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COMPOSITIONS DETERGENTES

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Description

TECHNICAL FIELD

[0001] The present invention relates to particulate detergent compositions containing nonionic surfactants. The invention is particularly concerned with particulate detergent compositions having high bulk density, especially those containing alkali metal aluminosilicate builder.

BACKGROUND AND PRIOR ART

[0002] Nonionic surfactants have beneficial cleaning characteristics when included in detergent formulations, as they are particularly effective in removing hydrophobic soils such as hydrocarbon oils, complex fats and other long-chain unsaturated and saturated glycerides.

[0003] However when particulate detergent compositions containing nonionic surfactants come in contact with aqueous solutions the nonionic surfactants tend to form viscous phases which impede delivery from the dispenser of an automatic washing machine or from a delivery device, and give poor dispersion and dissolution in the wash liquor.

[0004] In high bulk density powders the problem is exacerbated because the capillary diameter of the powder bed is smaller than in lower bulk density powders and water penetration is therefore slower. Delivery problems have also proved especially acute with powders containing water insoluble builders such as alkali metal aluminosilicates.

[0005] It has now been discovered that the difficulty of producing a detergent powder containing ethoxylated alcohol nonionic surfactants and having good delivery and dissolution characteristics, without the need for any processing modifications, can be overcome by the use of short-chain nonionic surfactants of strictly controlled alkyl chain length, and the exclusion of certain other ethoxylated nonionic surfactants, notably the longer-chain materials of low degrees of ethoxylation. Surprisingly, this benefit is achieved without loss of detergency performance, and performance can even be improved.

[0006] Particulate detergent compositions containing short-chain nonionic surfactants are disclosed in GB-A-1 460 646, GB-A-1 462 133, GB-A-1 462 134, GB-A-1 485 316 and GB-A-1 566 326 (Procter & Gamble); GB-A-1 519 433 and FR 2 303 850A (Rhone-Poulenc); EP 200 953A and WO 91 10718A (Henkel). However, the use of short-chain nonionic surfactants to improve the delivery characteristics of a high-bulk-density particulate detergent composition is not disclosed.

DEFINITION OF THE INVENTION

[0007] The present invention accordingly provides a particulate detergent composition having a bulk density of at least 600 g/l and comprising a surfactant system comprising a nonionic surfactant, at least one detergency builder and optionally other detergent ingredients, wherein the nonionic surfactant comprises a condensation product of ethylene oxide with an aliphatic alcohol having an average alkyl chain length of less than C_{12} and an average degree of ethoxylation from 4 to 8, and the surfactant system is free of ethoxylated nonionic surfactants which are condensation products of ethylene oxide and aliphatic alcohol having an average chain length of C_{12} or above and an average degree of ethoxylation below 7.

[0008] The invention further provides the use of a nonionic surfactant which is a condensation product of ethylene oxide with an aliphatic alcohol having an average alkyl chain length of less than C_{12} and an average degree of ethoxylation from 4 to 8 to improve the delivery into the wash of a particulate detergent composition having a bulk density of at least 600 g/l.

DETAILED DESCRIPTION OF THE INVENTION

The short-chain nonionic surfactant

[0009] The detergent compositions of the invention are characterised by a surfactant system containing as an essential ingredient a nonionic surfactant, which is a condensation product of ethylene oxide with an aliphatic alcohol with an average alkyl chain length less than C_{12} and an average degree of ethoxylation from 4 to 8. This component will be referred to hereinafter as the short-chain nonionic surfactant.

[0010] Commercial nonionic surfactants are generally mixtures containing a spread of chain lengths around an average value. The surfactant system is free of nonionic surfactants which are commercial materials having an average chain length of C_{12} and above and an average degree of ethoxylation below 7.

[0011] It is within the scope of the invention for ethoxylated nonionic surfactants, other than the specifically excluded class defined above, additionally to be present. However, preferred compositions of the invention are substan-

tially free of all ethoxylated nonionic surfactants (commercial mixtures), of any degree of ethoxylation, having an average alkyl chain length of C_{12} or above.

[0012] Preferably the short-chain nonionic surfactant is derived from an alcohol of which at least 25% by weight, more preferably at least 50 wt% and most preferably at least 75 wt%, has an alkyl chain length below C_{12}. Advantageously the surfactant system may be substantially free of any nonionic surfactant material having a chain length of C_{12} or above.

[0013] Despite the absence of longer-chain (C_{12} and above) low-EO (less than 7EO) nonionic surfactants, well-known for their oily soil detergency, the compositions of the invention exhibit excellent detergency performance on a range of soils and also show superior dispersion characteristics.

[0014] Nonionic surfactants having an average alkyl chain length within the range of from C_9 to $C_{11.5}$ are preferred; more specifically those having an average alkyl chain length within the ranges of from C_9 to C_{11}, and from C_{10} to $C_{11.5}$.

[0015] Either primary or secondary alcohol ethoxylates are used, but primary alcohol ethoxylates are generally preferred.

[0016] The average number of ethylene oxide groups per mole of alcohol in the nonionic condensation product is 4 to 8. It may advantageously be 6.5 or less.

[0017] Nonionic surfactants derived from alcohols containing some branched-chain material may give some benefits both in detergency and in improved powder delivery amd dissolution.

[0018] It is preferred for the level of free alcohol in the nonionic surfactant to be less than 5 wt%, more preferably less than 1 wt%.

[0019] Details of some nonionic alcohol ethoxylate surfactants suitable for use in the present invention are given below (* denotes Trade Mark). Mixtures of these materials may also be used in order to achieve intermediate degrees of ethoxylation.

Dobanol* 91 series ex Shell			
Ethoxylates:	Dobanol 91-5		5 EO
	Dobanol 91-6		6 EO
	Dobanol 91 4-6		4-6 EO
Nominal description: C_{9-11} alcohol with 20-25% branching (C_1-C_4).			
Average chain length:	10.14		
Chain length distribution:			
C_8	linear	0.7	0.7
C_9	linear	17.5	19.0
	C_8 2-methyl	1.0	
	C_7 2-ethyl	0.3	
	C_6 2-propyl	0.2	
C_{10}	linear	40.7	45.8
	C_9 2-methyl	2.9	
	C_8 2-ethyl	1.0	
	other branched	1.2	
C_{11}	linear	25.5	33.3
	C_{10} 2-methyl	2.4	
	C_9 2-ethyl	1.0	
	Other branched	4.4	
C_{12}	linear	0	1.6
	branched	1.6	

Lialet* 111 series ex Enichem			
Ethoxylates:	Lialet 111-4		4 EO
	Lialet 111-5		5 EO
	Lialet 111-6		6 EO
	Lialet 111 4-6		4-6 EO
	Lialet 111 6.9		6.9 EO
Nominal description: C_{11} alcohol with 50-60% branching (C_1-C_4).			
Average chain length:	11.0		
Chain length distribution:			
C_{11}	linear	49.2	96.10
	C_{10} 2-methyl	17.3	
	C_9 2-ethyl	9.3	
	C_8 2-propyl	9.7	
	C_7 2-butyl and C_6 2-pentyl	10.6	

Vista* (Alfonic*) series ex Vista Chemicals			
Ethoxylates:	Vista 1012-62		6.25 EO
	Vista 1012-52		4.3 EO
	Vista Novel II 1012-52		4.5 EO (narrow range)
Nominal description: C_{10-12} linear alcohol			
Average chain length:	10.20		
Chain length distribution:			
C_{10}	linear	90.0	
C_{12}	linear	10.0	

Other short-chain nonionic surfactants

[0020] The following materials are also suitable for use in the present invention:

Acropol* 91 4-6 ex Exxon:
C_{9-11} chain, 35% branching (C_{1-4}), 4-6 EO
Dobanol* 1 series ex Shell:
98.5% C_{11}, with traces of C_{10} and C_{12}
Synperonic* 91-4-6 ex ICI:
C_{9-11} chain, 60% branching (C_1), 4-6 EO
Lialet* 91 4-6 ex Enichem:
C_{9-11} chain, 60% branching (C_{1-4}), 4-6 EO
Inbentin* $C_{10}E_4$ ex Kolb:

C_{10} linear chain, 4 EO

Nonionic surfactants excluded from the present invention

[0021] Longer-chain nonionic surfactants having average degrees of ethoxylation below 7 are excluded from the present invention. Those include the following materials:

Coconut-based materials such as the Lorodac* series ex DAC Chemicals:
C_{12}-C_{16}, average chain length 12.75
Low-ethoxylated Synperonic* nonionics ex ICI, eg Synperonic A3 (3EO) :
C_{13-15}, average chain length 13.65:

C_{13}	linear	44.0	67.2
	C_{12} 2-methyl	11.9	
	C_{11} 2-ethyl	3.8	
	C_{10} 2-propyl	3.1	
	C_9 2-butyl and C_8 2-pentyl	4.4	
C_{15}	linear	20.9	35.1
	C_{14} 2-methyl	2.4	
	C_{13} 2-ethyl	1.0	
	C_{12} 2-propyl	0.8	
	C_{11} 2-butyl and C_{10} 2-pentyl and C_9 2-hexyl	2.4	

Low-ethoxylated Dobanol* 23 materials ex Shell (C_{12-13} with 18.1% branching):

C_{12}	38.4
C_{13}	58.9
C_{14}	1.2

Low-ethoxylated Dobanol* 25 materials ex Shell (C_{12-15} with 22.9% branching):

C_{12}	19.9
C_{13}	31.2
C_{14}	29.4
C_{15}	19.1

Low-ethoxylated Dobanol* 45 materials ex Shell (C_{14-15} with 14.8% branching):

C_{14}	60.3
C_{15}	37.5

Other ethoxylated nonionic surfactants

[0022] As indicated above, any other, longer-chain ethoxylated nonionic surfactants present should not have an average degree of ethoxylation of less than 7. Materials having an average chain-length of C_{12} or above and an average degree of ethoxylation of 7 or above may, however, be present.

[0023] Thus, materials corresponding to those listed above as excluded from the present invention, for example, the coconut, Synperonic and Dobanol 23 alcohol ethoxylates, but having higher degrees of ethoxylation, may be present in the compositions of the invention, in addition to the short-chain low-ethoxylated nonionic surfactant which is essential. For example, a short-chain material may be used in combination with coconut alcohol 7EO.

[0024] Most preferably, however, no ethoxylated nonionic surfactants, of any degree of ethoxylation, having average alkyl chain lengths of C_{12} or above are present.

[0025] The total amount of all nonionic detergent-active compounds present in the compositions of the invention is suitably within the range of of from 2 to 50 wt%, preferably from 5 to 30 wt%.

Other detergent-active compounds

[0026] Provided that nonionic surfactants of the class specifically excluded above are absent, other detergent-active materials may be present in the compositions of the invention.

[0027] Detergent-active material present other than the nonionic surfactants may be other anionic (soap or non-soap), cationic, zwitterionic, amphoteric, or any combination of these.

[0028] Anionic detergent-active compounds may be present in an amount of from 0 to 40 wt%, preferably from 0 to 20 wt%. It is preferred if the ratio of nonionic surfactant to anionic surfactant is within the range of 2:8 to 9:1.

[0029] Synthetic anionic surfactants are well known to those skilled in the art. Examples include alkylbenzene sulphonates, particularly sodium linear alkylbenzene sulphonates having an alkyl chain length of C_8-C_{15}; primary and secondary alkyl sulphates, particularly sodium C_{12}-C_{15} primary alcohol sulphates, olefin sulphonates; alkane sulphonates; dialkyl sulphosuccinate; and fatty acid ester sulphonates.

[0030] It may also be desirable to include one or more soaps of fatty acids. These are preferably sodium soaps derived from naturally occurring fatty acids, for example, the fatty acids from coconut oil, beef tallow, sunflower or hardened rapeseed oil.

Amount of surfactant system

[0031] The total amount of detergent-active material (surfactant) in the compositions of the invention is suitably from 5 to 50 wt%. Of particular interest are high-performance compositions containing relatively high levels of surfactant, preferably from 15 to 50 wt%.

[0032] Compositions may advantageously contain at least 20 wt%, more advantageously at least 25 wt%, of the surfactant system.

Preferred surfactant systems

[0033] Especially preferred compositions in accordance with the invention have surfactant systems consisting essentially of short-chain ethoxylated nonionic surfactant as defined above either in combination with primary alcohol sulphate (PAS), or alone.

[0034] The primary alcohol sulphate (PAS) that may optionally be present, preferably constituting up to 40 wt% of the surfactant system, may have a chain length in the range of C_8-C_{18}, preferably C_{12}-C_{16}, with a mean value preferably in the C_{12-15} range. Especially preferred is PAS consisting wholly or predominantly of C_{12}-C_{14} material.

[0035] If desired, mixtures of different chain lengths may be used as described and claimed in EP 342 917A (Unilever).

[0036] Predominantly or wholly straight-chain PAS is generally preferred; PAS of vegetable origin, and more especially PAS from coconut oil (cocoPAS) is especially preferred. However, it is also within the scope of the invention to use branched PAS as described and claimed in EP 439 316A (Unilever).

[0037] The PAS is present in the form of the sodium or potassium salt, the sodium salt generally being preferred.

[0038] Surfactant systems of especial interest consist essentially of

(i) from 60 to 100 wt%, preferably from 65 to 100 wt%, of the ethoxylated nonionic surfactant, and
(ii) from 0 to 40 wt%, preferably from 0 to 35 wt% of primary C_8-C_{18} alcohol sulphate.

[0039] Particulate detergent compositions of high bulk density containing such surfactant systems are described

and claimed in EP 544 492A (Unilever).

[0040] According to a first embodiment of the invention, the surfactant system consists essentially of from 65 to 80 wt%, preferably from 65 to 75 wt%, of ethoxylated nonionic surfactant (i) and from 20 to 35 wt%, preferably from 25 to 35 wt%, of the primary alcohol sulphate (ii). In this system, the following ethoxylated nonionic surfactants have been found to give especially good detergency:

an average alkyl chain length of C_{10}-$C_{11.5}$ and an average degree of ethoxylation of from 4 to 5.

[0041] According to a second embodiment of the invention, the surfactant system consists essentially of from 80 to 95 wt%, preferably from 85 to 95 wt%, of the ethoxylated nonionic surfactant (i) and from 5 to 20 wt%, preferably from 5 to 15 wt%, of the primary alcohol sulphate (ii). In this system, the following ethoxylated nonionic surfactants have been found to give especially good detergency:

an average alkyl chain length of C_{10}-$C_{11.5}$ and an average degree of ethoxylation of from 4 to 6.5.

[0042] According to a third embodiment of the invention, the surfactant system consists essentially of ethoxylated nonionic surfactant (i) alone. In this system, the following ethoxylated nonionic surfactants have been found to give especially good detergency:

(a) an average alkyl chain length of C_9-C_{11} and an average degree of ethoxylation of from 4.5 to 5.5, or
(b) an average alkyl chain length of C_{10}-$C_{11.5}$ and an average degree of ethoxylation of from 4 to 6.5.

[0043] However, in all three embodiments the use of any short-chain nonionic surfactant of chain length C_9 to $C_{11.5}$ and ethoxylation of 4 to 6.5 is beneficial.

Detergency builders

[0044] The detergent powders of the invention contain one or more detergency builders, suitably in an amount of from 5 to 80 wt%, preferably from 20 to 60 wt%.

[0045] The invention is especially applicable to compositions containing alkali metal aluminosilicates as builders.

[0046] Alkali metal (preferably sodium) aluminosilicates may generally be incorporated in amounts of from 5 to 60% by weight (anhydrous basis) of the composition, preferably from 25 to 55 wt%, and suitably, in a heavy duty detergent composition, from 25 to 48 wt%.

[0047] The alkali metal aluminosilicate may be either crystalline or amorphous or mixtures thereof, having the general formula:

$$0.8\text{-}1.5\ Na_2O\ .\ Al_2O_3\ .\ 0.8\text{-}6\ SiO_2$$

[0048] These materials contain some bound water and are required to have a calcium ion exchange capacity of at least 50 mg CaO/g. The preferred sodium aluminosilicates contain 1.5-3.5 SiO_2 units (in the formula above). Both the amorphous and the crystalline materials can be prepared readily by reaction between sodium silicate and sodium aluminate, as amply described in the literature.

[0049] Suitable crystalline sodium aluminosilicate ion-exchange detergency builders are described, for example, in GB 1 429 143 (Procter & Gamble). The preferred sodium aluminosilicates of this type are the well-known commercially available zeolites A and X, and mixtures thereof.

[0050] The zeolite may be the commercially available zeolite 4A now widely used in laundry detergent powders. However, according to a preferred embodiment of the invention, the zeolite builder incorporated in the compositions of the invention is maximum aluminium zeolite P (zeolite MAP) as -described and claimed in EP 384 070A (Unilever). Zeolite MAP is defined as an alkali metal aluminosilicate of the zeolite P type having a silicon to aluminium ratio not exceeding 1.33, preferably within the range of from 0.90 to 1.33, and more preferably within the range of from 0.90 to 1.20.

[0051] Especially preferred is zeolite MAP having a silicon to aluminium ratio not exceeding 1.07. The calcium binding capacity of zeolite MAP is generally at least 150 mg CaO per g of anhydrous material.

[0052] In the compositions of the present invention, the use of zeolite MAP gives two particular advantages: it is a more effective builder than zeolite 4A, and, quite independently, it enables higher total surfactant levels, and more nonionic-rich surfactant systems, to be incorporated without loss of powder flow properties.

[0053] The use of zeolite MAP as a carrier for liquid detergent ingredients is described and claimed in EP 521 635A (Unilever).

[0054] Preferred zeolite MAP for use in the present invention is especially finely divided and has a d_{50} (as defined below) within the range of from 0.1 to 5.0 microns, more preferably from 0.4 to 2.0 microns and most preferably from 0.4 to 1.0 microns. The quantity "d_{50}" indicates that 50 wt% of the particles have a diameter smaller than that figure, and there are corresponding quantities "d_{80}", "d_{90}" etc. Especially preferred materials have a d_{90} below 3 microns as well as a d_{50} below 1 micron.

[0055] The compositions in accordance with the invention may contain alkali metal, preferably sodium, carbonate, to increase detergency and to ease processing. Sodium carbonate may generally be present in amounts ranging from 1 to 60 wt%, preferably from 2 to 40 wt%, and most suitably from 2 to 13 wt%. However, compositions free of alkali metal carbonate are also within the scope of the invention.

[0056] Other builders may also be included in the detergent compositions of the invention is necessary or desired.

[0057] Especially preferred supplementary builders are polycarboxylate polymers, more especially polyacrylates and acrylic/maleic copolymers, suitably used in amounts of from 0.5 to 15 wt%, especially from 1 to 10 wt%; and monomeric polycarboxylates, more especially citric acid and its salts, suitably used in amounts of from 3 to 35 wt%, more preferably from 5 to 30 wt%.

[0058] Preferred compositions of the invention preferably do not contain more than 5 wt% of inorganic phosphate builders, and are desirably substantially free of phosphate builders.

Other ingredients

[0059] Fully formulated laundry detergent compositions in accordance with the present invention may additionally contain any suitable ingredients normally encountered, for example, inorganic salts such as sodium silicate or sodium sulphate; organic salts such as sodium citrate; antiredeposition aids such as cellulose derivatives and acrylate or acrylate/maleate polymers; fluorescers; bleaches, bleach precursors and bleach stabilisers; proteolytic and lipolytic enzymes; dyes; coloured speckles; perfumes; foam controllers; fabric softening compounds.

Processing and powder properties

[0060] The particulate detergent compositions of the invention may in principle be prepared by any of the available tower (spray-drying), non-tower (granulation) or combination processes.

[0061] Of especial interest are compositions of high bulk density - at least 600 g/l, preferably at least 700 g/l and more preferably at least 800 g/l - which may be prepared by granulation and/or densification in a high-speed mixer/granulator.

[0062] The high-speed mixer/granulator, also known as a high-speed mixer/densifier, may be a batch machine such as the Fukae (Trade Mark) FS, or a continuous machine such as the Lödige (Trade Mark) Recycler CB30. Suitable processes are described, for example, in EP 340 013A, EP 367 339A, EP 390 251A, EP 420 417A and EP 506 184A (Unilever).

[0063] One suitable method comprises spray-drying a slurry of compatible heat-insensitive ingredients, including zeolite and any other builders, and at least part of the detergent-active compounds: densifying the resulting base powder in a batch or continuous high-speed mixer/granulator; and then spraying on or postdosing those ingredients, for example, bleach, enzymes, unsuitable for processing via the slurry.

[0064] In another method, the spray-drying step can be omitted altogether, a high bulk density base powder being prepared directly from its constituent raw materials, by mixing and granulating in a high-speed mixer/granulator, and then postdosing bleach and other ingredients as in the spray-drying/post-tower densification route.

[0065] Generally the inorganic builders and other inorganic materials (for example, zeolite, sodium carbonate) are granulated with the surfactants, which act as binders and granulating or agglomerating agents. Where an anionic surfactant such as PAS is present, a mobile surfactant blend as described in EP 265 203A (Unilever) or EP 507 402A (Unilever) may suitably be used. Any optional ingredients as previously mentioned may be incorporated at any suitable stage in the process. In accordance with normal detergent powder manufacturing practice, bleach ingredients (bleaches, bleach precursor, bleach stabilisers), proteolytic and lipolytic enzymes, coloured speckles, perfumes and foam control granules are most suitably admixed (postdosed) to the dense granular product after it has left the high-speed mixer/granulator.

[0066] The low-ethoxylated short-chain nonionic surfactants with which the present invention is concerned will not normally be included in the base powder but will be admixed with, for example, sprayed onto, the finished base powder. Nonionic surfactants of higher ethoxylation may be included in the base powder, post-added, or both. Preferably at least a part of any higher-ethoxylated nonionic surfactant is included in the base powder, while either low-ethoxylated surfactant alone or a mixture of higher- and low-ethoxylated nonionic surfactant is post-added.

EXAMPLES

[0067] The following non-limiting examples illustrate the invention. Examples identified by numbers are those of the invention, those identified by letters are comparative. Parts and percentages are by weight unless otherwise stated.

[0068] The abbreviations used in the Examples indicate the following materials:

cocoPAS	Linear C_{12-14} primary alcohol sulphate (sodium salt) derived from coconut oil, ex Philippine Refining Co.
Zeolite 4A	Wessalith (Trade Mark) P powder ex Degussa
Zeolite MAP	Zeolite MAP prepared by a method similar to that described in Examples 1 to 3 of EP 384 070A (Unilever); Si:Al ratio 1.0-1.07.
Carbonate	Sodium carbonate
Silicate	Sodium alkaline silicate
Metaborate	Sodium metaborate
Polymer	Acrylic/maleic copolymer: Sokalan (Trade Mark) CP5 ex BASF
Perborate mono	Sodium perborate monohydrate
TAED	Tetraacetylethylenediamine, as 83 wt% granules
EDTMP	Ethylenediaminetetramethylenephosphonic acid, calcium salt: Dequest (Trade Mark) 2041 or 2047 ex Monsanto (34 wt% active)
Antifoam	Antifoam granules in accordance with EP 266 863B (Unilever)

Examples 1 to 4, Comparative Example A

[0069] Detergent compositions having a surfactant system consisting of 30 parts of cocoPAS and 70 parts of nonionic surfactant were prepared to the following general formulation:

	parts	%
cocoPAS	5.10	6.71
Nonionic surfactant (see below)	11.90	15.66
Zeolite 4A	32.0	42.11
Carbonate	10.0	13.16
Silicate	0.5	0.66
Metaborate	16.5	21.70
	76.0	100.00

[0070] Detergencies (removal of radio-labelled triolein soil from polyester) were compared in the tergotometer using a 5 g/l product concentration, 24° (French) hard water and a wash temperature of 20°C.

[0071] The results, in Table 1, show that the detergency of the coconut 7EO/3EO can be matched or surpassed with the shorter-chain materials provided that the degree of ethoxylation is suitably chosen. In this PAS/nonionic system the Lialet 111-4 and Lialet 111-5 gave excellent results.

Table 1

Ex.	Nonionic surfactant	Chain length (average)	EO	Detergency
1	Dobanol 91-5	10.14	5.0	12.4
2	Lialet 111-4	11.0	4.0	27.1
3	Lialet 111-5	11.0	5.0	27.1
4	Lialet 111-6	11.0	6.0	9.5
A	Coco 7EO (30 pts), coco 3EO-(40 pts).	12.75	4.5-5	23.3

Examples 5 to 8, Comparative Example B

[0072] The procedure of Examples 1 to 4 and A was repeated using compositions in which the surfactant systems

each consisted of 10 parts of cocoPAS and 90 parts of ethoxylated nonionic. The results are shown in Table 2.

[0073] In this PAS/nonionic system, the best nonionics were Lialet 111-4 and Lialet 111-5. Dobanol 91-5 and Lialet 111-6 also gave acceptable results.

	parts	%
cocoPAS	1.70	2.24
Nonionic surfactant (see below)	15.30	20.13
Zeolite 4A	32.0	42.11
Carbonate	10.0	13.16
Silicate	0.5	0.66
Metaborate	16.5	21.70
	76.0	100.00

Table 2

Ex.	Nonionic surfactant	Chain length (average)	EO	Detergency
5	Dobanol 91-5	10.14	5.0	33.5
6	Lialet 111-4	11.0	4.0	41.7
7	Lialet 111-5	11.0	5.0	37.8
8	Lialet 111-6	11.0	6.0	34.2
A	Coco 7EO (40 pts), coco 3EO (50 pts).	12.75	4.5-5	36.1

Examples 9 to 12, Comparative Example C

[0074] The procedure of Examples 1 to 6 and A was repeated using compositions containing ethoxylated nonionic surfactant as the sole surfactant. The results are shown in Table 3.

[0075] In an all-nonionic system, the best performers were found to be Dobanol 91-5, and all three Lialet 111's.

Table 3

Ex.	Nonionic surfactant	Chain length (average)	EO	Detergency
9	Dobanol 91-5	10.14	5.0	53.3
10	Lialet 111-4	11.0	4.0	51.4
11	Lialet 111-5	11.0	5.0	49.9
12	Lialet 111-6	11.0	6.0	50.8
C	Coco 7EO (50 pts), coco 3EO (50 pts).	12.75	4.5-5	47.6

Examples 13 and 14, Comparative Example F

[0076] These Examples show how the use of short-chain nonionic surfactants in accordance with the invention improve the dissolution of a particulate detergent composition in the wash liquor.

[0077] Detergent base powders having bulk densities of about 800 g/litre were prepared to the following general formulation:

	parts	wt%
Zeolite	51.2	31.8
Sodium Citrate	5.3	8.5
Water	9.2	14.8
Nonionic surfactant	15.8	25.5
	62.1	100.0

[0078] The powders were prepared by spray-drying a slurry of all the ingredients except the nonionic surfactant, which was subsequently stirred into the powder and fluid bed mixed for 10 minutes at 70°C; the powders were then allowed to weather. The nonionic surfactants used were as follows:

Ex.	Nonionic surfactant	Chain length (average)	EO
F	Synperonic A7 (ICI)	13.65	7.0
G	Coco 6.5 EO (Kolb)	12.75	6.5
13	Dobanol 91-6 (Shell)	10.14	6.0
14	Vista 1012-62 (Vista)	10.2	6.25

[0079] The dissolution of the powders was studied in a Miele (Trade Mark) W756 front-loading automatic washing machine. 15 g of the powder was placed in the drum of the machine, which was programmed for the economy main wash with a cold water fill (10.5 litres demineralised water, isothermal at 11°C). No load was present.

[0080] The percentage of the powder dissolved was calculated using a standard conductance procedure. This involved measuring the conductance of the wash liquor at a given time and comparing the reading with that of a liquor containing the -same weight of fully dissolved powder of identical formulation. The results are tabulated in Table 6.

Table 6

	Amount of powder dissolved (%)			
Time (mins)	0.5	1.0	2.0	3.0
F	53.8	79.2	91.7	94.9
G	42.5	74.4	91.7	96.7
13	59.9	82.9	94.6	97.3
14	59.1	83.9	94.9	97.8

Examples 15 to 17 and Comparative Example H

[0081] A similar experiment was carried out using fully formulated detergent powders, in which base powders similar to those used in Examples 13, 14 and F were admixed with other ingredients to give powders having bulk densities of about 800 g/litre having the following formulations:

	wt%
Zeolite	31.8

(continued)

	wt%
Sodium Citrate	5.3
Water	9.2
Surfactant	15.8
	62.1
Carbonate	9.7
Perborate mono	15.0
TAED	7.8
EDTMP	0.4
Antifoam granules	2.5
Silicate	2.5
	100.0

[0082] The surfactants used were as follows:

Ex.	Nonionic surfactant	Chain length (av.)	EO
H	Synperonic A7 (ICI)	13.65	7.0
15	Dobanol 91-4 (Shell)	10.14	4.0
16	Dobanol 91-4 (Shell) (70 pts), cocoPAS (30 pts)	10.14	4.0
17	Lialet 111-4	11.0	4.0

[0083] Dissolution was assessed using the methodology of Examples 13, 14 and F, with the difference that the powder sample size was 25 g. Results were as shown in Table 7.

Table 7

	Amount of powder dissolved (%)			
Time (mins)	0.5	1.0	2.0	3.0
H	33.5	61.2	88.1	96.3
15	43.4	73.4	94.3	98.0
16	38.0	65.5	93.6	98.6
17	41.6	69.8	92.5	97.1

Example 18 and Comparative Example J

[0084] This Example demonstrates the benefit of short-chain nonionic surfactant in improving delivery of powder from the dispenser of a front-loading automatic washing machine.

[0085] High-bulk-density (about 800 g/litre) particulate detergent compositions were prepared to the general formulations used in Examples 15 to 17. The surfactants used were as follows:

Ex.	Nonionic surfactant	Chain length (av)	EO
J	Synperonic A7	13.65	7.0
18	Dobanol 91-6	10.14	6.0

[0086] To determine dispenser residues, an experimental procedure similar to that described for Examples 13 and 14 was carried out using the same washing machine and programme, and 25 g powder samples. However, after 8 minutes, when the water inlet part of the wash cycle was complete, the machine was stopped and the residue of the powder removed from the dispenser drawer, dried and weighed directly.

[0087] This procedure was repeated three times for each powder. The mean residue remaining in the dispenser was calculated as a percentage of the original weight of powder. The results are shown in Table 8.

Table 8

Example	Mean Residue (wt%)
J	13.6
18	2.8

Example 19, Comparative Example K

[0088] This Example demonstrates, using three different test methods, the benefit of short-chain nonionic surfactant in improving powder solubility and reducing particulate residues deposited on washed articles.

[0089] The powders had the general formulation given below. In each case, the base powder was prepared by granulation with in-situ neutralisation in a high-speed mixer/granulator, as described in EP 420 417A and EP 506 184A (Unilever), and the remaining ingredients were then admixed. The finished powders had bulk densities in the 800-900 g/l range. All had a "fines" (particles smaller than 180 microns) content below 5 wt%.

	wt%
CocoPAS	5.81
Nonionic surfactant	13.16
Soap	2.04
Zeolite MAP	36.03
Carbonate	0.96
SCMC	0.89
Water	4.98
	63.88
Silicate	2.90
Percarbonate	20.50
Mn catalyst	2.40
TAED	4.75
EDTMP	0.37
Enzyme granules	1.75
Antifoam granules	3.00

(continued)

	wt%
Perfume	0.45
	100.00

[0090] The nonionic surfactants used were as follows:

Ex K	Coco 7EO (44 parts)	12.75	7EO
	Coco 3EO (56 parts)	12.75	3EO
Ex 19	Vista 1012-62	10.2	6.25 EO

(i) Solubility test

[0091] Each powder sample was dispersed in water at 20°C and stirred for 2 minutes. The liquor was then passed through a 100 micrometre wire filter, and any solid residues that would not pass through the filter were dried for 24 hours at 100°C and weighed.

	Residue (wt% of sample)
Comparative Example K	3.4
Example 19	3.2

(ii) "Cage" test

[0092] Delivery characteristics of the powders were compared using a model system which simulates the delivery of a powder in an automatic washing machine, under more adverse conditions than those normally encountered in a real wash situation.

[0093] For this test a cylindrical vessel having a diameter of 4 cm and a height of 7 cm, made of 600 micrometre pore size stainless steel mesh, and having a top closure made of Teflon and a bottom closure of the mesh just described, was used. The top closure had inserted therein a 30 cm metal rod to act as a handle, and this handle was attached to an agitator arm positioned above 1 litre of water at 20°C in an open container. By means of this agitator apparatus the cylindrical vessel, held at 45 degrees, could be rotated through a circle with a 10 cm radius over a period of 2 seconds and allowed to rest for 2 seconds, before the start of the next rotation/rest cycle.

[0094] A 50 g powder sample was introduced into the cylindrical vessel which was then closed. The vessel was attached to the agitator arm which was then moved down to a position such that the top of the cylindrical vessel was just below the surface of the water. After a 10 second delay, the apparatus was operated for 15 rotation/rest cycles.

[0095] The cylindrical vessel and handle were removed from the water and and the vessel detached from the handle. Surface water was carefully poured off, and any powder residues transferred to a preweighed container and dried for 24 hours at 100°C. The weight of dried residue as a percentage of the initial powder weight (50 g) was then calculated.

	Residue (wt% of sample)
Comparative Example K	51.6
Example 19	26.6

[0096] It must be stressed that because the powder is confined in the cylindrical vessel during the test the residue values seen will be much higher than in a real situation where an open delivery device is used. The test is nevertheless valuable in detecting differences in wetting and delivery behaviour between different formulations and checking that behaviour under the worst possible conditions.

(iii) Black pillowcase test

[0097] This test employed a Siemens Siwamat (Trade Mark) Plus 3700 front-loading automatic washing machine, and the methodology was as follows.

[0098] A 100 g dose of powder was placed in a flexible delivery device of the type supplied with commercially available high bulk density powders, for example, Lever Persil (Trade Mark) Micro System powders in the UK: a spherical container of flexible plastics material having a diameter of approximately 4 cm and a top opening of diameter approximately 3 cm.

[0099] The delivery device was placed inside a black cotton pillowcase having dimensions of 30 cm by 60 cm, taking care to keep it upright, and the pillowcase was then closed by means of a zip fastener. The pillowcase containing the (upright) delivery device was then placed on top of a 3.5 kg dry cotton washload in the drum of the washing machine.

[0100] The machine was operated on the "heavy duty cycle" at a wash temperature of 60°C, using water of 15° French hardness and an inlet temperature of 20°C. At the end of the wash cycle the pillowcase was removed, opened and turned inside out, and the level of powder residues on its inside surfaces determined by visual assessment using a scoring system of 1 to 3: a score of 3 corresponds to a residue of approximately 75 wt% of the powder, while 1 indicates no residue. A panel of five assessors was used to judge each pillowcase and allot a score. With each powder the wash process was carried out ten times and the scores were averaged over the ten repeats.

[0101] The scores were as follows:

Example K	1.0
Example 19	0.3

Example 20, Comparative Example L

[0102] In this Example the dispersability of high bulk density base powders containing different nonionic surfactants was compared in a test designed to detect the formation of gel surfactant phases as the powder is wetted.

[0103] The powders, made by a high-speed granulation process as described in Example 19, had the following formulations (in weight%) and bulk densities above 800 g/litre:

	L	20
CocoPAS	9.5	9.5
Nonionic surfactant:		
Lorodac 7	21.5	-
Dobanol 91-6T	-	22.7
Soap	3.3	-
Zeolite MAP (anhydr)	55.2	57.2
SCMC	1.5	1.2
Fluorescers	-	0.4
Water	9.0	9.0
	100.0	100.0

[0104] The nonionic surfactants in these powders were as follows:

		Chain length (average)	
Example L	Lorodac 7	12.75	7EO
Example 20	Dobanol 91-6T	10.14	6EO

[0105] The dispersion test was carried out as follows. An 0.3 g sample of powder was placed in a small spoon and wetted by holding the spoon horizontally in water at 10°C for 1 minute. The spoon was then removed and surplus water poured off. The spoon with the damp powder was then placed horizontally in a 500 ml beaker of water at 10°C and a stirrer (a magnetic flea set to give a 25 mm vortex) was activated. Turbidity (as indicator of the dispersion of the zeolite) was measured as a function of time.

[0106] The 90% dispersion times were as follows:

Comparative Example L	6.25 minutes
Example 20	1.33 minutes

Example 21, Comparative Example M

[0107] The procedure of Examples 20 and L was repeated using two further base powders of bulk density above 800 g/litre, also prepared by high-speed granulation as in previous Examples. The formulations (in parts by weight) were as follows:

	M	21
CocoPAS	6.51	6.51
Nonionic surfactant:		
Lorodac 7	6.48	-
Lorodac 3	8.19	-
Lialet 111-7	-	6.48
*Lialet 111-3	-	8.19
Soap	2.26	2.26
Zeolite MAP (hydr)	41.74	41.74
Carbonate	1.11	1.11
SCMC	1.02	1.02

* not part of the short chain surfactants of the invention

[0108] The nonionic surfactants were as follows:

		Chain length (av.)	
Example M	Lorodac 7	coconut (12.75)	7EO
	Lorodac 3	coconut (12.75)	3EO
Example 21	Lialet 111-7	11.0	7EO
	*Lialet 111-3	11.0	3EO

* not part of the short chain surfactants of the invention

[0109] The 90% dispersion times were as follows:

Comparative Example M	4.50 minutes
Example 21	1.66 minutes

Examples 22 and 23, Comparative Example N

[0110] In this experiment, a comparison was made between the detergency of a predissolved powder, and the detergency of the same powder when added to the tergotometer as a wetted powder. The difference indicates the delay in, or loss of, detergency attributable to incomplete powder dissolution.

[0111] Base powders were prepared by high-speed granulation as in earlier Examples, and the remaining ingredients were postdosed. The bulk densities of the powders were above 800 g/litre, and the formulations (in parts by weight) were as follows:

	N	22	23
Base powder			
CocoPAS	6.51	6.51	-
Nonionic surfactant:			
Lorodac 7	6.48	-	-
Lorodac 3	8.19	-	-
Lialet 111-7	-	6.48	-
*Lialet 111-3	-	8.19	-
Vista Novel II 1012-52	-	-	14.67
Soap	2.26	2.26	2.26
Zeolite MAP (hydr)	41.74	41.74	41.74
Carbonate	1.11	1.11	1.11
SCMC	1.02	1.02	1.02
Postdosed			
Coated percarbonate	16.85	16.85	16.85
Compacted silicate (80%)	3.67	3.67	3.67

* not part of the short chain surfactants of the invention.

[0112] The nonionic surfactants were as follows:

		Chain length (av.)	
Example N	Lorodac 7	coconut (12.75)	7EO
	Lorodac 3	coconut (12.75)	3EO
Example 22	Lialet 111-7	11.0	7EO
	*Lialet 111-3	11.0	3EO
Example 23	Vista Novel II 1012-52 (narrow range)	10.2	4.5 EO

* not part of the short chain surfactants of the invention

[0113] The tests were carried out using radio-labelled triolein model soil on polyester fabric at 20°C in 500 ml of 24° (calcium only) hard water, at a product concentration of 5 g/litre.

[0114] For the test runs using wetted powder, the powder sample (2.5 g) was placed in a heap on a piece of cotton sheeting (10 cm x 10 cm), wetted with a small amount of demineralised water, and allowed to stand for 2 minutes before adding to the wash water. The wash was then started immediately. For the test runs using predissolved powder, the powders were dissolved fully in the wash water before the start of the wash.

[0115] Detergencies are expressed as percentage removal of the triolein soil, measured after wash times of 6, 10 and 20 minutes. The percentage detergency delivered is defined as follows:

$$\frac{\text{Detergency as powder}}{\text{Detergency predissolved}} \times 100$$

Comparative Example N

[0116]

Wash time (minutes)	Detergency		% Detergency delivered
	predissolved	as powder	
6	16.56	6.82	41.2
10	27.31	12.88	47.2
20	40.96	25.14	61.4

Example 22

[0117]

Wash time (minutes)	Detergency		% Detergency delivered
	predissolved	as powder	
6	11.07	6.95	62.8
10	18.41	12.99	70.6
20	27.69	24.76	89.4

Example 23

[0118]

Wash time (minutes)	Detergency		% Detergency delivered
	predissolved	as powder	
6	60.50	36.07	59.6
10	70.91	52.35	73.8
20	79.36	68.20	85.9

[0119] These results show that the shorter-chain nonionic surfactants delivered a higher percentage of the maximum possible detergency. The results also show the better detergency given by the narrow-range short chain Vista material, as compared with a mixture of two broader-range materials.

Claims

1. A particulate detergent composition having a bulk density of at least 600 g/l and comprising a surfactant system comprising a nonionic surfactant, at least one detergency builder and optionally other detergent ingredients, wherein the nonionic surfactant comprises a condensation product of ethylene oxide with an aliphatic alcohol having an average alkyl chain length of less than C_{12} and an average degree of ethoxylation from 4 to 8, and the surfactant system is free of ethoxylated nonionic surfactants which are condensation products of ethylene oxide and aliphatic alcohol having an average chain length of C_{12} or above and an average degree of ethoxylation below 7.

2. A detergent composition as claimed in claim 1, wherein the nonionic condensation product has an average alkyl chain length within the range of from C_9 to $C_{11.5}$ and an average degree of ethoxylation of from 4 to 8.

3. A detergent composition as claimed in claim 1, wherein the surfactant system is substantially free of ethoxylated nonionic surfactant having an average alkyl chain length of C_{12} or above.

4. A detergent composition as claimed in claim 1, wherein at least 50% by weight of the alcohol from which the nonionic condensation product is derived has an alkyl chain length below C_{12}.

5. A detergent composition as claimed in claim 4, wherein at least 75% by weight of the alcohol from which the nonionic condensation product is derived has an alkyl chain length below C_{12}.

6. A detergent composition as claimed in claim 1, wherein the nonionic condensation product has an average chain length within the range of from C_9 to C_{11}.

7. A detergent composition as claimed in claim 1, wherein the alcohol of the nonionic condensation product has an average chain length of within the range of from C_{10} to $C_{11.5}$.

8. A detergent composition as claimed in claim 1, wherein the average degree of ethoxylation of the nonionic condensation product lies within the range of from 4 to 6.5.

9. A detergent composition as claimed in claim 1, wherein the surfactant system further comprises anionic surfactant.

10. A detergent composition as claimed in claim 9, wherein the anionic surfactant comprises primary alcohol sulphate.

11. A detergent composition as claimed in claim 9, wherein the surfactant system consists essentially of

    (i) from 60 to 100 wt% of the ethoxylated nonionic surfactant, and
    (ii) from 0 to 40 wt% of primary C_8-C_{18} alcohol sulphate.

12. A detergent composition as claimed in claim 1, which contains from 15 to 50 wt% of the surfactant system.

13. A detergent composition as claimed in claim 1, which comprises from 5 to 80 wt% of a detergency builder.

14. A detergent composition as claimed in claim 13, which comprises as detergency builder from 20 to 60 wt% (anhydrous basis) of alkali metal aluminosilicate.

15. A detergent composition as claimed in claim 13, which comprises as detergency builder from 20 to 60 wt% (anhydrous basis) of alkali metal aluminosilicate which comprises zeolite P having a silicon to aluminium ratio not exceeding 1.33.

16. A detergent composition as claimed in claim 1, having a bulk density of at least 700 g/l.

17. Use of a nonionic surfactant which is a condensation product of ethylene oxide with an aliphatic alcohol having an average alkyl chain length of less than C_{12} and an average degree of ethoxylation from 4 to 8 to improve the delivery into the wash of a particulate detergent composition having a bulk density of at least 600 g/l.

Patentansprüche

1. Eine teilchenförmige Waschmittelzusammensetzung mit einer Schüttdichte von zumindest 600 g/l und enthaltend ein Surfactant-System, enthaltend ein nichtionisches Surfactant, zumindest einen Waschkraftbuilder und gegebenenfalls andere Waschmittelbestandteile, worin das nichtionische Surfactant ein Kondensationsprodukt von Ethylenoxid mit einem aliphatischen Alkohol mit einer durchschnittlichen Alkyl-Kettenlänge von weniger als C_{12} und einem durchschnittlichen Ethoxylierungsgrad mit einem Wert von 4 bis 8 umfaßt, und das Surfactant-System frei von ethoxylierten nichtionischen Surfactants ist, welche Kondensationsprodukte von Ethylenoxid und aliphatischem Alkohol sind, mit einer durchschnittlichen Kettenlänge von C_{12} oder darüber und einem durchschnittlichen Ethoxylierungsgrad von unterhalb 7.

2. Eine Waschmittelzusammensetzung nach Anspruch I, worin das nichtionische Kondensationsprodukt eine durchschnittliche Alkyl-Kettenlänge innerhalb des Bereiches von C_9 bis $C_{11,5}$ und einen durchschnittlichen Ethoxylierungsgrad von 4 bis 8 hat.

3. Eine Waschmittelzusammensetzung nach Anspruch I, worin das Surfactant-System im wesentlichen frei von ethoxyliertem nichtionischen Surfactant mit einer durchschnittlichen Alkyl-Kettenlänge von C_{12} oder darüber ist.

4. Eine Waschmittelzusammensetzung nach Anspruch 1, worin zumindest 50 Gewichtsprozent des Alkohols, von dem das nichtionische Kondensationsprodukt abgeleitet ist, eine Alkyl-Kettenlänge von unterhalb C_{12} aufweisen.

5. Eine Waschmittelzusammensetzung nach Anspruch 4, worin zumindest 75 Gewichtsprozent des Alkohols, von dem das nichtionische Kondensationsprodukt abgeleitet ist, eine Alkyl-Kettenlänge von unterhalb C_{12} aufweisen.

6. Eine Waschmittelzusammensetzung nach Anspruch I, worin das nichtionische Kondensationsprodukt eine durchschnittliche Kettenlänge innerhalb des Bereichs von C_9 bis C_{11} aufweist.

7. Eine Waschmittelzusammensetzung nach Anspruch I, worin der Alkohol des nichtionischen Kondensationsprodukts eine durchschnittliche Kettenlänge von innerhalb des Bereichs von C_{10} bis $C_{11,5}$ aufweist.

8. Eine Waschmittelzusammensetzung nach Anspruch 1, worin der durchschnittliche Ethoxylierungsgrad des nichtionischen Kondensationsprodukts innerhalb des Bereichs von 4 bis 6,5 liegt.

9. Eine Waschmittelzusammensetzung nach Anspruch 1, worin das Surfactant-System ferner anionisches Surfactant enthält.

10. Eine Waschmittelzusammensetzung nach Anspruch 9, worin das anionische Surfactant primäres Alkoholsulfat enthält.

11. Eine Waschmittelzusammensetzung nach Anspruch 9, worin das Surfactant-System im wesentlichen aus

(i) von 60 bis 100 Gewichtsprozent des ethoxylierten nichtionischen Surfactants, und

(ii) von 0 bis 40 Gewichtsprozent des primären C_8-C_{18}-Alkoholsulfats

besteht.

12. Eine Waschmittelzusammensetzung nach Anspruch 1, welche von 15 bis 50 Gewichtsprozent des Surfactant-Systems enthält.

13. Eine Waschmittelzusammensetzung nach Anspruch 1, welche von 5 bis 80 Gewichtsprozent eines Waschkraftbuilders enthält.

14. Eine Waschmittelzusammensetzung nach Anspruch 13, welche als Waschkraftbuilder von 20 bis 60 Gewichtsprozent (wasserfreie Basis) Alkalimetallaluminosilicat enthält.

15. Eine Waschmittelzusammensetzung nach Anspruch 13, welche als Waschkraftbuilder von 20 bis 60 Gewichtsprozent (wasserfreie Basis) Alkalimetallaluminosilicat enthält, welches Zeolith P mit einem Silicium-zu-Aluminium-Verhältnis, das 1,33 nicht übersteigt, enthält.

16. Eine Waschmittelzusammensetzung nach Anspruch 1, die eine Schüttdichte von zumindest 700 g/ℓ aufweist.

17. Die Verwendung eines nichtionischen Surfactants, welches ein Kondensationsprodukt von Ethylenoxid ist, mit einem aliphatischen Alkohol mit einer durchschnittlichen Alkyl-Kettenlänge von weniger als C_{12} und einem durchschnittlichen Ethoxylierungsgrad von 4 bis 8 zur Verbesserung der Zuführung einer teilchenförmigen Waschmittelzusammensetzung mit einer Schüttdichte von zumindest 600 g/ℓ in die Wäsche.

Revendications

1. Une composition détergente particulaire ayant une densité en masse d'au moins 600 g/l et comprenant un système tensioactif comprenant un agent tensioactif non ionique, au moins un édificateur de détergence et, de façon optionnelle, d'autres ingrédients détergents, dans laquelle l'agent tensioactif non ionique comprend un produit de condensation d'un oxyde d'éthylène avec un alcool aliphatique ayant une longueur de chaîne alkyle inférieure à C_{12} et un degré moyen d'éthoxylation allant de 4 à 8, le système tensioactif ne contenant pas d'agents tensioactifs non ioniques éthoxylés qui soient des produits de condensation d'oxyde d'éthylène et d'alcool aliphatique ayant une longueur de chaîne de C_{12} ou supérieure et un degré moyen d'éthoxylation inférieur à 7.

2. Une composition détergente selon la revendication 1, dans laquelle le produit de condensation non ionique a une longueur moyenne de chaîne alkyle comprise dans la gamme allant de C_9 à $C_{11,5}$ et un degré moyen d'éthoxylation allant de 4 à 8.

3. Une composition détergente selon la revendication 1, dans laquelle le système tensioactif ne contient substantiellement pas d'agent tensioactif non ionique éthoxylé ayant une longueur moyenne de chaîne alkyle de C_{12} ou supérieure.

4. Une composition détergente selon la revendication 1, dans laquelle au moins 50 % en masse de l'alcool duquel est dérivé le produit de condensation non ionique, a une longueur de chaîne alkyle inférieure à C_{12}.

5. Une composition détergente selon la revendication 4, dans laquelle au moins 75 % en masse de l'alcool duquel est dérivé le produit de condensation non ionique, a une longueur de chaîne alkyle inférieure à C_{12}.

6. Une composition détergente selon la revendication 1, dans laquelle le produit de condensation non ionique a une longueur de chaîne moyenne comprise dans la gamme allant de C_9 à C_{11}.

7. Une composition détergente selon la revendication 1, dans laquelle l'alcool du produit de condensation non ionique a une longueur de chaîne moyenne comprise dans la gamme allant de C_{10} à $C_{11,5}$.

8. Une composition détergente selon la revendication 1, dans laquelle le degré moyen d'éthoxylation du produit de condensation non ionique est compris dans la gamme allant de 4 à 6,5.

9. Une composition détergente selon la revendication 1, dans laquelle le système tensioactif comprend en outre de l'agent tensioactif anionique.

10. Une composition détergente selon la revendication 9, dans laquelle l'agent tensioactif anionique comprend du sulfate d'alcool primaire.

11. Une composition détergente selon la revendication 9, dans laquelle le système tensioactif est essentiellement composé de :

(i) de 60 à 100 % en masse de l'agent tensioactif non ionique éthoxylé , et

(ii) de 0 à 40 % en masse de sulfate d'alcool primaire en C_8-C_{18}.

12. Une composition détergente selon la revendication 1, qui contient de 15 à 50 % en masse du système tensioactif.

13. Une composition détergente selon la revendication 1, qui contient de 5 à 80 % en masse d'un édificateur de détergence.

14. Une composition détergente selon la revendication 13, qui contient en tant qu'édificateur de détergence, de 20 à 60 % en masse (base anhydre) d'aluminosilicate de métal alcalin.

15. Une composition détergente selon la revendication 13, qui contient en tant qu'édificateur de détergence, de 20 à 60 % en masse (base anhydre) d'aluminosilicate de métal alcalin qui comprend de la zéolite P ayant un rapport silicium/aluminium ne dépassant pas 1,33.

16. Une composition détergente selon la revendication 1, ayant une densité en masse d'au moins 700 g/l.

17. Utilisation d'un agent tensioactif non ionique qui est un produit de condensation d'oxyde d'éthylène avec un alcool aliphatique ayant une longueur moyenne de chaîne alkyle inférieure à C_{12} et un degré moyen d'éthoxylation allant de 4 à 8, afin d'améliorer la distribution dans le lavage d'une composition détergente particulaire ayant une densité en masse d'au moins 600 g/l.