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(54) A SLIDING PROPERTY IMPROVER FOR USE IN WASHING

(57) A laundry creamy smoothness improver, comprising potassium metaphosphate; a detergent composition comprising the above creamy smoothness improver, and a solubilizing agent; a process for hand-washing, wherein washing is carried out under conditions of a potassium metaphosphate concentration in water of 30 mg/L or more and a liquor ratio of 2 or more; ; laundry creamy smoothness improver granules, comprising potassium metaphosphate; a detergent composition comprising the above creamy smoothness improver granules and a solubilizing agent; and a detergent composition comprising the above creamy smoothness improver granules. The laundry creamy smoothness improver or the laundry creamy smoothness improver granules can be suitably used for hand-washing and washing-machine washing.

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a laundry creamy smoothness improver and laundry creamy smoothness improver granules capable of avoiding cloth damages. More specifically, the present invention relates to an additive in washing on the bases of new technical ideas: The hand-washing ability is improved in that washing can be performed with a reduced power by improving the smoothness between items during hand-washing and that the rate of rubbing the laundry items (number of rubbings per unit time) is likely to be increased, and the damages of the items to be washed due to rubbing between the laundry items and the cut damages and rubbing damages generated on hands due to rubbing hands with each other are suppressed. In addition, the present invention relates to a detergent composition containing the above creamy smoothness improver or the above creamy smoothness improver granules. Further, the present invention relates to a process for hand-washing in the presence of a potassium metaphosphate. In addition, the present invention relates to a method of avoiding cloth damages by, for instance, increasing smoothness between the fibers against the damages of fibers which are causative of loss of well kept shape due to mechanical power such as stirring in washing machines.

BACKGROUND OF THE INVENTION

[0002] Washing methods can be roughly classified into hand-washing and washing-machine washing. Recently, with the widespread of washing-machines, washing-machine washing tends to be increased. However, there are still needs for hand-washing from the viewpoint of easy removal of dirt stains and economic advantages.

[0003] Therefore, developments have been made on detergents having preferred properties during hand-washings. For instance, Japanese Unexamined Patent Laid-Open No. Hei 10-504056 discloses a method of improving irritability to skin during hand-washing by formulating an anionic surfactant, a cationic surfactant and a nonionic surfactant in a specified ratio. In addition, regarding the control of bubbles, highly foamable surfactants such as LAS and AS for increasing foam; a nonionic surfactant such as polyoxyethylene alkyl ether for regulating bubbles; and soaps for improvement in foam off during rinsing have been generally known. Concretely, Japanese Examined Patent Publication No. Hei 8-13987 discloses a detergent composition having excellent dissolubility, foaming ability and rinsing ability by containing an anionic surfactant, a specified nonionic surfactant and a fatty acid soap in a specified ratio.

[0004] However, studies on techniques for improving facilitation of hand-washing (smoothness when the items to be washed are rubbed) have not been so far made.

SUMMARY OF THE INVENTION

[0005] Specifically, the present invention relates to:

[1] a laundry creamy smoothness improver, containing potassium metaphosphate;
[2] the laundry creamy smoothness improver according to the above [1], wherein potassium metaphosphate has a K/P molar ratio of less than 1;
[3] the laundry creamy smoothness improver according to the above [1] or [2], wherein the creamy smoothness improver is used for hand-washing;
[4] a detergent composition containing the laundry creamy smoothness improver of the above [1], and a solubilizing agent;
[5] the detergent composition according to the above [4], wherein the solubilizing agent contains an ion source for substitution in an amount of at least 0.5 times equivalent based on potassium ion in potassium metaphosphate;
[6] the detergent composition according to the above [4], further containing a surfactant and/or a builder;
[7] the detergent composition according to the above [6], further containing as a builder a metal ion capturing agent having a calcium ion capturing ability of 100 mg $CaCO_3$/g or more in an amount of 5% by weight or more;
[8] the detergent composition according to the above [7], wherein the metal ion capturing agent is a water-soluble organic substance;
[9] the detergent composition according to the above [4], further containing a silicate;
[10] the detergent composition according to the above [9], wherein the silicate is sodium silicate;
[11] the detergent composition according to the above [4], further containing a phosphate;
[12] the detergent composition according to the above [11], wherein the phosphate is sodium tripolyphosphate;
[13] a process for hand-washing, wherein washing is carried out under conditions of a potassium metaphosphate concentration in water of 30 mg/L or more and a liquor ratio of 2 or more;
[14] laundry creamy smoothness improver granules, containing potassium metaphosphate;

[15] the laundry creamy smoothness improver granules according to the above [14], wherein the potassium metaphosphate has an average particle size of 0.5 μm or more and 200 μm or less;
[16] the laundry creamy smoothness improver granules according to the above [14], wherein the creamy smoothness improver granules are used for hand-washing;
[17] the laundry creamy smoothness improver granules according to the above [14], further containing a binder substance;
[18] the laundry creamy smoothness improver granules according to the above [17], wherein the binder substance is polyethylene glycol;
[19] the laundry creamy smoothness improver granules according to the above [14], wherein the creamy smoothness improver granules have an average particle size of 100 μm or more and less than 2000 μm;
[20] the laundry creamy smoothness improver granules according to the above [14], further containing a solubilizing agent;
[21] a detergent composition containing the laundry creamy smoothness improver granules of the above [14] and a solubilizing agent;
[22] a detergent composition containing the laundry creamy smoothness improver granules of the above [20];
[23] the detergent composition according to the above [21], wherein the solubilizing agent contains an ion source for substitution in an amount of at least 0.5 times equivalent based on potassium ion in potassium metaphosphate; and
[24] the detergent composition according to the above [21], further containing a surfactant and/or a builder.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

Figure 1 is a schematic graph showing calibration curve prepared in the method for determining calcium (Ca) ion capturing capability at a calcium ion electrode, which shows the relationship between the logarithm of the calcium ion concentration and voltage; and
Figure 2 is a schematic graph showing the relationship between the calcium ion concentration prepared in the method for determining calcium (Ca) ion capturing capability at a calcium ion electrode and the amount of sample added dropwise, wherein the calcium ion concentration at an amount A of sample added dropwise is defined as the calcium ion capturing capability of the sample.

DETAILED DESCRIPTION OF THE INVENTION

[0007] The present invention relates to a laundry creamy smoothness improver capable of improving smoothness between items to be washed during hand-washing, so that washing can be performed with a reduced power, and hand-washing is facilitated by increasing the rate of rubbing laundry items (number of rubbings per unit time), and further capable of accomplishing a so-called hand-care effect in which the skin after drying after the hand-washing feels soft and smooth, and a so-called laundry item-care, in which loss of well kept shape due to mechanical power such as stirring in washing machines can be avoided; a creamy smoothness improver for hand-washing; a detergent composition containing these creamy smoothness improvers; and a process for hand-washing in which smoothness is improved when rubbing together the items to be washed with each other in hand-washing.

[0008] In addition, before hand-washing is performed, there are many cases where hand-washing is started after items to be washed are soaked, and the soaked items are allowed to stand for a period of several minutes to several hours in a liquid prepared by dissolving a detergent composition in water. In such cases, the effects of improving smoothness exhibited by the dissolution of the potassium metaphosphate are lowered with the passage of time. The smoothness-keeping time period can be extended by making the particle size of the potassium metaphosphate larger. However, the insoluble remnants of the potassium phosphate and deposition on clothes become problematic. Therefore, the present invention relates to laundry creamy smoothness improver granules in which improvement in smoothness between the items to be washed, in both cases where the laundry items are not soaked and the laundry items are soaked without generating insoluble remnants of the potassium metaphosphate and deposition on clothes, so that washing is performed with a reduced power, and hand-washing is facilitated by increasing rate of rubbing items to be washed (number of rubber per unit time); and a detergent composition containing the laundry creamy smoothness improver granules.

[0009] These and other advantages of the present invention will be apparent from the following description.

[0010] As a result of intensive studies by remarking on completely new property "smoothness" when the items to be washed are rubbed together in washing in order to meet the needs of carrying out hand-washing conveniently, the present inventors have found that the above problems can be solved by separately adding a laundry creamy smoothness improver containing a potassium metaphosphate to a detergent composition during hand-washing, or using a detergent composition containing the above laundry creamy smoothness improver. The present invention has been perfected

thereby. Furthermore, in consideration of the fact there are many cases where hand-washing is started after soaking the items for several minutes to several hours or so, by using those prepared by granulating the potassium metaphosphate alone, or those prepared by granulating a potassium metaphosphate together with a binder substance and/or other components, washing can be performed with a reduced power not only in hand-washing immediately after the addition but also in hand-washing after soaking for several minutes to several hours, whereby feel of hand-washing is enhanced, and the rate of rubbing items to be washed (number of rubbings per unit time) is increased. The present invention has been perfected thereby.

< Laundry Creamy Smoothness Improver >

[0011] The laundry creamy smoothness improver can be used by mixing the improver with a detergent, or can be directly added separately from the detergent upon washing.

[0012] The laundry creamy smoothness improver of the present invention contains a potassium metaphosphate. Concrete examples thereof include the potassium metaphosphate alone or a mixture of the potassium metaphosphate with other base agents.

[0013] The potassium metaphosphate will be described later. Also, the other substances as referred to herein may be any substances generally used in a detergent composition without inhibiting the actions of the potassium metaphosphate. For instance, sodium sulfate, zeolite, polyethylene glycol, an alkyl sulfate or the like can be properly used.

[0014] The amount of the potassium metaphosphate is preferably from 30 to 100% by weight, more preferably from 50 to 100% by weight of the laundry creamy smoothness improver.

[0015] When the laundry creamy smoothness improver having the above constitution is composed of the potassium metaphosphate alone, the potassium metaphosphate can be directly used, or formed into fine powder by pulverization treatment.

[0016] Also, when the laundry creamy smoothness improver is a mixture of the potassium metaphosphate with other base agents, the laundry creamy smoothness improver can be prepared by mixing these components by a known method.

[0017] The laundry creamy smoothness improver of the present invention servers to improve smoothness between items to be washed during hand-washing, thereby facilitating hand-washing, to enhance feel in hand-washing, and to accomplish hand-care as well as laundry item-care. Accordingly, the present invention also relates to a creamy smoothness improver for hand-washing.

[0018] The form of the laundry creamy smoothness improver (hereinafter simply referred to as "creamy smoothness improver") is not particularly limited. The form may be any agent forms such as powders, granules, liquids, or slurries/pastes. In order that the smoothness is quickly exhibited to laundry items thoroughly, it is preferable to use the creamy smoothness improver in the form of powder or granule.

[0019] In addition, by granulating the above creamy smoothness improver in the form of a granule or a capsule, there are some advantages such as the improvement in smoothness between the items to be washed is maintained in any cases where the laundry items are soaked and where the laundry items are not soaked without the generation of the insoluble remnants of the potassium metaphosphate and deposition on clothes, so that washing can be carried out with a reduced power, and the rate of rubbing the laundry items (number of rubbings per unit time) is increased, thereby facilitating the hand-washing. The laundry creamy smoothness improver granules will be described later.

[0020] It is preferable that the creamy smoothness improver or creamy smoothness improver granules of the present invention are contained in the detergent composition, from the viewpoints of convenience upon use and dissolubility. Here, the above creamy smoothness improver is not limited by a composition, a form, a preparation process of the detergent composition used, and can exhibit its effects in all of the detergent compositions containing a solubilizing agent which will be described later.

< Detergent Composition >

[0021] One of the significant features of the detergent composition of the present invention resides in that the detergent composition contains the above creamy smoothness improver and/or creamy smoothness improver granules, and a solubilizing agent. Since the detergent composition has the above features, the effects such as the washing liquid in which a detergent composition is dissolved upon washing becomes a lotion-like viscous solution, so that smoothness is also improved between the items to be washed in hand-washing, whereby washing can be performed with a reduced power, and hand-washing ability such as tendency of increasing the rate of rubbing items to be washed is improved, and further hand-care effects, in which the dried skin after the hand-washing is felt to be tender and smooth, and laundry item-care effects are exhibited.

[0022] The detergent composition may be in any agent forms such as powders, granules, liquids or pastes, or may be molded into an aggregate, a tablet or the like by a secondary processing. In order to quickly exhibit smoothness in the laundry items thoroughly, it is preferable that the detergent composition is in the form of powder or granule.

[0023] Here, the washing liquid as used herein refers to a liquid for performing washing such as one in which the above detergent composition is dissolved or suspended.

[0024] Each of the components used in the present invention will be explained hereinbelow.

1. Potassium Metaphosphate

[0025] The potassium metaphosphate usable in the present invention refers to a substance which has very low solubility in water, but shows water solubility by salt exchange with a solubilizing agent (a compound containing a sodium ion source, a lithium ion source, or an ammonium ion source). Among them, a high-molecular weight potassium metaphosphate (molecular weight: about ten thousands to several dozen millions) represented by $(KPO_3)_n$ is suitable for improving the smoothness between the items to be washed during the hand-washing, thereby improving the hand-washing ability. The term potassium metaphosphate as used herein includes those in which potassium is partially substituted by sodium, lithium or the like.

[0026] The potassium metaphosphate is generally prepared by the process represented as follows:

$$nKH_2PO_4 \rightarrow (KPO_3)_n + nH_2O$$

[0027] Specifically, potassium dihydrogenphosphate (KH_2PO_4) is heated to carry out intermolecular dehydration to form a potassium metaphosphate. Manufactured articles of various degrees of polymerization are obtained depending upon factors such as difference in heating temperature and heating time. The higher the temperature of the dehydration reaction, the larger the degree of polymerization.

[0028] The baking temperature during the dehydration reaction is preferably 400°C or higher, more preferably 500°C or higher, even more preferably 600°C or higher, from the viewpoint of smoothness after the immersion, and the baking temperature is preferably 1500°C or lower, more preferably 1300°C or lower, even more preferably 1200°C or lower, from the viewpoint of energy consumption.

[0029] The molecular weight of the potassium metaphosphate is preferably 10000 or more, more preferably 100000 or more, even more preferably 200000 or more, even more preferably 500000 or more, from the viewpoint of improvement in hand-washing ability. The molecular weight of the potassium metaphosphate is preferably 50000000 or less, more preferably 20000000 or less, from the viewpoint of availability. In addition, the potassium metaphosphate does not have any particular limitations in an upper limit in its molecular weight, as long as the potassium metaphosphate shows water solubility in the presence of a solubilizing agent. The larger the molecular weight, the higher the effect of improving the hand-washing ability. Here, in a case where sodium dihydrogenphosphate or the like is partly contained in addition to potassium dihydrogenphosphate during heating, an effect as a creamy smoothness improver can be also exhibited as long as the intermolecular dehydration (condensation) is carried out.

[0030] In addition, potassium metaphosphate has a K/P molar ratio of preferably less than 1, more preferably (a value excluding 1) to 0.8, even more preferably from 0.999 to 0.9, even more preferably from 0.999 to 0.94, even more preferably from 0.995 to 0.96, even more preferably from 0.99 to 0.98, from the viewpoint of smoothness after the immersion. Here, the K/P molar ratio as referred to herein is a value determined by the determination method described in Examples set forth below.

[0031] The content of the potassium metaphosphate of the detergent composition is preferably 0.5 parts by weight or more, more preferably 1 part by weight or more, even more preferably 3 parts by weight or more, even more preferably 5 parts by weight or more, even more preferably 7 parts by weight or more, even more preferably 10 parts by weight or more, based on 100 parts by weight of the detergent composition, from the viewpoint of improvement in hand-washing ability. In addition, the content of the potassium metaphosphate of the detergent composition is preferably 30 parts by weight or less, more preferably 20 parts by weight or less, based on 100 parts by weight of the detergent composition, from the viewpoint of maintaining easy handling of the items to be washed after washing.

[0032] It is preferable that the amount of the potassium metaphosphate formulated is increased according to the increase in the amount of the nonionic surfactant in the detergent composition and the increase in the ratio to the amount of the nonionic surfactant and the entire surfactant components of the detergent composition.

[0033] In addition, when a washing liquid is prepared by dissolving a detergent composition in water, the concentration of the potassium metaphosphate in water is preferably 15 mg/L or more, more preferably 30 mg/L or more, even more preferably 60 mg/L or more, from the viewpoint of obtaining excellent hand-washing ability. Also, the concentration is preferably 3000 mg/L or less, more preferably 1500 mg/L or less, even more preferably 1000 mg/L or less, from the viewpoint of easy handling of the items to be washed after washing. It is preferable that the above concentration of potassium phosphate in water is increased according to the lowering of the liquor ratio, which is a weight ratio of water to laundry items, i.e. weight of water/weight of laundry items, the increase in the water hardness of the washing liquid, and the increase in the amount of the nonionic surfactant in the detergent composition and the increase in the ratio to the amount of the nonionic surfactant and the entire surfactant components of the detergent composition.

2. Solubilizing Agent

[0034] The potassium metaphosphate is extremely hardly soluble in water, but shows water solubility in the presence of a solubilizing agent. The solubilizing agent as used herein refers to a compound containing a sodium ion source and/or a lithium ion source and/or or an ammonium ion source, wherein the sources can substitute potassium of the potassium metaphosphate. Therefore, in the detergent composition, by using the above creamy smoothness improver or creamy smoothness improver granules, each containing the potassium metaphosphate, together with a solubilizing agent, the potassium metaphosphate dissolves even when the detergent composition is dissolved in water, so that the washing liquid becomes a lotion-like viscous solution, whereby consequently giving advantages such as smoothness between the items to be washed is improved, and the hand-washing is improved.

[0035] The above solubilizing agent includes all those sodium ion sources and/or lithium ion sources and/or or ammonium ion sources which replace potassium of the potassium metaphosphate. Even more useful solubilizing agents are inorganic salts and organic salts of sodium, lithium and ammonium, including, for instance, sodium carbonate, sodium chloride, sodium sulfate, sodium sulfite, sodium carboxylates such as sodium citrate, sodium phosphate, sodium silicate, sodium salts of polycarboxylic acids, sodium salts of polysulfonic acids, lithium halides and lithium sulfate. Among them, inorganic salts and organic salts of sodium are most preferable. In addition, a salt form of a surfactant or a fatty acid, a metal ion capturing agent or the like can also serve as a solubilizing agent.

[0036] Since the above potassium metaphosphate shows water solubility by replacing potassium ion in the potassium metaphosphate with sodium ion and/or lithium ion and/or ammonium ion, it is desired to use the potassium metaphosphate in a state that can be dissolved in order to obtain an excellent hand-washing ability. Although some effects can be exhibited if a part of potassium in the potassium metaphosphate can be replaced, it is preferable that the amount of the solubilizing agent is one that can supply sodium ions and/or lithium ions and/or ammonium ions in an amount that can completely replace potassium ions in the potassium metaphosphate contained in the washing liquid from the viewpoint of economic advantages. The amount of the solubilizing agent is preferably 0.5 times equivalent or more, more preferably 1 time equivalent or more, even more preferably 2 times equivalent or more, even more preferably 3 times equivalent or more, when the amount that can supply sodium ions and/or lithium ions and/or ammonium ions in the same amount as that of potassium ions in the potassium metaphosphate is defined as 1 time equivalent. On the other hand, there is a little effect of improving hand-washing ability in the presence of excess sodium ions and/or lithium ions and/or ammonium ions based on the potassium ions. From this viewpoint, the amount of the solubilizing agent is preferably 400 times equivalent or less, more preferably 200 times equivalent or less, even more preferably 100 times equivalent or less. In addition, the amount of the solubilizing agent is preferably 30 times equivalent or less, more preferably 20 times equivalent or less, from the viewpoint of even more maintaining the effect of improving smoothness.

[0037] Incidentally, when necessary amounts of sodium ions and/or lithium ions and/or ammonium ions are formulated in the detergent composition for other purposes, it is not necessary to separately add a solubilizing agent to the detergent composition.

3. Surfactant and/or Builder

[0038] The detergent composition of the present invention can contain a surfactant and/or a builder.

[0039] As the surfactant, those generally used for detergents can be used. The surfactant includes, for instance, anionic surfactants and nonionic surfactants. Examples of the surfactant include anionic surfactants such as alkylbenzenesulfonates, alkyl ether or alkenyl ether sulfates, alkyl or alkenyl sulfuric esters, α-olefinsulfonates, alkanesulfonates, N-acylamino acid-type surfactants, alkyl ether or alkenyl ether carboxylates, amino acid-type surfactants, alkyl or alkenyl phosphoric esters, or salts thereof; and nonionic surfactants such as polyoxyalkylene alkyl (or alkenyl) ethers, polyoxyethylene alkyl phenyl ethers, higher fatty acid alkanolamides or alkylene oxide adducts, sucrose fatty acid esters, alkyl glycosides and fatty acid glycerol monoesters.

[0040] Among them, alkylbenzenesulfonates, alkyl ether sulfates, alkyl sulfuric esters are preferable, even more preferably alkylbenzenesulfonates, from the viewpoint of enhancing the effect of smoothness.

[0041] The content of the above anionic surfactant and the nonionic surfactant is preferably 5% by weight or more, more preferably 10% by weight or more, even more preferably 12% by weight or more, even more preferably 15% by weight or more, even more preferably 17% by weight or more, of the detergent composition, from the viewpoint of washing performance. In addition, the content of the above anionic surfactant and the nonionic surfactant is preferably 40% by weight or less, more preferably 35% by weight or less, even more preferably 30% by weight or less, even more preferably 26% by weight or less, of the detergent composition, from the viewpoint of powder properties.

[0042] In the detergent composition of the present invention, there can be further formulated a surfactant such as a betain-type amphoteric surfactant, a phosphoric ester-based surfactant, a soap, or an cationic surfactant in a proper amount.

[0043] The builder includes metal ion capturing agents, alkalizing agents, anti-redeposition agents and the like.

[0044] Among them, since there is a feature of lowering the effect of improving smoothness with the elevation of the amount of the water hardness-increasing component in the washing liquid, it is very effective to formulate a metal ion capturing agent in the detergent composition as a builder and to capture the water hardness-increasing component in the washing liquid for exhibiting the properties of the potassium metaphosphate. Even more, those metal ion capturing agents having a calcium ion capturing ability of 100 mg $CaCO_3$/g or more are more effective. The metal ion capturing agent includes ion exchange materials such as zeolites and crystalline silicates; water-soluble organic substances such as polymers such as polyacrylates and acrylic acid-maleic acid copolymers (salts); and chelating agents such as sodium tripolyphosphate, ethylenediaminetetraacetates, methylglycinediacetates and citrates.

[0045] Sodium carbonate and amorphous sodium silicate are not included in the metal ion capturing agent.

[0046] The alkalizing agent includes carbonates and silicates. Amorphous sodium silicate is preferable from the viewpoint of enhancing the effect of smoothness.

[0047] The anti-redeposition agent includes carboxymethyl cellulose, polyethylene glycols and the like.

[0048] The amount of the builder formulated is preferably 5% by weight or more, more preferably 10% by weight or more, even more preferably 15% by weight or more, even more preferably 20% by weight or more, of the detergent composition, from the viewpoint of improving hand-washing ability. In addition, the amount of the builder formulated is preferably 60% by weight or less, more preferably 40% by weight or less, even more preferably 30% by weight or less, of the detergent composition, from the viewpoint of the balance of the formulation.

4. Silicates and Phosphates (excluding potassium metaphosphate)

[0049] The detergent composition of the present invention may contain a silicate or a phosphate, thereby giving an advantage that the effects of improving smoothness can be further improved.

[0050] As the silicates, amorphous and crystalline silicates have been known, and any of those can be used. It is desired that those silicates having an SiO_2/M_2O ratio, wherein M is an alkali metal, of 1 or more, preferably 1.5 or more, more preferably 2 or more, and those silicates having an SiO_2/M_2O ratio of preferably 4 or less, more preferably 3 or less. Here, the even more preferable silicates are amorphous silicates, and JIS No. 1 Sodium Silicate or JIS No. 2 Sodium Silicate can be suitably used. The amount of the silicate formulated is preferably 3% by weight or more, more preferably 5% by weight or more, even more preferably 7% by weight or more, of the detergent composition, from the viewpoint of hand-washing ability. In addition, the amount of the silicate formulated is preferably 30% by weight or less, more preferably 20% by weight or less, of the detergent composition, from the viewpoint of suppressing the insoluble remnants during washing while maintaining an effect of improving smoothness at a high level.

[0051] The phosphate includes sodium tripolyphosphate, sodium pyrophosphate, sodium dihydrogenphosphate, sodium hydrogenphosphate, sodium phosphate and the like, and sodium tripolyphosphate is preferred. The amount of the phosphate formulated is preferably 5% by weight or more, more preferably 10% by weight or more, even more preferably 15% by weight or more, of the detergent composition, from the viewpoint of hand-washing ability. In addition, the amount of the phosphate formulated is preferably 40% by weight or less, more preferably 30% by weight or less, of the detergent composition, from the viewpoint of satisfying both of an effect of improving smoothness and detergency.

[0052] In the present invention, among the above components, since the metal ion capturing agent, the silicate and the phosphate are formulated in amounts mentioned above, there is an advantage that hand-washing ability is excellently maintained even when the amount of the potassium metaphosphate formulated is reduced.

5. Other Additives

[0053] In the detergent composition of the present invention, there can be formulated an enzyme, a perfume, a fluorescer, a pigment or the like in a proper amount.

6. Process for Preparing Detergent Composition

[0054] The detergent composition of the present invention having the constitution as mentioned above can be prepared by appropriately blending each of the above-mentioned components by a known method.

[0055] Incidentally, since the potassium metaphosphate contained in the detergent composition of the present invention shows water solubility in the presence of the solubilizing agent in water as mentioned above, it is preferable to reduce the water content during the preparation process and during storage. For instance, when the detergent composition is prepared by a spray-drying method, it is desired that the creamy smoothness improver and/or creamy smoothness improver granules are added in the granulation step, the surface modification step, the after-blending step or the like after the spray-drying step.

[0056] In addition, when a washing liquid is prepared by separately adding a detergent composition containing components except for the creamy smoothness improver during hand-washing, and a creamy smoothness improver, it is

preferable to use a mixture of the potassium metaphosphate with other base agents as the creamy smoothness improver for the purpose of suppression of the generation of doughy mass during the dissolution.

[0057] In addition, the solubilizing agent may be contained in the creamy smoothness improver and/or creamy smoothness improver granules and/or in the detergent composition, so that the solubilizing agent is not necessarily contained in the detergent composition.

[0058] Examples of the detergent composition include those detergent compositions having the compositions and prepared by a process described in Tokkyocho Koho: Shuchi Kanyo Gijutsu Shu (Clothes Powder Detergent: Japanese Patent Office), 10(1998)-25(7159).

< Creamy Smoothness Improver Granules >

[0059] One of the significant features of the laundry creamy smoothness improver granules of the present invention resides in that the laundry creamy smoothness improver granules contain a potassium metaphosphate, and are in the form of granules.

[0060] Since the laundry creamy smoothness improver granules of the present invention have the above features, there are some advantages that excellent smoothness is maintained between the items to be washed without generation of insoluble remnants of the potassium metaphosphate and deposition on laundry items, in a case where the laundry items are soaked or even in a case where the laundry items are soaked for a long period of time, so that washing can be performed with a reduced power, and a rate of rubbing the laundry items is likely to be increased, whereby hand-washing is facilitated.

[0061] In addition, in a washing machine washing, cloth damages can be avoided by increasing the smoothness between the fibers in order to meet the problem of the fiber damages which are causative of loss of well kept shape or the like by a mechanical power such as stirring.

[0062] Therefore, the present invention also relates to creamy smoothness improver granules for hand-washing.

[0063] The granules as referred to in the present invention means those obtained by granulating a potassium metaphosphate alone, or obtained by granulating a mixture of a potassium metaphosphate with a binder substance and/or other components. The shapes of the granules include particles, capsules and the like.

[0064] In the present invention, by carrying out granulation as described above, there are advantages that handling property upon addition of the granules to a detergent composition in the preparation process is improved, and that generation of doughy mass can be prevented in a case where the granules are added separately from the detergent composition.

[0065] Each of the components usable in the laundry creamy smoothness improver granules of the present invention (hereinafter also simply referred to as granules) will be described hereinbelow.

1. Potassium Metaphosphate (Case Used for Granules)

[0066] The potassium metaphosphate may be the same one as that used in the above creamy smoothness improver.

[0067] The potassium metaphosphate formulated in the granules has an average particle size of preferably 0.5 μm or more, more preferably 1 μm or more, even more preferably 5 μm or more, even more preferably 10 μm or more, even more preferably 30 μm or more, from the viewpoint of easy handling. On the other hand, the potassium metaphosphate has an average particle size of preferably 300 μm or less, more preferably 200 μm or less, even more preferably 100 μm or less, from the viewpoints of granulation property and dissolubility (suppression of insoluble remnants and deposition to laundry items).

[0068] The method for adjusting the average particle size of the potassium metaphosphate to the above-mentioned range includes a method of carrying out pulverization treatment with a known pulverizer such as ATOMIZER manufactured by Fuji Paudal Co., Ltd. or PINMILL manufactured by Hosokawa Micron Corporation.

[0069] By adjusting the potassium metaphosphate used in the granulation to a smaller particle size as described above, there are advantages that insoluble remnants and deposition to laundry items can be suppressed.

[0070] The content of the potassium metaphosphate is preferably 10% by weight or more, more preferably 30% by weight or more, even more preferably 50% by weight or more, of the granules, from the viewpoint of formulation. On the other hand, the content of the potassium metaphosphate is more preferably 95% by weight or less, even more preferably 90% by weight or less, even more preferably 80% by weight or less, of the granules, from the viewpoint of dissolubility.

[0071] In the present invention, the above potassium metaphosphate may be granulated alone or in admixture with a binder substance and other substances.

2. Binder Substance

[0072] The binder substance is not particularly limited, so long as the binder is capable of binding the components

constituting the laundry creamy smoothness improver granules with each other. A water-soluble binder is preferable, from the viewpoint of dissolubility of the granules, even more preferably a thermoplastic water-soluble binder capable of solidifying at a temperature of 40°C or less and having a binding ability, from the viewpoint of storage stability. As the water-soluble binder, a polyethylene glycol having an average molecular weight of from 2000 to 30000, preferably from 5000 to 15000, a saturated or unsaturated fatty acid having 8 to 18 carbon atoms, or the like is used, and even more polyethylene glycol is preferable. These binder substances can be used alone or in admixture. The amount of the binder substance is preferably in a weight ratio of 0.05 times that of the potassium metaphosphate or more, more preferably 0.07 times or more, and the amount of the binder substance is 10 times that of the potassium metaphosphate or less, more preferably 4 times or less, even more preferably 3 times or less.

3. Other Components

[0073] The other components in the granules may be any compound so long as they are generally used as a detergent composition without hindering the action of the potassium metaphosphate. A solubilizing agent, a metal ion capturing agent, a silicate, a phosphate or the like can be properly used.

[0074] Among them, since the granules contain a solubilizing agent, there is an advantage that the solubilizing agent is not needed to be formulated in the main detergent itself. The solubilizing agent may be the same as those mentioned above.

4. Process for Preparing Granules

[0075] The process for preparing granules of the present invention is not particularly limited. For instance, the granules can be prepared by agitation-tumbling granulation process, extrusion granulation process, spray cooling process, and the like. The embodiments of the agitation-tumbling granulation process include, for instance, a process including the steps of mixing a sodium metaphosphate, a binder substance and other components such as a solubilizing agent (sodium source and/or lithium source), heating the components to melt the binder substance, granulating the mixture, and cooling the granules; a process including the steps of adding a dissolved binder substance to a sodium metaphosphate and other components such as a solubilizing agent (sodium source and/or lithium source) while stir-mixing the sodium metaphosphate and the other components, and granulating the mixture; a process including the steps of adding an aqueous binder solution to a sodium metaphosphate and other components such as a solubilizing agent (sodium source and/or lithium source), while stir-mixing the sodium metaphosphate and other components, granulating the mixture and thereafter drying the granules; and the like. The embodiments of extrusion granulation process include, for instance, a process including the steps of melting and mixing a sodium metaphosphate, a binder substance and other components such as a solubilizing agent (sodium source and/or lithium source), extruding and granulating the mixture through an extruder-granulator; a process including a step of melting and mixing a sodium metaphosphate, a binder aqueous solution and other components such as a solubilizing agent (sodium source and/or lithium source), extruding the mixture through an extruder-granulator, and drying the extruded product; and the like. The embodiments of spray-cooling process include, for instance, a process including the steps of melting and mixing a sodium metaphosphate, a binder substance and other components such as a solubilizing agent (sodium source and/or lithium source), spraying the mixture through a nozzle to a low-temperature space to give granules; and the like.

[0076] Incidentally, in a case where a solubilizing agent is used, since the potassium metaphosphate is dissolved and becomes viscous by the water content in the presence of the solubilizing agent, it is preferable that the water content during granulation is controlled. In such a case, it is suitable to use a thermoplastic water-soluble binder capable of solidifying at a temperature of 40°C or less and having binding ability. The water-soluble binder includes a polyethylene glycol having an average molecular weight of from 2000 to 30000, preferably from 5000 to 15000, a saturated or unsaturated fatty acid having 8 to 18 carbon atoms and the like, and even more polyethylene glycol is preferable. In addition, in a case where water and an aqueous binder solution are used as binder substances, it is preferable that the binder substance is sufficiently dried in the subsequent step.

[0077] As the mixers usable in the granulation include those for the agitation-tumbling granulation process, for instance, High-Speed Mixer manufactured by Fukae Powtec Corp., PLOUGH SHARE Mixer manufactured by PACIFIC MACHINERY & ENGINEERING Co., LTD. and the like; extrusion granulators such as PELLETER DOUBLE, Twin Dome Gran manufactured by Fuji Paudal Co., Ltd.; and the like.

[0078] The granules obtained by the above process may be subjected to size adjustment by disintegration, spheroidization or the like where necessary, for the purposes of improving external appearance and yield after the granulation. The devices used in disintegration include Power Mill manufactured by K.K. Dalton, Flash Mill manufactured by Fuji Paudal Co., Ltd., Fitz Mill manufactured by Fitzpatrick (USA), COMIL manufactured by Comil (Canada), Speed Mill manufactured by Okada Seiko K.K., and the like. The spheroidization devices include Marumerizer manufactured by Fuji Paudal Co., Ltd. When the above thermoplastic water-soluble binder is used, the temperature for feeding the binder

to the disintegrator is preferably cooled to an ambient temperature or so. For instance, if the granules are fed to a vibrating cooling device to cool the granules to a given temperature, and thereafter disintegrated, there is an advantage that the deposition of the disintegrated product is suppressed within the disintegrator.

[0079] The size-adjusted granules may be adjusted to a given particle size by classification in order to reduce fine powder and/or coarse granules. By adjusting the particle size by classification, the external appearance upon use can be improved. The fine powder and/or coarse granules generated by classification may be, for instance, pulverized to be used as a raw material for the granules, or re-dissolved to be used as a raw material, whereby its yield can be increased.

5. Qualities of the Granules

[0080] As the particle size of the granules of the present invention, the average particle size is preferably 100 μm or more, more preferably 150 μm or more, even more preferably 200 μm or more, from the viewpoint of sustainability of the effect of improving hand-washing property. Also, the average particle size is preferably less than 2000 μm, more preferably less than 1500 μm, even more preferably less than 1000 μm, from the viewpoints of external appearance and dissolubility.

[0081] Among them, those granules which are spherical are most preferable, from the viewpoints of external appearance and classification property. In a case of extrusion granules which are not subjected to spheroidization treatment, those having a ratio of an extrusion diameter to a length of nearly 1 are preferred. In addition, the granules having a particle size distribution such that the granules are in even sizes are preferred from the viewpoint of external appearance. On the other hand, the water content in the granules in a final manufactured article is preferably 10% by weight or less, more preferably 5% by weight or less, even more preferably 1% by weight or less, from the viewpoint of storage stability.

[0082] The creamy smoothness improver granules prepared by the process described above can be contained in the detergent composition in the same manner as the above creamy smoothness improver.

[0083] Since the detergent composition containing the creamy smoothness improver and/or the creamy smoothness improver granules of the present invention having the above constitutions are used, effects such as improvement in smoothness between items to be washed is maintained, without generating insoluble remnants of the potassium metaphosphate and deposition on laundry items in either a case where the laundry items are not soaked or a case where the laundry items are soaked for a long period of time, so that hand-washing is facilitated without hindering the detergency, and a satisfactory hand-care is accomplished are exhibited.

< Process for Hand-washing >

[0084] The process for hand-washing of the present invention is a process including the step of carrying hand-washing under the conditions of a concentration of a potassium metaphosphate in water of 30 mg/L or more and a liquor ratio of 2 or more. The process includes, for instance, a process including the steps of adding a potassium metaphosphate to a washing liquid as a part of detergent components or separately from the detergent components, and carrying out hand-washing; and the like. Specific embodiments include a process including the step of adding the above creamy smoothness improver or creamy smoothness improver granules to a washing liquid as a part of detergent components or separately from the detergent components, and carrying out hand-washing.

[0085] In the present invention, since the concentration of the potassium metaphosphate in water and the liquor ratio are adjusted to specified ranges as mentioned above, there are some advantages that the washing liquid becomes a lotion-like viscous liquid, so that the improvement in the smoothness between the items to be washed is felt, and that dissolubility of the potassium metaphosphate and its adsorption to the surface of the items to be washed are accelerated, with the increase in the liquor ratio, so that the improvement of the smoothness between the items to be washed is realized.

[0086] The concentration of the potassium metaphosphate in water is preferably 15 mg/L or more, more preferably 30 mg/L or more, even more preferably 60 mg/L or more, from the viewpoint of improving smoothness. In addition, the concentration of the potassium metaphosphate is preferably 3000 mg/L or less, more preferably 1500 mg/L or less, even more preferably 1000 mg/L or less, from the viewpoint of easy handling of the items to be washed after washing. In addition, it is preferable that the concentration of the potassium metaphosphate in water is increased according to the lowering of the liquor ratio, the increase in the water hardness of the washing liquid, and the increase in the amount of the nonionic surfactant and the increase in the ratio to the amount of the nonionic surfactant and the entire surfactant components of the detergent composition.

[0087] In addition, the liquor ratio, which is a weight ratio of water to laundry items is preferably 2 or more, more preferably 3 or more, even more preferably 4 or more, even more preferably 5 or more, from the viewpoints of dissolubility and adsorption to items to be washed. The liquor ratio is preferably 20 or less, more preferably 15 or less, from the viewpoint of easy hand-washing.

[0088] By using the process for hand-washing of the present invention having the constitution as described above, effects such as the smoothness can be improved when the items to be washed are rubbed with each other during

hand-washing, and washing can be performed in a reduced power and rate of rubbing laundry items (number of times of rubbing per unit time) is increased, so that feel in hand-washing is improved, whereby accomplishing hand-care, are exhibited.

[0089] In addition, by using the process for hand-washing of the present invention, cloth damages can be avoided by increasing smoothness between the fibers against the damages of fibers which are causative of loss of well kept shape in mechanical power such as stirring in washing with a washing machine as well as hand-washing, whereby a so-called "laundry item-care effects" can be exhibited.

[0090] In addition, in either a case where the laundry items are soaked or a case where the laundry items are not soaked, when insoluble remnants of the potassium metaphosphate and the deposition on laundry items are not generated, effects such as the improvement in smoothness between the items to be washed is maintained, so that washing can be performed with a reduced power, and the rate of rubbing the laundry items (number of times of rubbing per unit time) is increased, whereby the feel in the hand-washing is enhanced, so that hand-care is further accomplished, are shown.

[0091] In the present invention, even more preferable creamy smoothness improving effects can be evaluated by performing hand-washing under the washing conditions according to the following hand-washing evaluation method.

[0092] In addition, the increase in viscosity of the washing liquid by the formulation of the potassium metaphosphate is a causative factor for exhibiting viscidity, thereby consequently improving the smoothness. Therefore, the hand-washing property can be quantitatively evaluated by the determination of viscosity of the washing liquid.

< Method for Evaluating Hand-Washing >

[Conditions for Hand-Washing]

[0093] The method for evaluating hand-washing in the present invention will be explained as follows. A 8.2 L polypropylene washtub (manufactured by YAZAKI) having a diameter of 30 cm and a depth of 13 cm was charged with 2 liters of hard water (Ca/Mg molar ratio: 7/3) corresponding to 89.3 mg $CaCO_3$/liter, temperature-controlled to 25°C, and a detergent composition weighed so as to be 15 g is supplied into the water, and the water is continued to be stirred with a vigorousness that the water is not spilled from the washtub. After 30 seconds from the beginning of stirring, a 100% cotton T-shirt (white, manufactured by Gunze, L size) is soaked in the washing liquid in the washtub so that an entire T-shirt is sufficiently soaked. Thereafter, the breast portions of the T-shirt are held with both hands from the back side of the T-shirt, and the breast portions of the T-shirt are rubbed with each other. The portions are rubbed together upon taking the shirt out of the washing liquid. After rubbing together for every 3 to 5 times, the rubbed portions are temporarily soaked in the washing liquid. The easiness in rubbing when the portions are rubbed together is judged in Ranks 1 to 5 as smoothness. When this evaluation is carried out only with the water prepared above, the wrinkles of the T-shirt hinder the smoothness, the portions to be rubbed together are hardly likely to be rubbed because there are no bubbles in the portions rubbed together, so that the smoothness is worsened. In such a case, the smoothness is defined to have a rank of 1. The state of each rank is as follows.

Rank 1: very low smoothness and some feel of squeakiness, thereby making it very difficult to perform hand-washing.
Rank 2: low smoothness and some feel of squeakiness, thereby not easily performing hand-washing.
Rank 3: smoothness being medium level, and being capable of performing hand-washing without squeakiness.
Rank 4: smoothness being high, being capable of performing hand-washing more easily without squeakiness.
Rank 5: smoothness being very high, being capable of performing hand-washing very easily without squeakiness.

[0094] Incidentally, in the above test, an average value of the evaluation results of 6 panelists are obtained to give the rank.

EXAMPLES

[0095] The following examples further describe and demonstrate embodiments of the present invention. The examples are given solely for the purposes of illustration and are not to be construed as limitations of the present invention. Incidentally, Table 1 shows the composition of the detergent composition obtained in each of Examples and Comparative Examples.

[0096] The methods for determining the physical properties in the present invention will be described hereinbelow.

[Determination of Metal Ion Capturing Ability]

[0097] The metal ion capturing ability of the metal ion capturing agents was determined for each of the cases where the metal ion capturing agent is an ion exchange material and where the metal ion capturing agent is a chelating agent

in accordance with the following methods.

< Ion Exchange Material >

[0098] A 0.1 g sample of an ion exchange material was accurately weighed and added to 100 ml of a calcium chloride aqueous solution (500 ppm concentration, when calculated as $CaCO_3$), and thereafter the mixture was stirred at 25°C for 60 minutes. Thereafter, the mixture was filtered with Membrane Filter (Advantech, made of nitrocellulose) with 0.2 μm pore size. The Ca content contained in 10 ml of the filtrate was determined by an EDTA titration, and a calcium ion exchange capacity (cationic exchange capacity) of the ion exchange material was calculated from the titer.

< Polymer or Chelating Agent >

[0099] All of the solutions used herein were adjusted with the following buffer:

Buffer: 0.1 M NH_4Cl-NH_4OH buffer (pH 10.0)

(1) Preparation of Calibration Curve

[0100] A standard calcium ion solution was prepared and used for obtaining a calibration curve showing the relationships between the logarithm of the calcium ion concentration and the voltage, as shown in Figure 1.

(2) Determination of Calcium Ion Capturing Capacity

[0101] About a 0.1 g sample was weighed into a 100 mL volumetric flask, and the volumetric flask was filled up to a volume of 100 mL with the above buffer. A $CaCl_2$ aqueous solution (pH 10.0) having a concentration of 20000 ppm calculated as $CaCO_3$ was added dropwise from a burette for reading each sample voltage. A blank sample was also determined.

[0102] The dropwise addition was carried out by adding 0.1 to 0.2 ml each of the $CaCl_2$ aqueous solution, and voltage reading was taken at each addition to obtain a calcium ion concentration from the calibration curve given in Figure 1.

[0103] The calcium ion concentration of the upper line corresponding to the amount A of samples added dropwise shown in Figure 2 was defined as calcium ion capturing ability.

< Method for Determination of Molecular Weight of Calcium Metaphosphate >

[0104] The molecular weight of calcium metaphosphate refers to a weight-average molecular weight. The molecular weight of calcium metaphosphate was determined according to gel permeation chromatography (GPC) method under the following conditions, and calculated using a calibration curve of polyethylene glycol.

Column:	GMPWXL + GMPWXL, manufactured by Tosoh Corporation
Eluent:	0.02 M Phosphate buffer/acetonitrile = 90/10 (volume ratio)
Temperature:	40°C
Flow Rate:	1 mL/min.
Sample Concentration, Amount:	0.1% by weight (solubilizing agent: sodium tripolyphosphate: 0.6% by weight), 100 μl
Detector:	Differential refractometer (RID)

< Method for Determining Average Particle Size of Calcium Metaphosphate >

[0105] The average particle size (μm) of calcium metaphosphate was determined by using a laser scattering particle size distribution analyzer ("LA-920," manufactured by HORIBA, Ltd.) on a volume basis under the conditions of a refractive index of 1.2, ultrasonic intensity of 7, irradiation time for ultrasonic wave of 1 minute, and a stirring rate of 4. The sample (calcium metaphosphate) was dispersed in ion-exchanged water as a dispersion medium at 25°C. The average particle size as used herein refers to a median diameter.

< Method for Determining Time Period Corresponding to Soaking Time >

[0106] Three grams of a detergent composition containing a laundry creamy smoothness improver or a detergent

composition containing laundry creamy smoothness improver granules was added to 500 ml of hard water having a water hardness corresponding to 89.3 mg $CaCO_3$/liter (a molar ratio of Ca/Mg: 7/3) at 25°C. After the mixture was stirred at 700 r/m with a stirrer piece (7 mm x 40 mm), the stirring was stopped, and the mixture was allowed to stand for 10 minutes. After the mixture was allowed to stand, the mixture was again started to be stirred at 300 r/m, and the viscosity was determined with an SV viscometer (model number: SV-10, K.K. A & D) at the same time. The mixture was allowed to stand in the same manner while changing the time periods for allowing the mixture to stand from 20 minutes to 180 minutes in an increment of 10 minutes. The case where the value of the viscosity after the start of re-stirring was 2 mPa or more was judged to have an effect of improving hand-washing ability due to the improvement in smoothness, and the maximum time period that the mixture was allowed to stand to give an improving effect was defined as a time period corresponding to soaking time.

< Method for Evaluation of Insoluble Remnants >

[0107] The evaluation method was carried out under the following conditions:

- washing machine: Matsushita Electric "NA-F42Y5"
- laundry items: 20 pieces of black cloths [blend fabrics (polyester/cotton: 65/35) weight ratio]
- detergent: 40 g
- washing course: intermediate water level (amount of water indicated: 40 liters), washing for 9 minutes → rinsing twice → spin-drying for 3 minutes → drying (allowing to stand at 20°C, 40% RH for 24 hours); after drying the laundry items, 10 pieces were arbitrarily selected out of the 20 pieces of the black cloths. The deposition of insoluble substances to the black cloths and residual property at this time were evaluated as follows:

[Deposition to Black Cloths and Residual Property]

[0108]

no problem (no deposition)	(○)
slight deposition	(Δ)
some deposition	(×)
considerable deposition	(××)

< Dishcloth Care (MA Test Pieces) >

(1) Preparation of Pre-Treated Cloths

[0109] A fully automatic washing machine (Toshiba, trade name: "AW-D802VP") was furnished. With setting the washing water level to 45 L, the washing machine was charged with a total of 10 pieces of Cotton T-shirts (about 2.2 kg). Further, a compact-type powder detergent (trade name: "ATTACK," Kao Corporation) was supplied to the washing machine in accordance with a standard dosage, and a cycle of washing for 8 minutes, spin-drying for 3 minutes, rinsing in still water twice, and spin-drying for 3 minutes, and thereafter the T-shirts were dried with a drying machine. This washing cycle was repeated 5 times, to give a pre-treated cloth.

(2) Dishcloth Care Test (MA Test Pieces)

[0110] Five pieces out of the ten T-shirts obtained as the above pre-treated cloths were subjected to sewing with a sewing machine MA (Machine Action) test fabrics manufactured by Testfabrics, Inc. at a breast portion. The MA test fabrics as used herein were those described in Frants Szaras; "The mechanical action in washing machines, MA-test pieces instruction and application" (1982).

[0111] A fully automatic washing machine (Toshiba, "AW-D802VP") was furnished. With setting the washing water level to 45 L, the washing machine was charged with a total of 10 pieces of Cotton T-shirts (about 2.2 kg) containing the T-shirts sewed with the above MA test fabrics. Sixty grams of the detergent composition was supplied to the washing machine, and a washing cycle of washing for 8 minutes, spin-drying for 3 minutes, rinsing in still water twice, and spin-drying for 6 minutes, and thereafter the MA test fabrics were taken off from the T-shirts without drying. The number of frayed threads were counted.

(3) Evaluation Criteria for the Judgment of Dishcloth Care

[0112] The judgment was made by obtaining an average of the frayed threads of the 5 pieces of the MA test fabrics.

< Feel of Washing Liquid >

[0113] The feel of the washing liquid in Examples was evaluated by judging the presence or absence of the smoothness in the degree of flow of the washing liquid when the washing liquid was scooped with hands to a height 30 cm above the washbowl and then dropped to the washbowl.

[0114] In addition, the feel of skin after drying was evaluated by hand-washing for about 5 minutes, washing off the washing liquid adhered to hands with tap water for 15 seconds, and allowing the hands to stay on a piece of towel (cotton 100%), for 10 seconds each for both front and back sides of the hands. The feel of hands after absorbing the moisture on the front and back sides of the hands with the towel were evaluated on the basis of the following criteria.

[Evaluation Criteria]

[0115]

◎: Skin of the hands after drying feels tender and smooth.
O: No outstanding feel after drying (the same as that where a detergent containing no potassium metaphosphate was used).

(Comparative Example 1)

[0116] The amount 370 kg of water, 200 kg of a 50% by weight aqueous sodium dodecylbenzenesulfonate, 50 kg of a 40% by weight aqueous No. 2 silicate, 100 kg of sodium carbonate, 147.5 kg of sodium sulfate, 5 kg of polyethylene glycol, 2.5 kg of a CBS fluorescer, and 125 kg of zeolite were mixed together, to give a homogeneous slurry. Thereafter, the obtained slurry was spray-dried, to give a detergent composition. The smoothness of the resulting detergent composition is shown in Table 2. This detergent composition had a smoothness rank of 2. An average number of the frayed threads of the 5 pieces of MA test fabrics was 60/piece.

(Comparative Example 2)

[0117] In accordance with Example 3 described in Japanese Patent Gazette No. 3123757, 465 kg of water, 48 kg of a 50% by weight aqueous sodium dodecylbenzenesulfonate, 135 kg of a 40% by weight aqueous sodium polyacrylate, 120 kg of sodium carbonate, 60 kg of sodium sulfate, 9 kg of sodium sulfite, 3 kg of a CBS fluorescer, and 300 kg of zeolite were mixed together, to give a homogeneous slurry. Thereafter, the obtained slurry was spray-dried, to give base particles.

[0118] A mixed solution containing 100 parts by weight of the base particles, 15 parts by weight of a nonionic surfactant, 15 parts by weight of an anionic surfactant and 1 part by weight of polyethylene glycol was mixed with stirring, to give a detergent composition. The smoothness of the resulting detergent composition is shown in Table 2. This detergent composition had a smoothness rank of 1. An average number of the frayed threads of the 5 pieces of MA test fabrics was 60/piece.

(Example 1)

[0119] The amount 4.0 kg of the detergent composition obtained in Comparative Example 1 was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.04 kg of potassium metaphosphate (manufactured by Wako Pure Chemical Industries, Ltd., model number: 169-07045) was added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing a laundry creamy smoothness improver. The smoothness of the resulting detergent composition is shown in Table 2. This detergent composition had a smoothness rank of 3, and gave very excellent feel to the skin after drying.

(Example 2)

[0120] The amount 4.0 kg of the detergent composition obtained in Comparative Example 1 was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.4 kg of potassium metaphosphate

(manufactured by Wako Pure Chemical Industries, Ltd., model number: 169-07045) was added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing a laundry creamy smoothness improver. The smoothness of the resulting detergent composition is shown in Table 2. A washing liquid dissolving the detergent composition was a viscous liquid, and the detergent composition had a smoothness rank of 5, and gave very excellent feel to the skin after drying.

(Example 3)

[0121] The amount 377.5 kg of water, 140 kg of a 50% by weight aqueous sodium dodecylbenzenesulfonate, 50 kg of a 40% by weight aqueous No. 2 silicate, 100 kg of sodium carbonate, 157.5 kg of sodium sulfate, 5 kg of polyethylene glycol, 2.5 kg of a CBS fluorescer, 125 kg of zeolite, 37.5 kg of a 40% by weight aqueous sodium polyacrylate and 5 kg of carboxymethyl cellulose were mixed together, to give a homogeneous slurry. Thereafter, the obtained slurry was spray-dried, to give a detergent composition. The amount 4.0 kg of the resulting detergent composition was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.40 kg of potassium metaphosphate (manufactured by Wako Pure Chemical Industries, Ltd., model number: 169-07045), 12 g of cellulase and 12 g of protease were added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes while perfuming 12 g of a perfume, to give a detergent composition containing a laundry creamy smoothness improver. The smoothness of the resulting detergent composition is shown in Table 2. A washing liquid dissolving the detergent composition was a viscous liquid, and the detergent composition had a smoothness rank of 5, and gave very excellent feel to the skin after drying.

(Example 4)

[0122] The amount 347.5 kg of water, 200 kg of a 50% by weight aqueous sodium dodecylbenzenesulfonate, 50 kg of a 40% by weight aqueous No. 2 silicate, 100 kg of sodium carbonate, 132.5 kg of sodium sulfate, 5 kg of polyethylene glycol, 2.5 kg of a CBS fluorescer, 125 kg of zeolite and 37.5 kg of 40% by weight aqueous acrylic acid-maleic acid copolymer were mixed together, to give a homogeneous slurry. Thereafter, the obtained slurry was spray-dried, to give a detergent composition. The amount 4.0 kg of the resulting detergent composition was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.28 kg of potassium metaphosphate (manufactured by Wako Pure Chemical Industries, Ltd., model number: 169-07045) was added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing a laundry creamy smoothness improver. The smoothness of the resulting detergent composition is shown in Table 2. A washing liquid dissolving the detergent composition was a viscous liquid, and the detergent composition had a smoothness rank of 5, and gave very excellent feel to the skin after drying.

(Example 5)

[0123] The amount 322.5 kg of water, 250 kg of a 50% by weight aqueous sodium dodecylbenzenesulfonate, 50 kg of a 40% by weight aqueous No. 2 silicate, 100 kg of sodium carbonate, 102.5 kg of sodium sulfate, 5 kg of polyethylene glycol, 2.5 kg of a CBS fluorescer, 125 kg of zeolite, 37.5 kg of 40% by weight aqueous acrylic acid-maleic acid copolymer and 5 kg of carboxymethyl cellulose were mixed together, to give a homogeneous slurry. Thereafter, the obtained slurry was spray-dried, to give a detergent composition. The amount 4.0 kg of the resulting detergent composition was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.28 kg of potassium metaphosphate (manufactured by Wako Pure Chemical Industries, Ltd., model number: 169-07045), 12 g of cellulase and 12 g of protease were added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes while perfuming 12 g of a perfume, to give a detergent composition containing a laundry creamy smoothness improver. The smoothness of the resulting detergent composition is shown in Table 2. A washing liquid dissolving the detergent composition was a viscous liquid, and the detergent composition had a smoothness rank of 5, and gave very excellent feel to the skin after drying.

(Example 6)

[0124] The amount 370 kg of water, 200 kg of a 50% by weight aqueous sodium dodecylbenzenesulfonate, 50 kg of a 40% by weight aqueous No. 2 silicate, 100 kg of sodium carbonate, 130 kg of sodium sulfate, 5 kg of polyethylene glycol, 2.5 kg of a CBS fluorescer, 125 kg of zeolite and 17.5 kg of ethylenediaminetetraacetic acid were mixed together, to give a homogeneous slurry. Thereafter, the obtained slurry was spray-dried, to give a detergent composition. The amount 4.0 kg of the resulting detergent composition was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.28 kg of potassium metaphosphate (manufactured by Wako Pure Chemical

Industries, Ltd., model number: 169-07045) was added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing a laundry creamy smoothness improver. The smoothness of the resulting detergent composition is shown in Table 2. A washing liquid dissolving the detergent composition was a viscous liquid, and the detergent composition had a smoothness rank of 5, and gave very excellent feel to the skin after drying.

(Example 7)

[0125] The amount 370 kg of water, 200 kg of a 50% by weight aqueous sodium dodecylbenzenesulfonate, 50 kg of a 40% by weight aqueous No. 2 silicate, 100 kg of sodium carbonate, 135 kg of sodium sulfate, 5 kg of polyethylene glycol, 2.5 kg of a CBS fluorescer, 125 kg of zeolite and 12.5 kg of methylglycininediacetic acid were mixed together, to give a homogeneous slurry. Thereafter, the obtained slurry was spray-dried, to give a detergent composition. The amount 4.0 kg of the resulting detergent composition was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.28 kg of potassium metaphosphate (manufactured by Wako Pure Chemical Industries, Ltd., model number: 169-07045) was added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing a laundry creamy smoothness improver. The smoothness of the resulting detergent composition is shown in Table 2. A washing liquid dissolving the detergent composition was a viscous liquid, and the detergent composition had a smoothness rank of 5, and gave very excellent feel to the skin after drying.

(Example 8)

[0126] The amount 325 kg of water, 200 kg of a 50% by weight aqueous sodium dodecylbenzenesulfonate, 125 kg of a 40% by weight aqueous No. 2 silicate, 70 kg of sodium carbonate, 147.5 kg of sodium sulfate, 5 kg of polyethylene glycol, 2.5 kg of a CBS fluorescer and 125 kg of zeolite were mixed together, to give a homogeneous slurry. Thereafter, the obtained slurry was spray-dried, to give a detergent composition. The amount 4.0 kg of the resulting detergent composition was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.28 kg of potassium metaphosphate (manufactured by Wako Pure Chemical Industries, Ltd., model number: 169-07045) was added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing a laundry creamy smoothness improver. The smoothness of the resulting detergent composition is shown in Table 2. A washing liquid dissolving the detergent composition was a viscous liquid, and the detergent composition had a smoothness rank of 5, and gave very excellent feel to the skin after drying. An average number of the frayed threads of the 5 pieces of MA test fabrics was 50/piece.

(Example 9)

[0127] The amount 370 kg of water, 200 kg of a 50% by weight aqueous sodium dodecylbenzenesulfonate, 50 kg of a 40% by weight aqueous No. 2 silicate, 100 kg of sodium carbonate, 147.5 kg of sodium sulfate, 5 kg of polyethylene glycol, 2.5 kg of a CBS fluorescer, 25 kg of zeolite and 100 kg of sodium tripolyphosphate were mixed together, to give a homogeneous slurry. Thereafter, the obtained slurry was spray-dried, to give a detergent composition. The amount 4.0 kg of the resulting detergent composition was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.28 kg of potassium metaphosphate (manufactured by Wako Pure Chemical Industries, Ltd., model number: 169-07045) was added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing a laundry creamy smoothness improver. The smoothness of the resulting detergent composition is shown in Table 2. A washing liquid dissolving the detergent composition was a viscous liquid, and the detergent composition had a smoothness rank of 5, and gave very excellent feel to the skin after drying. An average number of the frayed threads of the 5 pieces of MA test fabrics was 50/piece.

(Example 10)

[0128] The amount 0.3 kg of potassium metaphosphate (manufactured by Wako Pure Chemical Industries, Ltd., model number: 169-07045) and 0.3 kg of sodium sulfate were supplied into a High-Speed Mixer (manufactured by Mitsui Miike Machinery Co., Ltd., capacity: 2 L, equipped with a jacket), and the mixture was stirred while rotating the main shaft at 3600 r/m for 3 minutes. Thereafter, the mixture was taken out of the mixer, to give a mixture of laundry creamy smoothness improvers (potassium metaphosphate: 50% by weight, sodium sulfate: 50% by weight).

[0129] The smoothness in the case of each of the detergent compositions obtained in Comparative Examples 1 and 2 and the above mixtures of the laundry creamy smoothness improvers added in the ratio shown in Table 1 upon

hand-washing is shown in Table 2. The washing liquids to which the detergent composition and the laundry creamy smoothness improver granules were dissolved become viscous solutions, and the detergent composition had a smoothness rank of 5, and gave very excellent feel to the skin after drying.

- continued -

	Ex. 7	Ex. 8	Ex. 9	Ex. 10	Comp. Ex. 1	Comp. Ex. 2
Detergent Composition						
Sodium Dodecylbenzenesulfonate [%]	20	20	20	20	20	14.7
Polyoxyethylene Alkyl Ether [%]						11.5
Polyethylene Glycol [%]	1	1	1	1	1	0.8
Sodium Polyacrylate [%]						7.2
Carboxymethyl Cellulose [%]						1.2
Sodium Sulfite [%]					29.5	8
Sodium Sulfate [%]	27	29.5	29.5	29.5	20	16.1
Sodium Carbonate [%]	20	14	20	20	25	40.2
Zeolite [%]	25	25	5	25	4	
JIS No. 2 Sodium Silicate [%]	4	10	4	4		
Sodium Tripolyphosphate [%]			20			
Acrylic Acid-Maleic Acid Copolymer (Na salt) [%]						
Sodium Ethylenediaminetetraacetate [%]						
Sodium Methylglycinediacetate [%]	2.5					
Fluorescer [%]	0.5	0.5	0.5	0.5	0.5	0.4
Cellulase [%]						
Protease [%]						
Perfume [%]						
Total [%]	100	100	100	100	100	100
Creamy Smoothness Improver						
Potassium Metaphosphate [%]	7	7	7	10		
Sodium Sulfate [%]				10		

Table 1

	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6
Detergent Composition						
Sodium Dodecylbenzenesulfonate [%]	20	20	14	20	25	20
Polyoxyethylene Alkyl Ether [%]						
Polyethylene Glycol [%]	1	1	1	1	1	1
Sodium Polyacrylate [%]			3			
Carboxymethyl Cellulose [%]			1		1	
Sodium Sulfite [%]						
Sodium Sulfate [%]	29.5	29.5	30.6	26.5	19.6	26
Sodium Carbonate [%]	20	20	20	20	20	20
Zeolite [%]	25	25	25	25	25	25
JIS No. 2 Sodium Silicate [%]	4	4	4	4	4	4
Sodium Tripolyphosphate [%]						
Acrylic Acid-Maleic Acid Copolymer (Na salt) [%]				3	3	
Sodium Ethylenediaminetetraacetate [%]						3.5
Sodium Methylglycinediacetate [%]						
Fluorescer [%]	0.5	0.5	0.5	0.5	0.5	0.5
Cellulase [%]			0.3		0.3	
Protease [%]			0.3		0.3	
Perfume [%]			0.3		0.3	
Total [%]	100	100	100	100	100	100
Creamy Smoothness Improver						
Potassium Metaphosphate [%]	1	10	10	7	7	7
Sodium Sulfate [%]						

- continued -

[0130] In the table, the molecular weight of the polyethylene glycol is 13000, the molecular weight of the sodium polyacrylate is 10000, and the molecular weight of acrylic acid-maleic acid copolymer (Na salt) is 70000.

Table 2

	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6
Evaluation						
Smoothness	3	5	5	5	5	5
Feel of Skin After Drying	◎	◎	◎	◎	◎	◎

- continued -

- continued -

	Ex. 7	Ex. 8	Ex. 9	Ex. 10	Comp. Ex. 1	Comp. Ex. 2
Evaluation						
Smoothness	5	5	5	5	2	1
Feel of Skin After Drying	◎	◎	◎	◎	○	○

Preparation of Detergent Composition

[0131] The amount 370 kg of water, 200 kg of a 50% by weight aqueous sodium dodecylbenzenesulfonate, 50 kg of a 40% by weight aqueous No. 2 silicate, 100 kg of sodium carbonate, 147.5 kg of sodium sulfate, 5 kg of polyethylene glycol, 2.5 kg of a CBS fluorescer and 125 kg of zeolite were mixed together, to give a homogeneous slurry. Thereafter, the obtained slurry was spray-dried, to give a detergent composition.

(Example 11)

[0132] Potassium metaphosphate (manufactured by Wako Pure Chemical Industries, Ltd., model number: 169-07045) was pulverized with an atomizer (manufactured by Fuji Paudal Co., Ltd., Model A-7.5) under the conditions of a hammer rotational speed of 8500 r/m, a feeding rate of raw materials of 60 kg/hr, a screen diameter of 0.7 mm, to give potassium metaphosphate having an average primary particle size of about 60 μm.

[0133] The amount 4.0 kg of the above detergent composition was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.4 kg of the above pulverized potassium metaphosphate was added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing a laundry creamy smoothness improver. The evaluation results for the resulting detergent composition containing a laundry creamy smoothness improver are shown in Table 3. A washing liquid immediately after dissolving the detergent composition was a viscous liquid, and the detergent composition containing a laundry creamy smoothness improver had smoothness rank of 5 and a time period corresponding to soaking time of 20 minutes (smoothness rank after soaking: 4) and residual property/adhesion to the black cloth of O, and gave very excellent feel to the skin after drying.

(Example 12)

[0134] The amount 4.0 kg of the above detergent composition was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.4 kg of potassium metaphosphate (manufactured by Wako Pure Chemical Industries, Ltd., model number: 169-07045, average particle size: about 300 μm) was added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing a laundry creamy smoothness improver. The evaluation results for the resulting detergent composition containing a laundry creamy smoothness improver are shown in Table 3. A washing liquid immediately after dissolving the detergent composition was a viscous liquid, and the detergent composition containing a

laundry creamy smoothness improver had a smoothness rank of 5 and a time period corresponding to soaking time of 120 minutes (smoothness rank after soaking: 5) and residual property/adhesion to the black cloth of ×, and gave very excellent feel to the skin after drying.

(Example 13)

[0135] The amount 0.4 kg of the pulverized potassium metaphosphate obtained in the same manner as in Example 11 and 0.086 kg of sodium lauryl sulfate (manufactured by Kao Corporation, trade name: "EMAL 10 powder") were supplied into a High-Speed Mixer (manufactured by Mitsui Miike Machinery Co., Ltd., capacity: 2 L, equipped with a jacket), and the mixture was stirred while rotating the main shaft at 3600 r/m, while allowing a hot water of 80°C to flow through the jacket at 10 L/minute until the temperature of the mixture reached 70°C. Subsequently, 0.086 kg of polyethylene glycol (manufactured by Kao Corporation, K-PEG6000), previously heated to 70°C, was added thereto, and continued to be stirred for 3 minutes, and thereafter the mixture was taken out from the mixer. Next, the resulting mixture was extruded through a screen having a 0.5 mm diameter with an extruder-granulator (manufactured by K.K. Dalton, trade name: "Domegran") and densified. The resulting extruded mixture was cooled, disintegrated with a particle size-controlling device (Power Mill manufactured by K.K. Dalton, screen diameter: 1.0 mm), and classified to adjust its particle sizes to 700 μm or less to 355 μm or more, to give laundry creamy smoothness improver granules (potassium metaphosphate: 70% by weight, sodium lauryl sulfate: 15% by weight, polyethylene glycol: 15% by weight).

[0136] The amount 4.0 kg of the same detergent composition as that used in Example 11 was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.57 kg of the above laundry creamy smoothness improver granules were added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing a laundry creamy smoothness improver. The smoothness of the resulting detergent composition containing laundry creamy smoothness improver granules are shown in Table 3. A washing liquid dissolving the detergent composition was a viscous liquid, and the detergent composition containing laundry creamy smoothness improver granules had a smoothness rank of 5 and a time period corresponding to soaking time of 60 minutes (smoothness rank after soaking: 5) and residual property/adhesion to black cloth of O, and gave very excellent feel to the skin after drying.

(Example 14)

[0137] The amount 0.4 kg of the pulverized potassium metaphosphate obtained in the same manner as in Example 11 and 0.086 kg of sodium lauryl sulfate (manufactured by Kao Corporation, trade name "EMAL 10 powder") were supplied into a High-Speed Mixer (manufactured by Mitsui Miike Machinery Co., Ltd., capacity: 2 L, equipped with a jacket), and the mixture was stirred while rotating the main shaft at 3600 r/m, while allowing a hot water of 80°C to flow through the jacket at 10 L/minute until the temperature of the mixture reached 70°C. Subsequently, 0.086 kg of polyethylene glycol (manufactured by Kao Corporation, trade name: "K-PEG6000"), previously heated to 70°C, was added thereto and continued to be stirred for 3 minutes, and thereafter the mixture was taken out from the mixer. Next, the resulting mixture was extruded through a screen having a 0.5 mm diameter with an extruder-granulator (manufactured by K.K. Dalton, trade name: "Domegran") and densified. The resulting extruded mixture was cooled, disintegrated with a particle size-controlling device (Power Mill manufactured by K.K. Dalton, screen diameter: 1.5 mm), and classified to adjust its particle sizes to 1000 μm or less to 355 μm or more, to give laundry creamy smoothness improver granules (potassium metaphosphate: 70% by weight, sodium lauryl sulfate: 15% by weight, polyethylene glycol: 15% by weight).

[0138] The amount 4.0 kg of the same detergent composition as that used in Example 11 was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.57 kg of the above laundry creamy smoothness improver granules were added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing laundry creamy smoothness improver granules. The smoothness of the resulting detergent composition containing laundry creamy smoothness improver granules are shown in Table 3. A washing liquid dissolving the detergent composition was a viscous liquid, and the detergent composition containing laundry creamy smoothness improver granules had a smoothness rank of 5 and a time period corresponding to soaking time of 150 minutes (smoothness rank after soaking: 5) and residual property/adhesion to black cloth of O, and gave very excellent feel to the skin after drying.

(Example 15)

[0139] The amount 0.4 kg of the pulverized potassium metaphosphate obtained in the same manner as in Example 11 and 0.086 kg of sodium lauryl sulfate (manufactured by Kao Corporation, trade name: "EMAL 10 powder") were supplied into a High-Speed Mixer (manufactured by Mitsui Miike Machinery Co., Ltd., capacity: 2 L, equipped with a jacket), and the mixture was stirred while rotating the main shaft at 3600 r/m, while allowing a hot water of 80°C to flow

through the jacket at 10 L/minute until the temperature of the mixture reached 70°C. Subsequently, 0.086 kg of polyethylene glycol (manufactured by Kao Corporation, trade name: "K-PEG6000"), previously heated to 70°C, was added thereto, and continued to be stirred for 3 minutes, and thereafter the mixture was taken out from the mixer. Next, the resulting mixture was extruded through a screen having a 0.5 mm diameter with an extruder-granulator (manufactured by K.K. Dalton, trade name: "Domegran") and densified. The resulting extruded mixture was cooled, disintegrated with a particle size-controlling device (Power Mill manufactured by K.K. Dalton, screen diameter: 2.0 mm), and classified to adjust its particle sizes to 1410 μm or less to 355 μm or more, to give laundry creamy smoothness improver granules (potassium metaphosphate: 70% by weight, sodium lauryl sulfate: 15% by weight, polyethylene glycol: 15% by weight).

[0140] The amount 4.0 kg of the same detergent composition as that used in Example 11 was supplied into a concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L), thereafter 0.57 kg of the above laundry creamy smoothness improver granules were added thereto, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing laundry creamy smoothness improver granules. The smoothness of the resulting detergent composition containing laundry creamy smoothness improver granules are shown in Table 3. A washing liquid dissolving the detergent composition was a viscous liquid, and the detergent composition containing laundry creamy smoothness improver granules had a smoothness rank of 5 and a time period corresponding to soaking time of 180 minutes (smoothness rank after soaking: 5) and residual property/adhesion to black cloth of O, and gave very excellent feel to the skin after drying.

Table 3

	Ex. 11	Ex. 12	Ex. 13	Ex. 14	Ex. 15
Detergent Composition					
Sodium Dodecylbenzenesulfonate [%]	20	20	20	20	20
Polyethylene Glycol [%]	1	1	1	1	1
Sodium Sulfate [%]	29.5	29.5	29.5	29.5	29.5
Sodium Carbonate [%]	20	20	20	20	20
Zeolite [%]	25	25	25	25	25
Sodium Silicate [%]	4	4	4	4	4
Fluorescer [%]	0.5	0.5	0.5	0.5	0.5
Total [%]	100	100	100	100	100
Creamy Smoothness Improver					
Potassium Metaphosphate [%]	10	10			
Creamy Smoothness Improver Granules					
Potassium Metaphosphate [%]			10	10	10
Polyethylene Glycol [%]			2.14	2.14	2.14
Sodium Lauryl Sulfate [%]			2.14	2.14	2.14
Properties of Creamy Smoothness Improver					
Average Particle Size of Potassium Metaphosphate [μm]	60	300	60	60	60
Particle Size of Creamy Smoothness Improver [μm]			500-355	1000-355	1410-355
Evaluation					
Smoothness (immediately after → after soaking)	5 → 4	5 → 5	5 → 5	5 → 5	5 → 5
Time Period Corresponding to Soaking Time [min]	20	120	60	150	180
Residuality/Deposition	○	×	○	○	○

Examples 16 to 26

[0141] Potassium metaphosphate was prepared according to the following method, and its evaluation for hand-washing was carried out.

[0142] H_3PO_4 (manufactured by Wako Pure Chemical Industries, Ltd, reagent special grade, purity 85%, Lot. CKL2218) was added to KH_2PO_4 (manufactured by Sigma-Aldrich Japan K.K., reagent special grade, Lot. A8347, K/P molar ratio = 1.00) so that a K/P molar ratio of potassium metaphosphate after baking takes a value as shown in Table 4, and baked at a temperature as shown in Table 4 for 3 hours. The resulting baked product was pulverized with a mortar, to give potassium metaphosphate.

[0143] The amount 4.0 kg of the detergent composition obtained in Comparative Example 1 was introduced into a

concrete mixer (manufactured by Koyo Kikai Sangyo K.K., capacity: 40L). Subsequently, each of potassium metaphosphates prepared under the conditions as shown in Table 4 was added thereto in the proportion (ratio to the detergent composition) as shown in Table 4, and the components were mixed in the mixer at a slanting angle of 30° and a rotational speed of 20 r/m for 3 minutes, to give a detergent composition containing a laundry creamy smoothness improver. The smoothness of the resulting detergent composition containing a laundry creamy smoothness improver is shown in Table 4.

[0144] The smoothness evaluation was carried out by the evaluation for hand-washing. As a result of Table 4, the K/P molar ratio is less than 1 and shows an even more excellent smoothness rank. In addition, the smoothness rank changes depending upon the baking temperatures, and shows an excellent smoothness at 400°C or higher.

[0145] Here, the K/P molar ratio was obtained in accordance with the following determination method.

< Method for Determination of K/P Molar Ratio >

[0146] A 0.1 g sample was placed in a platinum crucible, and further 5 g of $Li_2B_4O_7$ and 0.5 g of a stripping agent (Li_2CO_3 : LiBr : $LiNO_3$ = 5:1:1 in a weight ratio) were added thereto, and melted at 1230°C with a bead-sampler (manufactured by Tokyo Kagaku K.K., NT-2100) to give glass beads.

[0147] K and P in the glass beads were determined (XRF intensity) under the following conditions with a fluorescent X-ray analyzer (manufactured by K.K. Rigaku, ZSX100e).

X-Ray Source: Rh tube

Voltage, electric current: 50 kV, 50 mA

Spectral Crystal	Detector	Angle
- K : LiF	SC (scintillation counter)	136.68 deg
- P : Ge	PC (proportional counter)	141.19 deg

[0148] The calculation of the K/P molar ratio was made by determining the values for KH_2PO_4 (manufactured by Sigma-Aldrich Japan K.K., reagent special grade) in the same manner as that of the samples, and calculating a K/P molar ratio of the sample as follows using a K/P molar ratio of 1.00 as a standard.

$$\text{K/P Molar Ratio} = \frac{[\text{XRF Intensity of K (sample)} \times \text{XRF Intensity of P (reagent)}]}{[\text{XRF Intensity of P (sample)} \times \text{XRF Intensity of K (reagent)}]}$$

Table 4

	K/P Molar Ratio	Baking Temp. (°C)	Formulation Amount of Potassium Metaphosphate (ratio to detergent)	Evaluation for Hand-washing (Rank for Smoothness)
Example 16	0.9	700	10%	5
Example 17	0.96	700	10%	5
Example 18	0.97	700	10%	5
Example 19	0.98	700	8%	5
Example 20	0.99	700	10%	5
Example 21	0.98	300	10%	3
Example 22	0.98	400	10%	4
Example 23	0.98	500	10%	4
Example 24	0.98	600	10%	5
Example 25	0.98	850	7%	5
Example 26	1	700	10%	3

[0149] The laundry creamy smoothness improver and the laundry creamy smoothness improver granules of the present

invention are suitably used for hand-washing of clothes, especially in hand-washing requiring soaking for a long period of time.

[0150] By using the laundry creamy smoothness improver of the present invention, effects such as smoothness between items to be washed during hand-washing is improved, so that washing can be performed with a reduced power, and hand-washing is facilitated by increasing the rate of rubbing items to be washed (number of rubbings per unit time) are exhibited. Further, by using the laundry creamy smoothness improver granules of the present invention, insoluble remnants of potassium metaphosphate and deposition to clothes are not generated so that the same effects are exhibited in a case where the clothes are not soaked and a case where the clothes are soaked for a long period of time. Moreover, effects such as a so-called hand-care, which is attained by increasing feel in hand-washing, and a so-called clothes-care, in which cloth damages can be avoided by increasing smoothness between fibers against the damages of fibers which are causative of loss of well kept shape due to mechanical power such as stirring in washing machines.

[0151] The present invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

Claims

1. A laundry creamy smoothness improver, comprising potassium metaphosphate.

2. The laundry creamy smoothness improver according to claim 1, wherein said potassium metaphosphate has a K/P molar ratio of less than 1.

3. The laundry creamy smoothness improver according to claim 1 or 2, wherein the creamy smoothness improver is used for hand-washing.

4. A detergent composition comprising the laundry creamy smoothness improver of claim 1, and a solubilizing agent.

5. The detergent composition according to claim 4, wherein the solubilizing agent contains an ion source for substitution in an amount of at least 0.5 times equivalent based on potassium ion in potassium metaphosphate.

6. The detergent composition according to claim 4, further comprising a surfactant and/or a builder.

7. The detergent composition according to claim 6, further comprising as a builder a metal ion capturing agent having a calcium ion capturing ability of 100 mg $CaCO_3$/g or more in an amount of 5% by weight or more.

8. The detergent composition according to claim 7, wherein the metal ion capturing agent is a water-soluble organic substance.

9. The detergent composition according to claim 4, further comprising a silicate.

10. The detergent composition according to claim 9, wherein the silicate is sodium silicate.

11. The detergent composition according to claim 4, further comprising a phosphate.

12. The detergent composition according to claim 11, wherein the phosphate is sodium tripolyphosphate.

13. A process for hand-washing, wherein washing is carried out under conditions of a potassium metaphosphate concentration in water of 30 mg/L or more and a liquor ratio of 2 or more.

14. Laundry creamy smoothness improver granules, comprising potassium metaphosphate.

15. The laundry creamy smoothness improver granules according to claim 14, wherein said potassium metaphosphate has an average particle size of 0.5 μm or more and 200 μm or less.

16. The laundry creamy smoothness improver granules according to claim 14, wherein the creamy smoothness improver granules are used for hand-washing.

17. The laundry creamy smoothness improver granules according to claim 14, further comprising a binder substance.

18. The laundry creamy smoothness improver granules according to claim 17, wherein the binder substance is polyethylene glycol.

19. The laundry creamy smoothness improver granules according to claim 14, wherein the creamy smoothness improver granules have an average particle size of 100 μm or more and less than 2000 μm.

20. The laundry creamy smoothness improver granules according to claim 14, further comprising a solubilizing agent.

21. A detergent composition comprising the laundry creamy smoothness improver granules of claim 14 and a solubilizing agent.

22. A detergent composition comprising the laundry creamy smoothness improver granules of claim 20.

23. The detergent composition according to claim 21, wherein the solubilizing agent contains an ion source for substitution in an amount of at least 0.5 times equivalent based on potassium ion in potassium metaphosphate.

24. The detergent composition according to claim 21, further comprising a surfactant and/or a builder.

FIG. 1

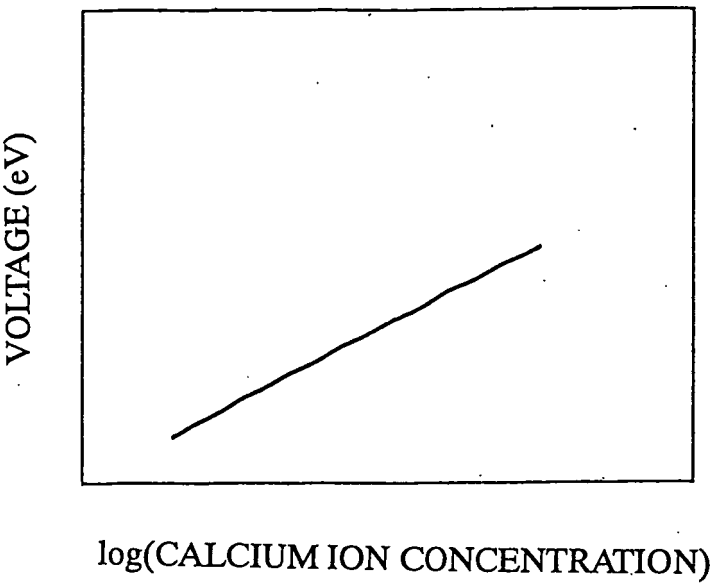
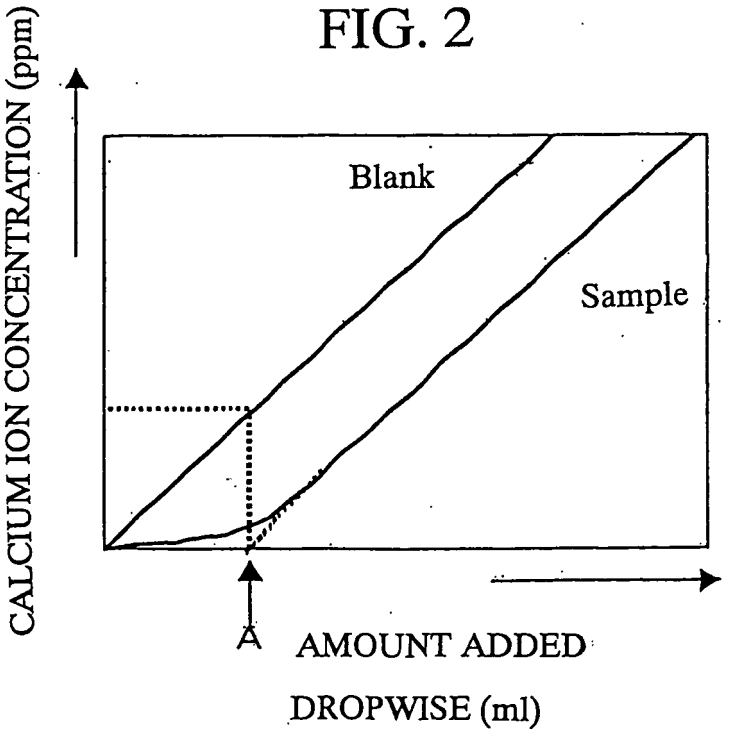

VOLTAGE (eV)
log(CALCIUM ION CONCENTRATION)

FIG. 2


CALCIUM ION CONCENTRATION (ppm)
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Sample
A
AMOUNT ADDED
DROPWISE (ml)