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(54) DETERGENT COMPOSITION

(71) We, IMPERIAL CHEMICAL INDUSTRIES LIMITED, Imperial Chemical House, Millbank, London SW1P 3JF a British Company do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

5 The present invention relates to a detergent composition, in particular to an anhydrous non-ionic detergent composition containing builders. 5

Heavy duty detergent compositions for use, for example, in domestic washing machines are commonly sold in the form of powders. The advantage of a powder is that it enables a wide range of inorganic builders to be incorporated into the composition, wider than if an aqueous composition were formulated because some builders e.g. sodium tripolyphosphate 10 are unstable in the presence of water and others e.g. sodium perborate in the presence of water oxidise organic components of the composition. It is also impossible to formulate a homogeneous liquid aqueous composition with organic surfactant and the desired quantity of inorganic builders. The disadvantage of a powder from the manufacturer's point of view is 15 that it is relatively expensive to make. Compared with an equivalent aqueous composition a powder requires more expensive drying equipment for its production, and as well as being expensive such equipment is often difficult and sometimes hazardous to operate.

We have now devised a composition which is liquid and which contains organic surfactants and builders of the type, and in the concentration, which heretofore has only 20 been achieved in powder form.

According to the invention a detergent composition which is a liquid at room temperature comprises a dispersion of one or more builders in a substantially water free non-ionic liquid surfactant which contains a dispersant for the builder.

25 Any builder which is known for use in detergent compositions may be used in the composition according to the present invention. Generally such builders are inorganic in nature but some organic products in particular sodium carboxymethylcellulose may be used. Suitable inorganic builders include phosphates, e.g. trisodium phosphate, tetrasodium pyrophosphate, sodium hexametaphosphate and, preferably, sodium tripolyphosphate, carbonates e.g. sodium carbonate, sodium bicarbonate and sodium sesquicarbonate, 30 clays e.g. kaolin, montmorillonites and sodium bentonite, and miscellaneous salts e.g. sodium borate, sodium perborate, sodium percarbonate, sodium meta-silicate, sodium sulphate and sodium chloride. The potassium analogues of these sodium compounds may also be used. It is preferred that a mixture of builders be present in the composition, e.g. sodium tripolyphosphate, sodium metasilicate and sodium perborate.

35 In order to provide an effective dispersion of the builder(s) in the liquid non-ionic surfactant it is desirable that at least 90% of the particles of the builder have particle sizes of less than 100, preferably less than 10, microns in diameter. The composition contains a dispersant to facilitate and to stabilise the dispersion. We have found a particularly effective dispersant to be a combination of finely divided silica (5 to 100 preferably 7 to 40 millimicrons diameter particles) such as is sold under the trade name AEROSIL, which 40

may be used together with a compound containing one or more polyether groups. Preferably the compound containing the polyether group(s) has a molecular weight in the range 500 to 1,000,000 more preferably 20,000 to 100,000. The compound containing the polyether group(s) may be the result of grafting polyether chains onto a suitable substrate e.g. in a simple case the product of reacting glycerol with ethylene oxide. Numerous substrates are known as being amenable to reaction with an olefin oxide to give a polyoxyalkylene chain comprising ether groups e.g. substrates which are compounds containing one or more carboxyl, hydroxyl or amino groups. The most convenient substrate is water which reacts with an alkylene oxide to produce a polyalkylene glycol. Although polyethylene glycol is preferred, polypropylene glycol, polybutylene glycol and glycols derived from mixtures of ethylene oxide and/or butylene oxide may also be used. In the latter case the glycol may contain the different alkylene oxides in random arrangement or in the form of blocks of the respective polyalkylene oxide. The preferred compound containing the polyether group(s) is polyethylene glycol with a molecular weight in the range 60,000 to 100,000.

The non-ionic surfactant which is a component of the composition according to the invention is also preferably an alkylene oxide derivative. In particular, the non-ionic surfactant may be an alkylene oxide derivative of an amide, alkyl phenol or an alkanol. The alkyl group in the alkylphenol may be straight chain or branched chain and may contain from 6 to 20 carbon atoms, e.g. para-nonyl phenol or para-dodecylphenol. The alkanol may contain 6 to 20 carbon atoms, particularly 10 to 16 carbon atoms. The alcohol is preferably a primary or secondary alkanol having a linear or mono branched alkyl group.

The composition may usefully comprise two non-ionic surfactants, one of which fulfills a surfactant function and the other of which both fulfills a surfactant function and reduces the pour point of the composition. The former surfactant may for example comprise alcohols having 12 to 16 carbon atoms which have been alkoxyated with 5 to 15 moles of ethylene and/or propylene oxide; the other surfactant may be a linear or branched chain C_{6-11} alcohol alkoxyate which comprises 2 to 8 moles of ethylene and/or propylene oxide per mole, branched chain alcohols being preferred in the C_{8-11} range and linear alcohols being preferred in the C_{6-8} range, or an alkyl phenol alkoxyate having 2 to 6 moles of ethylene and/or propylene oxide per molecule the alkyl group suitably being in a paraposition and having 6 to 12 carbon atoms.

A further surfactant of the anionic or cationic type may be included if desired. Such anionic or cationic surfactants may be of known type for example the anionic detergents may be soaps, alkylbenzene or olefine sulphonates, alcohol sulphates or alcohol alkoxyate sulphates; the cationic surfactants are suitably di- C_{14-20} and preferably di- C_{16-18} alkyl, di-lower alkyl ammonium salts or hydroxides for example chlorides or sulphates. The lower alkyl groups are suitably methyl groups.

In general however the alkylphenol or alkanol derivative may comprise 2 to 20 alkylene oxide units which are preferably ethylene oxide units although a minor number of propylene oxide or a lesser number of butylene oxide units may also be present. The amide is suitably a mono- or di-alkanol amide e.g. a mono- or di-ethanolamide preferably of a C_6 to C_{30} more preferably C_{10} to C_{20} alkanolic acid, e.g. coconut acids, tallow acids or stearic acid. An alternative non-ionic surfactant for use in a composition according to the invention comprises a copolymer of ethylene oxide with propylene oxide and/or butylene oxide. The copolymer comprises a block of propylene and/or butylene oxide units on to which is grafted the ethylene oxide. The block preferably comprises 20 to 40 propylene oxide units, particularly about 30 such units and 20 to 30 particularly about 26 ethylene oxide units.

It is a feature of the composition according to the invention that the dispersion of the builder(s) in the non-ionic surfactant is particularly stable. If the builder(s) do separate at all then the resulting phase is loosely flocculated and is readily redispersible while if the relative amounts of the builder(s) and nonionic surfactant in the composition is correctly chosen there is little phase separation as the liquid fills the space between the loosely packed builder particles. The composition may contain 20 to 70% by weight builder(s) It is preferred that the composition contain 30 to 60% and more preferably 40 to 60% by weight builder(s) the remainder preferably being substantially non-ionic surfactant together with the dispersant. The amount of dispersant present is suitably up to 5% by weight while the composition may also contain additives conventionally found in detergent compositions e.g. optical brighteners, ethylene diamine tetra acetic acid, dyes, perfumes or enzymes. The invention will now be further described with reference to the following Example.

Example 1

Compositions were made up comprising

5	Builders*	42 parts and 45 parts by weight	5
	Non-ionic surfactant**	58 parts and 55 parts by weight	
	Polyethylene glycol (m.wt 80,00)	1 part and 1 part by weight	

10 by mixing the components together and then stirring for 20 minutes with a high shear homogeniser. 2 parts by weight finely divided silica (AEROSIL) were then added and mixed into the composition by stirring for the minimum period of time. 10

15	*The builders were		15
	sodium tripolyphosphate	82.3% w/w	
	sodium silicate	15.2% w/w	
20	sodium carbonate	2.4% w/w	20

25 **The non-ionic surfactant comprised a mixture of 87.4% w/w alcohol alkoxyates (derived from a mixture of C₁₃ and C₁₅ primary alcohols comprising 55% straight chain and 45% chain with a methyl branch in the 2-position alkoxyated with a mixture of ethylene oxide (92% w/w) and propylene oxide (8% w/w) to give an average alkylene oxide chain length of 9). 25
10.9% w/w coconut acids diethanolamide and 1.7% w/w "Fluolite" (optical brightener). "Fluolite" is a trade mark.

30 The two compositions were stable and the dispersion did not break even after 3 weeks storage at 0°C, ambient temperature, or 50°C. 30

In washing tests the compositions proved to be approximately as effective, under comparable conditions, as three different commercial powders.

Example 2

Compositions were made up from the following components:

5	Sodium tripolyphosphate	30 parts by weight	5
	Sodium metasilicate	2 parts by weight	
	Sodium percarbonate	8 parts by weight	
10	C ₁₀ alcohol derived by hydro-	10.5 parts by weight	10
	formylation of propylene trimer		
15	and ethoxylated with an average		15
	of 6 ethylene oxide units per		
	molecule.		
20	A surfactant mixture comprising	42 parts by weight	20
	87.4% w/w alcohol alkoxyates		
25	(derived from a mixture of C ₁₃		25
	and C ₁₅ primary alcohols comprising		
	55% straight chain and 45% with a		
30	methyl branch in the 2-position		30
	alkoxylated with a mixture of		
35	ethylene oxide (92% w/w) and		35
	propylene oxide (8% w/w) to give		
	an average alkylene oxide chain		
40	length of 7)		40
	Coconut acid diethanolamide	6.5 parts by weight	
45	"FLUOLITE" * (optical brightener)	1.0 parts by weight	45
	AEROSIL *	2.5 parts by weight	

*FLUOLITE and AEROSIL are trademarks

50 In the second composition the ethoxylated isodecanol was replaced by an ethoxylate of a 50
mixture of C₇ to C₉ primary alcohols comprising approximately 30% w/w linear, 60% w/w
branched and 10% w/w alicyclic alcohols. The ethoxylate contained an average of 6 ethylene
oxide units per molecule.

55 The two formulations were stable and the dispersions did not break after 3 weeks storage 55
at 0°C, ambient temperature and 50°C respectively, while the washing ability of the two
compositions was comparable with commercial powders.

It should also be noted that the dispersant used in the two formulations described above
was "AEROSIL" alone as compared with the dispersant described in Example 1 which
comprised "AEROSIL" and a polyethylene glycol.

Example 3

Four compositions according to the invention were made up as in Example 1, using the following components:

5	<i>Composition (a)</i>		5
	“Synperonic“ 87K *	49% by weight	
10	A mixture of straight and branched chain primary C ₇ , C ₈ and C ₉ aliphatic and alicyclic alcohols ethoxylated		10
15	with an average of 6 moles of ethylene oxide (“Alphanol” 6)	11% by weight	15
	Sodium tripolyphosphate	25% by weight	
20	Sodium silicate	3% by weight	20
	Sodium percarbonate	7% by weight	
25	Carboxymethylcellulose	1% by weight	25
	“Fluolite” optical brightener	1% by weight	
30	Ethylene diamine tetra acetic acid (di-sodium salt)	1% by weight	30
	“Aerosil” dispersant	2% by weight	
35	<i>Composition (b)</i>		35
	“Synperonic” 87K *	31% by weight	
40	“Alphanol” 6	8% by weight	40
	Sodium tripolyphosphate	41% by weight	
45	Sodium percarbonate	10% by weight	45
	Sodium silicate	5% by weight	
	Carboxymethylcellulose	1% by weight	
50	Ethylene diamine tetra acetic acid (di-sodium salt)	1% by weight	50
	“Fluolite” optical brightener	1% by weight	
55	“Aerosil” dispersant	2% by weight	55

The above compositions are low foam detergents suitable for use with automatic washing machines.

	<i>Composition (c)</i>		
	"Synperonic" 87 K *	46% by weight	
5	Dodecyl benzene sulphonate	9% by weight	5
	Sodium tripolyphosphate	33% by weight	
10	Sodium silicate	6% by weight	10
	Sodium carbonate	1% by weight	
	Carboxymethylcellulose	1% by weight	
15	"Fluolite" optical brightener	1% by weight	15
	Ethylene diamine tetra acetic		
20	acid (di-sodium salt)	1% by weight	20
	"Aerosil" dispersant	2% by weight	
	<i>Composition (d)</i>		
25	"Synperonic" 87K *	48% by weight	25
	A mixture of isomeric branched		
30	chain primary C ₁₀ aliphatic alcohols		30
	ethoxylated to an average of 5 to 8		
	moles of ethylene oxide	12% by weight	
35	Sodium tripolyphosphate	31% by weight	35
	Sodium percarbonate	2% by weight	
40	Sodium silicate	2% by weight	40
	Carboxymethylcellulose	1% by weight	
45	Ethylene diamine tetra acetic		45
	acid (di-sodium salt)	1% by weight	
	"Fluolite" optical brightener	1% by weight	
50	"Aerosil" dispersant	2% by weight	50
	Compositions (c) and (d) are high foam detergents suitable for use in twin-tub washing machines. The sodium tripolyphosphate, silicate, and percarbonate were anhydrous in all cases.		
55	The above compositions were tested in washing efficiency and compared with three well-known commercial washing powders by the following procedure.		55
60	Pieces of 4 inches by 3 inches standard soiled cotton cloth supplied by Krefeld were washed in 1 litre test solutions for 10 minutes at 50°C and 100 revolutions per minute in a Tergotometer. The powders were used at a concentration of 5 grammes per litre and the compositions of the invention at a concentration of 1.25 grammes per litre. The light reflectance before and after washing was determined using a Gardner Reflectometer and the difference in reflectance before and after washing, which is a measure of the effectiveness of the washing process, was measured. The results were as follows:		60
65	Composition (a) reflectance change 29 units,		65
	Composition (b) reflectance change 29 units,		

Compositions (c) and (d) reflectance change 27 units.

The powder detergents gave reflectance changes of 30, 28 and 27 units respectively. These results indicate comparable washing efficiency using the products of this invention at the above concentrations.

5	<i>Example 4</i>	5
	A composition was made up as described in Example 1, from the following components:	
10	"Synperonic" 87K *	41% by weight
10	"Alphanol" 6	9% by weight
	Sodium tripolyphosphate (anhydrous)	33% by weight
15	Sodium silicate (anhydrous)	4% by weight
	Sodium percarbonate (anhydrous)	8% by weight
	Carboxymethylcellulose	1% by weight
20	Ethylene diamine tetra acetic	20
	acid (di-Sodium salt)	1% by weight
25	"Fluolite" optical brightener	1% by weight
	"Aerosil" dispersant	2% by weight

30 The washing test of Example 3 was repeated using the above formulation and comparing it with the best of the powder detergents tested in Example 3, but using Empa soiled cotton test squares at 60° C. The reflectance change in the powder detergent was 21 units and with the formulation was 28 units.

35 * A product of adding 7 moles of a mixture of ethylene oxide and propylene oxide in a molar proportion of 92 to 8 to a mixture of C₁₃ to C₁₅ primary alcohols of which 55% had straight chains and 45% 2-methyl substituted chains.

"Synperonic" and "Alphanol" are trade marks of Imperial Chemical Industries Ltd.

WHAT WE CLAIM IS:-

- 40 1. A detergent composition which is a liquid at room temperature and which comprises a dispersion of one or more builders in a substantially water free non-ionic liquid surfactant and which contains a dispersant for the builder.
- 45 2. A compositions as claimed in claim 1 in which the builder is sodium or potassium carboxy methylcellulose, a phosphate, a sodium or potassium carbonate, a clay, a sodium or potassium borate, sodium or potassium carbonate, a clay, a sodium or potassium borate, sodium or potassium perborate, sodium or potassium percarbonate, sodium or potassium metaspulphate, sodium or potassium sulphate or sodium or potassium chloride.
- 50 3. A composition as claimed in claim 1 or 2 in which at least 90% of the particles of the builder are less than 100 microns in diameter.
- 50 4. A composition as claimed in claim 1, 2 or 3 in which at least 90% of the particles of the builder are less than 10 microns in diameter.
- 50 5. A composition as claimed in any preceding claim in which the dispersant comprises finely divided silica.
- 55 6. A composition as claimed in claim 5 in which the average diameter of the silica particles is 7 to 40 millimicrons.
- 55 7. A composition as claimed in claim 5 or 6 which comprises a compound containing one or two polyether groups which has a molecular weight in the range 500 to 1,000,000.
- 60 8. A composition as claimed in any preceding claim in which the non-ionic surfactant is an alkoxylate of an amide, alkyl/phenol or alkanol.
- 60 9. A composition as claimed in any preceding claim which comprises (a) a non-ionic surfactant which is an alkoxylate of a C₁₂ to C₁₆ alcohol with 5 to 15 moles of ethylene and/or propylene oxide per mole, and (b) an alkoxylate of a linear or branched chain C₆ to C₁₁ alcohol with 2 to 8 moles of ethylene oxide per mole and/or an alkoxylate of an alkyl phenol with 2 to 6 moles of ethylene and/or propylene oxide per mole.
- 65 10. A composition as claimed in any preceding claim which comprises an anionic or cationic surfactant.

11. A composition as claimed in any preceding claim in which the non-ionic surfactant comprises 2 to 20 alkylene oxide units per mole.
12. A composition as claimed in any preceding claim which comprises 30 to 60% by weight of builder, the remainder being substantially non-ionic surfactant together with the dispersant. 5
13. A composition as claimed in claim 1 substantially as described in any of the Examples.
14. A process of washing fabric which comprises dissolving a composition as claimed in any preceding claim in water, contacting the fabric with the aqueous solution and agitating the fabric to separate it from soiling materials and removing the fabric from the solution. 10

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