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(71) Applicant (for all designated States except US): **AKZO NOBEL N.V.** [NL/NL]; Velperweg 76, NL-6824 BM Arnhem (NL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **DERY, Maurice, O.** [US/US]; 24 North Meadow Lane, Putnam Valley, NY 10579 (US). **SOLIMAN, Andrew** [US/US]; 220 Pelham Road, Apt. 6N, New Rochelle, NY 10805 (US). **BELL, John, P.** [US/US]; 47 Lee Avenue, Ossining, NY 10562 (US).

(74) Agent: **SCHALKWIJK, Pieter, Cornelis**; Akzo Nobel N.V., Intellectual Property Department (AIP), P.O. Box 9300, NL-6800 SB Arnhem (NL).

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(54) Title: AQUEOUS LAUNDRY DETERGENT COMPOSITIONS HAVING IMPROVED SOFTENING AND ANTISTATIC PROPERTIES

(57) Abstract: The invention relates to aqueous, 2-in-1 laundry detergent compositions comprising conventional cleaning agents and at least one softening agent that comprises at least one amido alkyl amine quaternary compound. The 2-in-1 laundry detergent composition of the invention is phase stable and provides excellent cleaning performance and superior through-the-wash-softening and antistatic properties.



WO 2008/000333 A1

AQUEOUS LAUNDRY DETERGENT COMPOSITIONS HAVING IMPROVED  
SOFTENING AND ANTISTATIC PROPERTIES

5 Field of the Invention

The present invention generally relates to the use of amido alkyl amine quaternaries as softening-through-the-wash and antistatic agents.

Background of the Invention

10 The prior art is filled with attempts to formulate laundry detergent compositions that have good cleaning properties together with textile softening properties so as to avoid the necessity of using a separate rinse-added textile softener product in addition to the usual laundry detergent. Such products are often referred to as 2-in-1 laundry detergents. Since cleaning by definition involves  
15 the removal of unwanted material from the textile surface and textile softening normally involves deposition of softening agent onto the same surface, these attempts have typically required a compromise in formulation between cleaning and softening performance.

20 Cationic surfactants have long been known as useful additives in laundry detergent compositions for the purpose of providing laundered textiles with a softening, static control and/or sanitization benefit. Attempts to formulate aqueous laundry detergent compositions containing anionic surfactants and a cationic surfactant, such as a quaternary ammonium salt, for softening-through-  
25 the-wash and static control benefits have resulted in poor physical product characteristics including phase split and/or poor fabric cleaning performance.

U.S. Patent Nos. 5,466,394 and 5,622,925 to Procter and Gamble both disclose a heavy duty liquid detergent composition containing certain levels of anionic  
30 surfactants and a quaternary ammonium fabric softening active. The preferred quaternary ammonium active is lauryl trimethyl ammonium chloride. It is believed that the invention disclosed in this application offers superior performance benefits over that in 5,466,394 and 5,622,925.

Therefore, it is an object of the present invention to provide a 2-in-1 laundry detergent composition which provides excellent through-the-wash-cleaning, along with softening and anti-static benefits.

5

It has now been found that aqueous, 2-in-1 laundry detergent compositions comprising anionic cleaning agents and softening agents can be formulated which provide through-the-wash-softening and antistatic benefits, excellent cleaning performance, and are phase stable. More specifically, it has been  
10 found that amido alkyl amine quaternaries, when employed in typical laundry detergent formulations, provide excellent through-the-wash-softening and antistatic properties.

#### Summary of the Invention

15 The present invention generally relates to the use of amido alkyl amine quaternaries as through-the-wash-softening and antistatic agents. More specifically, the present invention relates to aqueous, 2-in-1 laundry detergent compositions comprising conventional cleaning agents and at least one softening agent that is an amido alkyl amine quaternary compound. The 2-in-1  
20 laundry detergent composition of the invention is phase stable, provides excellent cleaning performance and superior through-the-wash-softening and antistatic properties.

#### Detailed Description of the Invention

25 In accordance with the present invention, it has been found that stable, aqueous, 2-in-1 laundry detergent compositions that provide excellent cleaning performance and superior through-the-wash-softening and antistatic properties can be prepared. More specifically, the present inventors have found that amido alkyl amine quaternaries, when employed in typical laundry detergent  
30 formulations, provide excellent through-the-wash-softening and antistatic properties.

The stable, aqueous, 2-in-1 laundry detergent compositions herein contain a cleaning or deterative surfactant component, typically an anionic surfactant component, and an amido alkyl amine quaternary component.

5 Anionic Surfactant Component

The 2-in-1 aqueous detergent compositions of the invention typically comprise from about 10% to about 40%, in another embodiment from about 15% to about 25%, by weight of the detergent composition, of an anionic surfactant component. The anionic surfactant component contains alkyl polyethoxylate  
10 sulfates and/or alkyl sulfates, and may contain other non-soap anionic surfactants, or mixtures thereof.

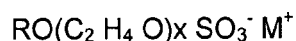
Useful anionic surfactants include the water-soluble salts, particularly the alkali metal, ammonium, and alkylammonium (e.g., monoethanolammonium or  
15 triethanolammonium) salts, of organic sulfuric reaction products having in their molecular structure an alkyl group containing from about 10 to about 20 carbon atoms and a sulfonic acid or sulfuric acid ester group. (Included in the term "alkyl" is the alkyl portion of aryl groups.) Examples of this group of synthetic surfactants are the alkyl sulfates, especially those obtained by sulfating the  
20 higher alcohols (C<sub>8</sub> -C<sub>18</sub> carbon atoms), such as those produced by reducing the glycerides of tallow or coconut oil.

Another class of useful anionic surfactants are the water-soluble salts of paraffin sulfonates containing from about 8 to about 24, in another embodiment from 12  
25 to 18, carbon atoms; alkyl glyceryl ether sulfonates, including but not limited to ethers of C<sub>8-18</sub> alcohols (for example, those derived from tallow and coconut oil); alkyl phenol ethylene oxide ether sulfates containing from about 1 to about 4 units of ethylene oxide per molecule and from about 8 to about 12 carbon atoms in the alkyl group; and alkyl ethylene oxide ether sulfates containing from about  
30 1 to about 4 units of ethylene oxide per molecule and from about 10 to about 20 carbon atoms in the alkyl group.

Still other useful anionic surfactants include the water-soluble salts of esters of  $\alpha$ -sulfonated fatty acids containing from about 6 to 20 carbon atoms in the fatty acid group and from about 1 to 10 carbon atoms in the ester group; the water-soluble salts of 2-acyloxy-alkane-1-sulfonic acids containing from about 2 to 9  
5 carbon atoms in the acyl group and from about 9 to about 23 carbon atoms in the alkane moiety; the water-soluble salts of olefin sulfonates containing from about 12 to 24 carbon atoms; and  $\beta$ -alkyloxy alkane sulfonates containing from about 1 to 3 carbon atoms in the alkyl group and from about 8 to 20 carbon atoms in the alkane moiety.

10

A class of preferred anionic surfactants are the alkyl sulfates and alkyl ether sulfates of the formula



wherein R is an alkyl chain having from about 10 to about 22 carbon atoms, saturated or unsaturated, and the longest linear portion of the alkyl chain is 15  
15 carbon atoms or less on the average, M is a cation capable of making the compound water-soluble, especially an alkali metal, ammonium or substituted ammonium cation, and x is from 0 to about 15. The anionic surfactant component of the present compositions comprises from about 5% to about  
20 40%, preferably from about 7% to about 36%, most preferably from about 10% to about 25%, by weight of the detergent composition, of alkyl sulfates and/or alkyl ether sulfates as described above.

Other preferred anionic surfactants include, but are not limited to, non-ethoxylated C<sub>12-15</sub> primary and secondary alkyl sulfates. Under cold water  
25 washing conditions, i.e. less than about 65°F, a mixture of such ethoxylated and non-ethoxylated alkyl sulfates is especially useful. Mixtures of the alkyl sulfates with the above-described paraffin sulfonates, alkyl glyceryl ether sulfonates, and esters of  $\alpha$ -sulfonated fatty acids are also useful.

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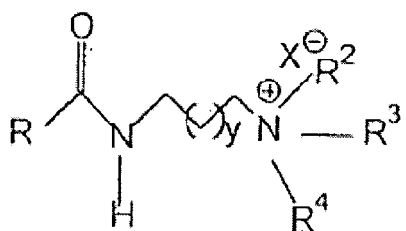
Another useful class of anionic surfactants are those known as alkyl benzene sulfonates. These include alkyl benzene sulfonates in which the alkyl group

contains from about 9 to about 15 carbon atoms, in straight-chain or branched configuration, e.g. those of the type described in U.S. Patent Nos. 2,220,099 and 2,477,383, both of which are incorporated herein by reference.

- 5 The invention is not limited by choice of anionic surfactants and other known classes of anionic surfactants can also be usefully employed in the context of the invention.

Amido alkyl amine Quaternary Surfactant

- 10 The compositions of the invention also contain from about 1% to about 10%, in another embodiment from about 2% to about 7%, and in yet another embodiment from about 3% to about 5%, by weight of an amido alkyl quaternary surfactant of the formula:



(I)

15

wherein

- R is a saturated or unsaturated, branched or straight-chain alkyl group, in another embodiment an alkyl group of from about 6 to about 26 carbon atoms, and in still another embodiment an alkyl group of 12 to about 22 carbon atoms; with the proviso that not more than 80% of said saturated or unsaturated, branched or unbranched alkyl group has from 16 to 18 carbon atoms;
- 20 R<sup>2</sup> and R<sup>3</sup> are each alkyl, alkoxyalkyl, hydroxyalkyl, polyalkoxy alkyl, hydroxyl alkyl sulfonate, alkyl sulfonate or alkylarylsulfonate; in another embodiment C<sub>1</sub> – C<sub>8</sub> alkyl, C<sub>1</sub> – C<sub>8</sub> alkoxyalkyl, C<sub>1</sub> – C<sub>8</sub> hydroxyalkyl, C<sub>1</sub> – C<sub>8</sub> polyalkoxy, with the
- 25 degree of polymerization ranging from 2 to 30, and in still another embodiment C<sub>1</sub> – C<sub>4</sub> alkyl, C<sub>1</sub> – C<sub>4</sub> alkoxyalkyl, C<sub>1</sub> – C<sub>4</sub> hydroxyalkyl, C<sub>1</sub> – C<sub>4</sub> polyalkoxy, with the degree of polymerization ranging from 2 to 30;

$R^4$  is a saturated or unsaturated hydrocarbon such as alkyl, aryl, aralkyl, alkaryl, saturated or unsaturated; in another embodiment H or a  $C_1 - C_4$  saturated or unsaturated alkyl group;

wherein any two of  $R^2$ ,  $R^3$ , and  $R^4$ , together with the nitrogen atom to which they are attached, form a heterocyclic ring,

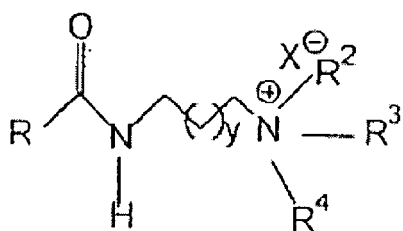
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$y$  is an integer from 1 to 12, in another embodiment 1 to 6, and in still another embodiment 1 to 3, and

$X^-$  is a compatible anion. Suitable anions include, but are not limited to, halides, oxo ions of phosphorous, sulfur or chloride, and various organic anionic molecules.

10

In another embodiment the surfactant is an alkylamido propyl trialkyl ammonium quaternary compound having the following general formula:



(I)

15 wherein R is tallowalkyl  $R^2$ ,  $R^3$ , and  $R^4$  are methyl,  $y$  is 1, and  $X^-$  is as defined above, preferably methosulfate.

This class of compounds can be prepared by quaternizing the corresponding alkylamido propyl trimethylamide with methylene chloride, ethyl chloride, benzyl chloride, vinyl chloride, butyl chloride, dimethyl sulfate, diethyl sulfate, chlorohydroxyalkylsulfonate, chloroalkylsulfonates and the like, and mixtures thereof.

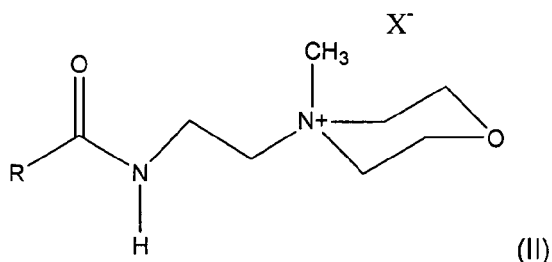
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The long-chain saturated or unsaturated, branched or straight-chain alkyl groups, R, are hydrophobic in nature and are generally derived from one or more fatty acids, which are reacted with an amine to form the amide. Examples of fatty acids include, but are not limited to, cetyl, oleyl, stearyl, erucyl, and

25

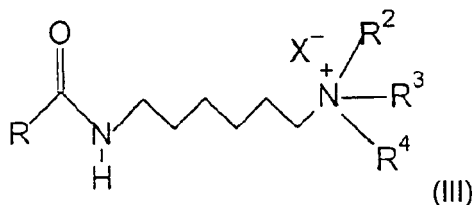
derivatives of tallow, coco, soya, rapeseed oils and the like, and mixtures thereof. It is preferred that R comprise not more than 80% of said saturated or unsaturated, branched or straight-chain alkyl groups having from 16 to 18 carbon atoms, the remainder of R being selected from saturated or unsaturated, branched or straight-chain alkyl groups having from 6 to 26 carbon atoms. It is preferred that the parent fatty acids from which the R group is derived have an IV of from 20-100, in another embodiment 30-90, in another embodiment 40-80, and in still another embodiment 45-65.

10 In another embodiment, the quaternary ammonium salt is an amido ethyl morpholine quaternary salt of the following general structure:

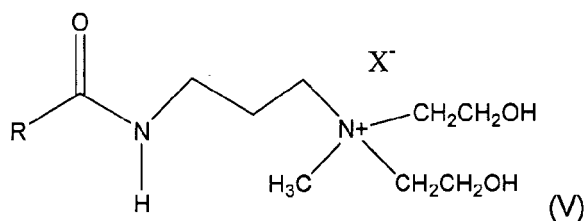
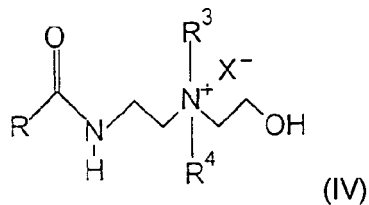


wherein R and X<sup>-</sup> are as defined above. A useful surfactant corresponding to the above formula is isosteryl amido ethyl morpholine lactate.

Non-limiting examples of other useful quaternary salts include the following structures:

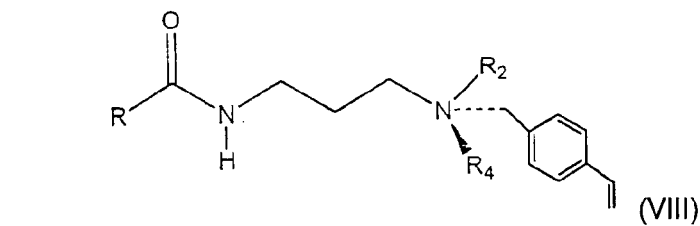
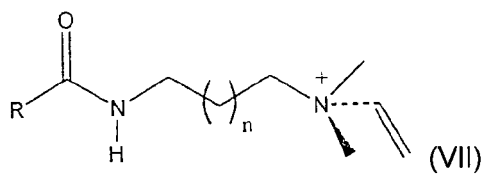
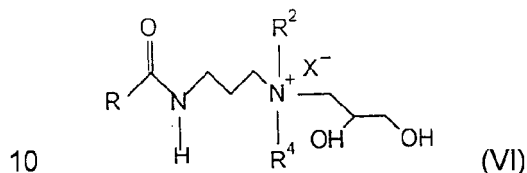


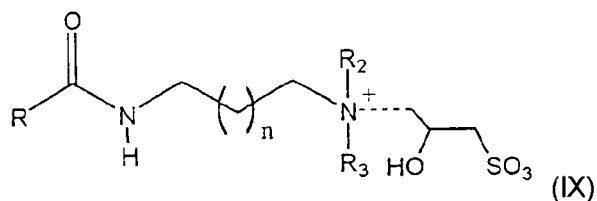
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wherein R, R<sup>2</sup>, R<sup>3</sup>, R<sup>4</sup>, and X<sup>-</sup> are as defined above. Preferably, R has from about 6 to about 26 carbon atoms, more preferably from about 12 to about 24 carbon atoms. A specific example of a compound falling within structure (V) is tallowalkylamidopropyl-N-di(2-hydroxyethyl)methyl ammonium chloride.

Additional examples of useful quaternary salts include, but are not limited to, those corresponding to the following structures:

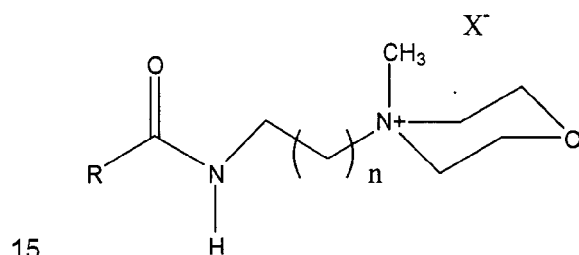




wherein R, R<sup>2</sup>, R<sup>3</sup>, R<sup>4</sup> are as defined above.

X may be halides, oxo ions of phosphorous, sulfur or chloride, and various  
 5 organic anions, including chlorides, bromides, iodides, oxides of phosphorous,  
 hypochlorides, phosphates, phosphates, oxides of sulfur, sulfates, sulfites,  
 sulfonates, phosphates, acetates, carboxylates, chlorates, perchlorates,  
 salicylates, phthalates, lactates, maleates, glycinates, citrates, citric acid, lactic  
 acid, salicylic acid, phthalic acid, benzoic acid, naphthoic acid, amino acids, and  
 10 so forth.

In an especially useful embodiment, amido propyl morpholine quaternary salts  
 of the following general structure are employed as the cationic component:



wherein R comprises not more than 80% of a saturated or unsaturated,  
 branched or linear alkyl group having from 16 to 18 carbon atoms, and mixtures  
 thereof, the remainder of R being selected from saturated or unsaturated,  
 20 branched or straight-chain alkyl groups having from about 6 to about 26 carbon  
 atoms and n is an integer from 1-2.

The 2-in-1 detergent composition of the invention generally comprises a weight ratio of anionic surfactant component to amido alkyl amine quaternary ammonium softening agent of from about 1:1 to about 20: 1

#### 5 Fatty Acid

The 2-in-1 detergent compositions of the present invention may optionally contain from 0% to about 10%, preferably from about 2% to about 7%, most preferably from about 3% to about 5%, by weight of a fatty acid or fatty acid salt containing from about 8 to about 20 carbon atoms. The fatty acid or fatty acid  
10 salt can also contain from about 1 to about 10 ethylene oxide units in the hydrocarbon chain.

Suitable fatty acids or fatty acid salts are saturated and/or unsaturated, branched or straight-chain and can be obtained from natural sources such as  
15 plant or animal esters (e.g. palm kernel oil, palm oil, coconut oil, babassu oil, safflower oil, tall oil, castor oil, tallow and fish oils, grease, and mixtures thereof), or synthetically prepared (e.g. via the oxidation of petroleum or by hydrogenation of carbon monoxide via the Fisher Tropsch process). Examples of suitable saturated fatty acids or fatty acid salts for use in the compositions of  
20 this invention include capric, lauric, myristic, palmitic, stearic, arachidic, and behenic acid. Suitable unsaturated fatty acid species include palmitoleic, oleic, linoleic, linolenic, and ricinoleic acid. Examples of preferred fatty acids or fatty acid salts are saturated C<sub>12</sub> fatty acid, saturated C<sub>12</sub> -C<sub>14</sub> fatty acids, and saturated or unsaturated C<sub>12</sub> to C<sub>18</sub> fatty acids, and mixtures thereof.

25

#### Optional Components

The compositions of the present invention can also contain up to about 30%, preferably from about 1% to about 20%, more preferably from about 2% to  
30 about 10%, by weight of an ethoxylated nonionic surfactant. Particularly useful are ethoxylated alcohols and ethoxylated alkyl phenols of the formula  
 $R(OC_2H_4)_n OH,$

wherein R is selected from the group consisting of aliphatic hydrocarbon radicals containing from about 8 to about 15 carbon atoms and alkyl phenyl radicals wherein the alkyl groups contain from about 8 to about 12 carbon atoms, and the average value of n is from about 5 to about 15. Ethoxylated  
5 alcohols having an average of from about 10 to about 15 carbon atoms in the alcohol and an average degree of ethoxylation of from about 6 to about 12 moles of ethylene oxide per mole of alcohol can also be advantageously employed. Surfactants such as those described above can be found in U.S. Patent Nos. 4,284,532 and 4,285,841, which are incorporated herein by  
10 reference.

The addition of the ethoxylated nonionic surfactant to compositions of the present invention is helpful in providing physical stability to the detergent product, i.e. preventing phase splits and precipitation. In most cases, at least  
15 about 2% of the nonionic surfactant in the present detergent compositions can alleviate and/or eliminate physical stability problems.

The compositions herein also preferably contain up to about 30%, in another embodiment from about 1% to about 20%, and in still another embodiment from  
20 about 1% to about 10%, by weight of a detergent builder material. While all manner of detergent builders known in the art can be used in the present compositions, the type and level of builder should be selected such that the final composition has an initial pH of from about 7.0 to about 9.0 at a concentration of from about 1% to about 10% by weight in water at 20°C. In liquid detergent  
25 compositions, the builder preferably represents from about 1% to about 20%, in another embodiment from about 3% to about 10%, by weight of the composition. Citric acid is an example of a particularly useful builder. Other examples of builders include, but are not limited to, sodium citrate, sodium carbonate, and sodium sulfate.

30 Enzymes can be included in the formulations of the invention for a wide variety of fabric laundering purposes, including removal of protein-based,

carbohydrate-based, or triglyceride-based stains, for example, and for fabric restoration. The enzymes to be incorporated include proteases, amylases, lipases, and cellulases, as well as mixtures thereof. Other types of enzymes may also be included. They may be of any suitable origin, such as vegetable,  
5 animal, bacterial, fungal, and yeast origin. However, their choice is governed by several factors such as pH-activity and/or stability optima, thermostability, stability versus active detergents, builders, and so on. In this respect bacterial or fungal enzymes are preferred, such as bacterial amylases and proteases, and fungal cellulases. Particularly preferred compositions herein contain from  
10 about 0.05% to about 2% by weight of detergent enzymes, especially the amylases, proteases, and mixtures thereof, of the type well known to detergent formulators.

Enzymes are normally incorporated at levels sufficient to provide up to about 5  
15 mg by weight, more typically about 0.01 mg to about 3 mg, of active enzyme per gram of the composition. Stated otherwise, the compositions herein will typically comprise from about 0.001% to about 5%, preferably 0.01% to 1%, by weight of a commercial enzyme preparation. Protease enzymes are usually present in such commercial preparations at levels sufficient to provide from 0.005 to 0.1  
20 Anson units (AU) of activity per gram of composition. The types of enzymes employable and the methods for effectively employing them in detergent compositions are within the area of expertise of one of ordinary skill in the art.

Optionally, the compositions herein may also contain various additional  
25 stabilizers such as, for example, borate-type stabilizers. Typically, such stabilizers will be used at levels in the compositions from about 0.25% to about 10%, preferably from about 0.5% to about 5%, more preferably from about 0.75% to about 4%, by weight of boric acid or other borate compound capable of forming boric acid in the composition (calculated on the basis of boric acid).  
30 Boric acid is preferred, although other compounds such as boric oxide, borax and other alkali metal borates (e.g. sodium ortho-, meta- and pyroborate, and sodium pentaborate) are suitable. Substituted boric acids (e.g. phenylboronic

acid, butane boronic acid, and p-bromo phenylboronic acid) can also be used in place of boric acid.

Other optional components for use include, but are not limited to, neutralizing agents, buffering agents, phase regulants, hydrotropes, polyacids, suds regulants, opacifiers, antioxidants, bactericides, dyes, perfumes, brighteners, and the like. Non-limiting examples of neutralizing agents for use herein are organic bases, especially triethanolamine and monoethanol amine, which provide a better detergency performance than inorganic bases such as sodium and potassium hydroxides.

The following non-limiting examples illustrate the compositions and utility of the present invention.

15

**Example 1**

A premium commercial heavy-duty liquid laundry detergent was purchased (Tarrytown NY) and quaternary ammonium compounds were added to it in the stated proportions.

20

	Example A	Example B	Example C
commercial detergent	100%	96%	96%
lauryltrimethylammonium chloride			4%
Trimethyltallowalkylamidopropylammonium chloride		4%	

Standard laundry loads were washed in an automatic clothes washer. Each load used 0.48 cup (123 grams) of one of the above detergents compositions, providing about 1,900 PPM of the detergent composition to the wash water solution. The wash water was at 36-40°F and the water contained 40 PPM of Ca<sup>++</sup>:Mg<sup>++</sup> (3:1). After a standard wash cycle (wash, rinse, and spin) the loads were placed in standard electric clothes driers and tumble-dried. After 70

minutes of drying, a polyester swatch was removed from the standard clothes bundle and the amount of static present on this swatch was determined using a Point Simco Electrostatic Field Meter.

- 5 The averaged results from an experiment repeated in triplicate and reported as nano coulombs are given in the chart below. The data is a comparison of the static reduction of a detergent containing 4% lauryltrimethylammonium chloride vs. 4% tallowalkylamidopropyl trimethylammonium chloride vs. the commercial laundry detergent without the addition of quaternary ammonium compounds. As  
 10 can be seen from the data, lower is better, the incorporation of tallowamidopropyl trimethylammonium chloride significantly reduces the build-up of static in the clothes dryer.

**Example 2.**

- 15 A premium commercial heavy-duty liquid laundry detergent was purchased (Tarrytown NY). The brand of detergent was different from the one used in Example 1.

	Example D	Example E	Example F
commercial detergent	100%	98%	96%
trimethyltallowamidopropylammonium chloride		2%	4%

- 20 Standard laundry loads were washed in an automatic clothes washer. Each load used 0.48 cup (123 grams) of one of the above detergents compositions, providing about 1,900 PPM of the detergent composition to the wash water solution. The wash water was at 36-40°F and contained 40 PPM of Ca<sup>++</sup>:Mg<sup>++</sup> (3:1). After a standard wash cycle (wash, rinse, and spin) the loads were placed  
 25 in standard electric clothes driers and tumble-dried. After 30, 45, and 60 minutes of drying, a polyester swatch was removed from the standard clothes bundle and the amount of static present on each swatch was determined using a Point Simco Electrostatic Field Meter. The charge is reported in nano coulombs.

Below is a chart comparing the static reduction of a detergent containing 4% tallowamidopropyltrimethylammonium chloride vs. the commercial laundry detergent without the addition of quaternary ammonium compounds. As can be seen from the data, lower is better, the incorporation of tallowamidopropyl trimethylammonium chloride significantly reduces the build-up of static in the clothes dryer.

10 **Example 3.**

Standard laundry loads including four terry cloth towels were washed in an automatic clothes washer. Each load used 0.48 cup (123 grams) of detergent composition A or B, providing about 1,900 PPM of the detergent composition to the wash water solution. The wash water temperature was 36-40°F and the water contained 40 PPM of Ca<sup>++</sup>:Mg<sup>++</sup> (3:1). After a standard wash cycle (wash, rinse, and spin) half of the loads were placed in standard electric clothes driers and tumble-dried. The other half of each load was placed on standard drying racks and allowed to dry at ambient conditions for at least 24 hrs. For each load, the softness of the terry cloth towels was graded manually by a panel of trained graders. The graders were asked to make a selection of preference between towels washed with either detergent A or detergent B. The towels had been dried under either "line dry" or "tumble-dried" conditions. It is clear from the results summarized in the table below that the graders preferred laundry detergents containing the compositions of the present invention.

25

	% Graders Preferring Example B
Tumble Dried	83%
Line Dried	77%

**Example 4.**

A variation of ASTM method D 4265 was used to determine the effect on the cleaning performance of detergents containing tallowalkylamidopropyl trimethyl

ammonium quaternaries. The initial reflectance of four soiled and three unsoiled swatches was determined using a Hunter Lab Ultrascan XE spectrophotometer with a 420 nm UV filter. The fabric swatches were obtained from Testfabrics, Inc. The soiled swatches were WFK-20C and the unsoiled swatches were WFK-20A. The washing and rinsing of the swatches was performed using a Terg-O-Tometer. The wash conditions were 32°C, 120 PPM water hardness, 10 minutes with a 1,000 g wash solution. The detergent concentration in the wash water was 0.17% wt. One rinse was performed at 21°C, 120 PPM water hardness for 2 minutes with a 1,000 g rinse solution. Eight spectrophotometric readings were taken on every swatch. The detergents from Examples D and F were used. A ratio of soil removed vs. the initial soil content of the swatch was used to calculate the detergency percentage. The results are given in the table below. As is evident from the data below, incorporation of the tallowalkylamidopropyltrimethyl ammonium quaternary into the detergent formulation does not negatively impact the ability to remove soil. In this case a slightly better cleaning performance was observed. Redeposition is the property where soil is deposited onto clean fabric during the wash cycle. The redeposition performance was measured for the laundry detergents of Examples D and F and they were found to be comparable.

20

**Example 5.**

Component	Example G	Example H	Example I	Example J
Water %	45.2	41.2	43.2	41.2
NaOH 1N %	1.8	1.8	1.8	1.8
DDBSA %	6.9	6.9	6.9	6.9
Sodium lauryl ether sulfate %	23.9	23.9	23.9	23.9
Ethoxylated alcohol %	7.1	7.1	7.1	7.1
Sodium citrate %	2.4	2.4	2.4	2.4
Sodium sulfate %	0.3	0.3	0.3	0.3
Sodium carbonate %	2.0	2.0	2.0	2.0
Ethanol %	3.3	3.3	3.3	3.3
Propylene glycol %	6.9	6.9	6.9	6.9
Trimethyltallowalkylamido-propylammonium methosulfate %	0	4		
Lauryltrimethylammonium chloride total	100	100	2	4
			100	100

DDBSA is Witconic® 1298S  
 Sodium lauryl ether sulfate is Witcolate® ES-1  
 Ethoxylated alcohol is Tomadol® 25-7

Four laundry detergent formulations, Examples G through J, were prepared by blending the surfactants listed in the table in the disclosed weight percentages. Example I was not stable and formed a second layer on standing. Example J formed a thick gel-like phase on addition of the lauryltrimethylammonium chloride and separated into two layers on standing. Neither formulation I nor formulation J formed a clear/stable one phase solution and as a result both were deemed unsuitable to be tested as a laundry detergent.

Three standard laundry loads were washed in an automatic clothes washer. Each load used 0.48 cup (123 grams) of either detergent G or detergent H, providing about 1,900 PPM of the detergent composition to the wash water solution. The wash water was at 36-40°F and contained 40 PPM of Ca<sup>++</sup>:Mg<sup>++</sup> (3:1). After a standard wash cycle (wash, rinse, and spin) the three loads were each placed in standard electric clothes driers and tumble-dried. Every five minutes during the drying cycle, a polyester swatch was removed from the standard clothes bundle and the amount of static present on each swatch was determined using a Point Simco Electrostatic Field Meter. The charge was recorded in nano coulombs. A summation of every recorded static measurement was performed, thus giving the total charge generated during the 60-minute drying cycle. The averaged results from the three individual tests are reported in the table below. As is evident from the results, use of Example H significantly reduced the amount of static in the total drying cycle compared to Example G.

	Total static (in nano coulombs) produced during a 60-minute drying cycle
Example G	5,009
Example H	4,077

25

**Example 6.**

A premium commercial heavy-duty liquid laundry detergent was purchased (Tarrytown NY). The brand of detergent was different from the one used in Example 1.

5

	Example				
	D	F	J	K	L
commercial detergent	100%	96%	96%	96%	96%
trimethyltallowamidopropylammonium chloride		4%			
trimethylcocalkylamidopropylammonium chloride			4%		
trimethylerucylamidopropylammonium chloride				4%	
trimethylhydrogentatedtallowalkylamidopropylammonium methosulfate					4%
Charge after sixty minutes (nano coulombs)	1,200	800	~1,200	~1,200	1,500

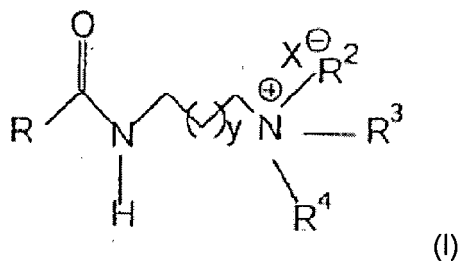
Standard laundry loads were washed in an automatic clothes washer. Each load used 0.48 cup (123 grams) of one of the above detergents compositions (D-L), providing about 1,900 PPM of the detergent composition to the wash water solution. The wash water was at 36-40°F and contained 40 PPM of Ca<sup>++</sup>:Mg<sup>++</sup> (3:1). After a standard wash cycle (wash, rinse, and spin) the loads were placed in standard electric clothes driers and tumble-dried. After 60 minutes of drying, a polyester swatch was removed from the standard clothes bundle and the amount of static present on each swatch was determined using a Point Simco Electrostatic Field Meter. The charge is reported in the table above in nano coulombs.

As is evident from the data in the table above, the only material that was effective in reducing the static in a clothes dryer was that derived from tallow fatty acid. Without wishing to be bound by theory, it is believed that a certain amount of unsaturation is needed in the R group of the amidopropylamine to

provide suitable antistatic effects. Coco fatty acid, which typically has an IV value of 8-12, is not effective in reducing static. Unsaturation alone is not the only factor that needs to be considered, the chain length of the R group is also important. Pure chain lengths, such as eurucic, do not give favourable results in  
5 this test. Therefore, the combination of R group that is composed of no more than 80% of a single chain length and has an IV value of 20-100 is the most preferred.

## CLAIMS

1. A 2-in-1 laundry detergent composition having improved softening and anti-static properties comprising at least one anionic deterative surfactant component and at least one cationic softening agent comprising an amido alkyl amine quaternary ammonium compound of the formula:



10 wherein

R is a saturated or unsaturated, branched or straight-chain alkyl group having an IV of from 20 to 90, wherein not more than 80% of said alkyl group has from 16 to 18 carbon atoms, the remainder of R being selected from a saturated or unsaturated, branched or straight-chain alkyl group of from about 6 to about 26 carbon atoms,

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R<sup>2</sup> and R<sup>3</sup> are each alkyl, alkoxyalkyl, hydroxyalkyl, polyalkoxy alkyl, hydroxyl alkyl sulfonate, alkyl sulfonate or alkylarylsulfonate;

R<sup>4</sup> is a saturated or unsaturated hydrocarbon such as alkyl, aryl, aralkyl, alkaryl;

20

wherein any two of R<sup>2</sup>, R<sup>3</sup>, and R<sup>4</sup>, together with the nitrogen atom to which they are attached, may optionally form a heterocyclic ring,

y is an integer from 0 to 12,

X is an anion, and the IV of said cationic softening agent is from 20 to 100.

25

2. The composition of claim 1 wherein R is a saturated or unsaturated, branched or straight-chain alkyl group having from about 6 to about 26

carbon atoms, wherein not more than 80% of said alkyl group has from 16 to 18 carbon atoms;  $R^2$  and  $R^3$  are each independently selected from  $C_1 - C_8$  alkyl,  $C_1 - C_8$  alkoxyalkyl,  $C_1 - C_8$  hydroxyalkyl,  $C_1 - C_8$  polyalkoxy, with the degree of polymerization ranging from 2 to 30;  $R^4$  is a saturated or unsaturated alkyl, aryl, aralkyl, alkaryl group, wherein any two of  $R^2$ ,  $R^3$ , and  $R^4$ , together with the nitrogen atom to which they are attached, may optionally form a heterocyclic ring, and  $X^-$  is an anion selected from halides, oxo ions of phosphorous, sulfur or chloride, compatible organic anionic molecule, or mixtures thereof, and the like.

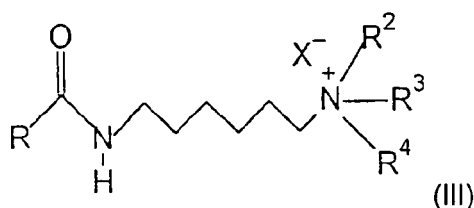
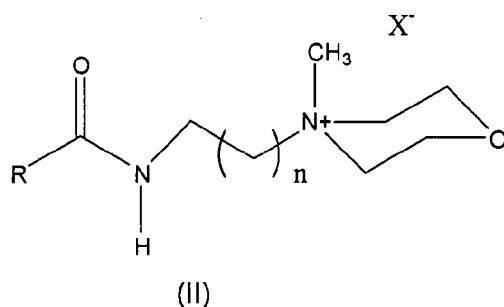
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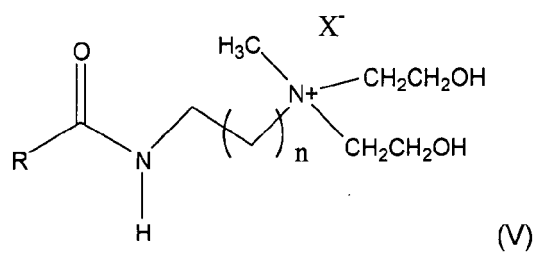
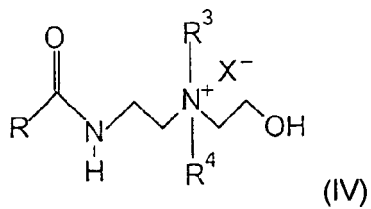
3. The composition of claim 2 wherein R is a saturated or unsaturated, branched or straight-chain alkyl group of 12 to about 22 carbon atoms, wherein not more than 80% of said alkyl group has from 16 to 18 carbon atoms;  $R^2$  and  $R^3$  are each  $C_1 - C_4$  alkyl,  $C_1 - C_4$  alkoxyalkyl,  $C_1 - C_4$  hydroxyalkyl,  $C_1 - C_4$  polyalkoxy, with the degree of polymerization ranging from 2 to 30;  $R^4$  is a saturated or unsaturated  $C_1 - C_4$  alkyl group, and R has an IV of from 40-65.

15

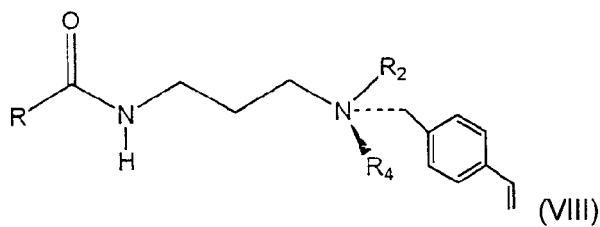
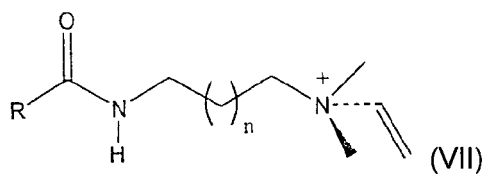
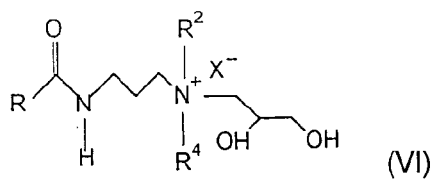
4. The composition of claim 1 wherein said amido alkyl amine quaternary ammonium compound comprises at least one compound of the formulae:

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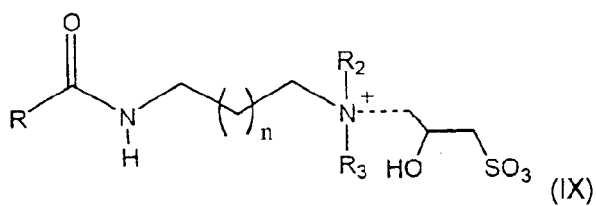




5



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or mixtures thereof, wherein

R is a saturated or unsaturated, branched or straight-chain alkyl group of from about 6 to about 26 carbon atoms, wherein not more than 80% of said alkyl group has from 16 to 18 carbon atoms;

5 R<sup>2</sup> and R<sup>3</sup> are each C<sub>1</sub> – C<sub>8</sub> alkyl, C<sub>1</sub> – C<sub>8</sub> alkoxyalkyl, C<sub>1</sub> – C<sub>8</sub> hydroxyalkyl, C<sub>1</sub> – C<sub>8</sub> polyalkoxy, with the degree of polymerization ranging from 2 to 30; and

R<sup>4</sup> is a saturated or unsaturated alkyl, aryl, aralkyl, alkaryl, wherein any two of R<sup>2</sup>, R<sup>3</sup>, and R<sup>4</sup>, together with the nitrogen atom to which they are  
10 attached, may optionally form a heterocyclic ring,

n is an integer from 1 to 12, and

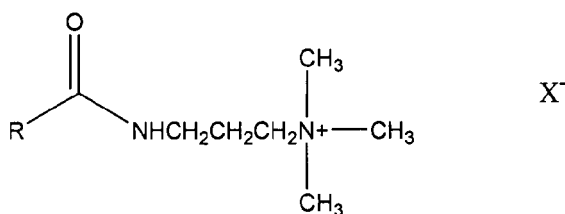
X<sup>-</sup> is an anion that imparts water-solubility to said quaternary ammonium compound.

15 5. The composition of claim 1 wherein X<sup>-</sup> is selected from halides, oxo ions of phosphorous, sulfur or chloride, organic anions of chlorides, bromides, iodides, oxides of phosphorous, hypochlorides, phosphates, phosphates, oxides of sulfur, sulfates, sulfites, sulfonates, phosphates, acetates, carboxylates, chlorates, perchlorates, salicylates, phthalates, lactates,  
20 maleates, glycinates, citrates, citric acid, lactic acid, salicylic acid, phthalic acid, benzoic acid, naphthoic acid, amino acids, and mixtures thereof.

25 6. The composition of claim 5 wherein X<sup>-</sup> is selected from halides, oxo ions of phosphorous, sulfur or chloride, organic anions of chlorides, bromides, iodides, oxides of phosphorous, hypochlorides, phosphates, phosphates, oxides of sulfur, sulfates, sulfites, sulfonates, phosphates, acetates, carboxylates, chlorates, perchlorates, salicylates, phthalates, lactates, maleates, glycinates, citrates, citric acid, lactic acid, salicylic acid,  
30 phthalic acid, benzoic acid, naphthoic acid, amino acids, and mixtures thereof.

7. The composition of claim 1 wherein said amidoalkylamine quaternary ammonium compound comprises tallow amidopropyltrimethyl ammonium quaternary salt, an amidopropylmorpholine quaternary salt, an isosteryl-amidoethyl morpholine lactate, dimethylalkylglycerolammonium chloride, 5 amidopropylmorpholine quaternary salt, or mixtures thereof.

8. The composition of claim 2 wherein said amidoalkylamine quaternary ammonium compound is of the following structure:



10

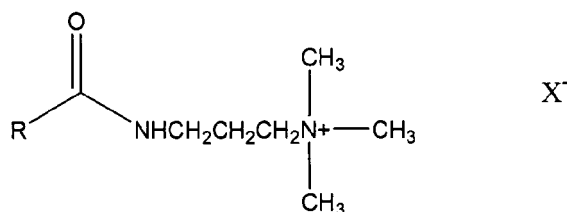
wherein R has an IV of from 30-90 and comprises not more than 80% of a saturated or unsaturated, branched or unbranched alkyl group having from 16 to 18 carbon atoms, and mixtures thereof, the remainder of R 15 being selected from saturated or unsaturated, branched or straight-chain alkyl groups having from about 6 to about 26 carbon atoms.

9. The composition of claim 1 wherein said composition comprises from about 1% to about 10% by weight of said amido alkyl amine quaternary ammonium compound. 20

10. The composition of claim 1 wherein the weight ratio of anionic surfactant component to amido alkyl amine quaternary ammonium compound is from about 1:1 to about 20: 1. 25

11. The composition of claim 1 wherein said deterative surfactant is an anionic surfactant.

12. The composition of claim 11 wherein said anionic surfactant comprises water-soluble salts of alkyl sulfates, paraffin sulfonates containing from about 8 to about 24 carbon atoms; alkyl glyceryl ether sulfonates, esters of  $\alpha$ -sulfonated fatty acids, olefin sulfonates containing from about 12 to
- 5 24 carbon atoms;  $\beta$ -alkyloxy alkane sulfonates containing from about 1 to 3 carbon atoms in the alkyl group and from about 8 to 20 carbon atoms in the alkane moiety, non-ethoxylated C<sub>12-15</sub> primary and secondary alkyl sulfates, alkyl benzene sulfonates, and mixtures thereof.
- 10 13. The composition of claim 12 wherein said anionic surfactant is a water-soluble alkyl sulfate and alkyl polyethoxylate sulfate of the formula
- $$\text{RO}(\text{C}_2\text{H}_4\text{O})_x\text{SO}_3^- \text{M}^+$$
- wherein R is a saturated or unsaturated alkyl chain having from about 10 to about 22 carbon atoms, M is a cation, and x is from 0 to about 15.
- 15 14. The composition of claim 13 wherein said laundry detergent composition comprises from about 5 to 40% by weight of said deterative surfactant.
- 20 15. A 2-in-1 laundry detergent composition having improved softening and anti-static properties comprising at least one anionic deterative surfactant component and at least one softening agent compound, wherein said softening agent comprises at least one compound of the formula:



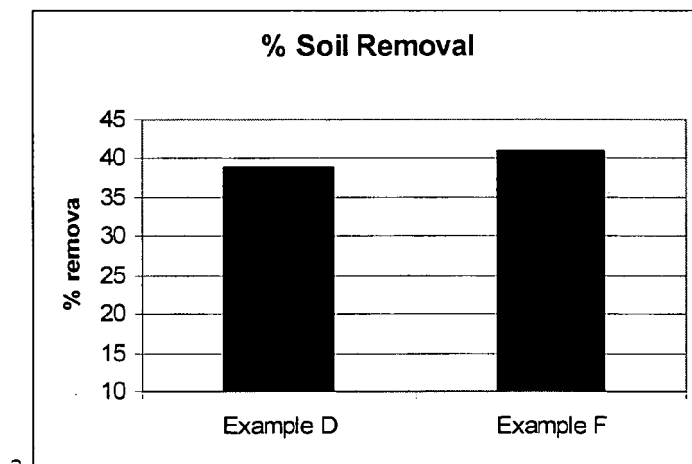
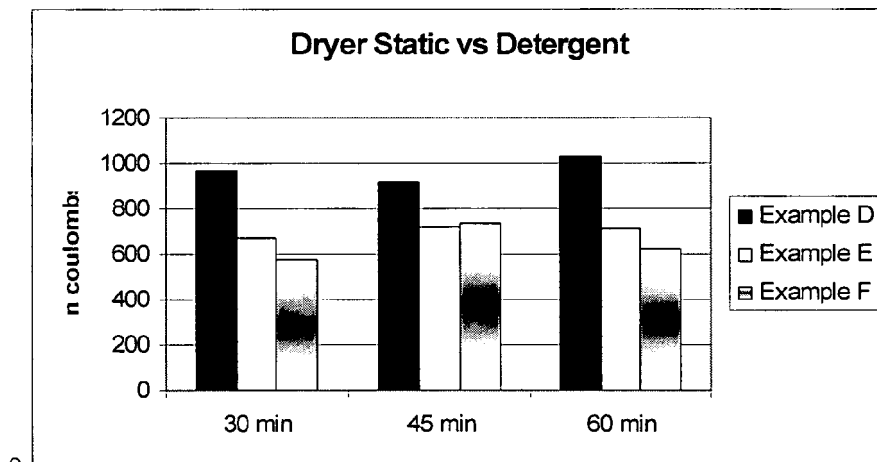
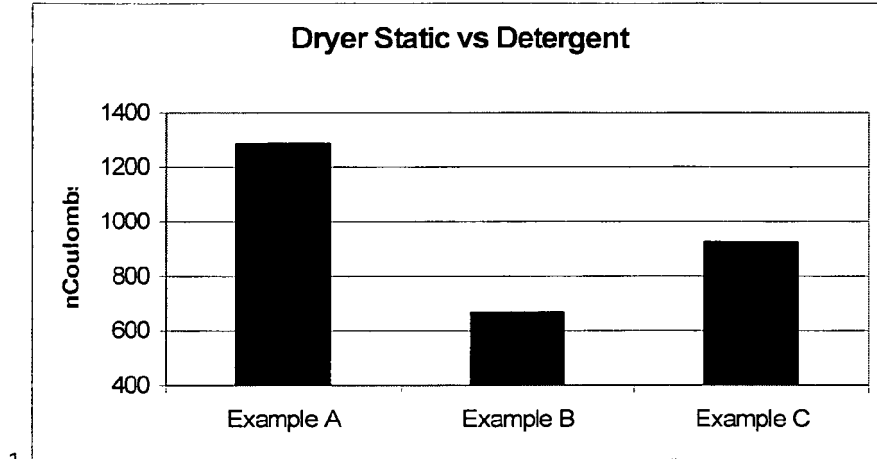
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wherein R comprises not more than 80% of a saturated or unsaturated, branched or unbranched alkyl group having from 16 to 18 carbon atoms, and mixtures thereof, the remainder of R being selected from saturated

or unsaturated, branched or straight-chain alkyl groups having from about 6 to about 26 carbon atoms, and wherein the IV of said R is from 20-10.

- 5 16. The composition of claim 15 which comprises from about 5 to 40% by weight of said deterative surfactant and from 1% to about 10% by weight of said softening agent.
17. The composition of claim 16 wherein the weight ratio of said deterative surfactant to said softening agent is from about 1:1 to about 20: 1.  
10
18. The composition of claim 8 wherein the IV of said R group is from 45 to 65.

Drawings



# INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2007/004826

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. C11D3/32      C11D1/02      C11D1/52				
According to International Patent Classification (IPC) or to both national classification and IPC				
<b>B. FIELDS SEARCHED</b>				
Minimum documentation searched (classification system followed by classification symbols) C11D				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	EP 0 258 923 A2 (AKZO NV [NL]) 9 March 1988 (1988-03-09)	1-18		
X	----- example 12	15		
X	US 4 255 294 A (RUDY JEROME ET AL) 10 March 1981 (1981-03-10) columns 16,17; example 4	1-18		
X	US 5 376 287 A (BORCHER SR THOMAS A [US]) ET AL) 27 December 1994 (1994-12-27) column 1, lines 41-43,66,67 column 2, lines 35-38 column 3, lines 12-44 column 7, lines 28,29 column 10, lines 57-60	1-18		
<input type="checkbox"/> Further documents are listed in the continuation of Box C.				
<input checked="" type="checkbox"/> See patent family annex.				
* Special categories of cited documents :				
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;">                     *A* document defining the general state of the art which is not considered to be of particular relevance                      *E* earlier document but published on or after the international filing date                      *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)                      *O* document referring to an oral disclosure, use, exhibition or other means                      *P* document published prior to the international filing date but later than the priority date claimed                 </td> <td style="width: 50%; border: none; vertical-align: top;">                     *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention                      *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone                      *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.                      *Z* document member of the same patent family                 </td> </tr> </table>			*A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *Z* document member of the same patent family
*A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *Z* document member of the same patent family			
Date of the actual completion of the international search	Date of mailing of the international search report			
28 September 2007	08/10/2007			
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer  <p style="text-align: center; font-weight: bold;">CULMANN, J</p>			

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2007/004826

Patent document cited in search report	Publication date	Patent family member(s)	Publication date		
EP 0258923	A2	09-03-1988	NO	873671 A	03-03-1988
			US	4851138 A	25-07-1989
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US 4255294	A	10-03-1981	NONE		
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US 5376287	A	27-12-1994	NONE		
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