

MIXED SURFACTANT LAUNDRY DETERGENT COMPOSITION
OF IMPROVED DETERGENCY AND METHOD OF USE

The present invention relates to laundry detergent compositions. More particularly, this invention relates to laundry detergents with improved detergency obtained from a mixture of an acid-terminated non-ionic surfactant with a quaternary ammonium salt surfactant.

There have been many disclosures in the art relating to detergency compositions containing cationic softening agents, including the quaternary ammonium compound softening agents, some of which may also function as cleaning or surfactant compounds, with non-ionic surface-active compounds. As representative of this art, mention can be made of U.S. Patents 4,264,457, 4,239,659, 4,259,217, 4,222,905, 3,951,879, 3,360,470, 3,351,483, and 3,644,203. In addition U.S. Patents 3,537,993, 3,583,912, 3,983,079 4,203,872 and 4,264,479, specifically disclose combinations of non-ionic surface-active agent, cationic fabric softener and another ionic surfactant or modifier, such as zwitterionic surfactants, amphoteric surfactants, and the like.

U.S. Patent 4,222,905 to Cockrell, Jr. discloses laundry detergent compositions which may be in liquid form and which are formulated from certain non-ionic surfactants and certain cationic surfactants, at a non-ionic:cationic weight ratio of from 5:1 to about 1:1.

Non-ionic/cationic mixed surfactant detergent compositions having a non-ionic:cationic weight ratio

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of from about 1:1 to 40:1, in which the non-ionic surfactant is limited to the class having a hydrophilic-lipophilic balance (HLB) of from about 5 to about 17, and wherein the cationic surfactant is limited to the class of mono-higher alkyl quaternary ammonium compounds in which the higher alkyl group has from about 20 to about 30 carbon atoms, are disclosed by Murphy in U.S. Patent 4,239,659.

In the commonly assigned co-pending U.S. application Serial No. 597,948 filed April 9th 1984 corresponding to British Application No. 8509084, Serial No. 2158454, we disclose that acid-terminated non-ionic surfactants can function as viscosity control and gel inhibiting agents for improving dispensibility, dispersibility and stability of non-aqueous liquid non-ionic surfactant compositions. We also disclose in that application that when added to the wash solution the acid-terminated non-ionic surfactant is converted to an anionic surfactant. Nevertheless, the acid-terminated non-ionic surfactants are not considered to substantially contribute to the overall cleaning performance, i.e. detergency, of the non-ionic surfactant composition.

There remains a need in the art to provide further improvements in detergency of both liquid and powdery detergent compositions so that, for example, the compositions can be provided in more concentrated form with a consequential improvement in reduction of packaging costs and in convenience to the consumer.

It has now been discovered that the detergency of the acid-terminated non-ionic surfactants are synergistically promoted by the presence of a quaternary ammonium salt surfactant. While improved cleaning

performance can be obtained over relatively wide ratios of the acid-terminated non-ionic and the quaternary ammonium salt surfactant, best cleaning performance has been observed at approximately 1:1 molar ratios.

5. Accordingly, in a first aspect, the present invention provides a detergent composition consisting of a mixture of an acid-terminated non-ionic surfactant and a cationic surfactant in which the weight ratio is in the range of 4:1 to 1:4 preferably from less than 3:1 to 1:3, especially about 1.

10. The acid modified non-ionic surfactant preferably comprises at least one compound which is the reaction product between a non-ionic surfactant which is a poly C₂ to C₃ alkoxyated fatty alcohol having a terminal OH group with a polycarboxylic acid or polycarboxylic acid anhydride.

The cationic surfactant is preferably a quaternary ammonium salt surfactant, e.g. a mono- or poly-ethoxylated quaternary ammonium salt surfactant.

20. This aspect of the invention also extends to a detergent composition comprising an acid-modified non-ionic surfactant which comprises at least one compound which is the reaction product between a non-ionic surfactant which is a poly C₂ to C₃ alkoxyated fatty alcohol having a terminal OH group with a polycarboxylic acid or polycarboxylic acid anhydride, and a cationic surfactant which is a mono- or poly-ethoxylated quaternary ammonium salt surfactant.

25. In another aspect of the invention, the present invention provides heavy duty laundry liquid non-ionic detergent compositions wherein the detergency of the non-ionic surfactant detergent compound is enhanced due to the synergistic effect between a mixture of an acid-
- 30.

terminated non-ionic surfactant and a cationic surfactant.

- Thus the invention also extends to a built heavy duty laundry detergent composition, the surfactant
5. content of which consists of a mixture of an acid-terminated non-ionic surfactant, a cationic surfactant, and a non-ionic surfactant which is not acid-terminated, up to 20% by weight of the non-ionic which is not acid-terminated optionally being replaced by
10. another surfactant which is not an acid terminated non-ionic surfactant; in such a composition the acid-terminated non-ionic surfactant and the cationic surfactant are preferably present in a weight ratio in the range of from about 4:1 to 1:4.

15. A particular embodiment of this aspect of the invention is a built heavy duty laundry detergent composition comprising

- (A) 20 to 80% by weight non-ionic surfactant which is not acid terminated, optionally with up to 20%
20. by weight replaced by another surfactant which is not an acid terminated non-ionic surfactant;

(B) 10 to 40% by weight of acid-terminated non-ionic surfactant;

- (C) 10 to 40% by weight cationic surfactant,
25. the sum of (A) + (B) + (C) being at least 30% by weight of the total composition; and

(D) detergent builder(s) present in an amount of up to about 60% by weight.

- The invention also extends to a liquid detergent
30. composition the surfactant content of which consists of

(A) a liquid non-ionic surfactant which is not acid-terminated,

(B) an acid-terminated non-ionic surfactant and

5. (B) and (C) may be provided by a detergent composition according to the first aspect of the present invention.

10. detergent compositions, and solid detergent compositions having improved detergency due to the presence therein of a mixture of an acid-terminated non-ionic surfactant and a cationic surfactant.

15. one essential component of the detergent compositions of this invention, can be considered in a particularly preferred form to be a non-ionic

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surfactant which has been modified to convert a free hydroxyl (OH) group thereof to a moiety having a carboxy (COOH) group, for example, by reaction with a polycarboxylic acid anhydride, e.g. succinic anhydride.

5. More specifically, the non-ionic surfactant may be of the type having an organic hydrophobic moiety and an organic hydrophilic moiety, the latter including an hydroxyl group at its terminus in which the terminal hydroxyl group is modified to a moiety containing a carboxyl group. Preferably, the reaction product between the non-ionic surfactant and the polycarboxylic acid anhydride forms the partial, e.g. half, ester of the polycarboxylic acid.

15. It is also within the scope of the present invention to use linkages other than the carboxylic ester linkages, such as ether, thioether, or urethane linkages, formed by conventional reactions. For instance, to form an ether linkage, the non-ionic surfactant may be treated with a strong base (to convert its hydroxyl group to an ONa group, for instance) and then reacted with a halocarboxylic acid such as chloroacetic acid or chloropropionic acid or the corresponding bromo compound. Thus, the resulting carboxylic acid may have the formula $R-Y-ZCOOH$ where R is the residue of a non-ionic surfactant (on removal of a terminal OH), Y is oxygen or sulphur, and Z represents an organic linkage such as a hydrocarbon group of, for example, 1 to 10 carbon atoms, which may be attached to the oxygen (or sulphur) of the formula
25. directly or by means of an intervening linkage such as
- 30.

an oxygen- or nitrogen-containing linkage, for example:



10 The nonionic synthetic organic detergent employed in the practice of the present invention as a precursor of the acid-terminated non-ionic surfactant, or directly as the non-ionic surfactant, may be any of a wide variety of such compounds, which are well known and, for example, are described at length in the text Surface Active Agents, Vol. II, by Schwartz, Perry and Berch, published in 1958 by Interscience Publishers, 15 and in McCutcheon's Detergents and Emulsifiers, 1969 Annual. Usually, the non-ionic detergents are poly-lower alkoxyated lipophiles wherein the desired hydrophile-lipophile balance is obtained from addition of a hydrophilic poly-lower alkoxy group to a lipophilic moiety. A preferred class of the non-ionic detergent employed is poly-lower alkoxyated higher alkanols wherein the alkanol is of 10 to 18 carbon atoms and wherein the number of mols of lower alkylene oxide (of 2 to 3 carbon atoms) is from 3 to 12. Of such 20 materials it is preferred to employ those wherein the higher alkanol is a higher fatty alcohol of 10 to 11 or 12 to 15 carbon atoms and which contain from 5 to 8 or 5 to 9 lower alkoxy groups per mol. Preferably, the lower alkoxy is ethoxy but in some instances, it may be 25 desirably mixed with propoxy, the latter, if present, usually being a minor (less than 50%) proportion. Exemplary of such compounds are those wherein the alkanol is of 12 to 15 carbon atoms and which contain 30

about 7 ethylene oxide groups per mol, e.g. Neodol (Registered Trade Mark) 25-7 and Neodol 23-6.5, which products are made by Shell Chemical Company, Inc. The former is a condensation product of a mixture of higher fatty alcohols averaging about 12 to 15 carbon atoms, with about 7 mols of ethylene oxide and the latter is a corresponding mixture wherein the carbon atom content of the higher fatty alcohol is 12 to 13 and the number of ethylene oxide groups present averages about 6.5. The higher alcohols are primary alkanols. Other examples of such detergents include Tergitol (Registered Trade Mark) 15-S-7 and Tergitol 15-S-9, both of which are linear secondary alcohol ethoxylates made by Union Carbide Corp. The former is a mixed ethoxylation product of 11 to 15 carbon atoms linear secondary alkanol with seven mols of ethylene oxide and the latter is a similar product but with nine mols of ethylene oxide being reacted.

One particularly preferred group of non-ionic surfactants based on linear secondary alkanols are those available from British Petroleum Co. under the designation "Surfactant T". The "Surfactant T" non-ionics are obtained by ethoxylation of secondary C₁₃ fatty alcohols and have a narrow distribution of ethylene oxide (EO) units from molecule to molecule and have the following characteristics:

	EO	Pour Point	Cloud Point
<u>Nonionic</u>	<u>Content</u>	<u>(°C)</u>	<u>(1% sol'n)</u>
			<u>(°C)</u>
Surfactant T5	5	<-2	<25
5 Surfactant T7	7	-2	38
Surfactant T8*	8	2	48
Surfactant T9	9	6	58
Surfactant T12	12	20	88

10 *"Surfactant T8" was artificially prepared by mixing equal amounts of Surfactant T7 and Surfactant T9 (1:1 mixture).

15 The nonionic surfactant which is a linear secondary C₁₃ fatty alcohol condensed with an average of 8 moles ethylene oxide per mole of fatty alcohol, and in which there are substantially no molecules containing less than 7 or more than 9 moles EO, such as
 20 less than 10% by weight, preferably less than 3% by weight, in total, of the lower and high EO substitutions, is an especially preferred liquid non-ionic surfactant in view of its good balance between relatively low pour point, relative high cloud point and primarily because it is capable of resisting forming a
 25 gel when added to cold water, for example, at temperatures as low as about 5°C or lower.

Also useful in the compositions of the present invention are higher molecular weight non-ionics, such as Neodol 45-11, which are similar ethylene oxide
 30 condensation products of higher fatty alcohols, with the higher fatty alcohol being of 14 to 15 carbon atoms and the number of ethylene oxide groups per mol being about 11. Such products are also made by Shell

Chemical Company.

Other useful non-ionics are represented by the Plurafac series from BASF Chemical Company which are the reaction product of a higher linear alcohol and a mixture of ethylene and propylene oxides, containing a mixed chain of ethylene oxide and propylene oxide, terminated by a hydroxyl group. Examples include Plurafac (Registered Trade Mark) RA30, Plurafac RA40 (a C_{13} - C_{15} fatty alcohol condensed with 7 moles propylene oxide and 4 moles ethylene oxide), Plurafac D25 (a C_{13} - C_{15} fatty alcohol condensed with 5 moles propylene oxide and 10 moles ethylene oxide) and Plurafac B26. Another group of preferred liquid non-ionics are available from Shell Chemical Company, Inc. under the Dobanol (Registered Trade Mark) trade mark: Dobanol 91-5 is an ethoxylated C_9 - C_{11} fatty alcohol with an average of 5 moles ethylene oxide; Dobanol 25-7 is an ethoxylated C_{12} - C_{15} fatty alcohol with an average of 7 moles ethylene oxide.

In the preferred poly-lower alkoxyated higher alkanols, to obtain the best balance of hydrophilic and lipophilic moieties the number of lower alkoxies will usually be from 40% to 100% of the number of carbon atoms in the higher alcohol, preferably 40 to 60% thereof and the non-ionic detergent will preferably contain at least 50% of such preferred poly-lower

- alkoxy higher alkanol. Higher molecular weight alkanols and various other normally solid non-ionic detergents and surface active agents may be contributory to gelation of the liquid detergent and
5. consequently, will preferably be omitted or limited in quantity in the compositions of the present invention which are in the form of non-aqueous liquids, although minor proportions thereof may be employed for their cleaning properties, etc. With respect to both
 10. preferred and less preferred non-ionic detergents, the alkyl groups present therein are generally linear, although branching may be tolerated, such as at a carbon next to or two carbons removed from the terminal carbon of the straight chain and away from the ethoxy
 15. chain, if such branched alkyl is not more than three carbons in length. Normally, the proportion of carbon atoms in such a branched configuration will be minor rarely exceeding 20% of the total carbon atom content of the alkyl group. Similarly, although linear alkyls
 20. which are terminally joined to the ethylene oxide chains are highly preferred and are considered to result in the best combination of detergency, biodegradability and non-gelling characteristics, medial or secondary joiner to the ethylene oxide in the chain
 25. may occur as in the Surfactant T non-ionics described above. When propylene oxide is present in the lower alkylene oxide chain, it will usually be less than 20% thereof and preferably less than 10% thereof.

When greater proportions of non-terminally

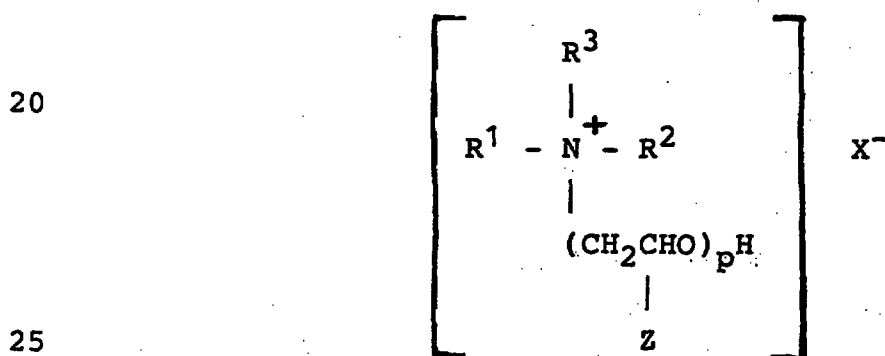
30. alkoxyated alkanols, propylene oxide-containing poly-

- lower alkoxyated alkanols and less hydrophilic-lipophile balanced non-ionic detergents than mentioned above are employed and when other non-ionic detergents are used instead of the preferred non-ionics recited
5. herein, the resulting product may not have as good detergency, stability, viscosity and non-gelling properties as the preferred non-aqueous liquid compositions but use of viscosity and gel controlling compounds can also improve the properties of the
 10. detergents based on such non-ionics. In some cases, as when a higher molecular weight poly-lower alkoxyated higher alkanol is employed, often for its detergency, the proportion thereof will be regulated or limited as in accordance with the results of various
 15. experiments, to obtain the desired detergency and still have the product non-gelling and of desired viscosity. Also, it has been found that it is only rarely necessary to utilise the higher molecular weight non-ionics for their detergent properties since the
 20. preferred non-ionics described herein are excellent detergents and additionally, permit the attainment of the desired viscosity in the liquid detergent without gelation at low temperature. Of course, there will be a broader latitude in the selection of the non-ionic
 25. surfactant for the aqueous and solid detergent compositions of the present invention. Mixtures of two or more these liquid non-ionics can also be used and in some cases advantages can be obtained by the use of such mixtures.
 30. The acid-terminated non-ionic surfactant is used

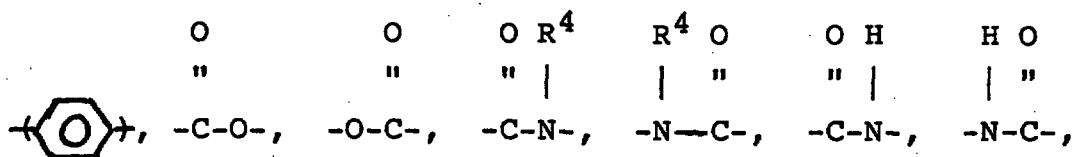
as its admixture with a cationic surfactant to provide synergistic levels of detergency. Substantially any cationic substance having surface-active properties can be used in conjunction with the acid-terminated non-ionic surfactant. A particularly preferred class of the cationic surfactant is the ethoxylated quaternary ammonium salt surfactant compounds which are mono-, or poly-ethoxylated with up to about 12 ethylene oxide groups, attached at one or two of the four available positions on the quaternary nitrogen atom.

More generally, however, any of the cationic surfactant compounds disclosed in the aforementioned U.S. Patent 4,259,217 to Murphy, et al in columns 8 to 15, inclusive, can also be used in the compositions of the present invention.

The particularly preferred cationic surfactants referred to above have the general formula:



wherein R^1 represents an organic group containing a straight or branched alkyl or alkenyl group optionally substituted with up to 3 phenyl or hydroxy groups, and optionally interrupted by up to 4 structures selected from the group consisting of:



5 O O H H O
 | | |
 " " "
 -O-, -O-C-O-, -O-C-N-, -N-C-O-, and mixtures thereof,

wherein R^4 represents an alkyl or hydroxyalkyl group
 10 containing 1 to 4 carbon atoms, or a benzyl group, and
 which contains from about 8 to 22 carbon atoms, and
 which may additionally contain up to 12 ethylene oxide
 groups; R^2 represents the group R^1 or an alkyl or
 hydroxyalkyl group containing 1 to 6 carbon atoms, or a
 15 benzyl group; R^3 represents the group R^2 or
 $(\text{CH}_2\text{CHZO})_q\text{H}$; Z represents a hydrogen atom or a methyl
 group; and q and p are, independently, from 1 to 12;
 and X represents a water-soluble anion, such as a
 halide, methyl sulphate, sulphate, or nitrate.

20 Preferably, in the above formula, R^1 represents an
 alkyl or alkenyl group having from about 10 to 20
 carbon atoms which may optionally be substituted by an
 hydroxyl group, and which may additionally contain up
 to 12 ethylene oxide groups; R^2 represents the group R^1
 25 or an alkyl or hydroxyalkyl group; R^3 represents the
 group R^2 or $(\text{C}_2\text{H}_4\text{O})_q\text{H}$; Z represents a hydrogen atom;
 and q and p are, independently, numbers from 1 to 12.

Examples of the cationic ethoxylated quaternary
 ammonium surfactant compounds include,
 30 dipolyethoxylated lauryl hydroxy ethyl ammonium

- chloride, dipolyethoxy stearyl methyl ammonium
chloride, dipolyethoxy stearyl methyl ammonium
chloride, polyethoxy distearyl methyl ammonium
chloride, N-polyethoxy N-polyethoxylated C₁₆ alkyl N,N-
5. dimethyl ammonium chloride, and dipolyethoxy
palmitylalkyl methyl ammonium methosulphate.

- Specific examples of this class of cationic
surfactant include N-ethyl N-cocoammonium ethoxylate
(15) bisulphate (Quaternium 54) wherein the total
10. amount of ethoxylation averages 15 moles of ethylene
oxide per mole of quaternary nitrogen, N-methyl-N-
oleyl-ammonium ethoxylate (2) wherein there are an
average of 2 moles of ethylene oxide per mole of
quaternary nitrogen, N-methyl-N-stearyl ammonium
15. propoxylate (15) bisulphate, wherein there are an
average of 15 moles of propylene oxide per quaternary
nitrogen, and the like.

- In a preferred embodiment of the present
invention, the acid-terminated non-ionic surfactant and
20. the cationic surfactant are combined in substantially a
1:1 molar complex. However, molar excesses of either
component can also be used, for example, molar ratios
of acid-terminated non-ionic to cationic may broadly
fall within the range of from about 4:1 to 1:4,
25. preferably 1.5:1 to 1:1.5.

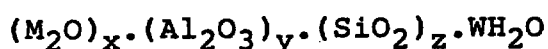
- While the mixture of the acid-terminated non-ionic
surfactant and cationic surfactant provide enhanced
detergency when used alone, it is preferred to use the
surfactant mixture in combination with at least one
30. other surfactant. In the preferred liquid detergent

- compositions, the other surfactant is preferably one of the liquid non-ionic surfactants described above, for example the Surfactant T8 (whether prepared directly as such or as a mixture of Surfactant T7 and Surfactant T9), used alone or in combination with a minor amount of an anionic, cationic, amphoteric or zwitterionic surfactant. These other types of ionic and amphoteric surfactants are very well known in the art and any of these known surfactants can be used.
5. Accordingly, highly preferred compositions of the present invention are surfactant mixtures of:
- (A) a liquid non-ionic surfactant;
 - (B) a non-ionic surfactant having an organic hydrophobic moiety and an organic hydrophilic moiety,
15. the said hydrophilic moiety including an hydroxyl group at its terminus, which has been modified to convert said terminal hydroxyl group to a moiety having a carboxyl group, (i.e. an acid-terminated non-ionic surfactant); and
- (C) a cationic surfactant, preferably an ethoxylated quaternary ammonium salt surfactant.
- The amount of the component (A) is generally in the range of from about 40% to about 90%, preferably from about 50% to about 80%, based on the surfactant
25. mixture, and the total amount of components (B) plus (C) is correspondingly, from about 10% to about 60%, preferably from about 20% to about 50% of the surfactant mixture. Furthermore, up to about 20%, preferably up to about 10%, especially preferably up to
30. about 5% of the liquid non-ionic surfactant may be

replaced by another, e.g. an anionic, surfactant, such as, for example, a linear alkyl benzene sulphonate, paraffin sulphonate, olefin sulphonate or alcohol sulphate.

5 In addition to the surfactant mixture of (A), (B) and (C), the detergent compositions according to the present invention may also and preferably do include water soluble detergent builder salts. The builder salt preferably comprises from about 30% to about 75%
10 by weight of the composition. Typical suitable builders include, for example, those disclosed in U.S. Patents 4,316,812, 4,264,466 and 3,630,929. Water soluble inorganic alkaline builder salts which can be used alone with the detergent compound or in admixture
15 with other builders are alkali metal carbonates, borates, phosphates, polyphosphates, bicarbonates and silicates. (Ammonium or substituted ammonium salts can also be used.) Specific examples of such salts are sodium tripolyphosphate, sodium carbonate, sodium
20 tetraborate, sodium pyrophosphate, potassium pyrophosphate, sodium bicarbonate, potassium tripolyphosphate, sodium hexametaphosphate, sodium sesquicarbonate, sodium mono- and diorthophosphate, and potassium bicarbonate. Sodium tripolyphosphate (TPP) is
25 especially preferred. The alkali metal silicates are useful builder salts which also function to make the composition anticorrosive to washing machine parts. Sodium silicates of $\text{Na}_2\text{O}/\text{SiO}_2$ ratios of from 1.6/1 to 1/3.2 especially about 1/2 to 1/2.8 are preferred.
30 Potassium silicates of the same ratios can also be

used. Another class of builders useful herein are the water-insoluble aluminosilicates, both of the crystalline and amorphous type. Various crystalline zeolites (i.e. aluminosilicates) are described in British Patent 1,504,168, U.S. Patent 4,409,136 and Canadian Patents 1,072,835 and 1,087,477. An example of amorphous zeolites useful herein can be found in Belgian Patent 835,351. The zeolites generally have the formula:



wherein: x is 1, y is from 0.8 to 1.2 and preferably 1, z is from 1.5 to 3.5 or higher and preferably 2 to 3 and w is from 0 to 9, preferably 2.5 to 6 and M is preferably sodium. A typical zeolite is type A or similar structure, with type 4A particularly preferred. The preferred aluminosilicates have calcium ion exchange capacities of about 200 milliequivalents per gram or greater, e.g. 400 meq/g.

Other materials such as clays, particularly of the water insoluble types, may also be useful adjuncts in compositions according to the present invention. Particularly useful is bentonite. This material is primarily montmorillonite which is a hydrated aluminium silicate in which about 1/6th of the aluminium atoms may be replaced by magnesium atoms and with which varying amounts of hydrogen, sodium, potassium and calcium may be loosely combined. The bentonite in

- its more purified form (i.e. free from any grit, sand and the like) suitable for detergents invariably contains at least 50% montmorillonite and thus its cation exchange capacity is at least about 50 to 75 meq. per 100 g of bentonite. Particularly preferred bentonites are the Wyoming or Western U.S. bentonites which have been sold as Thixo-jels 1, 2, 3 and 4 by Georgia Kaolin Co. These bentonites are known to soften textiles as described in British Patent 401,413 to Marriott and British Patent 461,221 to Marriott and Dugan.

- Examples of organic alkaline sequestrant builder salts which can be used alone with the detergent or in admixture with other inorganic builders are alkali metal, ammonium or substituted ammonium, aminopolycarboxylates, e.g. sodium and potassium ethylene diaminetetraacetate (EDTA), sodium and potassium nitrilotriacetates (NTA) and triethanolammonium N-(2-hydroxyethyl)nitrilodiacetates. Mixed salts of these polycarboxylates are also suitable.

- Other suitable builders of the organic type include carboxymethylsuccinates, tartronates and glycollates. Of special value are the polyacetal carboxylates. The polyacetal carboxylates and their use in detergent compositions are described in 4,144,226; 4,315,092 and 4,146,495. Other patents on similar builders include 4,141,676; 4,169,934; 4,201,858; 4,204,852; 4,224,420; 4,225,685; 4,226,960; 4,233,422; 4,233,423; 4,302,564 and 4,303,777. Also relevant are European Patent Application Nos. 0015024;

0021491 and 0063399.

- Since the compositions of the present invention are generally highly concentrated, and, therefore may be used at relatively low dosages, it is desirable to
5. supplement any phosphate builder (such as sodium tripolyphosphate) with an auxiliary builder such as a polymeric carboxylic acid having high calcium binding capacity to inhibit incrustation which could otherwise be caused by formation of an insoluble calcium
 10. phosphate. Such auxiliary builders are also well known in the art.

- Various other detergent additives or adjuvants may be present in the detergent product to give it additional desired properties, either of functional or
15. aesthetic nature. Thus, there may be included in the formulation, minor amounts of soil suspending or anti-redeposition agents, e.g. polyvinyl alcohol, fatty amides, sodium carboxymethyl cellulose, hydroxypropyl methyl cellulose; optical brighteners, e.g. cotton,
 20. amine and polyester brighteners, for example, stilbene, triazole and benzidine sulphonate compositions, especially sulphonated substituted triazinyl stilbene, sulphonated naphthotriazole stilbene and benzidene sulphonate; most preferred are stilbene and triazole
 25. combinations.

- Bluing agent such as ultramarine blue; enzymes, preferably proteolytic enzymes, such as subtilisin, bromelin, papain, trypsin and pepsin, as well as amylase type enzymes, lipase type enzymes, and mixtures
30. thereof; bactericides, e.g. tetrachlorosalicylanilide,

- hexachlorophene; fungicides; dyes; pigments (water dispersible); preservatives; ultraviolet absorbers; anti-yellowing agents, such as sodium carboxymethyl cellulose, complex of C₁₂ to C₂₂ alkyl alcohol with C₁₂ to C₁₈ alkylsulphate; pH modifiers and pH buffers; colour safe bleaches, perfume and anti-foam agents or suds-suppressors, e.g. silicone compounds can also be used.

- The bleaching agents are classified broadly, for convenience, as chlorine bleaches and oxygen bleaches. Chlorine bleaches are typified by sodium hypochlorite (NaOCl), potassium dichloroisocyanurate (59% available chlorine), and trichloroisocyanuric acid (85% available chlorine). Oxygen bleaches are represented by sodium and potassium perborates, percarbonates, and perphosphates and potassium monopersulphate. The oxygen bleaches are preferred and the perborates, particularly sodium perborate monohydrate is especially preferred.

- The peroxygen compound is preferably used in admixture with an activator therefor. Suitable activators are those disclosed in U.S. Patent 4,264,466 or in Column 1 of U.S. Patent 4,430,244. Polyacylated compounds are preferred activators, among these, compounds such as tetraacetyl ethylene diamine ("TAED") and pentaacetyl glucose are particularly preferred.

- The activator usually interacts with the peroxygen compound to form a peroxyacid bleaching agent in the wash water. It is preferred to include a sequestering agent of high complexing power to inhibit any undesired reaction between such peroxyacid and hydrogen peroxide

in the wash solution in the presence of metal ions.

Preferred sequestering agents are able to form a complex with Cu^{2+} ions, such that the stability constant (pK) of the complexation is equal to or

5. greater than 6, at 25°C, in water, of an ionic strength of 0.1 mole/litre, pK being conventionally defined by the formula: $\text{pK} = -\log K$, where K represents the equilibrium constant. Thus, for example, the pK values for complexation of copper ion with NTA and EDTA at the
10. stated conditions are 12.7 and 18.8, respectively. Suitable sequestering agents include for example, in addition to those mentioned above, diethylene triamine pentaacetic acid (DETPA); diethylene triamine pentamethylene phosphonic acid (DTPMP); and ethylene
15. diamine tetramethylene phosphonic acid (EDITEMPA).

The composition may also contain an inorganic insoluble thickening agent or dispersant of very high surface area such as finely divided silica of extremely fine particle size (e.g. of 5-100 millimicrons

20. diameters such as sold under the name Aerosil) or the other highly voluminous inorganic carrier materials disclosed in U.S Patent 3,630,929, in proportions of 0.1-10%, e.g. 1 to 5%. It is preferable, however, that compositions which form peroxyacids in the wash bath
25. (e.g. compositions containing peroxygen compound and activator therefor) be substantially free of such compounds and of other silicates; it has been found, for instance, that silica and silicates promote the undesired decomposition of the peroxyacid.

30. In a preferred form of the invention, the mixture

- of liquid non-ionic surfactant and solid ingredients is subjected to an attrition type of mill in which the particle sizes of the solid ingredients are reduced to less than about 10 microns, e.g. to an average particle size of 2 to 10 microns or even lower (e.g. 1 micron).
5. Compositions whose dispersed particles are of such small size have improved stability against separation or settling on storage.

- In the grinding operation, it is preferred that
10. the proportion of solid ingredients be high enough (e.g. at least about 40% such as about 50%) that the solid particles are in contact with each other and are not substantially shielded from one another by the non-ionic surfactant liquid. Mills which employ grinding
15. balls (ball mills) or similar mobile grinding elements have given very good results. Thus, one may use a laboratory batch attritor having 8 mm diameter steatite grinding balls. For larger scale work a continuously operating mill in which there are 1 mm or 1.5 mm
20. diameter grinding balls working in a very small gap between a stator and a rotor operating at a relatively high speed (e.g. a CoBall mill) may be employed; when using such a mill, it is desirable to pass the blend of non-ionic surfactant and solids first through a mill
25. which does not effect such fine grinding (e.g. a colloid mill) to reduce the particle size to less than 100 microns (e.g. to about 40 microns) prior to the step of grinding to an average particle diameter below about 10 microns in the continuous ball mill.
30. The detergent compositions may also advantageously

- include a viscosity-controlling and gel-inhibiting agent in order to lower the temperature at which the non-ionic surfactant will form a gel when added to water. Such viscosity controlling and gel-inhibiting agents may be, for example, lower alkanol, e.g. ethyl alcohol (see U.S. Patent 3,953,380), alkali metal formates and adipates (see U.S. Patent 4,368,147), hexylene glycol, polyethylene glycol, and others. However, an especially preferred class of viscosity-controlling and gel-inhibiting compounds which can be used in the liquid non-ionic detergent compositions of the present invention are alkylene glycol ether compounds represented by the following general formula:



- wherein, R represents a C₁-C₅, preferably C₂ to C₅, especially preferably C₂ to C₄, and particularly C₄ alkyl group, R' represents a hydrogen atom or a methyl group preferably a hydrogen atom and n is a number of from about 1 to 4, preferably 2 to 4 on average.

- Preferred examples of these gel inhibiting compounds include ethylene glycol monoethyl ether (C₂H₅-O-CH₂CH₂OH), and diethylene glycol monobutyl ether (C₄H₉-O-(CH₂CH₂O)₂H). Diethylene glycol monoethyl is especially preferred because it is uniquely effective to control viscosity.

- The use of these glycol ether viscosity control and gel-inhibiting agents in substantially non-aqueous

built liquid non-ionic detergents compositions is disclosed in the co-pending, commonly assigned application entitled "LIQUID LAUNDRY DETERGENT COMPOSITION AND METHOD OF USE" which was filed on the

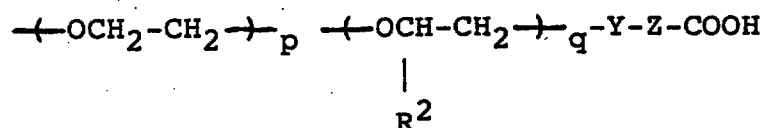
5. same day as the present application under Attorney's Docket IR.229. U.S. Application No. 687815, corresponding to G.B. Application No. 853/947 Serial No. A-2/69613.

- While the preferred gel-inhibiting compounds,
10. particularly diethylene glycol monobutyl ether, can be the only viscosity control and gel inhibiting additive in the compositions of the present invention, further improvements in the rheological properties of the anhydrous liquid non-ionic surfactant compositions can
15. be obtained by including in the composition a small amount of a non-ionic surfactant which has been modified to convert a free hydroxyl group thereof to a moiety having a free carboxyl group, as disclosed in the aforementioned commonly assigned, co-pending U.S.
20. Application Serial No. 597,948, filed 9th April 1984, corresponding to British Application No. 8509084 Serial No. , such as a partial ester of a non-ionic surfactant and a polycarboxylic acid and/or an acidic organic phosphorus compound having an acidic -
25. POH group, such as a partial ester of phosphorous acid and an alkanol.

The free carboxyl group modified non-ionic surfactants, which may be the same as, or different from component (B), and which may be broadly

30. characterised as polyether carboxylic acids, function

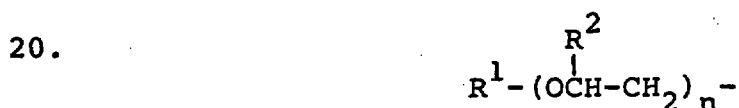
to lower the temperature at which the liquid non-ionic forms a gel with water. The acidic polyether compound can also decrease the yield stress of such dispersions, aiding in their dispersibility, without a corresponding decrease in their stability against settling. Suitable polyether carboxylic acids contain a grouping of the formula:



wherein, R^2 represents a hydrogen atom or a methyl group, Y represents oxygen or sulphur, Z represents an organic linkage, p is a positive number of from about 3 to about 50 and q is zero or a positive number of up to 10. Specific examples include the half-ester of Plurafac RA30 with succinic anhydride, the half-ester of Dobanol 25-7 with succinic anhydride, and the half-ester of Dobanol 91-5 with succinic anhydride. Instead of a succinic acid anhydride, other polycarboxylic acids or anhydrides may be used, e.g. maleic acid, maleic anhydride, glutaric acid, malonic acid, succinic acid, phthalic acid, phthalic anhydride, or citric acid. Furthermore, other linkages may be used, such as ether, thioether or urethane linkages, formed by conventional reactions. For instance, to form an ether linkage, the non-ionic surfactant may be treated with a strong base (to convert its OH group to an ONa group for instance) and then reacted with a halocarboxylic acid such as chloroacetic acid or

- chloropropionic acid or the corresponding bromo compound. Thus, the resulting carboxylic acid may have the formula $R-Y-ZCOOH$, wherein R represents the residue of a non-ionic surfactant (on removal of a terminal OH), Y represents oxygen or sulphur, and Z represents an organic linkage such as a hydrocarbon group of, say, one to ten carbon atoms which may be attached to the oxygen (or sulphur) of the formula directly or by means of an intervening linkage such as an oxygen containing linkage, e.g. an $\begin{array}{c} O \\ || \\ -C- \end{array}$ or $\begin{array}{c} O \\ || \\ -C-NH- \end{array}$ linkage.

- The polyether carboxylic acid may be produced from a polyether which is not a non-ionic surfactant, e.g. it may be made by reaction with a polyalkoxy compound such as polyethylene glycol or a monoester or monoether thereof which does not have the long alkyl chain characteristic of the non-ionic surfactants. Thus, R may have the formula:



- wherein, R^2 represents an hydrogen atom or a methyl group, R^1 represents an alkylphenyl or alkyl or other chain terminating group and "n" is at least 3 such as 5 to 25. When the alkyl group of R^1 is a higher alkyl group, R represents a residue of a non-ionic surfactant. As indicated above R^1 may instead be hydrogen or lower alkyl (e.g. methyl, ethyl, propyl, butyl) or lower acyl (e.g. acetyl). The acidic

polyether compound if present in the detergent composition, is preferably added dissolved in the non-ionic surfactant.

When the component (B) is used in a molar excess of the component (C) cationic surfactant, the excess acid-terminated non-ionic may function as a gel-inhibiting agent.

As disclosed in the commonly assigned co-pending U.S. Application Serial No. 597,793, filed 6th April 1984, corresponding to G.B. Application No. 8509083, Serial No. , the acidic organic phosphorus compound having an acidic -POH group can increase the stability of the suspension of builder, especially polyphosphate builders, in the non-aqueous liquid non-ionic surfactant.

The acidic organic phosphorus compound may be, for instance, a partial ester of phosphoric acid and an alcohol such as an alkanol which has a lipophilic character, having, for instance, more than 5 carbon atoms, e.g. 8 to 20 carbon atoms.

A specific example is a partial ester of phosphoric acid and a C₁₆ to C₁₈ alkanol (Empiphos (Registered Trade Mark) 5632 from Marchon); it is made up of about 35% monoester and 65% diester.

The inclusion of quite small amounts of the acidic organic phosphorus compound makes the suspension significantly more stable against settling on standing but remains pourable, presumably, as a result of increasing the yield value of the suspension, but

- decreases its plastic viscosity. It is believed that the use of the acidic phosphorus compound may result in the formation of a high energy physical bond between the -POH portion of the molecule and the surfaces of
5. the inorganic polyphosphate builder so that these surfaces take on an organic character and become more compatible with the non-ionic surfactant.

- The acidic organic phosphorus compound may be selected from a wide variety of materials, in addition
10. to the partial esters of phosphoric acid and alkanols mentioned above. Thus, one may employ a partial ester of phosphoric or phosphorous acid with a mono or polyhydric alcohol such as hexylene glycol, ethylene glycol, di- or tri-ethylene glycol or higher
 15. polyethylene glycol, polypropylene glycol, glycerol, sorbitol, or mono or diglycerides of fatty acids, in which one, two or more of the alcoholic OH groups of the molecule may be esterified with the phosphorus acid. The alcohol may be a non-ionic surfactant su
 20. as an ethoxylated or ethoxylated propoxylated higher alkanol, higher alkylphenol, or higher alkyl amide. The -POH group need not be bonded to the organic portion of the molecule through an ester linkage; instead it may be directly bonded to carbon (as in a
 25. phosphonic acid, such as a polystyrene in which some of the aromatic rings carry phosphonic acid or phosphinic acid groups; or an alkylphosphonic acid, such as propyl or laurylphosphonic acid) or may be connected to the carbon through other intervening linkages (such as
 30. linkages through O, S or N atoms). Preferably, the

carbon:phosphorus atomic ratio in the organic phosphorus compounds is at least about 3:1, such as 5:1, 10:1, 20:1, 30:1 or 40:1.

- The liquid mixed surfactant compositions
5. preferably include therein at least one detergent builder suspended in the liquid non-ionic surfactant. Suitable ranges of the surfactant and builder components include from about 0.5 to 1 part by weight of (A) non-ionic liquid surfactant; from about 0.12 to
10. 5 parts by weight of (B) acid-terminated non-ionic surfactant plus (C) cationic surfactant at a weight ratio of (B) to (C) in the range of from about 3:1 to 1:3, and from about 0.8 to 3 parts by weight of said at least one detergent builder salt, preferably at least
15. one inorganic detergent builder salt, especially preferably alkali metal polyphosphate, e.g. sodium tripolyphosphate.

- Furthermore, as described above one or more additional detergent adjuvants or additives can be
20. included in the formulation to provide specific functions commonly associated with heavy duty laundry detergents. Bleaching agents, for example, are preferred additives. Optical brighteners, dyes, perfumes, enzymes, and chelating agents, are also
25. commonly used and highly beneficial additives.

- In the preferred built heavy duty laundry detergent compositions of the present invention, typical proportions (based on the total composition, unless otherwise specified) of the ingredients are as
30. follows:

- (A) 20 to 80% by weight of non-ionic surfactant which is not acid terminated, preferably about 30 to 70%, especially preferably about 40 to 60%;
- (B) 10 to 40% by weight of acid-terminated non-ionic surfactant, preferably about 15 to 35%, especially preferably about 20 to 30%;
- (C) 10 to 40% by weight of cationic surfactant, preferably from about 15 to 35%, especially preferably about 20 to 30%;
10. the sum of (A) + (B) + (C) being at least 30% by weight of the total composition, preferably from about 40 to 90% by weight of the total composition; and
- (D) detergent builder(s) present in an amount of up to about 60% by weight, preferably within the range of about 10 to 60%, such as about 20 to 50%, especially about 25 to 40%; and desirably
- (E) viscosity-controlling and gel-inhibiting agent(s): (i) alkylene glycol ethers: up to about 20%, for example from about 2 to 15%; (ii) polyether carboxylic acid gel-inhibiting compound up to about 10%, for example about 1 to 10%, preferably about 2 to 8%; (iii) other, e.g. lower (C_1 - C_4) alkanols, or glycols; up to about 10%, preferably up to about 5%, for example 0.5 to 2%; and
25. (F) acidic organic phosphoric acid compounds, as anti-settling agent: up to 5%, for example, in the range of 0.01 to 5%, such as about 0.05 to 2%, preferably about 0.1 to 1%.
- Suitable ranges of other optional detergent additives are: enzymes - 0 to 2%, especially 0.7 to 1.3%; corrosion inhibitors - about 0 to 4%, and
- 30.

- preferably 5 to 30%; anti-foam agents and suds-suppressors - 0 to 15%, preferably 0 to 5%, for example 0.1 to 3%; thickening agent and dispersants - 0 to 15%, for example 0.1 to 10%, preferably 1 to 5%; soil
5. suspending or anti-redeposition agents and anti-yellowing agents - 0 to 10%, preferably 0.5 to 5%; colourants, perfumes, brighteners and bluing agents total weight 0% to about 2% and preferably 0% to about 1%; pH modifiers and pH buffers - 0 to 5%, preferably
10. 0 to 2%; bleaching agent - 0% to about 40% and preferably 0% to about 25%, for example 2 to 20%; bleach stabilisers and bleach activators 0 to about 15%, preferably 1 to 10%, for example, 0.1 to 8%; sequestering agent of high complexing power, in the
15. range of up to about 5%, preferably about 1/4 to 3%, such as about 1/2 to 2%. In the selections of the adjuvants, they will be chosen to be compatible with the main constituents of the detergent composition.

The preferred liquid non-ionic detergent

20. compositions of this invention are substantially anhydrous, although minor amounts of water, e.g. up to about 5%, preferably up to about 2%, especially less than 1%, can be tolerated.

The mixed acid-terminated non-ionic/cationic

25. surfactant complex of the present invention is also useful in aqueous cleaning compositions as well as in powder detergent compositions for its enhanced cleaning performance, especially in laundry detergent compositions. The detergent mixture may be used in
30. place of part or all of the conventional detergent

surfactant component of the usual aqueous or powder detergent compositions.

5 The invention may be put into practice in various ways and a number of specific embodiments will be described to illustrate the invention with reference to the accompanying examples.

All proportions and percentages are by weight unless otherwise indicated.

EXAMPLE 1

10 This is a comparison example.

A liquid non-ionic surfactant composition was prepared with the ingredients given in Table 1 below:

15

TABLE 1

<u>Ingredients</u>	<u>Amount (grams)</u>
Surfactant T7	0.375
Surfactant T9	0.375
Sodium tripolyphosphate	1.5
20 Mixture of:	0.25
Acid terminated non-ionic (B) ¹	
Cationic Surfactant (C) ²	
Ratio B:C	1:0

25

30

Notes on Table 1

- ¹ The acid-terminated non-ionic was acid-terminated Dobanol 91-5 prepared as described below in Example 8.
5. ² The cationic surfactant was Ethoquat 2T14 which is available from Armak Chemical Co.

EXAMPLES 2 TO 5

10. Example 1 was repeated with the ratio of the acid-terminated non-ionic (B) and the cationic surfactant (C) in the 0.25 gram mixture was varied to 3:1, 1:1, 1:3 and 0:1, as shown in Table 2 below. Example 5 is also a comparison example.
15. In order to demonstrate the improved detergency, i.e. cleaning performance, achieved by using both of the acid-terminated non-ionic surfactant and the cationic surfactant, (Examples 2, 3 and 4) as compared to the effects achieved using only one of
20. these two surfactants (Examples 1 and 5), the following tests were performed.

- Each of the five formulations given in Examples 1 to 5 was added to a bowl containing 600 ml of tapwater at 40°C or 60°C. In each solution, 6 Krefield soiled
25. swatches were cleaned. The reflectance (ΔR_d) values were measured. The results are shown in Table 2.

30.

TABLE 2

<u>Example</u>	<u>Ratio B:C</u>	<u>Reflectance</u>	<u>Δ Rd</u>
		<u>40°C</u>	<u>60°C</u>
5. 1	1:0	8.1	16.0
2	3:1	9.3	16.5
3	1:1	11.4	18.3
4	1:3	11.9	18.0
5	0:1	10.4	12.2

10.

These results clearly demonstrate the improved cleaning performance of the mixture of acid-terminated non-ionic surfactant with the cationic surfactant, especially at the 1:1 mixing ratios.

15. Specific examples of the acid-terminated non-ionic surfactant and the manner of preparation thereof are shown below.

EXAMPLE 6

- 400 g of non-ionic surfactant which is a C₁₃-C₁₅ alkanol which has been alkoxyated to introduce 6 ethylene oxide and 3 propylene oxide units per alkanol unit (Plurafac RA30) is mixed with 32 g of succinic anhydride and heated for 7 hours at 100°C. The mixture is then cooled and filtered to remove unreacted
25. succinic anhydride. Infrared analysis indicates that about one-half of the non-ionic surfactant has been converted to the acidic half ester thereof. The resulting product, therefore, is a mixture of about equal parts of unmodified non-ionic surfactant and its
30. acid-terminated half ester thereof and the mixture can

be used as such without separation of the unmodified non-ionic surfactant.

EXAMPLE 7

- 522 g of the non-ionic surfactant sold under the trade name Dobanol 25-7 (the product of ethoxylation of a C₁₂-C₁₅ alkanol, which product has about 7 ethylene oxide units per molecule of alkanol) is mixed with 100 g of succinic anhydride and 0.1 g of pyridine (which acts as an esterification catalyst) and heated at 260°C for 2 hours, cooled and filtered to remove unreacted succinic material. Infrared analysis indicates that substantially all of the free hydroxyls of the surfactant have reacted.

- Other esterification catalysts, such as, for example, alkali metal alkoxides such as sodium methoxide, may be used in place of, or in admixture with, the pyridine.

EXAMPLE 8

- Example 7 is repeated using 1000 g of Dobanol 91-5 (the product of ethoxylation of C₉-C₁₁ alkanol, which product has about 5 ethylene oxide units per molecule of alkanol) and 265 g of succinic anhydride.

- In the foregoing Examples 6 to 8, the carboxylic acid moiety is joined to the residue of the non-ionic surfactant by a carboxylic ester linkage. Instead of succinic acid anhydride, other polycarboxylic acid and acid anhydride compounds may be used, for example, maleic acid, maleic anhydride, glutaric acid, malonic acid, phthalic acid, phthalic anhydride, citric acid, and the like.

It is understood that the foregoing detailed description is given merely by way of illustration and that variations may be made therein without departing from the invention.

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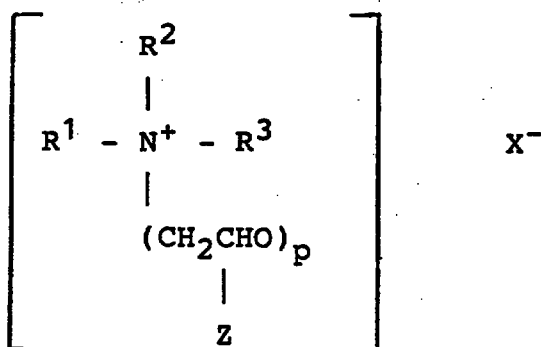
CLAIMS

1. A detergent composition consisting of a mixture of an acid-terminated non-ionic surfactant and a cationic surfactant in which the weight ratio is in the range of from 4:1 to 1:4.
5. 2. A detergent composition as claimed in Claim 1 in which the weight ratio is from less than 3:1 to 1:3.
10. 3. A detergent composition as claimed in Claim 1 in which the weight ratio is about 1:1.
15. 4. A detergent composition as claimed in Claim 1, 2 or 3 in which the acid modified non-ionic surfactant comprises at least one compound which is the reaction product between a non-ionic surfactant which is a poly C₂ to C₃ alkoxyated fatty alcohol having a terminal OH group with a polycarboxylic acid or polycarboxylic acid anhydride.
20. 5. A detergent composition as claimed in any one of Claims 1 to 4, in which the cationic surfactant is a quaternary ammonium salt surfactant.
25. 6. A detergent composition as claimed in any one of Claims 1 to 4 in which the cationic surfactant is a mono- or poly-ethoxylated quaternary ammonium salt surfactant.
- 30.



7. A detergent composition comprising an acid-modified non-ionic surfactant which comprises at least one compound which is the reaction product between a non-ionic surfactant which is a poly C₂ to C₃ alkoxyated fatty alcohol having a terminal OH group with a polycarboxylic acid or polycarboxylic acid anhydride, and a cationic surfactant which is a mono-or poly-ethoxylated quaternary ammonium salt surfactant.
5. 8. A detergent composition as claimed in Claim 5, 6 or 7, in which the quaternary ammonium salt surfactant has the formula:
- 10.

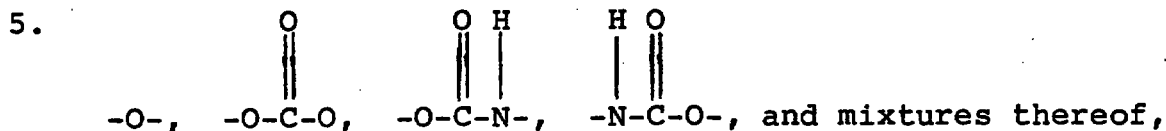
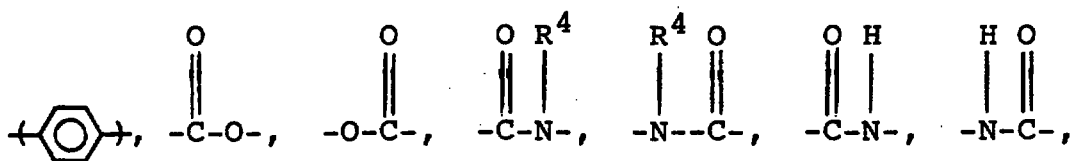
15.



20.

- wherein, R¹ represents an organic group containing a straight or branched alkyl or alkenyl group optionally substituted with up to 3 phenyl or hydroxy groups, and optionally interrupted by up to 4 structures selected from the group consisting of:
- 25.

30.



- wherein R^4 represents an alkyl or hydroxyalkyl group containing 1 to 4 carbon atoms, or a benzyl group, and which contains from about 8 to 22 carbon atoms, and which may additionally contain up to 12 ethylene oxide groups, R^2 represents the group R^1 or an alkyl or hydroxyalkyl group containing 1 to 6 carbon atoms, or a benzyl group; R^3 represents the group R^2 or $(\text{CH}_2\text{CHZO})_q\text{H}$; Z represents a hydrogen atom or a methyl group, and q and p are, independently, numbers from 1 to 12; and X represents a water-soluble anion.

20. 9. A detergent composition as claimed in Claim 1, substantially as specifically described herein.

25. 10. A built heavy duty laundry detergent composition, the surfactant content of which consists of a mixture of an acid-terminated non-ionic surfactant, a cationic surfactant, and a non-ionic surfactant which is not acid-terminated, up to 20% by weight of the non-ionic which is not acid-terminated optionally being replaced by another surfactant which is not an acid terminated non-ionic surfactant.



11. A built heavy duty laundry detergent composition as claimed in Claim 10 in which the acid-terminated non-ionic surfactant and the cationic surfactant are present in a weight ratio in the range of from about 4:1 to 1:4.

12. A built heavy duty laundry detergent composition as claimed in Claim 10 or Claim 11 in which the acid-terminated non-ionic surfactant and the cationic surfactant are provided by a detergent composition as claimed in any one of Claims 1 to 9.

13. A built heavy duty laundry detergent composition comprising

15. (A) 20 to 80% by weight non-ionic surfactant which is not acid terminated, optionally with up to 20% by weight replaced by another surfactant which is not an acid terminated non-ionic surfactant;

(B) 10 to 40% by weight of acid-terminated non-ionic surfactant;

20. (C) 10 to 40% by weight cationic surfactant, the sum of (A) + (B) + (C) being at least 30% by weight of the total composition; and

(D) detergent builder(s) present in an amount of up to about 60% by weight.

14. A liquid detergent composition the surfactant content of which consists of

(A) a liquid non-ionic surfactant which is not



acid-terminated,

(B) an acid-terminated non-ionic surfactant and

- (C) a cationic surfactant, up to 20% by weight of the non-ionic which is not acid-terminated optionally being replaced by another surfactant which is not an acid terminated non-ionic surfactant.
- 5.

15. A liquid detergent composition as claimed in Claim 14 in which components (B) and (C) are provided by a detergent composition as claimed in any one of Claims 1 to 8.
- 10.

16. A composition as claimed in Claim 14 or Claim 15, which further comprises an inorganic detergent builder salt which is stably suspended in the said surfactant mixture.
- 15.

17. A composition as claimed in Claim 16, in which the detergent builder salt is suspended throughout the said liquid non-ionic surfactant (A).
- 20.

18. A composition as claimed in Claim 15, 16 or 17, in which the said builder salt comprises sodium tripolyphosphate.
- 25.

19. A composition as claimed in Claim 15, 16, 17 or 18 in which the builder salt comprises from about 30% to about 75% by weight of the composition.

30. 20. A composition as claimed in any one of Claims



14 to 19, in which (B) and (C) are present at a molar ratio of from about 1.5:1 to about 1:1.5.

5. 21. A composition as claimed in any one of Claims 14 to 20, in which the surfactant mixture comprises from about 40% to about 90% by weight of (A) and from about 10% to 60% of (B) plus (C).

10. 22. A composition as claimed in any one of Claims 14 to 21, in which the liquid non-ionic surfactant (A) comprises at least one compound selected from the group consisting of C_{10} to C_{18} fatty alcohols which include from 3 to 12 moles of C_2 to C_3 alkylene oxide per mole of fatty alcohol.
- 15.

23. A composition as claimed in any one of Claims 14 to 22, which is substantially non-aqueous.

20. 24. A composition as claimed in any one of Claims 14 to 23, which comprises from about 0.5 to 1 part by weight (A), from about 0.12 to 5 parts by weight of (B) plus (C) at a weight ratio of (B) to (C) in the range of from 3:1 to 1:3, and from about 0.8 to 3 parts by weight of inorganic detergent builder salt.

25.

25. A liquid detergent composition as claimed in Claim 14, substantially as specifically described herein with reference to Example 2, 3 or 4.

30.
