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DETERGENT COMPOSITIONS

Al G. Peck, Normandy, Mo., assignor to Peck's Products Company, St. Louis, Mo., a corporation of Missouri

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This invention relates to detergent compositions and more particularly to detergent compositions having excellent sudsing and cleansing action.

Briefly, the present invention provides a detergent composition containing in combination an alkyl aryl sulfonate and an alkyl sulfonic acid compound.

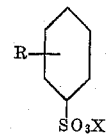
Among the objects of this invention are the provision of improved detergent compositions; the provision of detergent compositions which possess excellent sudsing properties; the provision of detergents which retain their sudsing action even in the presence of soil; and the provision of detergent compositions which form suds stable over extended periods of time. Other features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the products hereinafter described, the scope of the invention being indicated in the following claims.

There are numerous detergent materials and mixtures which are useful for cleaning, laundering and the like. Certain of these are effective in the presence of hard water as well as soft water, but it has been found that their sudsing action varies depending upon other components which may be present and that the suds which are formed are markedly reduced with the passage of time and particularly in the presence of grease soils. Although alkyl sulfates, which are the reaction products derived from individual higher molecular weight alcohols or from a mixture of such alcohols, are widely employed for cleansing purposes, the suds formed by such detergents are not only unstable with the passage of time or with extended agitation, but in addition the volume of suds is greatly reduced when brought into contact with soils such as grease soils. The alkyl aryl sulfonates, as a class, are recognized as having poorer foaming properties and foams which are less stable than the alkyl sulfates. Although various efforts have been made to stabilize such detergents and improvement has been obtained in the stability of suds formed, these suds have continued to be unstable in the presence of soils. Since the primary purpose of a detergent is to clean, this unstability has provided a major disadvantage. Increasing the stability of the suds themselves apart from their stability in the presence of soils does not provide the solution.

In accordance with the present invention, improved detergent compositions are provided which not only possess stability over extended periods of time but are unusually stable in the presence of soils, especially grease soils. The detergent compositions of this invention contain a water-soluble alkyl aryl sulfonate, for example an alkali metal salt such as sodium or potassium, or a water-soluble alkanolamine or alkylamine salt or mixtures thereof. The other component is an alkyl sulfonic acid compound such as an alkyl amide sulfonate, an alkyl ester sulfonate, or mixtures thereof.

The alkyl aryl sulfonates which are useful in the present invention are of the type:



in which R is an alkyl group containing from six to sixteen carbon atoms, the benzene ring may contain inert substituents such as a lower alkyl group (for example methyl) in a position not otherwise occupied, and X is an alkali metal, an alkanolamine or an alkylamine group, for example, sodium, potassium, triethanolamine, monoethanolamine, diethanol propanol amine or a nitro paraffin such as amino methyl propanol.

The alkyl sulfonic acid compound may be an alkyl amide sulfonate of the formula:

$$R_1—CON(R_2)—CH_2CH_2SO_3—R_3$$

or an alkyl ester sulfonate of the formula:

$$R_1—CH_2CH_2—SO_3—R_2$$

In the alkyl amide sulfonate, R_1 represents a hydrocarbon radical of an acid of the fatty acid series such as oleic, palmitic, lauric, or a mixture thereof such as is found in the fatty acids of corn, linseed, castor, cottonseed, coconut, etc. Also R_1 represents tall oil acids which are principally abietic acid (20 carbon atoms). Radicals containing from twelve to eighteen carbon atoms are preferred since compounds containing radicals having less than twelve carbon atoms or more than eighteen carbon atoms have less desirable physical properties or are otherwise less useful. R_2 represents an alkyl or cycloaliphatic group containing one to eight carbon atoms and R_3 is an alkali metal such as sodium or potassium, or an amine which forms a water-soluble salt with the alkyl amide sulfonic acid.

In the formula for the alkyl ester sulfonate R_1 represents a fatty acid radical such as oleic, palmitic, lauric, or mixtures of fatty acids such as corn, soya, linseed, castor, coconut, etc. Also R_1 represents tall oil acids which are principally abietic acid (20 carbon atoms). Radicals containing from twelve to eighteen carbon atoms are preferred. In the formula, R_2 is an alkali metal such as sodium or potassium.

In order to test the sudsing effect of the compositions of the present invention, 100 ml. of the solution to be tested was measured into a 1000 ml. graduated cylinder. The cylinder was placed in a water bath and the temperature of the test solution was adjusted to 120° F.±2° F. The solution was stirred thirty seconds and the foam was allowed to age thirty seconds before a reading of the volume was taken. Alternate stirring and aging, each for thirty seconds, was then carried out until the solution had been stirred for a total of one hundred fifty seconds with a reading being taken after each thirty second period of aging. After the final reading at one hundred fifty seconds, 5 ml. of grease soil (double distilled free fatty acid-Emersol 305) was added to the graduated cylinder and the alternate stirring and aging steps were repeated until one hundred fifty seconds of stirring time had passed. Readings of foam volume

were taken after each thirty second aging period. Since the stirring was carried out at a constant rate and since the temperature of the test solution was maintained constant, reproducible results were obtained.

The detergent compositions of the present invention contain from 10 to 80 parts by weight of alkyl sulfonic acid compound as defined above and the remainder alkyl aryl sulfonate from the group described above. The preferred range is 15 to 30 parts by weight of alkyl sulfonic acid compound with the remainder alkyl aryl sulfonate while the specific ratio which has been found most desirable is 30 parts by weight of alkyl sulfonic acid compound and 70 parts by weight of alkyl aryl sulfonate.

The following examples illustrate the invention:

Example 1

A mixture was formed of 90 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 10 parts of sodium N-oleoyl-N-methyl taurate, all by weight. An aqueous solution containing 0.12% by weight of the mixture was formed and tested as described above. The average amount of foam when the mixture was tested as described without soil was 156 ml., while after addition of 5 ml. of soil of the aforementioned type, it was 55 ml. However, from the amount of foam after soil was added to the individual components, it was calculated that the amount of foam for the mixture, after soil was added, would be 31 ml.

The detergent mixture is effective both in hard and soft water for the efficient removal of soil, especially in the case of oil or grease soils found on hard surfaces such as dishes and floors and on soft surfaces like textiles and even skin.

Example 2

Example 1 was repeated but the mixture was formed of 80 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 20 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The average of the amount of foam formed without soil was 159 ml., while with soil it was 70 ml. The calculated amount of foam, based upon the results obtained with the individual components of the mixture, was 33 ml. The detergent composition formed was effective for cleaning, especially surfaces bearing oil or grease soils.

Example 3

Example 1 was repeated but the mixture was formed of 70 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 30 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The average of the amount of foam formed without soil was 164 ml., while with soil it was 89 ml. The calculated amount of foam, based upon the results obtained with the individual components of the mixture, was 35 ml. The detergent composition formed was effective for cleaning, especially surfaces bearing oil or grease soils.

Example 4

Example 1 was repeated but the mixture was formed of 60 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 40 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The average of the amount of foam formed without soil was 161 ml., while with soil it was 69 ml. The calculated amount of foam, based upon the results obtained with the individual components of the mixture, was 37 ml. The detergent composition formed was effective for cleaning, especially surfaces bearing oil or grease soils.

Example 5

Example 1 was repeated but the mixture was formed of 50 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 50 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The average of the amount of

foam formed without soil was 156 ml., while with soil it was 67 ml. The calculated amount of foam, based upon the results obtained with the individual components of the mixture, was 39 ml. The detergent composition formed was effective for cleaning, especially surfaces bearing oil or grease soils.

Example 6

Example 1 was repeated but the mixture was formed of 40 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 60 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The average of the amount of foam formed without soil was 150 ml., while with soil it was 73 ml. The calculated amount of foam, based upon the results obtained with the individual components of the mixture, was 41 ml. The detergent composition formed was effective for cleaning, especially surfaces bearing oil or grease soils.

Example 7

Example 1 was repeated but the mixture was formed of 30 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 70 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The average of the amount of foam formed without soil was 161 ml., while with soil it was 74 ml. The calculated amount of foam, based upon the results obtained with the individual components of the mixture, was 43 ml. The detergent composition formed was effective for cleaning, especially surfaces bearing oil or grease soils.

Example 8

Example 1 was repeated but the mixture was formed of 20 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 80 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The average of the amount of foam formed without soil was 153 ml., while with soil it was 65 ml. The calculated amount of foam, based upon the results obtained with the individual components of the mixture, was 45 ml. The detergent composition formed was effective for cleaning, especially surfaces bearing oil or grease soils.

Example 9

Example 1 was repeated but using 90 parts of the sodium salt of decyl benzene sulfonic acid and 10 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 166 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 57 ml. The calculated amount of foam in the presence of soil, based upon the results obtained with the individual components of the mixture per se, was 30 ml.

Example 10

Example 9 was repeated but using 80 parts of the sodium salt of decyl benzene sulfonic acid and 20 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 153 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 65 ml. The calculated amount of foam in the presence of soil, based upon the results obtained with the individual components of the mixture per se, was 31 ml.

Example 11

Example 9 was repeated but using 70 parts of the sodium salt of decyl benzene sulfonic acid and 30 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 159 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 87 ml. The cal-

culated amount of foam in the presence of soil, based upon the results obtained with the individual components of the mixture per se, was 32 ml.

Example 12

Example 9 was repeated but using 50 parts of the sodium salt of decyl benzene sulfonic acid and 50 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 135 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 72 ml. The calculated amount of foam in the presence of soil, based upon the results obtained with the individual components of the mixture per se, was 35 ml.

Example 13

Example 9 was repeated but using 30 parts of the sodium salt of decyl benzene sulfonic acid and 70 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 145 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 73 ml. The calculated amount of foam in the presence of soil, based upon the results obtained with the individual components of the mixture per se, was 37 ml.

The detergent mixtures of the present invention may be employed in combination with neutral salts and alkali inorganic builder salts.

Example 14

A mixture was formed, as described in Example 1, of 90 parts of sodium dodecyl benzene sulfonate and 10 parts of sodium N-oleoyl-N-methyl taurate, all by weight. This was combined with neutral and alkali inorganic builder salts and an aqueous solution was formed containing 0.20% of the combined mixture. Of this, 0.016% was the combination of the alkyl aryl sulfonate and acyl alkyl taurate while 0.184% was the neutral and alkaline builder salts. When tested as described in Example 1 without soil, 132 ml. of foam was formed. When 1 ml. of soil was added as described above, the amount of foam was 53 ml. The calculated amount of foam in the presence of soil, based upon the test results with the sodium dodecyl benzene sulfonate alone and the sodium N-oleoyl-N-methyl taurate alone, was 26 ml.

Example 15

Example 14 was repeated but using 70 parts of sodium dodecyl benzene sulfonate and 30 parts of sodium N-oleoyl-N-methyl taurate, all by weight. This was combined with neutral and alkali inorganic builder salts and an aqueous solution was formed containing 0.20% of the combined mixture. Of this, 0.016% was the combination of the alkyl aryl sulfonate and acyl alkyl taurate while 0.184% was the neutral and alkaline builder salts. When tested as described in Example 1 without soil, 104 ml. of foam was formed. When 1 ml. of soil was added as described above, the amount of foam was 50 ml. The calculated amount of foam in the presence of soil, based upon the test results with the sodium dodecyl benzene sulfonate alone and the sodium N-oleoyl-N-methyl taurate alone, was 27 ml.

Example 16

Example 1 was repeated but using 90 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 10 parts of potassium N-oleoyl-N-methyl taurate, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 160 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 45 ml. The calculated amount of foam in the

presence of soil, based upon the results obtained with the individual components of the mixture per se, was 31 ml.

Example 17

Example 1 was repeated but using 70 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 30 parts of potassium N-oleoyl-N-methyl taurate, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 155 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 66 ml. The calculated amount of foam in the presence of soil, based upon the results obtained with the individual components of the mixture per se, was 36 ml.

Example 18

Example 1 was repeated but using 70 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 30 parts of the sodium salt of coconut fatty acid-N-methyl taurine, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 162 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 70 ml. The calculated amount of foam in the presence of soil, based upon the results obtained with the individual components of the mixture per se, was 44 ml.

Example 19

Example 1 was repeated but using 70 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 30 parts of sodium oleoyl isethionate, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 126 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 58 ml. The calculated amount of foam in the presence of soil, based upon the results obtained with the individual components of the mixture per se, was 30 ml.

Example 20

Example 1 was repeated but using 70 parts of the monoethanolamine salt of dodecyl benzene sulfonic acid and 30 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 161 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 75 ml. The calculated amount of foam in the presence of soil, based upon the results obtained with the individual components of the mixture per se, was 43 ml.

Example 21

Example 1 was repeated but using 35 parts of the monoethanolamine salt of dodecyl benzene sulfonic acid, 35 parts of the triethanolamine salt of dodecyl benzene sulfonic acid and 30 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 167 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 74 ml. The calculated amount of foam in the presence of soil, based upon the results obtained with individual components of the mixture per se, was 39 ml.

Example 22

Example 1 was repeated but using 90 parts of the diethanol propanol amine salt of dodecyl benzene sulfonic acid and 10 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 154 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 42 ml. The calculated amount of

foam in the presence of soil, based upon the results obtained with the individual components of the mixture per se, was 29 ml.

Example 23

Example 1 was repeated but using 70 parts of the diethanol propanol amine salt of dodecyl benzene sulfonic acid and 30 parts of sodium N-oleoyl-N-methyl taurate, all by weight. The test solution contained 0.12% by weight in water and the amount of foam obtained in the absence of soil was 137 ml. After 5 ml. of soil had been added and the test continued as described above, the amount of foam was 59 ml. The calculated amount of foam in the presence of soil, based upon the results obtained with the individual components of the mixture per se, was 32 ml.

The synergistic effect of the combination of the alkyl aryl sulfonates and the alkyl sulfonic acid compounds is obtained regardless of the type of soil involved.

Example 24

Example 3 was repeated but in lieu of the double distilled free fatty acid, 10 ml. of vegetable oil (Wesson) was utilized as the soil. The average amount of foam formed without soil was 153 ml., while with soil it was 169 ml. The calculated amount of foam, based upon the results obtained with the individual components of the mixture, was 123 ml.

Example 25

Example 3 was repeated but in lieu of the double distilled free fatty acid, 5 ml. of hydrogenated vegetable oil (Spry) was utilized as the soil. The average amount of foam formed without soil was 163 ml., while with soil it was 92 ml. The calculated amount of foam, based upon the results obtained with the individual components of the mixture, was 59 ml.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above products without departing from the scope of the invention, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. The method of increasing the stability and volume of suds of an alkyl aryl sulfonate-containing aqueous detergent solution in the presence of grease soil, comprising adding to an alkyl aryl sulfonate selected from the group consisting of the triethanolamine salt of dodecyl benzene sulfonic acid, approximately 10% to 50% by weight with respect to said sulfonate of an alkali metal N-oleoyl-N-methyl taurate.

2. The method of increasing the stability and volume of suds of an akyl aryl sulfonate-containing aqueous detergent solution in the presence of grease soil, comprising adding to the triethanolamine salt of dodecyl benzene sulfonic acid, approximately 15% to 30% by weight with respect to said sulfonate of sodium N-oleoyl-N-methyl taurate.

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