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ABRASIVE DETERGENT COMPOSITIONS

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This invention relates to improved detergents suitable for personal and other uses, and more particularly to compositions containing water-insoluble crystalline alkali-metal metaphosphate.

An object of my invention is to provide a detergent or cleanser which is non-hygroscopic and which can be readily packed in ordinary containers without taking special precautions to prevent moisture absorption.

Another object of the invention is to provide a detergent composition that is initially free-flowing and will remain free-flowing over long periods of time so that it can be readily dispensed from the ordinary type of dispensing mechanism without difficulty.

A still further object of my invention is to provide a detergent composition containing soap which has an improved lathering power and improved detergent qualities, and which will be non-irritating to the skin.

The glassy alkali-metal metaphosphates also known as alkali-metal phosphate glasses are widely known for their effectiveness in hard water because of their ability to soften water on the sequestration principle as disclosed in Hall Patent Re. 19,719. The glassy phosphates are hygroscopic and for that reason are not suitable for mixing with soap, in powder, flake, or bar form, or in liquid soaps, because of rehydration of the phosphate wholly or in part to orthophosphate with resultant loss of sequestering power and a deleterious effect on the soap because of the development of acidity. The glassy alkali-metal metaphosphates being hygroscopic, the moisture absorbed thereby would naturally destroy the free-flowing qualities of a dry mixed detergent composition containing these materials and soap containing water.

I have found that desirable detergent compositions can be prepared by using the water-insoluble crystalline metaphosphates since these materials are not hygroscopic and consequently a finely divided free-flowing composition will remain substantially unchanged in form until it is used. It has been found that the water-insoluble crystalline sodium metaphosphates can be solubilized by potassium, lithium, and ammonium compounds and that the water-insoluble crystalline potassium metaphosphates can be solubilized by sodium, lithium, and ammonium salts. Therefore, if I prepare a detergent composition containing a sodium soap of a fatty acid, I use a water-insoluble crystalline potassium metaphosphate or a mixture of this potassium salt and the water-insoluble crystalline sodium metaphosphate. If I employ a potassium soap of a fatty acid in my detergent composition, I use the water-insoluble crystalline sodium metaphosphate or I may use a mixture of this salt with the water-insoluble crystalline potassium meta-

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phosphate. In both cases, the alkali-metal of the soap acts in such a way as to solubilize the normally water-insoluble phosphates.

In ordinary detergent compositions which employ alkaline softening compounds that precipitate the hardness minerals from water, the soap lather is quickly broken by the formation of calcium and magnesium soaps which are water-insoluble. By solubilizing the water-insoluble phosphates used in my composition, water softening is obtained and it is believed that water-soluble complexes are formed with the hardness minerals of the water. There is no precipitation of the insoluble metallic soaps and full effectiveness of the detergents is made possible.

By using the insoluble phosphates in my detergent compositions, I have found that certain unexpected beneficial results are obtained. For example, since these phosphates are not instantaneously solubilized when the detergent is used, a certain abrasive action is noted even when I use only those amounts of phosphate required for sequestration of hardness, that is to say, 10% or less by weight. The insoluble phosphate provides a combined abrasive and sequestering action, the abrasive action diminishing as the phosphate solubilizes and the sequestering action increasing as solubilizing proceeds. In the presence of the solubilized phosphates, the detergents seem to exhibit improved dispersing properties and the viscosity of the soap lather seems to be considerably greater.

The crystalline water-insoluble sodium metaphosphates may be prepared by combining phosphoric anhydride and any suitable sodium alkali in proper proportions to produce mono-sodium orthophosphate. The mono-sodium orthophosphate is dehydrated at a temperature from about 300° to 500° C. producing the insoluble crystalline sodium metaphosphate. A process for producing insoluble sodium metaphosphate is disclosed by Taylor and Erdman in U. S. 2,356,799. The insoluble crystalline potassium metaphosphate may likewise be produced by dehydrating mono-potassium orthophosphate in a temperature range from 350°–800° C. or by combining phosphoric anhydride and an appropriate potassium alkali to produce mono-potassium orthophosphate which may be dehydrated at a temperature of from about 350°–900° C. thereby producing the crystalline potassium metaphosphate. The potassium metaphosphate may also be produced by melting mono-potassium orthophosphate at a temperature above 900° C. and allowing it to crystallize as it cools. In both the crystalline sodium and potassium metaphosphate the ratio of $M_2O:P_2O_5$ is 1:1, M being the alkali-metal of the oxide.

Generally speaking, I prefer to use from about 2–10% of crystalline water-insoluble alkali-metal

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phosphates in mixtures which contain added abrasive materials, in which mixtures I do not depend upon the phosphates for abrasive action. Where abrasive action is desired from the insoluble phosphates themselves, I may use as much as 40% by weight of the total mixture. Where I add both the water-insoluble crystalline sodium metaphosphate and the water-insoluble crystalline potassium metaphosphate to a detergent composition by which I desire to obtain abrasive effect, I may use from about 2-10% by weight of potassium metaphosphate and about 38-30% by weight of the sodium metaphosphate. The potassium metaphosphate will solubilize part of the sodium metaphosphate while the balance of the sodium metaphosphate will remain undissolved and will produce the desired abrasive effect in the composition.

In preparing my detergent composition I may use from about 20% to about 60% by weight of any appropriate soap of a fatty acid. For the dry mixtures which may be used in a dispensing mechanism or direct from the container in which they are packed, I prefer to use a finely-divided soap in granulated form although beads, ribbon, chips, or powder may be satisfactory. In some of my compositions I use an essentially anhydrous soap whereas in others the soap may contain about 10% of moisture. Although I prefer to use a soap having a titre in the range of from 20°-30° for my dry mixes, I may employ a soap having a lower titre if the final product is to be used only in cold water where quick lathering is desired. In mixtures which are in paste form, I prefer to employ a soft soap containing about 40-50% moisture. In most mixes, I use a sodium soap but in others, a potassium soap is employed. The soaps which are used in my paste detergent composition have a lower titre than those which are used in my free-flowing dry mixtures.

In some forms of detergent composition adapted for the washing of hands, I prefer to include from about 20% to about 60% by weight of an abrasive material which assists in removing deeply imbedded soil. I have found that corn meal is an excellent abrasive for this purpose, and depending on the degree of soil to be removed, I may use a meal of varying mesh size, the coarser mesh being preferable for removing the more tenacious type of soil, whereas the finer mesh is suitable for moderate soil. I have also found that ground corn kernel husks are suitable as an abrasive for my detergent, these being used either alone or admixed with corn meal or some other abrasive. Certain siliceous abrasives such as volcanic ash, pumice, diatomaceous earth, finely-divided sand or other suitable siliceous material may be used. Wood dust is also suitable as an abrasive for some of my detergent compositions.

In certain mixtures I may add an excess of a water-insoluble crystalline alkali-metal metaphosphate in finely-divided form. Part of this addition is solubilized by the alkali-metal ion of the soap or by the alkali-metal ion of one of the other ingredients in my composition. The balance of the water-insoluble crystalline metaphosphate is thereby rendered available in undissolved form to act as the sole abrasive ingredient or as one of several abrasive ingredients in my detergent composition.

In some of my detergent compositions I may use from about 5% to about 15% by weight of a supplemental water softening agent, this agent acting not only as a water softener but also as

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a mild alkali. Such phosphates as the pyrophosphates and tripolyphosphates provide additional water softening and supplemental alkalinity. By using small amounts of these supplemental softening agents, I may reduce somewhat the amount of crystalline water-insoluble alkali-metal phosphate which is considerably greater in cost than the supplemental softening agents themselves.

To most of the forms of detergent composition I prefer to add from about 5% to about 10% by weight of an alkali-metal buffering agent for the control of pH value. Such mild alkaline salts as sodium borate (borax), modified soda, sodium bicarbonate, and soda ash can be employed in small quantities. All of these compounds have mildly alkaline characteristics and since the crystalline insoluble metaphosphates do not impart alkalinity to the composition, these buffering agents are desirable in most instances.

In some cases, it may be desirable to incorporate from about 0.5% to about 5.0% by weight of an antiseptic agent in the detergent composition. Such antiseptic agents as sodium n-chloroparatoluenesulfonamid, commonly known as chloramine-T, n-dichloroparatoluenesulfonamid, commonly known as dichloramine-T, and sodium perborate, can be used. All of these agents have an effect in destroying certain bacteria which may be present on the surface that is to be washed by the detergent composition. Certain stabilizers of an organic nature should be included in the detergent composition where rancidity of the soap is likely to develop. Such compounds as carvacrol and eugenol are suitable in very small amounts, about 0.1% being sufficient. Perfumes may also be added to any of these compositions where desired.

The following are typical examples of detergent compositions which may be prepared in accordance with my invention:

Example I

	Percent
45 Sodium soap (20-80 mesh, essentially anhydrous) -----	27.5
Corn meal (30-80 mesh) -----	52.4
Potassium metaphosphate (crystalline-100 mesh) -----	4.0
50 Sodium tripolyphosphate (100-mesh, anhydrous) -----	10.0
Hydrated borax (40-100 mesh) -----	6.0
Eugenol -----	0.1
55	100.0

Free-flowing, stable, non-hygroscopic. Can be packed in ordinary containers without special precautions as to moisture absorption.

Example II

	Percent
50 Sodium soap (20-80 mesh, essentially anhydrous) -----	27.5
65 Corn meal (60-100 mesh) -----	50.4
Hydrated borax (40-100 mesh) -----	6.0
Sodium tripolyphosphate (100 mesh, anhydrous) -----	4.0
Potassium metaphosphate (100 mesh, anhydrous) -----	10.0
70 Eugenol -----	0.1
Sodium n-chloroparatoluenesulfonamid --	2.0
	100.0

75 Essentially the same as in Example I except for

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addition of antiseptic agent and use of a more finely ground abrasive.

Example III

	Percent
Sodium soap (20-80 mesh, 10% moisture) -	55.0
Siliceous abrasive (100-200 mesh) -----	35.0
Hydrated borax (40-100 mesh) -----	5.0
Potassium metaphosphate (crystalline-100 mesh) -----	5.0
	100.0

Example IV

	Percent
Sodium soap (20-80 mesh, 10% moisture) -	55.0
Sodium metaphosphate (crystalline-100 mesh) -----	35.0
Potassium metaphosphate (crystalline-100 mesh) -----	5.0
Sodium pyrophosphate, anhydrous (80 mesh) -----	5.0
	100.0

Abrasive characteristic derived from undissolved NaPO_3 crystalline.

Example V

	Percent
Potassium soap (soft-40% water) -----	55.0
Sodium metaphosphate (crystalline-100 mesh) -----	40.0
Potassium pyrophosphate -----	5.0
	100.0

Suitable as mechanic's handsoap or for cleansing painted surfaces. Abrasive effect obtained from undissolved NaPO_3 ; crystalline $\text{K}_4\text{P}_2\text{O}_7$ added for increased alkalinity and water softening power.

Example VI

	Percent
Sodium soap (soft-50% water, low titre) ---	30.0
Siliceous abrasive -----	50.0
Sodium tripolyphosphate -----	7.0
Potassium metaphosphate (crystalline) ---	10.0
Sodium perborate -----	3.0
	100.0

Suitable as a mechanic's hand soap. Contains antiseptic agent.

Example VII

	Percent
Sodium soap (powdered, 10% water content) -----	40.0
Corn meal husks -----	20.0
Corn meal -----	20.0
Sodium metaphosphate (crystalline) -----	10.0
Potassium metaphosphate (crystalline) ---	9.9
Carvacrol (stabilizer) -----	0.1
	100.0

Free-flowing non-hygroscopic product. Contains stabilizer to inhibit rancidity.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An abrasive soap composition which is free flowing and substantially non-hygroscopic and

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consisting essentially of the following constituents intimately mixed and in substantially the proportions stated by weight (a) water-soluble alkali-metal soap of a fatty acid, 20% to 60% (b) water-insoluble crystalline alkali-metal metaphosphate, 2% to 40% (c) an inert water-insoluble finely divided abrasive, 20% to 60%, and (d) an alkali-metal alkaline reacting salt, 5% to 10%, said salt being capable of buffering the pH of the composition when it is wetted with water, the alkali-metal of at least one of said constituents (a) and (d) being such as will solubilize the water-insoluble alkali-metal metaphosphate when the abrasive composition is wetted with water.

2. An abrasive soap composition which is free flowing and substantially non-hygroscopic and consisting essentially of the following constituents intimately mixed and in substantially the proportions stated by weight (a) water-soluble alkali-metal soap of a fatty acid, 20% to 60% (b) water-insoluble crystalline alkali-metal metaphosphate, 2% to 40% (c) an inert water-insoluble finely divided abrasive, 20% to 60% (d) a water-soluble alkali-metal alkaline reacting crystalline phosphate, 3% to 15%, said phosphate having water softening properties, and (e) an alkali-metal alkaline reacting pH buffering salt other than (d), 5% to 10%, the alkali-metal of at least one of said constituents (a), (d), and (e) being such as will solubilize the water-insoluble alkali-metal metaphosphate when the abrasive composition is wetted with water.

3. A composition according to claim 1 in which at least a part of constituent (b) is a water-insoluble crystalline potassium metaphosphate constituting from about 2% to about 10% by weight of the composition.

4. A composition according to claim 1 containing a small amount of an organic stabilizer for preventing rancidity of the soap while in storage.

5. A finely divided free-flowing abrasive soap composition consisting essentially of from about 20% to about 50% of anhydrous sodium soap, from about 20% to about 60% corn meal, from about 2% to about 10% water-insoluble crystalline potassium metaphosphate, from about 5% to about 15% alkali-metal tripolyphosphate, from about 5% to about 10% hydrated borax, and about 0.1% organic stabilizing agent to prevent rancidity of the soap while in storage.

6. An abrasive soap composition according to claim 1 characterized by the fact that the water-insoluble alkali metal metaphosphate of constituent (b) is a mixture of water-insoluble sodium metaphosphate and water-insoluble potassium metaphosphate.

7. An abrasive soap composition according to claim 1 characterized by the fact that constituent (b) is a water-insoluble sodium metaphosphate.

8. An abrasive soap composition consisting essentially of the following constituents intimately mixed and in substantially the proportions stated by weight (a) water-soluble alkali-metal soap of a fatty acid, 20% to 60% (b) a mixture of finely-divided water-insoluble sodium metaphosphate and water-insoluble potassium metaphosphate, 2% to 40% (c) finely-divided abrasive of the group of abrasives consisting of corn meal, corn kernel husks, pumice, volcanic ash, diatomaceous earth and sand, 20% to 60%, and (d) at least one alkali-metal alkaline reacting salt of the group consisting of borates, carbonates and bicarbonates, tripolyphosphates and pyro-

phosphates, 5% to 10%, for buffering the pH of the composition when it is wetted with water.

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