

SPECIFICATION

Detergent compositions

5 TECHNICAL FIELD

The present invention relates to detergent compositions in particulate or bar form which are adapted for fabric washing. The invention concerns in particular such compositions which are suitable for washing by hand in cool, ie cold or lukewarm water, as occurs widely in so-called developing countries and low cost formulations for use in developed countries.

10

BACKGROUND ART

A major problem in formulating detergent products for fabric washing by hand and in cool water, is the difficulty in reconciling the need for a highly effective detergency builders system which will adequately soften water during use under adverse washing conditions, which often also include low product dosage, with the fact that the users of such compositions cannot in general afford the most effective systems which would otherwise be desired. Nor indeed do the economies of the developing countries always permit the importation of large tonnages of foreign detergency builder materials such as sodium tripolyphosphate.

It has been proposed previously to use sodium carbonate as a detergency builder, and this material is widely available and relatively cheap. Unfortunately, however, sodium carbonate when used alone as the detergency builder does not function so effectively as would be desired, particularly at cool washing temperatures. Although the level of calcium ion concentration is lowered to a sufficient level by the presence of sodium carbonate, ie by precipitation of calcium carbonate, the precipitation process is a slow one and during the early part of the wash cycle the calcium concentration is higher than is desired for effective washing. During the initial period before the sodium carbonate is fully effective, there can be interaction between the calcium ions present and other ingredients in the detergent compositions. For example anionic detergent surfactants such as some sodium alkyl benzene sulphonates can be precipitated in the form of the calcium salts and this therefore contributes to a further reduction in detergency. Other types of detergent surfactants are known which are not precipitated by calcium ions, for example nonionic detergent surfactants, but these more sophisticated detergent surfactants tend to be more expensive, which mitigates against their use in the relatively cheap formulations.

DISCLOSURE OF THE INVENTION

The present invention seeks to provide a way of improving the effectiveness of sodium carbonate as a detergency builder, particularly under adverse washing circumstances, but without imposing a heavy cost burden on the compositions. This has been achieved by including a low level of pyrophosphate salt in the compositions.

According to the present invention, there is provided an alkaline detergent composition for fabric washing comprising a detergent surfactant, a filler salt and an alkali metal carbonate, containing

- (i) from 10% to 40% of a synthetic anionic, nonionic, amphoteric or zwitterionic detergent surfactant or a mixture thereof;
- (ii) from 10% to less than 40% of an alkali metal carbonate, at least 10% of the alkali metal carbonate being in fully neutralised form;
- (iii) from 1% to 12% of a pyrophosphate material selected from ammonium, sodium and potassium pyrophosphates;
- (iv) not more than 5% of other phosphate builder salts; and
- (v) from 5% to 50% of a filler salt,

all percentages being by weight of the composition and being calculated on an anhydrous basis. The composition may be in powder form or in the form of a laundry bar.

It has been found that the addition of the pyrophosphate material together with the alkali metal carbonate achieves a much more cost-effective building performance than either of the materials would do alone. It appears that the presence of the low level of pyrophosphate makes the calcium ion concentration drop very quickly to a satisfactory low level, after which the sodium carbonate maintains the calcium ion concentration at the low level. The resultant detergent compositions are cheaper because of the unsophisticated builder system, and yet give satisfactory detergency under the adverse washing conditions.

60 BEST MODE OF CARRYING OUT INVENTION

The pyrophosphate material used may be either potassium or preferably sodium pyrophosphate, as the latter is cheaper and more readily available. Normally the tetraalkali metal salts are used, but the partially neutralised alkali metal salts could be used if desired to form the compositions. In the latter event other more alkaline salts would also be present to maintain a high pH in the end product, with full neutralisation to the tetra alkali metal pyrophosphate salts.

The alkali metal pyrophosphate can be used initially as the anhydrous or hydrated salts, but it is preferred that the salts should be at least partially hydrated in the final detergent compositions, either by initial use of the hydrated salts or by hydration during powder production. The amount of the alkali metal pyrophosphate salt is calculated in anhydrous form and is preferably about 2 to about 10% by weight of the composition.

Advantageously, the amount of phosphorus in the formulation, in the form of the pyrophosphate, is from about 0.5% to about 2.5% by weight of the composition.

Some other phosphate builder salts may be present at low levels, not exceeding about 5% by weight of the composition, although this is not normally desired. Low levels of other phosphates are commonly present as impurities in the alkali metal pyrophosphates supplied, so the presence of the other phosphates may in practice be unavoidable. Such other phosphate builder salts include in particular sodium tripolyphosphate and sodium orthophosphate and the corresponding potassium salts when potassium pyrophosphate is used.

The alkali metal carbonate salt used may be potassium or preferably sodium carbonate or a mixture thereof. The carbonate salt is generally fully neutralised, but it may contain some potassium or sodium bicarbonate or sesquicarbonate. Alkali metal percarbonates may also be used.

The amount of the alkali metal carbonate used can be varied from 10% to less than 40% by weight of the compositions but it is preferred to use an amount of about 15% to about 30% by weight, and at least about 10% by weight of the carbonate must be fully neutralised, based on the weight of the composition. The amount of the alkali metal carbonate is determined on an anhydrous basis, although the carbonate salt may be hydrated before or during detergent production. The amount of bicarbonate can be up to about 20% by weight of the composition, which is equivalent to up to about 40% by weight of sesquicarbonate, but it is preferred to have a bicarbonate content of about 5% to about 15% by weight of the composition.

The detergent compositions must include from about 10% to about 40% by weight of a synthetic detergent surfactant. It is preferred to have a relatively high level of detergent surfactant present in the compositions, that is at least about 20% by weight of the compositions, as this facilitates the production of adequate lather levels under the conditions of usage in the developing countries, generally with a maximum level of about 30% for reasons of costs.

It is preferred to include a higher amount of synthetic detergent surfactant when the total amount of carbonate, pyrophosphate and other phosphate builder salts, if present, is lower and conversely the amount of synthetic detergent surfactant can be reduced when the total amount of builder salts is increased. Thus, it is preferred that the total amount of synthetic detergent surfactant, alkali metal carbonate, pyrophosphate material and other phosphate builder salts when present exceeds about 30%, and is preferably more than about 40% by weight of the composition.

It is particularly preferred to use an anionic detergent surfactant as these tend to be cheaper and more readily available in developing countries. The alkali metal alkyl benzene sulphonates, especially sodium linear secondary alkyl (C_{10} - C_{15}) benzene sulphonate, are particularly preferred. However, other anionic detergent surfactants which are generally water-soluble alkali metal salts of organic sulphates and sulphonates having alkyl radicals containing from about 8 to 22 carbon atoms may be employed. Examples of such other anionic detergent surfactants are sodium and potassium alkyl sulphates, especially those obtained by sulphating higher (C_8 - C_{18}) alcohols produced for example from tallow or coconut oil; sodium alkyl glyceryl ether sulphates, especially those ethers of the higher alcohols derived from tallow or coconut oil and synthetic alcohols derived from petroleum; sodium coconut oil fatty acid monoglyceride sulphates and sulphonates; sodium and potassium salts of sulphuric acid esters of higher (C_8 - C_{18}) fatty alcohol-alkylene oxide, particularly ethylene oxide, reaction products; the reaction products of fatty acids such as coconut fatty acids esterified with isethionic acid and neutralised with sodium hydroxide; sodium and potassium salts of fatty acid amides of methyl taurine; alkane monosulphonates such as those derived by reacting alpha-olefins (C_8 - C_{20}) with sodium bisulphite and then hydrolysing with a base to produce a random sulphonate; and olefin sulphonates, which term is used to describe the material made by reacting olefins, particularly C_8 - C_{20} alpha olefins, with SO_3 and then neutralising and hydrolysing the reaction product.

Nonionic detergent surfactants may be used in the detergent compositions although this is not generally desired because of their relatively high cost and because they tend to result in decreased lather properties. However, they may be used to give a boost to detergency properties at relatively low levels of for example up to about 5% by weight of the composition. The

nonionic detergent surfactants are the reaction products of compounds having hydrophobic groups and a reactive hydrogen atom, for example aliphatic alcohols, acids, amides or alkyl phenols with alkylene oxides, especially ethylene oxide either alone or with propylene oxide. Specific nonionic detergent surfactants are alkyl (C_6 - C_{22}) phenol-ethylene oxide condensates, generally 5 to 25 EO, ie 5 to 25 units of ethylene oxide per molecule; the condensation products of aliphatic (C_6 - C_{18}) primary or secondary linear or branched alcohols with ethylene

oxide, generally 6 to 30 EO, and products made by condensation of ethylene oxide with the reaction products of propylene oxide and ethylenediamine. Other so-called nonionic detergent surfactants include long chain tertiary amine oxides, long chain tertiary phosphine oxides and dialkyl sulphoxides. Mixtures of amine oxides with ethoxylated nonionic compounds can also be used.

Amounts of amphoteric or zwitterionic detergent surfactants may also be used in the compositions of the invention but this is not normally desired due to their relatively high cost. If any amphoteric or zwitterionic detergent surfactants are used it is generally in small amounts in compositions based on the much more commonly used synthetic anionic and/or nonionic detergent surfactants.

Apart from the essential detergent surfactants, and detergency builders, the detergent compositions of the invention can contain any of the conventional additives at the levels such materials are normally employed in fabric washing detergent compositions. However, the need to control the cost of products may in practice preclude the use of more expensive additives. Moreover, the washing conditions employed, particularly hand washing in cool water, make it less practical to use lather depressants, oxygen-based bleaching agents such as sodium perborate and sodium percarbonate with or without peracid bleach precursors, or enzymes such as proteases and amylases. However, where different washing conditions are used, such as machine washing at moderate or high temperatures, such additives will generally be included in the compositions, in particular from about 10% to about 50% of a peroxygen bleach by weight of the composition. The additives which are more commonly used in detergent compositions suitable for the developing countries include lather boosters such as alkanolamides, particularly the monoethanolamides derived from palm kernel fatty acids and coconut fatty acids, antiredeposition agents such as sodium carboxymethylcellulose, alkaline buffers such as sodium silicate, fluorescent agents, perfumes and colourants and the like.

It is particularly preferred to have present an inorganic filler salt to provide the compositions with sufficient bulk at an acceptable cost. The amount of the filler salt is from about 5% to about 50%, preferably about 15% to about 40%, by weight of the composition. These filler salts are generally considered to be inert materials, although in the case of the soluble salts such as sodium sulphate there can be some small effect on detergency due to their influence on the ionic concentration. When any insoluble filler materials are used such as calcium carbonate, it is important to have them as finely divided as possible so as not to cause undue deposition on the fabric being washed. Examples of other suitable inorganic fillers are borax, magnesium silicate, talc, calcium sulphate, sodium aluminosilicate and bentonite or other clays.

As alkali metal carbonate salts function as detergency builders by precipitation of their insoluble calcium salts, and the pyrophosphates can sometimes also act in this way, it can be advantageous to include an amount of an anti-deposition aid to inhibit deposition of such insoluble salts on the fabrics. The most effective antideposition aids are anionic polyelectrolytes, especially polymeric aliphatic carboxylates, for example alkali metal or ammonium, eg sodium, salts of homo- and co-polymers of acrylic acid or substituted acrylic acids. The amount of any such antideposition aids is normally from about 0.05% to about 5% by weight, preferably from about 0.1% to about 2% by weight, of the compositions. However, as such polymeric additives tend to be relatively expensive they are preferably used, if at all, at low levels within this range in the compositions of the invention.

Some soap may also be included in the compositions of the invention but not as the sole detergent surfactant. In general the soaps are relatively expensive and if used at only low levels they can have an undesirable suds depressing action. However, in some countries soap may be more widely available than imported synthetic detergent surfactants in which case a proportion of soap may be used, preferably not exceeding about half of the total surfactant present.

The compositions of the invention are required to be alkaline, but not too strongly alkaline as this could result in fabric damage and also be hazardous for use, especially in manual washing. It is desired in practice that the composition should give a pH of from about 9 to 11 in use in aqueous wash solution, preferably from about 9.5 to 10.5, as measured at a product concentration of about 0.1% w/v in water of 12°H (Ca) at 25°C. The pH of the detergent compositions in use is controlled in particular by the amount of the alkali metal carbonate salt present and on any other alkaline salts which may be used, especially alkali metal silicate.

Apart from its effect on pH control, the presence in the detergent compositions of an amount of an alkali metal silicate is generally advantageous in facilitating processing of the detergent compositions and giving generally improved powder properties. The type of alkali metal silicate used is preferably sodium silicate, for example sodium ortho-, meta- or preferably neutral or alkaline silicate. The more highly alkaline ortho- and meta silicates are normally only used at lower levels, in admixture with neutral or alkaline silicates.

The detergent compositions of the invention are required to be in particulate form, which includes powders and granules and they may be made by conventional techniques, for example by granulation or by slurry making and spray drying processes, so as to give substantially

homogenous products. The pyrophosphate may be post-dosed to the composition. Alternatively, they may be in the form of laundry bars which may be formed by conventional methods such as mixing and extruding.

The invention is illustrated by the following Examples in which parts and percentages are by weight and in which the amounts of the ingredients are expressed on an anhydrous basis, except where otherwise indicated.

EXAMPLES 1 TO 4

Six powdered detergent compositions including two control products A and B were prepared as follows:

	A	Ex 1	Ex 2	% B	Ex 3	Ex 4
15 Sodium alkyl benzene sulphonate	28	28	28	28	28	28
Sodium pyrophosphate	8	8	8	4	4	4
Sodium carbonate	0	10	20	0	15	30
20 Sodium alkaline silicate	—	—	—	10.0	—	—
Sodium sulphate	44	34	24	48	33	18
Water	—	—	—	to 100	—	—

Each of these compositions was then added to water of initially 30°F H (Ca) at 25°C, the product dosage being 3.5 g/l. The free calcium ion concentrations were then determined at intervals, with the following results:

	Ca ⁺⁺ (°FH)					
Comp Time:	Initially	$\frac{1}{2}$ min	1 min	2 min	4 mins	15 mins
35 A	30	13	11.5	11.5	11.5	11
Ex 1	30	5.4	5.0	4.7	4.9	5.2
Ex 2	30	1.75	1.6	1.7	1.6	1.7
B	30	21.5	20	20	19	17
Ex 3	30	9.0	7.8	7.8	7.6	7.0
40 Ex 4	30	2.7	2.3	2.3	2.2	2.0

The compositions were then tested for detergency using a product concentration of 2.5 g/l, calcium hardness of 15°H (French), liquor to cloth ratio of 5:1 and temperature of 25°C. Three artificially soiled test cloths were used and the detergency found by determining the change in light reflectance before and after washing, with the following results:

	Detergency (Increase in light reflectance)		
50 Composition	Test Cloth A	Test Cloth C	Test Cloth B
A	26.7	8.1	19.5
Ex 1	27.4	9.5	21.0
Ex 2	29.5	10.0	22.0
55 B	22.6	5.7	17.0
Ex 3	26.5	6.6	19.0
Ex 4	28.5	7.6	20.0

These results show a marked benefit in water softening properties and hence detergency for the compositions made according to the invention, especially with the higher carbonate levels.

EXAMPLE 5

Two detergent compositions were prepared to the following formulations:

Ingredient	% Example 5 Product C	
Sodium alkyl benzene sulphonate	25	25
Sodium pyrophosphate	7.5	—
Sodium carbonate	15	30
Sodium alkaline silicate	10	10
Sodium sulphate	26.5	19.0
Sodium carboxy methyl cellulose	0.5	0.5
Water	to 100	to 100

The compositions were then tested for detergency by the procedure as used in Examples 1 to 4, with the following results:

Composition	Detergency (Increase in light reflectance)		
	Test Cloth A	Test Cloth B	Test Cloth C
Example 5	35.9	24.5	11.1
Product C	28.3	20.2	4.2

The benefit of using a low pyrophosphate level with the sodium carbonate builder in the composition of the invention is readily apparent, compared with the control product C which had a higher level of sodium carbonate as the builder.

EXAMPLES 6 AND 7

The following formulations, including two controls D and E, were prepared:

Ingredient %	Ex 6	D	E	Ex 7
Sodium alkyl benzene sulphonate	28	28	28	28
Sodium pyrophosphate	10	—	10	12
Sodium carbonate	30	30	—	30
Sodium silicate	10	10	10	10
Sodium sulphate	12	22	42	10
Water	to 100			

The detergency performance of these compositions was investigated at product concentrations of 2.5 g/l, calcium hardness of 15°H (French), liquor to cloth ratio of 5:1 and a temperature of 25°C. Three artificially soiled test cloths were used and the detergency found by determining the change in light reflectance before and after washing, with the following results:

Formulation	Test cloth (Increase in light reflectance)		
	Test Cloth A	Test Cloth B	Test Cloth C
Ex 6	35.6	25.5	16.8
D	27.4	21.1	10.1
E	31.2	22.2	13.4
Ex 7	35.1	24.8	16.5

The test cloths used in Examples 2 to 7 were as follows:

Test Cloth A—A mixture of sebum fatty acids and carbon black impregnated into cotton-poplin.
Test Cloth B—A mixture of ground nut oil, indian ink, casein and iron oxide impregnated into cotton sheeting.
Test Cloth C—A mixture of bandy black clay, a nonionic detergent and a cationic detergent impregnated into cotton cloth.

The performance of the formulation of Example 6 was investigated at 60°C, the other test

conditions remaining the same, except that the test cloth was a tea stained cloth. The result was as follows:

5	Formulation	Change in reflectance	5
	Ex 6	0.3	

10 EXAMPLE 9

Detergent bars were prepared according to the following formulations:

15	Ingredient	Ex 9	% Control G	Control H	15
	Sodium alkyl benzene sulphonate	28	28	28	
	Sodium pyrophosphate	4	-	16	
20	Sodium carbonate	22	22	10	20
	Calcite	34	35	32.4	
	Sodium sulphate	6	5	6.5	
	Water	6	10	7.1	

25 The bars were used to hand wash Test Cloth C (referred to above) at a liquor to cloth ratio of 5:1, water hardness of 15°H (French) and a wash temperature of 25°C. The results were:

30	Formulation	Change in reflectance	30
	Ex 9	11.2	
	G	7.2	
	H	12.4	

35

CLAIMS

1. An alkaline detergent composition for fabric washing comprising a detergent surfactant, a
40 filler salt and an alkali metal carbonate characterised by containing 40
 - (i) from 10% to 40% of a synthetic anionic, nonionic, amphoteric or zwitterionic detergent surfactant or a mixture thereof;
 - (ii) from 10% to less than 40% of an alkali metal carbonate, at least 10% of the alkali metal carbonate being in fully neutralised form;
 - 45 (iii) from 1% to 12% of a pyrophosphate material selected from ammonium, sodium and 45 potassium pyrophosphates;
 - (iv) not more than 5% of other phosphate builder salts; and
 - (v) from 5% to 50% of a filler salt,
 all percentages being by weight of the composition and being calculated on an anhydrous basis.
- 50 2. A composition according to Claim 1, characterised in that the pyrophosphate material is a 50 sodium or potassium pyrophosphate.
3. A composition according to Claim 2, characterised in that the sodium or potassium pyrophosphate is present in an amount of 2% to 10% by weight of the composition.
4. A composition according to any one of Claims 1 to 3, characterised in that the
55 composition contains from 0.5% to 2.5% by weight of the composition of phosphorus in the 55 form of the pyrophosphate.
5. A composition according to any one of Claims 1 to 4, characterised in that the total amount of said synthetic detergent surfactant, alkali metal carbonate, pyrophosphate material and other phosphate builder salts, when present, is in excess of 30% by weight of the
60 composition. 60
6. A composition according to any one of Claims 1 to 5, characterised in that the composition additionally contains from 10% to 50% by weight of the composition of a peroxygen bleach other than an alkali metal percarbonate.
7. A composition according to Claim 2 or 3, characterised in that the composition
65 additionally contains one or more additives selected from lather suppressants, enzymes, lather 65



conditions remaining the same, except that the test cloth was a tea stained cloth. The result was as follows:

5	Formulation	Change in reflectance	5
	Ex 6	0.3	

10 EXAMPLE 9

Detergent bars were prepared according to the following formulations:

15	Ingredient	Ex 9	% Control G	Control H	15
	Sodium alkyl				
	benzene sulphonate	28	28	28	
	Sodium pyrophosphate	4	-	16	
20	Sodium carbonate	22	22	10	20
	Calcite	34	35	32.4	
	Sodium sulphate	6	5	6.5	
	Water	6	10	7.1	

25

The bars were used to hand wash Test Cloth C (referred to above) at a liquor to cloth ratio of 5:1, water hardness of 15°H (French) and a wash temperature of 25°C. The results were:

30	Formulation	Change in reflectance	30
	Ex 9	11.2	
	G	7.2	
	H	12.4	

35

CLAIMS

1. An alkaline detergent composition for fabric washing comprising a detergent surfactant, a filler salt and an alkali metal carbonate characterised by containing

(i) from 10% to 40% of a synthetic anionic, nonionic, amphoteric or zwitterionic detergent surfactant or a mixture thereof;

(ii) from 10% to less than 40% of an alkali metal carbonate, at least 10% of the alkali metal carbonate being in fully neutralised form;

(iii) from 1% to 12% of a pyrophosphate material selected from ammonium, sodium and potassium pyrophosphates;

(iv) not more than 5% of other phosphate builder salts; and

(v) from 5% to 50% of a filler salt,

all percentages being by weight of the composition and being calculated on an anhydrous basis.

2. A composition according to Claim 1, characterised in that the pyrophosphate material is a sodium or potassium pyrophosphate.

3. A composition according to Claim 2, characterised in that the sodium or potassium pyrophosphate is present in an amount of 2% to 10% by weight of the composition.

4. A composition according to any one of Claims 1 to 3, characterised in that the composition contains from 0.5% to 2.5% by weight of the composition of phosphorus in the form of the pyrophosphate.

5. A composition according to any one of Claims 1 to 4, characterised in that the total amount of said synthetic detergent surfactant, alkali metal carbonate, pyrophosphate material and other phosphate builder salts, when present, is in excess of 30% by weight of the composition.

6. A composition according to any one of Claims 1 to 5, characterised in that the composition additionally contains from 10% to 50% by weight of the composition of a peroxxygen bleach other than an alkali metal percarbonate.

7. A composition according to Claim 2 or 3, characterised in that the composition additionally contains one or more additives selected from lather suppressants, enzymes, lather



boosters, antiredeposition agents, alkaline buffers, fluorescent agents, perfumes, colourants and fillers.

8. A composition according to Claim 1, characterised in that the alkali metal carbonate is an alkali metal percarbonate.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon) Ltd.—1983.

Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.