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DETERGENT COMPOSITIONS COMPOSED OF ALKYLARYL SULFONATES AND N-ALKYL β-AMINOPROPIONATES

Royce G. Freese and Harold Wittcoff, Minneapolis, Minn., assignors to General Mills, Inc., a corporation of Delaware

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The present invention relates to detergent compositions composed of a mixture of alkali metal salts of alkylaryl sulfonic acids and alkali metal salts of N-alkyl β-aminopropionic acids. The alkylaryl sulfonates to which the present invention is directed are those in which the alkyl group contains from 8 to 14 carbon atoms. The N-alkyl β-aminopropionates are those in which the alkyl group contains from 16 to 18 carbon atoms and may be either saturated or unsaturated.

Isbell Patent 2,619,467 discloses compositions composed of N-alkyl β-aminopropionates with alkylaryl sulfonates. The specific alkylaryl sulfonates therein disclosed are those in which the alkyl group contains from 1 to 6 carbon atoms. It has now been discovered that the alkylaryl sulfonates in which the alkyl group contains from 8 to 14 carbon atoms and which are readily available commercially may be materially improved by the inclusion of a small quantity of an N-alkyl β-aminopropionate in which the alkyl group contains from 16 to 18 carbon atoms. Numerous other advantages are attendant the present invention and will be elaborated further hereinafter.

It is therefore an object of the present invention to provide a novel detergent composition composed of alkylaryl sulfonates in which the alkyl group contains from 8 to 14 carbon atoms and N-alkyl β-aminopropionates in which the alkyl group contains from 16 to 18 carbon atoms.

Heretofore interest in N-alkyl β-aminopropionate detergents has largely been with detergents in which the alkyl group contains 12 carbon atoms. By themselves these compositions are excellent foamers and possess reasonably good detergent properties. Since, however, these compounds are derived indirectly from coco fatty acids they are relatively expensive. The present invention takes advantage of the use of the longer chain N-alkyl β-aminopropionates in which the alkyl group contains from 16 to 18 carbon atoms. These materials are derived indirectly from oleic and stearic acid and accordingly are much less expensive than are the corresponding dodecyl compounds. Even these longer chain N-alkyl β-aminopropionates however, are more expensive than are other detergent materials commonly used such as the alkylaryl sulfonates. The alkylaryl sulfonates, however, are notorious for their poor foam stability. It has been found that it is possible to improve the foam stability of these alkylaryl sulfonates by the inclusion of a relatively small quantity of the longer chain N-alkyl β-aminopropionates. It has also been discovered that the longer chain N-alkyl β-aminopropionates are substantive to cloth and contribute a good hand or feel to the cloth. Since the two detergent materials are compatible it is possible to prepare a

detergent composition containing the two and it is found that some of the N-alkyl β-aminopropionate material is adsorbed on the fibers and is retained there to contribute softness to the fabric.

An addition of as little as 1% by weight of an aminopropionate to the alkylaryl sulfonate will improve foam stability. When compared at a normal use concentration of 0.1%, a mixed composition containing 5% of octadecyl aminopropionate and the balance alkylaryl sulfonate has a foam height, five minutes after generation, that is six times as high as that of the same alkylaryl sulfonate tested alone. Moreover, the aminopropionates are materially more effective than are the products presently sold as foam stabilizers for alkylaryl sulfonates. For example, a 5% addition of stearyl aminopropionate to an alkylaryl sulfonate will achieve the same degree of foam stability as a 15% addition of a lauryl diethanolamide, an important commercial foam stabilizer. By means of the present invention, it is possible to use a very small quantity of the more expensive fat-based foam stabilizer than is possible with materials such as the lauryl diethanolamide, even though these compounds are priced in the same approximate range. This represents a tremendous commercial advantage inasmuch as the alkylaryl sulfonates are extremely cheap and it is desirable to be able to use as large a proportion of them as possible.

A further advantage of the invention is that the longer chain aminopropionates are substantive to synthetic, cellulosic, and animal fibers. When such materials are treated with the aminopropionates improvement in hand or feel are easily discerned. There are many so-called cationic substantive textile finishing agents sold today. Their applications and general properties are well understood. Unfortunately, however, the vast majority of the products so described are precipitated and rendered inoperative in the presence of anionic surface active agents. This has meant that their application must be made in systems isolated from such negatively charged molecules. The facts that the aminopropionates improve hand or feel of textiles, hair, etc., to an extent easily comparable to the action of commercial cationic softening agents, and that they are compatible with anionic surface active agents, gives the aminopropionates a unique advantage.

As a result of the above facts, it is possible to prepare detergent compositions which serve not only to launder fabrics, but also to render them soft to the touch. It is also possible to prepare shampoo compositions which serve to not only cleanse the hair but also effect a softening or conditioning result. Thus, a hair-conditioning rinse and shampoo can be combined in one product.

Example 1

A series of sample solutions were prepared from distilled water at a detergent concentration of 0.1%. All of these solutions were adjusted to a pH of 10.0. 400 ml. samples of each solution were placed in quart metal jars and maintained at a temperature of 130° F. The jars were rotated in a Launderometer for 15 minutes. After 15 minutes, the foam for all solutions tested filled the jars completely. Further agitation did not appear to change foam density or character. The jars were removed from the Launderometer in random order, two at a time, one pair each 30 seconds. Meanwhile, the jars remaining in the Launderometer were rotated. The jars were then opened and exposed to air which resulted in a temperature drop of approximately 8° F. for all jars.

After being exposed to the air for 5 minutes the foam height was measured for each solution. The results are shown in the following table in which the results are expressed in ⅛ inch units.

Solution	Init. Foam Height	Foam Height After 5 Minutes
1. 0.1% sodium dodecylbenzene sulfonate	41	5
2. 0.095% sodium alkylaryl sulfonate + 0.005% sodium dodecyl β-aminopropionate	41	23
3. 0.095% sodium alkylaryl sulfonate + 0.005% sodium hexadecyl β-aminopropionate	41	33
4. 0.095% sodium alkylaryl sulfonate + 0.005% sodium octadecyl β-aminopropionate	41	31
5. 0.085% sodium alkylaryl sulfonate + 0.015% sodium lauryl diethanolamide	41	31

These data show that N-alkyl β-aminopropionates in which the alkyl group contains from 16 to 18 carbon atoms are three times as effective as lauryl diethanolamide in foam stabilization with alkylaryl sulfonates.

Example 2

In this example the comparative softening effects of the sodium N-alkyl β-aminopropionates with other commercial softening agents is demonstrated. Twenty-four Indianhead cotton fabric swatches, 10½" x 3⅜", were prepared. For each of the test solutions, 4 such cloths were soaked for 5 minutes in a solution of 0.4% concentrations. Next, these swatches were rinsed vigorously twice and dried. They were then tested for improvement in "hand" by two methods. The first method was simply a matter of grading softness by the "feel" of the cloth swatches. The second test was a so-called "bend" test. In the feel test the identifying numbers of the cloths were randomized and the feel test was conducted under blind-fold conditions. The 24 cloths were broken down into 4 series of 6 cloths each. Each series was ranked separately, one cloth in each series representing 1 product under test. Ranking was done alternately by two observers from 4 to 8 times on each series. The average relative rank for each cloth in a series was then calculated on the total number of first, second, third, etc. positions. The softest cloth received 6 points, the next 5, etc. The results are indicated in the following table:

Product	Rank
Dimethyl-dihydrogenated tallow quaternary ammonium chloride	48
Sodium octadecyl aminopropionate (pH 11)	36
Sodium octadecyl aminopropionate (pH 4)	32
Ahcovel G (a commercial softening agent)	25
Sodium oleyl aminopropionate	16
Sodium dodecylbenzene sulfonate	9

These data show that the sodium N-alkyl β-aminopropionates are only slightly inferior to one of the best known softening agents, the latter, however, being incompatible with the alkylaryl sulfonates.

The bend test involved folding the cloths twice over lengthwise. The folded cloths were then laid parallel on a bench with the ends of the cloths approaching a square edge. The cloths were then moved simultaneously slowly over the square edge of the bench. The softness was determined by observing which cloths bent first, the sooner the cloths bent, the softer the cloth. The results are indicated in the following table:

Product	Rank
Dimethyl-dihydrogenated tallow quaternary ammonium chloride	24
Sodium octadecyl aminopropionate (pH 11)	19
Sodium octadecyl aminopropionate (pH 4)	11
Ahcovel G (a commercial softening agent)	16
Sodium oleyl aminopropionate	10
Sodium dodecylbenzene sulfonate	4

These data show that in a strictly controllable test, the results of the feel test are substantiated.

Example 3

The detergency of sodium N-alkyl β-aminopropionates varies with the chain length of the alkyl group. The detergency of a series of sodium N-alkyl β-aminopropionates was determined by a typical Launderometer detergency test. In these tests a 0.1% solution of the detergent was employed, the solution was prepared in distilled water and the test washing conditions involved the use of a temperature of 130° F. for a washer time of 20 minutes. The results are indicated in the following table:

Solution	Difference between washed and unwashed cloths expressed on a MgO=100% scale
	Percent
0.1% sodium dodecyl β-aminopropionate (pH 10.0)	33.7±0.9
0.1% sodium hexadecyl β-aminopropionate (pH 10.0)	35.9±0.9
0.1% sodium octadecyl β-aminopropionate (pH 10.0)	33.7±0.9
0.1% sodium dodecylbenzene sulfonate (pH 10.0)	32.2±0.9
0.1% sodium stearate (pH 10.3)	36.4±0.9

While the above tests have all been conducted at 0.1% concentration of the active material in the test solution, it is apparent that these materials may be used at other levels. Similarly, the relative proportion of the N-alkyl β-aminopropionate and the alkylaryl sulfonates may be varied. Generally, however, the N-alkyl β-aminopropionate should be employed in a proportion of from 1 to 25% based on the total weight of the alkylaryl sulfonate and the N-alkyl β-aminopropionate. In place of the sodium salts of the N-alkyl β-aminopropionates and the alkylaryl sulfonates, other salts such as the potassium, ammonium and other organic base salts, may be used.

A further and particularly advantageous phase of the present subject matter is to be found in the fact that not only are the present compositions compatible with the polyphosphates used as builders but actually the polyphosphates seem to improve the foam stability of these compositions whereas in other detergents the polyphosphates may actually impair foam stability. The following example will demonstrate this fact.

Example 4

The following product was subjected to a standard washing machine foam test.

	G.
Sodium dodecylbenzene sulfonate	14.5
Sodium octadecyl aminopropionate	2.6
Sodium tripolyphosphates	21.4
Tetrasodium pyrophosphates	21.4

In this machine the tub held sixteen gallons of water. The tub was filled with water of 75 p.p.m. hardness at 120° F. and agitation was begun. Soil (in this instance screened vacuum cleaner dust) was added. The detergent was then added and agitation was continued for two minutes at which time six pounds of yard-square cotton sheeting was put in the tub. The foam height was noted initially, after 10 minutes and after 20 minutes of agitation, and again 15 minutes after the agitation was stopped. The foam heights at the various points were as follows:

Time:	Foam height
0 minute	350
10 minutes	275
20 minutes	100
15 minutes after agitation was stopped	70

Commercially the two active detergent components would be used in the proportion of from 20–40%, the balance being composed of the phosphates. It is apparent that

other builders such as sodium sulfate may also be used.

We hereby claim as our invention:

1. A detergent composition comprising a mixture of an N-alkyl beta-aminopropionate alkali metal salt in which the alkyl group contains from 16 to 18 carbon atoms and a dodecylbenzene sulfonate alkali metal salt and in which N-alkyl beta-aminopropionate constitutes from 1 to 25% by weight of the combined weight of the dodecylbenzene sulfonate and the N-alkyl beta-aminopropionate.

2. Composition according to claim 1 in which N-alkyl β-aminopropionate constitutes approximately 5% of the combined weight of the dodecyl benzene sulfonate and the N-alkyl β-aminopropionate and said alkali metal salt is sodium.

3. A detergent composition comprising approximately 5 parts by weight of hexadecyl β-aminopropionate alkali metal salt and approximately 95 parts of a dodecylbenzene sulfonate alkali metal salt.

4. A detergent composition comprising approximately 5 parts by weight of octadecyl β-aminopropionate alkali metal salt and approximately 95 parts of a dodecylbenzene sulfonate alkali metal salt.

5. A detergent composition comprising a mixture of an N-alkyl β-aminopropionate alkali metal salt, in which the alkyl group contains from 16 to 18 carbon atoms and a dodecylbenzene sulfonate alkali metal salt and in which N-alkyl β-aminopropionate constitutes from 1 to 25% by weight of the combined weight of the alkylaryl sulfonate and the N-alkyl β-aminopropionate, and from 60–80% of an alkali metal polyphosphate.

6. A detergent composition comprising a mixture of an N-alkyl β-aminopropionate alkali metal salt, in which the alkyl group contains from 16 to 18 carbon atoms and a dodecylbenzene sulfonate alkali metal salt and in which N-alkyl β-aminopropionate constitutes from 1 to 25% by weight of the combined weight of the alkylaryl sulfonate and the N-alkyl β-aminopropionate, and from 60–80% sodium tripolyphosphate and tetra sodium pyrophosphate combined.

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