and a layer covering said metal containing bleach catalyst, wherein said layer comprises or consists of the at least one enzyme. Furthermore, the "core" may comprise a support of a suitable material, coated by an intimate mixture of the at least one bleach catalyst and the at least one enzyme or the support is first coated by a bleach catalyst comprising layer, which is surrounded by an enzyme comprising layer. Non-limiting examples of suitable embodiments of the structure of granulate particles are shown in Figure 1.

[0017] With "intimate mixture" it is meant that the two ingredients of the core or the inner core (metal containing bleach catalyst and enzyme(s)) are homogeneously mixed without being chemically bonded to each other so that the metal containing bleach catalyst and the enzyme(s) retain their own chemical properties. In this context "homogeneously mixed" refers to a uniform mixture, in which every part has the same properties.

[0018] In the context of the present invention a "layer" is an overlay on top of a core or a layer below, thus surrounding the core within completely so that the core or the inner layer is completely covered and has no contact to other compounds, particles or substances than the ones forming the "layer" (or the core).

[0019] In all of the aforementioned embodiments the core can either comprise the mentioned ingredients (at least one bleach catalyst and at least one enzyme) together with further ingredients, e.g. ingredients suitable for the use in detergent compositions, or aiding the preparation of the granules, or the core may consist only of the ingredients bleach catalyst and enzyme(s). If the core comprises an inner core and at least one layer, this should be understood in a way that it is according to the invention that e.g. at least one layer (bleach catalyst or enzyme) or the inner core may comprise further ingredients, whereas another layer or the inner core can consist of only the bleach catalyst or the enzyme(s). In this context, the "inner core" refers either to a solid or porous particle or a carrier material comprising the at least one metal containing bleach catalyst, or the "inner core" is represented by a solid or porous particle or a carrier material covered by a layer comprising the at least one metal containing bleach catalyst, wherein the "inner core" is surrounded by a layer comprising at least one enzyme.

[0020] Carrier materials may be selected from the group consisting of salts, silicates, cellulose or derivatives or mixtures thereof, polyglucose, starch or derivatives or mixtures thereof, proteins others than enzymes, polyethylene, polysaccharides, guar gum, pectin, lignin, carragen gum and polyvinylalcohol or derivatives or mixtures thereof.

[0021] The "coating" according to the present invention is the outermost layer on the surface of the granulate particle, comprising or consisting of at least one water soluble coating material as defined below. The coating covers the "core" of the granulate particle. The coating thus protects the bleach catalyst and the enzyme(s) from any contact with air or other ingredients of cleaning compositions. It is particularly preferred that the coating doesn't comprise bleach catalyst or enzyme. The coating may amount up to 1 wt.-%, up to 5 wt.-%, up to 10 wt.-%, up to 25 wt.-%, up to 50 wt.-%, up to 75 wt.-% or up to 95 wt.-% of the granular particle.

[0022] With "water soluble coating" it is meant that a layer of the coating material having a thickness of 100 μm will be dissolved in distilled water at 20°C under agitation within 20 min, preferably within 10 min, more preferably within 5 min and most preferably within 2 min. Accordingly, due to fast solubility of the coating the catalyst will be released from the particle of the present invention in an appropriate time range. The "coating" may comprise besides the water soluble compound other ingredients, e.g. at least one polymer and/or at least one surfactant, however, no metal containing bleach catalyst, and no enzyme. Thus, according to the invention the bleach catalyst and the enzyme are not comprised in the outer coating of the granulate particle and thus have no contact to other detergent ingredients which are not part of the particle as long as the water soluble coating is not dissolved. Suitable polymers and surfactants for coating are described herein below. Particularly suitable are dispersant polymers, film forming polymers and surfactants having a melting point of at least 30 °C or above.

[0023] The thickness of the coating layer preferably is at least 10 nm, more preferably at least 100 nm, even more preferred at least 1 μm and most preferred at least 10 μm , whereas the coating preferably is at most 1 mm, more preferably at most 800 μm , even more preferred at most 500 μm and most preferred at most 200 μm .

[0024] Preferred water soluble compounds are water soluble organic polymers or carboxylate compounds, water soluble inorganic and organic salts, silicates, organic compounds having a molecular weight of less than 500 g/mol e.g. sugars, citrate, succinate, maleate and organic polymers having a molecular weight of 800 - 1.000.000 g/mol preferably selected from the group consisting of homo- and co-polymers, including graft co-polymers, more preferred from polyacrylic acid or derivatives thereof, polyethylene glycols or derivatives thereof, polyvinyl alcohol or derivatives thereof, polyvinylpyrrolidone or derivatives thereof, starch or derivatives thereof, cellulose or derivatives thereof, a polyvinyl alcohol-polyethylene glycol graft co-polymer, polyethylene, polysaccharides, polyglucose, guar gum, pectin, lignin, carrageen gum, proteins others than enzymes, citrate, succinate, maleate, sugars, salts, and silicates or mixtures of any of the mentioned.

[0025] The core of the granular particle of the present invention comprises at least one metal containing bleach catalyst that is selected from bleach-boosting transition metal salts or transition metal complexes such as, for example, manganese-, iron-, cobalt-, ruthenium- or molybdenum-salen or -carbonyl complexes. Manganese, iron, cobalt, ruthenium, molybdenum, titanium, vanadium and copper complexes with nitrogen-containing tripod ligands, as well as cobalt-, iron-, copper- and ruthenium-amine complexes may also be employed as the bleach catalysts. Such catalysts are broadly described in the state of the art, e.g. as mentioned above, and well known by skilled artisans.

[0026] In U.S. Pat. 4,430,243 one type of metal-containing bleach catalyst is disclosed which is a catalyst system comprising a transition metal cation of defined bleach catalytic activity, such as copper, iron, titanium, ruthenium tungsten, molybdenum, or manganese cations, an auxiliary metal cation having little or no bleach catalytic activity, such as zinc or aluminum cations, and a sequester having defined stability constants for the catalytic and auxiliary metal cations, particularly ethylenediaminetetraacetic acid, ethylenediaminetetra (methylenephosphonic acid) and water-soluble salts thereof.

[0027] Other types of bleach catalysts include the manganese-based complexes disclosed in U.S. Pat. 5,246,621 and U.S. Pat. 5,244,594. Preferred examples of these catalysts include $\text{Mn}^{\text{IV}}_2(\mu\text{-O})_3(1,4,7\text{-trimethyl-1,4,7-triazacyclononane})_2\text{-}(\text{PF}_6)_2$ ("MnTACN"), $\text{Mn}^{\text{III}}_2(\mu\text{-O})_1(\mu\text{-OAc})_2(1,4,7\text{-trimethyl-1,4,7-triazacyclononane})_2\text{-}(\text{ClO}_4)_2$, $\text{Mn}^{\text{IV}}_4(\mu\text{-O})_6(1,4,7\text{-triazacyclononane})_4\text{-}(\text{ClO}_4)_2$, $\text{Mn}^{\text{III}}\text{Mn}^{\text{IV}}_4(\mu\text{-O})_1(\mu\text{-OAc})_2(1,4,7\text{-trimethyl-1,4,7-triazacyclononane})_2\text{-}(\text{ClO}_4)_3$, and mixtures thereof. See also European patent application 549,272. Other ligands suitable for use herein include 1,5,9-trimethyl-1,5,9-triazacyclododecane, 2-methyl-1,4,7-triazacyclononane, 2-methyl-1,4,7-triazacyclononane, and mixtures thereof and mixtures of pentaamineacetate cobalt (III) nitrate and MnTACN.

[0028] The bleach catalysts useful in automatic dishwashing compositions and concentrated powder detergent compositions may also be used present invention. For examples of suitable bleach catalysts see U.S. Pat. 4,246,612 and U.S. Pat. 5,227,084, or U.S. Pat. 5,194,416 which teaches mononuclear manganese (IV) complexes such as $\text{Mn}(1,4,7\text{-trimethyl-1,4,7-triazacyclononane}(\text{OCH}_3)_3\text{-}(\text{PF}_6))$.

[0029] Still another type of bleach catalyst, as disclosed in U.S. Pat. 5,114,606, is a water-soluble complex of manganese (II), (III), and/or (IV) with a ligand which is a non-carboxylate polyhydroxy compound having at least three consecutive C-OH groups. Preferred ligands include sorbitol, iditol, dulcitol, mannitol, xylitol, arabinol, adonitol, meso-erythritol, meso-inositol, lactose, and mixtures thereof.

[0030] U.S. Pat. 5,114,611 teaches a bleach catalyst comprising a complex of transition metals, including Mn, Co, Fe, or Cu, with a non-(macro)-cyclic ligand. Said ligands are of the formula: $\text{R}^1\text{R}^2\text{N}=\text{C}-\text{B}(\text{R}^3)-\text{C}=\text{NR}^4$, wherein R^1 , R^2 , R^3 , and R^4 can each be selected from H, substituted alkyl and aryl groups such that each $\text{R}^1\text{-N}=\text{C}-\text{R}^2$ and $\text{R}^3\text{-C}=\text{N}-\text{R}^4$ form a five or six-membered ring. Said ring can further be substituted. B is a bridging group selected from O, S, CR^5R^6 , NR^7 and $\text{C}=\text{O}$, wherein R^5 , R^6 , and R^7 can each be H, alkyl, or aryl groups, including substituted or unsubstituted groups. Preferred ligands include pyridine, pyridazine, pyrimidine, pyrazine, imidazole, pyrazole, and triazole rings. Optionally, said rings may be substituted with substituents such as alkyl, aryl, alkoxy, halide, and nitro. Particularly preferred is the ligand 2,2'-bispyridylamine. Preferred bleach catalysts include Co, Cu, Mn, Fe, -bispyridylmethane and -bispyridylamine complexes. Highly preferred catalysts include $\text{Co}(2,2'\text{-bispyridylamine})\text{Cl}_2$, $\text{Di}(\text{isothiocyanato})\text{bispyridylamine-cobalt (II)}$, $\text{tris}(\text{di}2\text{-pyridylamine-cobalt(II) perchlorate})$, $\text{Co}(2,2'\text{-bispyridylamine})_2\text{O}_2\text{ClO}_4$, $\text{Bis-(2,2'\text{-bispyridylamine}) copper(II) perchlorate}$, $\text{tris}(\text{di-2-pyridylamine}) \text{ iron(II) perchlorate}$, and mixtures thereof.

[0031] Other examples include Mn gluconate, $\text{Mn}(\text{CF}_3\text{SO}_3)_2$, $\text{Co}(\text{NH}_3)_5\text{Cl}$, and the binuclear Mn complexed with tetra-N-dentate and bi-N-dentate ligands, including $\text{N}_4\text{Mn}^{\text{III}}(\mu\text{-O})_2\text{Mn}^{\text{IV}}\text{N}_4^+$ and $[\text{Bipy}_2\text{Mn}^{\text{III}}(\mu\text{-O})_2\text{Mn}^{\text{IV}}\text{bipy}_2]\text{-}(\text{ClO}_4)_3$.

[0032] Complexes of manganese in the valence state II, III, IV or V which preferably comprise one or a plurality of macrocyclic ligands with the donor functions N, NR, PR, O and/or S are particularly preferably employed. Ligands having nitrogen donor functions are preferably employed. In this regard, it is particularly preferred to select the at least one bleach catalyst from such having a group 1,4,7-trimethyl-1,4,7-triazacyclononane (Me-TACN), 1,4,7-triazacyclononane (TACN), 1,5,9-trimethyl-1,5,9-triazacyclododecane (Me-TACD), 2-methyl-1,4,7-trimethyl-1,4,7-triazacyclononane (Me/Me-TACN) and/or 2-methyl-1,4,7-triazacyclononane (Me/TACN) as the macromolecular ligands. Preferred manga-

nese complexes are for example $[\text{Mn}^{\text{II}}_2(\mu\text{-O})_1(\mu\text{-OAc})_2(\text{TACN})_2](\text{ClO}_4)_2$, $[\text{Mn}^{\text{III}}\text{Mn}^{\text{IV}}(\mu\text{-O})_2(\mu\text{-OAc})_1(\text{TACN})_2](\text{BPh}_4)_2$, $[\text{Mn}^{\text{IV}}_4(\mu\text{-O})_6(\text{TACN})_4](\text{ClO}_4)_4$, $[\text{Mn}^{\text{III}}_2(\mu\text{-O})_1(\mu\text{-OAc})_2(\text{Me-TACN})_2](\text{ClO}_4)_2$, $[\text{Mn}^{\text{III}}\text{Mn}^{\text{IV}}(\mu\text{-O})_1(\mu\text{-OAc})_2(\text{Me-TACN})_2](\text{ClO}_4)_3$, $[\text{Mn}^{\text{IV}}_2(\mu\text{-O})_3(\text{Me-TACN})_2](\text{PF}_6)_2$ (MnTACN) and $[\text{Mn}^{\text{IV}}_2(\mu\text{-O})_3(\text{Me/Me-TACN})_2](\text{PF}_6)_2(\text{OAc}=\text{OC}(\text{O})\text{CH}_3)$.

[0033] In a particularly preferred embodiment at least one metal containing bleach catalyst used according to the invention is MnTACN .

[0034] The bleach catalyst may amount from 0,1 - 25 wt.-%, more preferably from 0,5 - 15 wt.-%, even more preferably from 1 - 10 wt.-% of the granular particle.

[0035] The core of the granular particle of the present invention comprises at least one enzyme.

[0036] In general, enzymes are often used to aid the removal of stains. In most cases enzymes react with the soiling and break it down into pieces that have increased water solubility or are better dispersible in the washing liquid.

[0037] The enzymes that can be used in cleaning compositions include, but are not limited to, proteases, amylases, lipases, cellulases, mannanase, peroxidase, oxidase, xylanase, pullulanase, glucanase, pectinase, cutinase, hemicellulases, glucoamylases, phospholipases, esterases, keratanases, reductases, phenoxidases, lipoxygenases, ligninases, tannases, pentosanases, malanases, arabinosidases, hyaluronidase, chondroitinase, laccase or mixtures thereof. These enzymes are known to the skilled artisans and can be used for stabilizing the metal containing bleach catalyst in the granulate particle and in cleaning compositions.

[0038] Particularly preferred enzymes are selected from a group consisting of amylases, lipases, proteases, cellulases or mixtures thereof, most preferred at least one enzyme is a protease.

[0039] According to the present invention at least 2 wt.-% of the core of the granules is represented by the bleach catalyst and the enzyme(s). In a preferred embodiment of the invention at least 5 wt.-% of the core is represented by the bleach catalyst and the enzyme(s), preferably at least 10 wt.-%, more preferred at least 20 wt.-%, even more preferred at least 40 wt.-%. If no support is used in the inner core, the core of the granules may consist of the bleach catalyst and the enzyme(s) or up to 90 wt.-%, up to 80 wt.-% or up to 70 wt.-% are represented by the bleach catalyst and the enzyme(s).

[0040] In preferred embodiments of the invention at least one of the following parameters is fulfilled: the ratio of the at least one bleach catalyst to the at least one enzyme within the core is in the range from 100:1 to 1:100, preferably in the range from 50:1 to 1:50, more preferably in the range from 40:1 to 1:40, even more preferably in the range from 30:1 to 1:30, even more preferably in the range from 20:1 to 1:20, even more preferably in the range from 10:1 to 1:10, and most preferably in the range from 5:1 to 1:5; the ratio of the core to the coating (in wt.-%) is from 100:1 to 1:4, preferably from 80:1 to 1:2, more preferred from 60:1 to 1:1, even more preferred from 50:1 to 2:1 or 40:1 to 5:1, and most preferred in the range of 30:1 to 10:1 or 20:1.

[0041] Moreover, in a preferred embodiment the core may comprise as a further ingredient at least one of a water soluble compound as defined for the "coating" above mentioned and/or, carboxymethylcellulose, sugars having a molecular weight of less than 500 g/mol or at least one of the compounds mentioned above as a carrier in the core.

[0042] In a further aspect the invention provides a cleaning composition comprising said granulate particles and at least one further ingredient. Any of the commonly known ingredients for detergent compositions, in particular ingredients commonly used in automatic dishwashing detergent compositions can be used according to the present invention. Such further ingredients of automatic dishwashing compositions are described in detail below. The detergent composition can be provided in form a powder, granulates, a mono-layer tablet, a multi-layer or multiphase (e.g. tab in tab) tablet, a bar, a pouch, a pouch with different compartments, a liquid or any other suitable form or combinations thereof. Particularly preferred, the cleaning composition comprising said granulate particles is provided in form of a pouch, a pouch with different compartments or a tablet, preferably a multiphase tablet.

[0043] Preferably, the granular particle of the present invention is provided in combination with a cleaning composition, more preferably a cleaning composition as described in detail below, particularly preferably a compressed detergent composition. If the granular particle is combined with a cleaning composition, the ratio (wt/wt) of the granular particles to the remaining cleaning composition preferably is in the range of from 1:5 to 1:50.000, more preferably of from 1:10 to 1:10.000, and most preferably of from 1:25 to 1:500, which means that the composition comprises 0,002 - 20 wt.-%, preferably 0,01 - 10 wt.-%, more preferably 0,2 - 4 wt.-% of the granular particles.

FURTHER INGREDIENTS

[0044] The cleaning composition(s) of the present invention may further comprise any of the ingredients known in the art as common ingredients in detergent cleaning compositions, particularly in automatic dishwashing compositions. Such at least one further ingredient is selected from the group consisting of e.g. builders, surfactants, preferably non-ionic and/or anionic surfactants, polymers/cobuilders, enzymes, complexing agents, bleaching agents, bleach activators, dispersing agents, optical brighteners, stabilizers, colorants, odorants, anti-redeposition agents, anti-corrosion agents, tableting agents, disintegrants, silver protecting agents, dyes, and perfume, without any restriction.

[0045] Furthermore, all of the optional ingredients known in the state of the art to be effective or usable in detergent compositions, particular in automatic dishwashing compositions might be included.

[0046] Said further ingredients are not limiting the present invention.

[0047] The following further ingredients can be included in a cleaning composition of the present invention, or can be ingredients of a detergent composition combined with said granulate particle of the present invention.

5 BUILDER(S), CO-BUILDER(S), COMPLEXING AGENTS

[0048] The composition of the present invention preferably comprise one or more builder(s) as at least one further ingredient.

10 **[0049]** The main functions of the builders are to soften the washing water, to provide alkalinity and a buffering capacity to the washing liquid and to have an anti-redeposition or dispersing function in the cleaning composition. The physical properties of the cleaning composition are also depending on the builders that are used.

[0050] For controlling the pH of the composition, as well as its mineral hardness, inorganic as well as organic builders may be incorporated into the composition. In addition, these builders may assist in the removal of particulate soil. If present in the composition according to the present invention, the builder or the mixture of builders preferably will be present in an amount of from 0,1 to 90 wt.-%, preferably in an amount of from 5 - 80 wt.-%, more preferably in an amount of 8 - 70 wt.-%, and even more preferably in an amount of from 10 - 50 wt.-%, based on the whole composition.

20 **[0051]** Included among the builders in this context are, in particular, the silicates, aluminosilicates, carbonates, sulfates, organic co-builders, and-in cases where no environmental prejudices against their use exist-also the phosphates. Suitable phosphate builders include alkaline, ammonium or alkanolammonium salts of polyphosphates, including tripolyphosphates, pyrophosphates and polymeric meta-phosphates. In one embodiment, the composition of the present invention comprises less than 5 wt.-% of a polyphosphate builder, based on the whole composition.

[0052] Among the plurality of commercially obtainable phosphates, the alkali metal phosphates have the highest importance for the agents according to the present invention, with particular preference for pentasodium triphosphate, $\text{Na}_5\text{P}_3\text{O}_{10}$ (sodium tripolyphosphate) resp. pentapotassium triphosphate, $\text{K}_5\text{P}_3\text{O}_{10}$ (potassium tripolyphosphate).

25 **[0053]** If phosphates are used, the weight proportion of the phosphate in terms of the total weight of the cleaning composition is preferably from 1 to 70 wt.-%, more preferably from 10 to 60 wt.-%, and most preferred from 20 to 50 wt.-%.

[0054] In addition to or instead of an inorganic builder the composition of the present invention may as well comprise an organic detergent builder, including polycarboxylate builders in the form of their acid or a salt, including alkali metal salts such as potassium, sodium and lithium salts.

30 **[0055]** The group of preferred builders includes in particular the citrates as well as the carbonates and the organic co-builders. The term "citrate" hereby includes both citric acid as well as its salts, in particular its alkali metal salts.

[0056] Carbonate(s) and/or hydrogen carbonate(s), preferably alkali metal carbonate(s), particularly preferably sodium carbonate, are particularly preferably added in quantities of 5 to 70 wt.-%, preferably 10 to 40 wt.-% and especially 15 to 60 wt.-%, each relative to the weight of the dishwashing agent.

35 **[0057]** Polycarboxylates/polycarboxylic acids and phosphonates may be particularly mentioned as the organic co-builders. These classes of substances are described below.

[0058] Useful organic builders are, for example, the polycarboxylic acids that can be used in the form of the free acid and/or their sodium salts, polycarboxylic acids in this context being understood to be carboxylic acids that carry more than one acid function. These include, for example, adipic acid, succinic acid, glutaric acid, malic acid, tartaric acid, maleic acid, fumaric acid, sugar acids, amino carboxylic acids, nitrilotriacetic acid (NTA) and mixtures thereof. Besides their building effect, the free acids also typically have the property of an acidifying component and hence also serve to establish a relatively low and mild pH of the inventive agents. Succinic acid, glutaric acid, adipic acid, gluconic acid and any mixtures thereof are particularly to be mentioned in this regard.

40 **[0059]** Usable organic builder substances are, for example, the polycarboxylic acids usable in the form of the free acid and/or sodium salts thereof, "polycarboxylic acids" being understood as those carboxylic acids that carry more than one acid function. These are, for example, citric acid, adipic acid, succinic acid, glutaric acid, malic acid, tartaric acid, maleic acid, fumaric acid, sugar acids, aminocarboxylic acids, nitrilotriacetic acid (NTA), provided such use is not objectionable for environmental reasons, as well as mixtures thereof. The free acids typically also possess, besides their builder effect, the property of an acidifying component, and thus also serve to establish a lower and milder pH for washing or cleaning agents. To be recited in this context are, in particular, citric acid, succinic acid, glutaric acid, adipic acid, gluconic acid, and any mixtures thereof.

[0060] Citric acid or salts of citric acid are used with particular preference as a builder substance.

[0061] A further particularly preferred builder substance is methylglycinediacetic acid (MGDA). According to the invention it is particularly preferred to add MGDA as at least one builder / complexing agent into the composition.

55 **[0062]** Also suitable as builders are polymeric polycarboxylates; these are, for example, the alkali metal salts of polyacrylic acid or of polymethacrylic acid, for example those having a relative molecular weight from 500 to 70.000 g/mol or derivatives thereof.

[0063] The molecular weight indicated for polymeric polycarboxylates are herein weight-average molecular weights

Mw of the respective acid form that were determined in principle by means of gel permeation chromatography (GPC), a UV detector having been used. The measurement was performed against an external polyacrylic acid standard that yields realistic molecular weight values because of its structural affinity with the polymers being investigated.

[0064] Suitable polymers are, in particular, polyacrylates that preferably have a molecular weight from 2.000 to 20.000 g/mol. Of this group in turn, the short-chain polyacrylates, which have molecular weights from 2.000 to 10.000 g/mol and particularly preferably from 3.000 to 5.000 g/mol, may be preferred because of their superior solubility.

[0065] Also suitable are copolymeric polycarboxylates, in particular those of acrylic acid with methacrylic acid and of acrylic acid or methacrylic acid with maleic acid. Copolymers of acrylic acid with maleic acid that contain 50 to 90 wt.-% acrylic acid and 50 to 10 wt.-% maleic acid have been found particularly suitable. Their relative molecular weight, based on free acids, is equal to in general 2.000 to 70.000 g/mol, preferably 20.000 to 50.000 g/mol, and in particular 30.000 to 40.000 g/mol.

[0066] Oxydisuccinates and other derivatives of disuccinates, preferably ethylenediamine disuccinate, are additional suitable co-builders. Ethylenediamine-N,N'-disuccinate (EDDS) might be used, preferably in the form of its sodium or magnesium salts. Also preferred in this context are glycerol disuccinates and glycerol trisuccinates.

[0067] In order to improve cleaning performance and/or to adjust viscosity, liquid cleaning agents may contain at least one hydrophobically modified polymer, preferably a hydrophobically modified polymer containing carboxylic acid groups, the weight amount of the hydrophobically modified polymer in terms of the total weight of the cleaning agent being preferably 0,1 to 10 wt.-%, preferably between 0,2 and 8,0 wt.-%, and in particular 0,4 to 6,0 wt.-%.

[0068] Supplementing the builders described above, polymers having cleaning activity can be contained in the cleaning agent. The weight proportion of the polymers having cleaning activity in terms of the total weight of automatic cleaning agents according to the present invention is preferably from 0,1 to 20 wt.-%, preferably 1,0 to 15 wt.-%, and in particular 2,0 to 12 wt.-%.

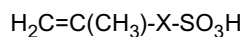
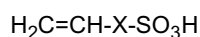
[0069] Sulfonic acid group-containing polymers, in particular those from the group of the copolymeric polysulfonates, are used preferably as polymers having cleaning activity. These copolymeric polysulfonates contain, besides sulfonic acid group-containing monomer(s), at least one monomer from the group of the unsaturated carboxylic acids.

[0070] Unsaturated carboxylic acids of the formula $R^1(R^2)C=C(R^3)COOH$ are used with particular preference as (an) unsaturated carboxylic acid(s), in which formula R^1 to R^3 , mutually independently, denote -H, -CH₃, a straight-chain or branched saturated alkyl residue having 2 to 12 carbon atoms, a straight-chain or branched, mono- or polyunsaturated alkenyl residue having 2 to 12 carbon atoms, alkyl or alkenyl residues as defined above substituted with -NH₂, -OH, or -COOH, or denote -COOH or -COOR⁴ where R⁴ is a saturated or unsaturated, straight-chain or branched hydrocarbon residue having 1 to 12 carbon atoms.

[0071] Particularly preferred unsaturated carboxylic acids are acrylic acid, methacrylic acid, ethacrylic acid, α -chloroacrylic acid, α -cyanoacrylic acid, crotonic acid, α -phenylacrylic acid, maleic acid, maleic acid anhydride, fumaric acid, itaconic acid, citraconic acid, methylenemalononic acid, sorbic acid, cinnamic acid, or mixtures thereof. The unsaturated dicarboxylic acids are of course also usable.

[0072] In the context of the sulfonic acid group-containing monomers, those of the formula $R^5(R^6)C=C(R^7)-X-SO_3H$, in which R^5 to R^7 , mutually independently, denote -H, -CH₃, a straight-chain or branched saturated alkyl residue having 2 to 12 carbon atoms, a straight-chain or branched, mono- or polyunsaturated alkenyl residue having 2 to 12 carbon atoms, alkyl or alkenyl residues substituted with -NH₂, -OH, or -COOH, or denote -COOH or -COOR⁴, where R⁴ is a saturated or unsaturated, straight-chain or branched hydrocarbon residue having 1 to 12 carbon atoms, and X denotes an optionally present spacer group that is selected from -(CH₂)_n- where n=0 to 4, -COO-(CH₂)_k- where k=1 to 6, -C(O)-NH-C(CH₃)₂-, -C(O)-NH-C(CH₃)₂-CH₂-, and -C(O)-NH-CH(CH₂CH₃)-, are preferred.

[0073] Among these monomers, those of the formulas



[0074] $HO_3S-X-(R^6)C=C(R^7)-X-SO_3H$, in which R^6 and R^7 , mutually independently, are selected from -H, -CH₃, -CH₂CH₃, -CH₂CH₂CH₃, -CH(CH₃)₂, and X denotes an optionally present spacer group that is selected from -(CH₂)_n- where n=0 to 4, -COO-(CH₂)_k- where k=1 to 6, -C(O)-NH-C(CH₃)₂-, -C(O)-NH-C(CH₃)₂-CH₂-, and -C(O)-NH-CH(CH₂CH₃)-, are preferred.

[0075] Particularly preferred sulfonic acid group-containing monomers in this context are 1-acrylamido-1-propanesulfonic acid, 2-acrylamido-2-propanesulfonic acid, 2-acrylamido-2-methyl-1-propanesulfonic acid, 2-methacrylamido-2-methyl-1-propanesulfonic acid, 3-methacrylamido-2-hydroxypropanesulfonic acid, allylsulfonic acid, methallylsulfonic acid, allyloxybenzenesulfonic acid, methallyloxybenzenesulfonic acid, 2-hydroxy-3-(2-propenyloxy)propanesulfonic acid, 2-methyl-2-propene-1-sulfonic acid, styrenesulfonic acid, vinylsulfonic acid, 3-sulfopropylacrylate, 3-sulfopropylmethacrylate, sulfomethacrylamide, sulfomethylmethacrylamide, and mixtures of the aforesaid acids or water-soluble salts

thereof.

[0076] The sulfonic acid groups can be present in the polymers entirely or partly in neutralized form. The use of partly or entirely neutralized sulfonic acid group-containing copolymers is preferred.

[0077] The molecular weight of the sulfo-copolymers can be varied in order to adapt the properties of the polymers to the desired application. Preferred automatic dishwashing agents are characterized in that the copolymers have molecular weights from 2.000 to 200.000 g/mol⁻¹, preferably from 4.000 to 25.000 g/mol⁻¹, and in particular from 5.000 to 15.000 g/mol⁻¹.

[0078] The copolymers can also encompass, besides carboxyl group-containing monomers and sulfonic acid group-containing monomers, at least one nonionic, preferably hydrophobic monomer. The use of these hydrophobically modified polymers allows to improve, in particular, the rinsing performance of automatic dishwashing agents according to the present invention.

[0079] Cleaning agents containing a copolymer encompassing

- i) carboxylic acid group-containing monomer(s),
- ii) sulfonic acid group-containing monomer(s),
- iii) optionally (a) nonionic monomer(s), are preferred according to the present invention.

[0080] The use of these terpolymers has made it possible to improve the rinsing performance of automatic dishwashing agents according to the present invention with respect to comparable dishwashing agents that contain sulfopolymers without the addition of nonionic monomers.

[0081] The nonionic monomers used are preferably monomers of the general formula $R^1(R^2)C=C(R^3)-X-R^4$, in which R^1 to R^3 , mutually independently, denote -H, -CH₃, or -C₂H₅, X denotes an optionally present spacer group that is selected from -CH₂-, -C(O)O-, and -C(O)-NH-, and R^4 denotes a straight-chain or branched saturated alkyl residue having 2 to 22 carbon atoms or an unsaturated, preferably aromatic residue having 6 to 22 carbon atoms.

[0082] Particularly preferred nonionic monomers are butene, isobutene, pentene, 3-methylbutene, 2-methylbutene, cyclopentene, hexene, hexene-1, 2-methylpentene-1, 3-methylpentene-1, cyclohexene, methylcyclopentene, cycloheptene, methylcyclohexene, 2,4,4-trimethylpentene-1, 2,4,4-trimethylpentene-2, 2,3-dimethylhexene-1, 2,4-dimethylhexene-1, 2,5-dimethylhexene-1, 3,5-dimethylhexene-1, 4,4-dimethylhexane-1, ethylcyclohexyne, 1-octene, α -olefins having 10 or more carbon atoms such as, for example, 1-decene, 1-dodecene, 1-hexadecene, 1-octadecene, and C22- α -olefin, 2-styrene, α -methylstyrene, 3-methylstyrene, 4-propylstyrene, 4-cyclohexylstyrene, 4-dodecylstyrene, 2-ethyl-4-benzylstyrene, 1-vinylnaphthalene, 2-vinylnaphthalene, acrylic acid methyl ester, acrylic acid ethyl ester, acrylic acid propyl ester, acrylic acid butyl ester, acrylic acid pentyl ester, acrylic acid hexyl ester, methacrylic acid methyl ester, N-(methyl)acrylamide, acrylic acid 2-ethylhexyl ester, methacrylic acid 2-ethylhexyl ester, N-(2-ethylhexyl)acrylamide, acrylic acid octyl ester, methacrylic acid octyl ester, N-(octyl)acrylamide, acrylic acid lauryl ester, methacrylic acid lauryl ester, N-(lauryl)acrylamide, acrylic acid stearyl ester, methacrylic acid stearyl ester, N-(stearyl)acrylamide, acrylic acid behenyl ester, methacrylic acid behenyl ester, and N-(behenyl)acrylamide, or mixtures thereof.

[0083] The weight proportion of the sulfonic acid group-containing copolymers in terms of the total weight of cleaning agents according to the present invention is preferably from 0,1 to 15 wt.-%, preferably from 1,0 to 12 wt.-%, and in particular from 2,0 to 10 wt.-%.

[0084] Organic co-builders that may be recited are in particular polycarboxylates/polycarboxylic acids, polymeric polycarboxylates, aspartic acid, polyacetals, dextrans or further organic co-builders.

[0085] A further preferred ingredient of cleaning compositions is at least one complexing agent. The cleaning composition of the present invention may optionally comprise one or more complexing agent(s) as at least one further ingredient.

[0086] Complexing agents are commonly used as co-builders to support the performance of the builders.

[0087] A function of complexing agents is to capture trace metal ions like, Cu(II), Fe(II), Fe(III), Mn(II), Cd(II), Co(II), Cr(III), Hg(II), Ni(II), Pb(II), Pd(II), Zn(II), Ca(II), Mg(II) These ions can interfere with or disturb certain processes of the detergent in the washing machine, like e.g. the bleach performance.

[0088] The complexing agent(s) that are known to be used in detergent compositions include, but are not limited to S,S-ethylenediamine-N,N'-disuccinic acid (S,S-EDDS), ethylenediaminetetraacetic acid (EDTA), diethylene triamine penta(methylene phosphonate) (DETPMP), nitrilotriacetic acid (NTA), ethanol diglycine (EDG), imino disuccinic acid (IDS), methylglycine diacetic acid (MGDA), diethylene triamine pentaacetic acid (DTPA), ethylene diamine dihydroxyphenyl acetic acid (EDDHA), N-(hydroxyethyl) ethylenediamine triacetic acid (HEDTA), hydroxyethylidene-1,1-diphosphonic acid (HEDP), phytic acid, diethylene triamine (DETA), triethylene tetramine (TETA), tetraethylene pentamine (TEPA), aminoethyl ethanolamine (AEEA), glutamic acid N,N-diacetic acid (GLDA), 1,3-propylenediamine tetraacetic acid (PDTA), glucoheptonic acid, dipicolinic acid, ethylene diamine tetra (methylene phosphonic acid) (EDTMPA), 2-hydroxyethyliminodiacetic acid (HEIDA) or water soluble salts thereof or mixtures thereof.

[0089] Further, phosphonates are preferred complexing agents. Useful phosphonates encompass, besides 1-hydroxyethane-1,1-diphosphonic acid, a number of different compounds such as, for example, diethylenetriaminepenta(meth-

ylenephosphonic acid) (DTPMP). Hydroxyalkane- or aminoalkanephosphonates are preferred in this Application. Among the hydroxyalkanephosphonates, 1-hydroxyethane-1,1-diphosphonate (HEDP) is of particular importance as a co-builder. It is used preferably as a sodium salt, the disodium salt reacting neutrally and the tetrasodium salt in alkaline fashion (pH 9). Suitable aminoalkanephosphonates are, e.g. ethylenediaminetetramethylenephosphonate (EDTMP), diethylenetriaminepenta(methylenephosphonic acid) (DTPMP), as well as higher homologs thereof. They are used preferably in the form of the neutrally reacting sodium salts, e.g. as a hexasodium salt of EDTMP resp. as a hepta- and octasodium salt of DTPMP. Of the class of the phosphonates, HEDP is preferably used as a builder. The aminoalkanephosphonates moreover possess a pronounced ability to bind heavy metals. It may accordingly be preferred, in particular if the agents also contain bleaches, to use aminoalkanephosphonates, in particular DTPMP, or mixtures of the aforesaid phosphonates.

[0090] Particularly preferred are one or more phosphonate(s) from the group of

- a) aminotrimethylenephosphonic acid (ATMP) and/or salts thereof,
- b) ethylenediaminetetra(methylenephosphonic acid) (EDTMP) and/or salts thereof,
- c) diethylenetriaminepenta(methylenephosphonic acid) (DTPMP) and/or salts thereof,
- d) 1-hydroxyethane-1,1-diphosphonic acid (HEDP) and/or salts thereof,
- e) 2-phosphonobutane-1,2,4-tricarboxylic acid (PBTC) and/or salts thereof,
- f) hexamethylenediaminetetra(methylenephosphonic acid) (HDTMP) and/or salts thereof,
- g) nitrilotri(methylenephosphonic acid) (NTMP) and/or salts thereof.

[0091] Washing- or cleaning compositions that contain 1-hydroxyethane-1,1-diphosphonic acid (HEDP) or diethylenetriaminepenta(methylenephosphonic acid) (DTPMP) as phosphonates are particularly preferred.

[0092] The cleaning compositions according to the present invention can of course contain two or more different phosphonates.

[0093] Preferred cleaning compositions may contain at least one complexing agent from the group above in terms of the total weight of the cleaning agent in a range from 0,01 to 8,0 wt.-%, preferably 0,02 to 5,0 wt.-%, and in particular 0,05 to 3,0 wt.-%.

[0094] Builders and co-builders can generally be added to the composition in acid form, neutralized or in a partly neutralized form. When used in a partly or completely neutralized form alkali metal salts are preferred, like sodium, potassium and lithium or ammonium salts.

SURFACTANTS

[0095] The cleaning composition of the present invention preferably comprise one or more surfactants as at least one further ingredient. Said surfactants may be selected from anionic, non-ionic, cationic or amphoteric surfactants, however, are preferably anionic and/or non-ionic.

[0096] The main functions of surfactants are changing the surface tension, dispersing, foam controlling and surface modification.

[0097] A special type of surfactants used in automatic dishwasher cleaning compositions is a 'carry-over' surfactant. A 'carry-over' surfactant has the property that some amount of the surfactant used remains in the machine after the rinsing cycles to give a performance during the final rinsing cycle and the (optional) drying phase of the whole washing cycle of the dishwashing machine. This type of surfactant is described in EP 1 524 313 in more detail.

[0098] For automatic dishwasher cleaning compositions alkoxylated nonionic surfactants and Gemini surfactants are commonly used. The alkoxy groups mostly consist of ethyleneoxide, propyleneoxide and butyleneoxide or combinations thereof. Also amphoteric surfactants are known to be used in automatic dishwasher detergent compositions.

[0099] Alkyl poly glucoside surfactants can also be used in automatic dishwasher cleaning compositions, preferably in a low foaming form.

[0100] Examples of possible surfactant as at least one further ingredient can be selected from the group consisting of anionic, cationic, non-ionic as well as amphoteric surfactants, and preferably may be selected from the group consisting of anionic or non-ionic surfactants or mixtures thereof. More preferably, the composition of the present invention comprises a mixture of anionic and non-ionic surfactants. If surfactants are present in the composition of the present invention, their amount preferably may be in the range of from 0,1 to 50 wt.-%, more preferably of from 1 to 30 wt.-%, even more preferably of from 1,5 to 25 wt.-%, even more preferably of from 1,5 to 20 wt.-%, and most preferably of from 1,5 to 15 wt.-%, based on the whole composition. Preferably the composition comprises at least one nonionic surfactants and optionally at least one anionic surfactant, wherein the ratio of the combined amount of anionic surfactants to the amount of non-ionic surfactants preferably is greater than 1:1 and more preferably is in the range of from 1,1:1 to 5:1.

[0101] Anionic surfactants suitable to be used in detergents, in particular in combination with enzymes are well known in the state of the art and include for example alkylbenzenesulfonic acids or salts thereof and alkylsulfonic acids or salts

thereof.

[0102] Suitable anionic alkylbenzene sulfonic or alkylsulfonic surfactants include in particular C₅-C₂₀, preferably C₁₀-C₁₆, even more preferably C₁₁-C₁₃ alkylbenzenesulfonates, in particular linear alkylbenzene sulfonates (LAS), alkylestersulfonates, primary or secondary alkenesulfonates, sulfonated polycarboxylic acids and any mixtures thereof. Alkylethersulfates may be used as well.

[0103] Further preferred surfactants are low foaming non-ionic surfactants. Washing or cleaning agents, particularly cleaning agents for dishwashing and among this preferably for automatic dishwashers, are especially preferred when they comprise non-ionic surfactants from the group of the alkoxyated alcohols. Preferred non-ionic surfactants are alkoxyated, advantageously ethoxyated, particularly primary alcohols preferably containing 8 to 18 carbon atoms and, on average, 1 to 12 moles of ethylene oxide (EO) per mole of alcohol, in which the alcohol group may be linear or, preferably, methyl-branched in the 2-position or may contain e.g. linear and methyl-branched residues in the form of the mixtures typically present in Oxo alcohol residues. Particularly preferred are, however, alcohol ethoxylates with linear groups from alcohols of natural origin with 6 to 22 carbon atoms, e.g. from coco-, palm-, tallow- or oleyl alcohol, and an average of 2 to 8 EO per mole alcohol. Exemplary preferred ethoxyated alcohols include C₁₂₋₁₄ alcohols with 3 EO or 4 EO, C₉₋₁₁ alcohols with 7 EO, C₁₃₋₁₅ alcohols with 3 EO, 5 EO or 7 EO, C₁₂₋₁₈ alcohols with 3 EO, 5 EO or 7 EO and mixtures thereof, such as mixtures of C₁₂₋₁₄ alcohols with 3 EO and C₁₂₋₁₈ alcohols with 5 EO. The cited degrees of ethoxylation constitute statistically average values that can be a whole or a fractional number for a specific product. Preferred alcohol ethoxylates have a narrowed homolog distribution (narrow range ethoxylates, NRE). In addition to these non-ionic surfactants, fatty alcohols with more than 12 EO can also be used. Examples of these are tallow fatty alcohol with 14 EO, 25 EO, 30 EO or 100 EO.

[0104] Accordingly, ethoxyated non-ionic surfactant(s) prepared from C₆₋₂₀ monohydroxy alkanols or C₆₋₂₀ alkylphenols or C₁₂₋₂₀ fatty alcohols and more than 12 mole, preferably more than 12 mole and especially more than 20 mole ethylene oxide per mole alcohol, are used with particular preference. A particularly preferred non-ionic surfactant is obtained from a straight-chain fatty alcohol containing 16 to 20 carbon atoms (C₁₆₋₂₀ alcohol), preferably a C₁₈ alcohol, and at least 12 moles, preferably at least 15 moles and more preferably at least 20 moles of ethylene oxide. Of these non-ionic surfactants, the so-called narrow range ethoxylates are particularly preferred.

[0105] Moreover, surfactant(s) that comprise one or more tallow fat alcohols with 20 to 30 EO in combination with a silicone defoamer are particularly preferably used.

[0106] Examples of preferred surfactants are selected from a group consisting of gemini surfactants with a short C-Chain (C₈-C₁₂) as spacer and two times 5-40EO groups as hydrophilic headgroups (e.g. Dehypon GRA, Dehypon E 127, Genapol EC 50, Genapol EC 65) and Long Chain (C₁₂-22) high ethoxyated (20-100EO) carry over surfactant Lutensol AT Types.

[0107] Further all surfactants commonly known to be used in cleaning compositions can be part of the composition, this includes all anionic, non-ionic, cationic and amphoteric surfactants known in the art. The present invention is not limited by any of the surfactants commonly used in automatic dishwashing compositions.

BLEACHING AGENT(S)

[0108] The composition of the present invention may optionally comprise one or more bleaching agent(s) as at least one further ingredient.

[0109] Bleaching agents can be used in a cleaning composition either alone or in combination with a bleach activator and/or a bleach catalyst. The function of the bleaching agent is the removal of bleachable stains and to achieve an antibacterial effect on the load and inside of the (dish)washing machine.

[0110] Bleaching agents that can be used in detergent compositions include, but are not limited to, active chlorine compounds, inorganic peroxygen compounds and organic peracids. Examples are sodium percarbonate, sodium perborate monohydrate, sodium perborate tetrahydrate, hydrogen peroxide, hydrogen peroxide based compounds, persulfates, peroxymonosulphate, peroxydisulphate, ε-phthalimido-perox-caproic acid, benzoyl peroxide, sodium hypochlorite, sodium dichloroisocyanurate, etc. as well as mixtures thereof. At least one bleaching agent is selected from inorganic bleaching agents, preferably from sodium perborate or sodium percarbonate or a mixture thereof.

[0111] The weight proportion of the bleaching agent in terms of the total weight of the cleaning composition is preferably from 1 to 40 wt.-%, more preferably from 2 to 30 wt.-%, and most preferred from 3 to 20 wt.-%.

BLEACH ACTIVATOR(S)

[0112] The composition of the present invention may optionally comprise one or more bleach activators as a further ingredient, however this is not necessary.

[0113] When inorganic peroxygen based bleaching agents are applied, a bleach activator provides the possibility to use a comparatively low temperature to achieve the desired bleaching performance. The bleach activator reacts with

the peroxygen to form an organic peracid. Depending from the used bleach activator these peracids can have a hydrophobic or a hydrophilic character.

[0114] Bleach activators agents that can be used in cleaning compositions include, but are not limited to, tetraacetylenediamine (TAED), sodium nonanoyloxybenzene sulfonate (NOBS), acetyl caprolactone, N-methyl morpholinium acetonitrile and salts thereof, sodium 4-(2-decanoyloxyethoxycarbonyloxy)benzenesulfonate (DECOBS) and salts thereof, lauryloxybenzylsulfonate (LOBS), iso-lauryloxybenzylsulfonate (I-LOBS), N-methylmorpholinium-acetonitril (MMA), Pentaacetylglucose, Nitrilquats, Benzoylcaprolactam (BzCL), 4-nitrobenzoylcaprolactam, 3-clorobenzoylcaprolactam, benzoyloxybenzylsulfonate (BOBS), phenylbenzoate (PhBz), decanoyloxybenzylsulfonate (C10-OBS), benzoylvalerolactam (BZVL), octanoyloxybenzylsulfonate (C8-OBS), 4-[N-(nonanoyl)aminohezanoyloxy]-benzylsulfonate-sodium salt (NACA-OBS), 10-undecenoyloxybenzylsulfonate (UDOBS), decanoyloxybenzoec acid (DOBA), perhydrolyzable ester, perhydrolytic enzyme combined with an by this enzyme hydrolysable substrate, acetyl caprolactone, Acetyl caprolactam (N-acetylhexanelactam) (e.g. Peractive LAC) N-methyl morpholinium acetonitrile and salts thereof (such as Sokalan BMG from BASF).

[0115] Preferably TAED is selected as bleach activator.

[0116] If a bleach activator is present, the weight proportion of the bleach activator in terms of the total weight of the cleaning composition is preferably from 0,01 to 10 wt.-%, more preferably from 0,1 to 5 wt.-%, and most preferred from 0,5 to 2 wt.-%.

[0117] The following further ingredients can be added in commonly used amounts:

ANTI-REDEPOSITION AGENT(S)

[0118] The cleaning composition of the present invention may optionally comprise one or more anti-redeposition agent(s) as at least one further ingredient.

[0119] The main function of anti-redeposition agents is the aid to prevent the soil from redepositing on the washing substrate when a washing liquor provides insufficient soil anti-redeposition capacity.

[0120] Anti-redeposition agent(s) can provide their effect by becoming adsorbed irreversibly or reversibly to the soil particles or to the substrate. Thereby the soil becomes better dispersed in the washing liquor or the substrate is occupied with anti-redeposition agent(s) on those places the soil could redeposit.

[0121] The anti-redeposition agent(s) that are known to be used in detergent compositions include, but are not limited to, carboxymethyl cellulose, polyester-PEG co-polymer, polyvinyl pyrrolidone based polymers etc.

ANTI-CORROSION AGENT(S)

[0122] The cleaning composition of the present invention may optionally comprise one or more anti-corrosion agent(s) as one further ingredient.

[0123] The main function of anti-corrosion agents is to minimize the amount of material damage caused on glass and metal during automatic dishwashing.

[0124] Glass corrosion occurs because metal ions are dissolved out of the glass surface. This occurs more intensively when soft tap water is used for the cleaning. In this case the builders and complexing agents can only bind a limited amount of hardness ions from the tap water and extract then (alkaline earth) metals from that glass surface. Also of influence for glass corrosion are the washing temperature, the quality of the glassware and the duration of the cleaning program.

[0125] Glass corrosion becomes visible in white lines or white clouds on the glass surface. The glass corrosion damage can be repaired by replacing the extracted metal ion, however preferably the glassware can be protected against glass corrosion.

[0126] Metal corrosion occurs in many cases when oxide, sulphide and/or chlorides are present in the washing liquid, which normally is a mixture of tap water, soil and a cleaning composition. The anions react with the metal or metal alloy surface of articles that are contained in the dishwashing machine. In the case of silver the silver salts which are formed give a discoloration of the silver metal surface which becomes visible after one or more cleaning cycles in an automatic dishwashing machine.

[0127] The occurrence of metal corrosion can be slowed down or inhibited by use of detergent ingredients that provides the metal with a protective film or ingredients forming compounds with the oxide, sulfide and/or chlorides to prevent them from reacting with the metal surface.

[0128] The protective film can be formed because the inhibitor ingredient may become insoluble on the metal or metal alloy surface, or because of adsorption to the surface by aid of free electron pairs of donor atoms (like N, S, O, P). The metals can be silver, copper, stainless steel, iron, etc.

[0129] The types of anti corrosion agents which often are used in detergent compositions or which are described in literature include, but are not limited to, triazole-based compounds (like tolyltriazole and 1,2,3-benzotriazole), polymers

with an affinity to attach to glass surfaces, strong oxidizers (like permanganate), cystine (as silver-protector), silicates, organic or inorganic metal salts, or metal salts of biopolymers. The metal of these metal salts can be selected from the group aluminum, strontium, barium, titanium, zirconium, manganese, lanthanum, bismuth, zinc, wherein the latter two are most commonly applied for the prevention of glass corrosion. Further compounds to be added e.g. are manganese compounds as described e.g. in WO2005/095570.

SILVER PROTECTING AGENTS

[0130] The cleaning composition of the present invention may optionally comprise one or more silver protecting agent(s) as one further ingredient.

[0131] Several silver protection agents that reduce silver corrosion have been described in the patent literature. The British patent GB 1131738 discloses dishwashing agents which use benzotriazoles as a corrosion inhibitor for silver. Benzotriazoles in the context of silver corrosion protection are also disclosed in the U.S. patent 2,549,539 and the European patents EP 135 226 and EP 135 227.

[0132] Another group of compounds used as silver corrosion protection agents comprises manganese salts or manganese complex compounds. The German patent number DE 4315397 discloses organic and inorganic redox compounds containing manganese(II) compounds, e.g. manganese(II)sulfate, manganese(II)acetoacetate and manganese(II)acetylacetonate. These low valent manganese compounds preferably have to be coated prior to their use in cleaning compositions containing bleaching agents in order to avoid their oxidation or decomposition during storage. EP 530 870 A1 discloses dinuclear manganese complexes in machine dishwashing compositions, wherein the manganese is in the III or IV oxidation state. EP 697 035 A1 describes automatic dishwashing compositions comprising at least partly water-soluble metal salts and/or metal complexes comprising manganese salts or complexes.

[0133] Examples of further corrosion inhibitors or anti-tarnish aids are paraffin oil, typically a predominantly branched aliphatic hydrocarbon having a number of carbon atoms in the range of from about 20 to about 50; preferred paraffin oil is selected from predominantly branched C 25-45 species with a ratio of cyclic to noncyclic hydrocarbons of about 32:68. A paraffin oil meeting those characteristics is sold by Wintershall, Salzbergen, Germany, under the trade name WINOG 70. When present, such protecting materials are preferably incorporated at low levels, e.g., from about 0,01 wt.-% to about 5 wt.-% of the automatic dishwashing composition.

[0134] Other corrosion inhibitor compounds include benzotriazole, tolyltriazole and comparable compounds; mercaptans or thiols including thionaphthol and thioanthranol; and finely divided Aluminium fatty acid salts, such as aluminium tristearate. The formulator will recognize that such materials will generally be used judiciously and in limited quantities so as to avoid any tendency to produce spots or films on glassware or to compromise the bleaching action of the compositions. For this reason, mercaptan anti-tarnishes which are quite strongly bleach-reactive and common fatty carboxylic acids which precipitate with calcium in particular are preferably avoided.

DYES

[0135] The composition of the present invention may optionally comprise one or more dyes as at least one further ingredient. The dye is used to colour the detergent, parts of the detergent or speckles in the detergent. This might render the product more attractive to the consumer.

[0136] Dyes that can be used in cleaning compositions include, but are not limited to, Nylosan yellow N-7GL, Sanolin brilliant flavine 8GZ, Sanolin yellow BG, Vitasyn quinoline yellow 70, Vitasyn tartrazine X90, Puricolor yellow AYE23, Basacid yellow 232, Vibracolor yellow AYE17, Simacid Eosine Y, Puricolor red ARE27, Puricolor red ARE14, Vibracolor red ARE18, Vibracolor red ARE52, Vibracolor red SRE3, Basacid red 316, Ponceau SX, Iragon blue DBL86, Sanolin blue EHRL, Sanolin turquoise blue FBL, Basacid blue 750, Iragon blue ABL80, Vitasyn blue AE90, Basacid blue755, Vitasyn patentblue V 8501, Vibracolor green AGR25. These dyes are available at the firms Clariant or BASF.

PERFUMES

[0137] The composition of the present invention may optionally comprise one or more perfumes as at least one further ingredient. The perfume is added to the cleaning composition to improve the sensorial properties of the product or of the machine load after cleaning.

[0138] The perfume can be added to the cleaning composition as a liquid, paste or as a cogranulate with a carrier material for the perfume. To improve the stability of the perfume it can be used in an encapsulated form or as a complex like for example a perfume-cyclodextrine complex.

[0139] Also perfumes that have a deodorizing effect can be applied. Such perfumes or raw materials encapsulate malodours by binding to their sulphur groups.

MISCELLANEOUS

[0140] The composition may further comprise other ingredients allowing a desired performance as known by the skilled artisan without limiting the invention.

[0141] In a particularly preferred embodiment of the invention a cleaning composition comprises granulate particles comprising a core and a coating, wherein the core comprises at least one metal containing bleach catalyst and at least one enzyme and the coating comprises at least one water soluble coating compound, wherein within the core the metal containing bleach catalyst is either in intimate mixture with the enzyme(s) or an inner core or layer comprising the metal containing bleach catalyst is coated with the enzyme(s), wherein at least 2 wt.-% of the ingredients of the core are represented by the metal containing bleach catalyst and the enzyme(s), 1 - 40 wt.-% of sodium percarbonate or sodium perborate, 0,1 - 10 wt.-% low-foaming non-ionic surfactant, 0,1 - 80 wt.-% builder and optionally 0,1 - 20 wt.-% polymer (wt.-% based on the entire cleaning composition).

[0142] In a preferred embodiment of the invention the cleaning composition is a dishwashing composition, preferably an automatic dishwashing composition.

[0143] In a further aspect the invention provides a method for cleaning tableware, glassware, dishware, cookware, flatware and/or cutlery in an automatic dishwashing appliance, said method comprising treating soiled tableware in an automatic dishwasher with a cleaning composition according to this invention or a solution comprising said cleaning composition.

[0144] In a further aspect the invention provides the use of an enzyme as described herein for stabilizing metal containing bleach catalyst(s) in a cleaning composition.

[0145] In a further aspect of the invention said granular particles are used in a cleaning composition, preferably said cleaning composition is used for dishwashing.

Figures

[0146] In Fig. 1 four possible embodiments of the granular particle of the present invention (A, B, C and D) are shown as cross-sections.

Examples

[0147] To compare the cleaning performance of modern automatic dishwashing compositions supplemented either with a granulate particle according to the present invention or with the same type of metal-containing bleach catalyst and enzyme in separate particles, the cleaning performance of the following automatic dishwashing cleaning compositions have been tested on tea-soiled cups in an IKW-based (Industrieverband Körperpflege- und Waschmittel e.V.) cleaning test. Unless otherwise stated, the test procedures were chosen according to the known IKW-procedures (published in SÖFW-Journal / 132 / 3-2006) on automatic dishwashing of tea-spoiled cups.

[0148] The basic cleaning formulation used in this test represents standard modern cleaning compositions without any bleach catalyst, supplemented either with coated enzyme granules and 6 mg MnTACN (crystallin uncoated) in separate particles (Formulation A) or enzyme and 6 mg MnTACN coated in a granulate particle according to this invention (Formulation B). Thus, Formulation B is characterized by 6 mg MnTACN, in form of a granulate particle according to this invention. 200 mg of the particles are supplemented to 19,8 g of a standard cleaning composition resulting in 20 g in total.

[0149] Cleaning compositions were stored for 0, 4, 8, or 12 weeks at room temperature before the tea-spoiled cups were cleaned in an automatic dishwasher (Miele G 1222 SC (GSL)) at a cleaning temperature of 45 °C using water with a hardness of 21 °dH. Each dosage used as cleaning composition was 20 g per wash.

Example 1

[0150]

		Storage time of the cleaning composition			
		0 weeks	4 weeks	8 weeks	12 weeks
Cleaning performance	Formula A	100	50	40	40
	Formula B	98	95	90	89

[0151] The cleaning performance of a cleaning composition according to Formula A decreases rapidly after a storage time of 4 weeks and is even more impaired after additional 4 to 8 weeks (8 or 12 weeks in total) of storage. Surprisingly, the cleaning performance of a cleaning composition according to Formula B (according to the granulate particle of the present invention) retains its high-quality cleaning ability even after long-term storage of 12 weeks.

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Claims

- 10 1. A granulate particle comprising a core and a coating, wherein the core comprises at least one metal containing bleach catalyst and at least one enzyme and the coating comprises at least one water soluble coating compound, wherein within the core the metal containing bleach catalyst is either in intimate mixture with the enzyme(s) or an inner core or layer comprising the metal containing bleach catalyst is coated with the enzyme(s), wherein at least 2 wt.-% of the ingredients of the core are represented by the metal containing bleach catalyst and the enzyme(s).
- 15 2. The granulate particle according to claim 1, wherein the water soluble compound is selected from water soluble organic polymers or carboxylate compounds, water soluble inorganic and organic salts, silicates, organic compounds having a molecular weight of less than 500 g/mol and organic polymers having a molecular weight of 800 - 1.000.000 g/mol.
- 20 3. The granulate particle according to claim 1 or 2, wherein the at least one metal-containing bleach catalyst is selected from cobalt (Co) containing or manganese (Mn) containing bleach catalysts, preferably MnTACN.
- 25 4. The granulate particle according to any of the preceding claims, wherein the enzyme is selected from a group consisting of amylases, lipases, glucooxidases, pectinases, proteases, cellulases, mannanase, peroxidase, oxidase, xylanase, pullulanase, glucanase, cutinase, hemicellulases, glucoamylases, phospholipases, esterases, keratanases, reductases, phenoloxidases, lipoxygenases, ligninases, tannases, pentosanases, malanases, arabinosidasases, hyaluronidase, chondroitinase laccase or mixtures thereof, even more preferred the enzyme is selected from a group consisting of proteases, lipases, cellulases or amylases or mixtures thereof, most preferred at least one enzyme is a protease.
- 30 5. The granulate particle according to any of the preceding claims, wherein at least 2 wt.-% of the core is represented by the bleach catalyst and the enzyme(s), preferably at least 5 wt.-%, more preferred at least 10 wt.-%, even more preferred at least 20 wt.-%, and most preferred at least 40 wt.-%.
- 35 6. The granulate particle according to any of the preceding claims, wherein at least one of the following parameters is fulfilled: the ratio of the bleach catalyst to the at least one enzyme within the core is in the range from 100:1 to 1:100, the ratio of the core to the coating (in wt.-%) is from 100:1 to 1:4.
- 40 7. A granulate particle according to any of the preceding claims, wherein the core comprises as further ingredients at least one of a water soluble compound as defined for the coating in claim 2 or carboxymethylcellulose.
- 45 8. A cleaning composition comprising granulate particles according to any of the preceding claims and at least one further ingredient.
- 50 9. The cleaning composition according to claim 8, wherein the at least one further ingredient is selected from the group comprising or consisting of builders, surfactants, preferably non-ionic and/or anionic surfactants, polymers/cobuilders, enzymes, complexing agents, bleaching agents, bleach activators, dispersing agents, optical brighteners, stabilizers, colorants, odorants, anti corrosion agents, tableting agents, disintegrants, silver protecting agents dyes, and perfume.
- 55 10. The cleaning composition according to any of claims 8 or 9, wherein the cleaning composition is a dishwashing composition, preferably an automatic dishwashing composition.
11. The cleaning composition according to any of claims 8 or 9, wherein the cleaning composition comprises besides the granulate particles 1 - 40 wt.-% of sodium percarbonate or sodium perborate, 0,1 - 10 wt.-% nonionic surfactant, preferably low-foaming non-ionic surfactant, 0,1 - 80 wt.-% builder and optionally 0,1 - 20 wt.-% polymer based on the entire cleaning composition.

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12. Method for cleaning tableware in an automatic dishwashing appliance, said method comprising treating soiled tableware in an automatic dishwasher with a cleaning composition according to any of claims 8 to 11 or a solution comprising said composition.

5 **13.** Use of an enzyme as defined in claim 4 for stabilizing metal containing bleach catalyst(s) in a granular particle according to claim 1 to 7 or in a cleaning composition according to any of claims 8 to 11.

14. Use of a granular particle according to claims 1 to 7 in a cleaning composition.

10 **15.** Use of a cleaning composition according to any of claims 8 - 11 for dishwashing.

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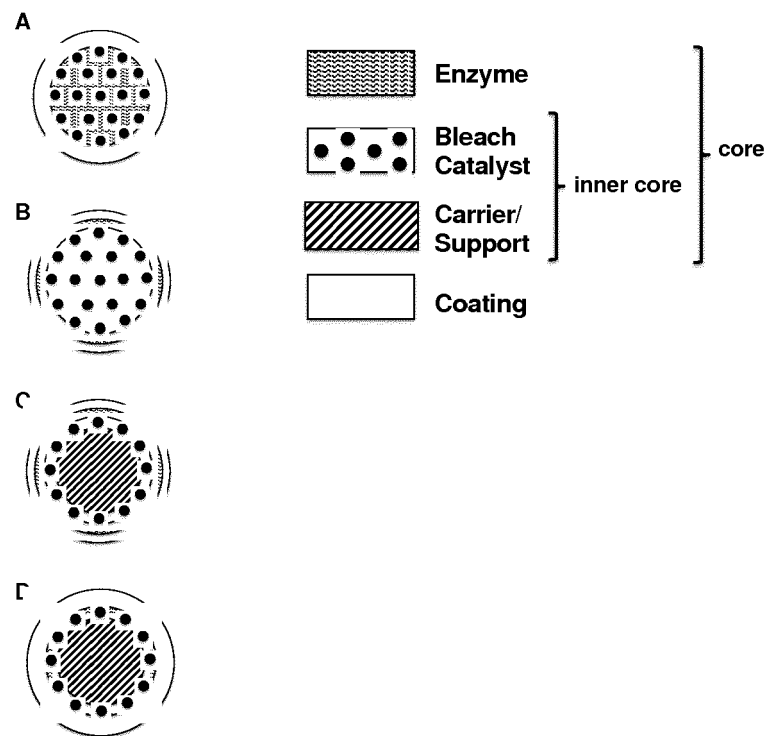
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Fig. 1





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