

UNITED STATES PATENT OFFICE

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PREPARATION OF DETERGENTS

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My invention relates to a process for improving the sudsing and detergent properties of sulfated alcohol detergents, especially when used in hard water, and to the products thus prepared.

5 The water-soluble salts of sulfated higher alcohols are well known to have good sudsing and detergent properties in most cases, but it has not previously been known that the sudsing and detergent properties of such compounds can be
10 very materially improved by the use of a certain proportion of unsulfated higher alcohols in connection with same.

I have discovered that products of greatly improved sudsing and detergent properties showing
15 greater economy in use are obtained when the above mentioned two classes of compounds are used together in rather definite proportions, and that to obtain the best results the proportion of unsulfated alcohols present must be adjusted to
20 a percentage within a certain range which is rather critical as will be more fully described hereinafter. A higher degree of whiteness is obtainable in the washing of soiled fabrics with my improved detergent than is obtainable with the
25 commercial alkyl sulfate detergents alone.

The alkyl sulfate detergents referred to herein are those derived usually from natural fats and fatty oils by first reducing same to alcohols, then sulfating with a sulfating agent such as sulfuric acid, chlorosulfonic acid, etc., and finally neutralizing the sulfated product with a suitable base
30 such as sodium or potassium hydroxide, ammonia, amines, organic bases, etc., to form water-soluble salts. It should be understood that the commercial grades of alkyl sulfates referred to herein, such as are commonly used as detergents, always contain considerable quantities of sodium sulfate or other inorganic salt, resulting from the
35 usual processes of manufacture, and therefore frequently contain only fifty per cent or less of the actual alkyl sulfate. Those which are most suitable for my use are the saturated products usually containing from about eight to about
40 fourteen carbon atoms in the alkyl radical, but

of course the alkyl sulfates prepared from hexadecyl and octadecyl alcohols may find use under certain conditions. The products obtained from coconut oil and similar oils are especially useful. These consist largely of the lauryl and myristyl
5 derivatives. These sulfated normal primary aliphatic alcohol detergents are hereinafter called "alkyl sulfates" for convenience.

The unsulfated alcohols which I may use for improving the properties of the alkyl sulfates
10 above mentioned when the addition of alcohols is necessary may be of several different classes, as follows:

(a) Individual saturated alcohols containing
15 from about eight to about fourteen carbon atoms in the molecule. These alcohols may be either primary or secondary, and may be used either pure or in the slightly impure commercial form.

(b) Mixtures of alcohols obtainable from natural fats (vegetable or animal oils or fats) and
20 waxes by reduction or other processes. Examples of suitable materials for this purpose are tallow, sperm oil, and coconut oil, coconut oil being especially suitable. Other oils of the coconut oil type, as defined by Lewkowitsch in "Chemical
25 Technology and Analyses of Oils, Fats and Waxes", sixth edition, 1922, pages 500 and 617, such as palm kernel oil for example, and other oils having a high saponification number similar to that of coconut oil, may also be used in place
30 of coconut oil.

(c) Alcohols derived from oxidized petroleum which consist predominantly of secondary aliphatic alcohols containing in the range of about
35 eight to about twenty-five carbon atoms per molecule. These alcohols, as shown by Luther et al. United States Patent 1,909,295, are saturated.

In adjusting the content of unsulfated alcohols in the detergent mixture, I find that in some cases
40 it is necessary to remove a portion of the alcohols already present when these are present in excessive amounts, and in other cases it is necessary to add unsulfated alcohols because these
45

are usually present in insufficient amounts for the best results. The latter is the more common condition. In either case, I adjust the percentage of unsulfated alcohols so that it will lie within the limits giving improved sudsing and detergent properties.

When the adjustment above mentioned requires a reduction in the amount of unsulfated alcohols, this may be accomplished either by extracting the excess alcohols by a suitable solvent, or in some cases by heating to a sufficiently high temperature to remove unsulfated alcohols, as in the operation of spray drying or drum drying or similar methods of drying. For convenience such methods of drying are referred to in the claims as "drying" operation and the products obtained thereby as "dried" products. When, on the other hand, the adjustment requires an increase in the amount of unsulfated alcohols, these may be added to the alkyl sulfate by any suitable mixing method either in the substantially dry form or in a water solution of the alkyl sulfate prior to use, as preferred. The method of mixing is not a part of my invention.

The proper adjustment may also be secured by suitably regulating the sulfation so as to leave the desired percentage of unsulfated alcohols. The sulfating reaction may be controlled by the amount and strength of the sulfating agent and/or the time and temperature of the reaction.

When alkyl sulfates containing a small amount of unsulfated alcohols are subjected to a high temperature spray drying operation or other heating treatment, they lose, mainly by evaporation, a portion of such unsulfated alcohols, and I find that such spray dried products are inferior in sudsing and detergent properties to the same material before such spray drying. If, however, I add to the spray dried product some of the unsulfated alcohols previously mentioned, so as to adjust the percentage to the proper amount, I obtain a product with greatly improved sudsing and detergent properties, which may be even better than these properties in the original material before spray drying.

Before proceeding to illustrate my process by examples, it should be understood that the following conditions apply in general to common laundering operations and to the examples hereinafter given. The temperatures of my sudsing and washing experiments were in the neighborhood of 100° F., although at temperatures both higher and lower, such as 130° F. and 80° F., for example, my detergent mixtures show similarly improved properties. The water used in the tests had a hardness equivalent to 21 grains of calcium and magnesium calculated as calcium carbonate in the molar ratio 2.9 calcium to 1.0 magnesium, which is an average ratio for hard water throughout the United States. The sudsing and detergency tests were made by standardized procedures known to give reliable results, comparable to those obtained in actual practice. Uniformly soiled fabrics were used and the degree of whiteness obtained was measured by a photoelectric grading apparatus entirely independent of the human equation.

In the examples now to be described, the alkyl sulfate used was the commercial sodium salt of alkyl sulfuric acid prepared from the alcohols obtained by reduction of coconut oil, but it should be understood that similar results are obtained with other alkyl sulfate detergents commonly

used. The commercial alkyl sulfate detergent used had the following approximate analysis.

	Percent
Sodium alkyl sulfate.....	46.5
Sodium sulfate.....	50.7
Sodium chloride.....	1.0
Moisture.....	0.5
Petroleum ether extract (mainly unsulfated alcohols)	1.3

The unsulfated alcohols used in these examples are shown in the table below, but it should be understood that these are merely illustrative of many other alcohols included in the classes previously mentioned, and I am not limited to the alcohols shown in these examples. "Lorol" is a commercially available product consisting of alcohols obtained by reduction of coconut oil. "Stenol" is a commercially available product consisting essentially of saturated aliphatic alcohols containing sixteen and eighteen carbon atoms per molecule. These various alcohols used in the experiments had the following analyses.

Alcohol	Iodine value	Sapon. value	Hydroxyl value	Theoretical hydroxyl value
n-Octyl (n-C ₈).....	.3	1.2	426	431
n-Decyl (n-C ₁₀).....	.4	1.2	349	355
n-Dodecyl (n-C ₁₂).....	.6	2.3	296	302
n-Tetradecyl (n-C ₁₄).....	2.5	1.1	242	262
"Lorol".....	1.4	1.1	272	-----
"Stenol".....	-----	-----	214	-----
Mixed alcohols from oxidized petroleum.....	8.0	8.0	209	-----

The procedure used for adjusting the percentage of each of these alcohols in its mixture with the commercial sodium alkyl sulfate previously described was as follows.

Weighed portions of each of the above alcohols were mixed with weighed portions of the commercial alkyl sulfate in various proportions, and from these, numerous separate solutions of different concentrations were prepared. An equal quantity of each of the solutions thus prepared was then tested in a standard detergency apparatus for two properties: first, for sudsing property, to determine the concentration required to give a definite amount of suds in water of standard 21 grains hardness at 100° F.; secondly, to determine the concentration of the mixture required to wash equally soiled fabrics to a standard same degree of whiteness.

Many tests were made with different amounts of each mixture to determine the amount required for equal results, and the results of these tests are shown below, wherein Table 1 shows the effect on sudsing, and Table 2 shows the effect on detergency. The figures in the first two columns show the percentages of unsulfated alcohol and commercial alkyl sulfate respectively in each mixture; the third and fourth columns show the amount of unsulfated alcohol per 100 parts actual (not commercial) alkyl sulfate in each mixture, the amount of unsulfated alcohol contained in the original commercial alkyl sulfate being included. In the columns under the names of the respective alcohols, wherein n-C₈ represents n-octyl alcohol, n-C₁₀ represents n-decyl alcohol, etc., the figures indicate in each case the concentration of the detergent mixture (commercial alkyl sulfate plus added unsulfated alcohol) required to give equivalent results.

TABLE 1

Sudsing

CONCENTRATION OF MIXTURE IN SOLUTION REQUIRED TO GIVE THE SAME QUANTITY OF SUDS (GRAMS PER 100 C. C.)

Percent alc.	Percent com. det.	Ratio*		Alcohol=						
		Alc.	Alkyl sulfate	n-C ₈	n-C ₁₀	n-C ₁₂	n-C ₁₄	"Lorol"	"Stanol"	Mixed alcs. from oxidized petr.
0	100	3	100	.080	.080	.080	.080	.080	.080	.070
3	97	10	100	.075	.062	.066	.068	.078	.080	.066
6	94	17	100	.066	.058	.056	.076	.066	.072	.066
9	91	24	100	.064	.053	.056	.080	.062	.076	.056
12	88	32	100	.058	.060	.072	.106	.078	.080	.070
16	84	44	100	.056	.074	.104	.130	.088	.106	
20	80	57	100	.046						
25	75	75	100	.05						

TABLE 2

Detergency

CONCENTRATION OF MIXTURE IN SOLUTION REQUIRED TO GIVE THE SAME DEGREE OF WHITENESS (GRAMS PER 100 C. C.)

Percent alc.	Percent com. det.	Ratio*		Alcohol=						
		Alc.	Alkyl sulfate	n-C ₈	n-C ₁₀	n-C ₁₂	n-C ₁₄	"Lorol"	"Stanol"	Mixed alcs. from oxidized petr.
0	100	3	100	.080	.080	.080	.080	.080	.080	.080
3	97	10	100	.072	.062	.062	.070	.072	.078	.066
6	94	17	100	.070	.060	.076	.070	.080	.070	.066
9	91	24	100	.064	.100	.126	.076	.096	.082	.056
12	88	32	100	.058	.210	.200	.106	.154	.082	.074
16	84	44	100	.058			.176		.120	
20	80	57	100	.052						
25	75	75	100	.058						

*Includes unsulfated alcohol in original commercial alkyl sulfate detergent.

Referring now to Table 1 showing results on sudsing, it will be noted that mixtures with various percentages up to 25 per cent alcohol and 75 per cent commercial alkyl sulfate were used, and that in most cases a smaller amount of the mixture sufficed to give the standard sudsing result than when 100 per cent commercial alkyl sulfate alone was used. It is also noted, however, that in general the alcohols with higher molecular weight when used in the higher percentages become less efficient, and may even be detrimental, but nevertheless in all cases an improvement results when a suitable proportion of unsulfated alcohol is used with the alkyl sulfate. For example, all the mixtures containing n-octyl alcohol showed improved results in that a smaller amount of each of these mixtures sufficed to give the standard sudsing result than with the commercial alkyl sulfate alone. In the case of the n-tetradecyl alcohol (fourteen carbon atoms), it is seen that equal or improved results are obtained as the percentage is increased up to about 9 per cent alcohol in the mixture, but beyond this point more of the mixture was required than of the commercial alkyl sulfate alone. It is obvious that the efficiency of the various unsulfated alcohols varies, but in all cases improved sudsing results are obtainable by adjusting the percentage within the proper range for each alcohol.

It is convenient also to express the percentage in terms of the ratio of unsulfated alcohol to the actual alkyl sulfate present as shown in the third column of the tables. As previously stated, these figures include the three parts of unsulfated alcohol per 100 parts actual alkyl sulfate contained in the original commercial alkyl sulfate detergent. This indicates, for example, that in the case

of the n-tetradecyl alcohol just referred to the maximum total amount of unsulfated alcohol which can be used with beneficial sudsing results will apparently be somewhat below 24 parts of alcohol per 100 parts of actual alkyl sulfate. In view of variations in unsulfated alcohol content of different forms of commercial alkyl sulfate detergents covered herein, the amount of alcohol which can be added will depend not only on the kind of alcohol used, but also on the unsulfated alcohol content of the commercial alkyl sulfate.

Referring now to Table 2 showing results of tests on detergency, results are to be interpreted in a similar way as explained in the discussion of Table 1 above. It is clear from the comparison of the two tables that a certain alcohol may be more beneficial in creating suds than in actual detergency, but in all cases a distinct improvement in detergency, as well as in sudsing, results when any of the alcohols mentioned is used in a suitable proportion. It is again apparent that the higher molecular alcohols are, in general, less efficient in detergency in the larger percentages and may then even be harmful. N-octyl alcohol (having the lowest molecular weight of the alcohols mentioned) gives outstanding results in both sudsing and detergency in all percentages tried, and can be used in this instance without harmful effect in proportions at least as high as 72 (75 minus 3) parts alcohol per 100 parts actual alkyl sulfate.

It will assist in making clear the beneficial results obtained if certain of the data shown in Tables 1 and 2 are recalculated to show the amount of commercial alkyl sulfate replaced by the alcohol, and thus obtain a figure showing the relative efficiency of each alcohol when used in

various percentages. These data are therefore shown in the following Tables 3 and 4 calculated as follows. Taking an example from Table 2 under n-decyl alcohol, using 6 per cent of the alcohol with 94 per cent commercial alkyl sulfate detergent, we find that .060 gram of this mixture in 100 c.c. of water was needed to wash the soiled fabric to the same whiteness as .080 gram of commercial alkyl sulfate detergent alone. Then the efficiency of this particular mixture as compared to the commercial alkyl sulfate detergent alone is expressed by the fraction

$$\frac{.08}{.06} = 1.33$$

From this it is evident that the effect of the unsulfated alcohol itself in this mixture must have been much higher than 1.33. This is shown by the following calculation based on the percentages of the two ingredients in the mixture, the known efficiencies of the commercial alkyl sulfate detergent (1.0) and the mixture (1.33), and finally in solving for "X", the efficiency of the unsulfated alcohol itself.

$$(.94 \times 1.0) + (.06 \times X) = 1.33$$

$$X = 6.5$$

It is evident from this, therefore, that in this mixture the alcohol performs the work in detergency of 6.5 times its weight of commercial alkyl sulfate detergent.

In accordance with this procedure, Tables 3 and 4 have been prepared, relating respectively to sudsing property and to detergent property, which show the efficiencies of the various unsulfated alcohols in these mixtures as compared to the commercial alkyl sulfate detergent present.

TABLE 3
Sudsing

EFFICIENCY OF ALCOHOLS

	Mixtures tested		
	97	91	88
Percent commercial alkyl sulfate detergent.....	3	9	12
Percent unsulfated alcohol.....			
Pts. actual alkyl sulfate.....	100	100	100
Pts. unsulfated alcohol*.....	17	24	32
Alcohols:			
n-Octyl.....	3.5	4	4
n-Decyl.....	10.5	7	4
n-Dodecyl.....	8	6	2
n-Tetradecyl.....	7	1	<0
"Lorol".....	2	4	1
"Stenol".....	1	1.5	1
Mixed alcohols from oxidized petroleum.....	3	4	1

TABLE 4
Detergency

EFFICIENCY OF ALCOHOLS

	Mixtures tested		
	97	94	91
Percent commercial alkyl sulfate detergent.....	3	6	9
Percent unsulfated alcohol.....			
Pts. actual alkyl sulfate.....	100	100	100
Pts. unsulfated alcohol*.....	10	17	24
Alcohols:			
n-Octyl.....	4.5	3.5	4
n-Decyl.....	10.5	6.5	<0
n-Dodecyl.....	10.5	2	<0
n-Tetradecyl.....	5.5	3.5	-1.5
"Lorol".....	4.5	1	<0
"Stenol".....	2	3.5	1
Mixed alcohols from oxidized petroleum.....	8	4.5	5

*Includes 3 parts alcohol contained in the original commercial alkyl sulfate detergent.

In the above Tables 3 and 4, the efficiency of each alcohol in improving the sudsing and detergency, respectively, is shown in various mixtures, as compared to the commercial alkyl sulfate present. It will be noted of n-octyl alcohol, as compared with the other alcohols, that considerably greater proportions are usable without harmful effect on the detergent property of the commercial alkyl sulfate detergent. It should be borne in mind that experimental work of this type involves unavoidably a small experimental error which may be the explanation for any apparent inconsistencies in the data given.

In the following Table 5, the figures show the approximate maximum and the optimum amounts of unsulfated alcohol per 100 parts actual alkyl sulfate which have been found useful in improving sudsing property. These figures were obtained from the smooth curves drawn through plotted efficiency data calculated from Tables 1 and 2 and have been corrected for the unsulfated alcohol contained in the original commercial alkyl sulfate detergent.

TABLE 5
Sudsing

Alcohol	Pts. alcohol per 100 pts. actual alkyl sulfate*	
	Max. hts. alcohol permissible without serious harmful effect	Optimum parts alcohol
n-Octyl.....	Greater than 75	63
n-Decyl.....	47	22
n-Dodecyl.....	38	22
n-Tetradecyl.....	24	12
"Lorol".....	35	22
"Stenol".....	32	17
Mixed alcohols from oxidized petroleum.....	32	22

*Includes 3 parts alcohol contained in the original commercial alkyl sulfate detergent.

Table 6, following, likewise shows the approximate maximum and optimum amounts of alcohol per 100 parts actual alkyl sulfate for improving detergency.

TABLE 6
Detergency

Alcohols	Pts. alcohol per 100 pts. actual alkyl sulfate*	
	Max. pts. alcohol usable without serious harmful effect	Optimum parts alcohol
n-Octyl.....	Greater than 75	50
n-Decyl.....	22	14
n-Dodecyl.....	17	12
n-Tetradecyl.....	24	17
"Lorol".....	17	12
"Stenol".....	22	17
Alcohols from oxidized petroleum.....	35	22

*Includes 3 parts alcohol contained in the original commercial alkyl sulfate detergent.

From inspection of the tables given, the following facts will be clearly evident.

(1) The sudsing property of the commercial alkyl sulfate detergent is improved when the content of unsulfated alcohol of any of the classes mentioned is adjusted to a suitable amount.

(2) The detergent property is likewise improved as in (1).

(3) There is in most cases an optimum figure for the use of each alcohol.

(4) There is in most cases a maximum amount for each alcohol beyond which improved results in either sudsing or detergency are not obtained.

(5) The C_{10} and C_{12} alcohols are the most efficient but the C_8 alcohol can be used in the highest percentages without harmful effect.

(6) From a practical standpoint, the effect of C_{10} and C_{12} alcohols is of particular interest and importance because these alcohols are readily obtainable in large quantities from coconut oil and similar oils by reduction or otherwise.

The effect of a given alcohol on the sudsing property of an alkyl sulfate cannot always be predicted from its effect on the detergent property, and vice versa. For example, experiments with n-hexyl alcohol show that it acts substantially as an inert diluent on a commercial alkyl sulfate detergent as regards sudsing property, but has a definite beneficial action on detergent property. Cetyl alcohol likewise acts as an inert diluent as regards sudsing property, but has some beneficial action on detergency.

In order to secure the best results, one should consider the purpose for which the resulting mixture is to be used, and also the kinds of alcohols available. In common laundering operations, for example, the sudsing property and the detergent property are of primary importance. It is possible from the data shown herein to select a suitable alcohol and to determine a suitable percentage in which markedly superior results will be obtained when this alcohol is used with a commercial alkyl sulfate detergent deficient in alcohol content.

Commercial alkyl sulfate detergents, such as those mentioned herein, commonly contain considerable percentages of inorganic salts, mainly sodium sulfate, due to the process of manufacture. The particular lot of commercial alkyl sulfate detergent used in the experiments described herein contained almost 52 per cent of sodium sulfate and sodium chloride, but the amount present may vary within a wide range with little if any effect on sudsing or detergency. Products containing as little as 10 per cent of water-soluble inorganic salts, for example, show practically identical results with those reported herein when the results are based on equal concentrations of actual alkyl sulfate.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. The process of improving the sudsing and detergent properties of a water-soluble salt of an alkyl sulfuric acid containing eight to eighteen carbon atoms in the alkyl radical which comprises adjusting the unsulfated aliphatic alcohol content of same to an amount sufficient to improve said properties but not below about 3 parts or in excess of 75 parts unsulfated aliphatic alcohol to 100 parts water-soluble salt, said unsulfated aliphatic alcohol being saturated and being taken from the group consisting of primary saturated aliphatic alcohols containing eight to fourteen carbon atoms in the molecule and secondary aliphatic saturated alcohols containing eight to twenty-five carbon atoms in the molecule.

2. The process of improving the sudsing and detergent properties of a water-soluble salt of a higher alkyl sulfuric acid prepared from an oil of the coconut oil type which comprises adjusting the unsulfated higher aliphatic alcohol content of same to an amount sufficient to improve said properties but not below about 3 parts or in excess of 75 parts unsulfated higher aliphatic alcohol to 100 parts water-soluble salt, said un-

sulfated higher aliphatic alcohol being saturated and containing eight to fourteen carbon atoms in the molecule and being obtained from an oil of the coconut oil type.

3. The process of improving the sudsing and detergent properties of a water-soluble salt of a primary alkyl sulfuric acid containing eight to eighteen carbon atoms in the alkyl radical and containing substantially less than 12 parts unsulfated higher alcohol to 100 parts of said salt which comprises adding to said salt and incorporating therewith an unsulfated saturated aliphatic alcohol having eight to fourteen carbon atoms in the molecule in amount sufficient to improve said sudsing and detergent properties, said amount being such that the final product does not contain below about 3 parts of or in excess of about 12 parts of said unsulfated saturated aliphatic alcohol to 100 parts of said salt.

4. The process of improving the sudsing and detergent properties of a water-soluble salt of a mixture of higher alkyl sulfuric acids derived from an oil of the coconut oil type and containing substantially less than 12 parts unsulfated higher alcohol to 100 parts said salt which comprises adding to said salt and incorporating therewith a mixture of unsulfated higher alcohols, consisting predominantly of saturated alcohols having 8 to 14 carbon atoms in the molecule and derived from an oil of the coconut oil type, in amount sufficient to improve said sudsing and detergent properties, said amount being such that the final product does not contain below about 3 parts of or in excess of about 12 parts of said unsulfated higher alcohol to 100 parts of said salt.

5. The process of improving the sudsing and detergent properties of a water-soluble salt of higher primary alkyl sulfuric acids derived from a mixture of higher alcohols consisting predominantly of normal dodecyl and normal tetradecyl alcohols, said salt containing substantially less than 12 parts unsulfated higher alcohol to 100 parts said salt which comprises adding to said salt and incorporating therewith n-decyl alcohol in amount sufficient to improve said sudsing and detergent properties, said amount being such that the final product does not contain below about 3 parts of or in excess of about 12 parts of said unsulfated higher alcohol to 100 parts of said salt.

6. The process of improving the sudsing and detergent properties of a water-soluble salt of higher primary alkyl sulfuric acids derived from a mixture of higher alcohols consisting predominantly of normal dodecyl and normal tetradecyl alcohols, said salt containing substantially less than 12 parts unsulfated higher alcohol to 100 parts of said salt which comprises adding to said salt and incorporating therewith n-dodecyl alcohol in amount sufficient to improve said sudsing and detergent properties, said amount being such that the final product does not contain below about 3 parts of or in excess of about 12 parts of said unsulfated higher alcohol to 100 parts of said salt.

7. The process of improving the sudsing and detergent properties of a water-soluble salt of a mixture of higher alkyl sulfuric acids derived from a mixture of higher alcohols consisting predominantly of normal dodecyl and normal tetradecyl alcohols, said salt containing substantially less than 12 parts unsulfated higher alcohol to 100 parts said salt, which comprises adding to said salt and incorporating therewith n-tetradecyl alcohol in amount sufficient to improve said sudsing

and detergent properties, said amount being such that the final product does not contain less than about 3 parts of or in excess of about 12 parts of said unsulfated higher alcohols to 100 parts of said salt.

8. That method of adjusting the sudsing properties of a water-soluble salt of an alkyl sulfuric acid having eight to eighteen carbon atoms in the alkyl radical which consists in adjusting the unsulfated higher fatty alcohol content thereof to maximum development of said properties, the said fatty alcohol being saturated and containing 8 to 14 carbon atoms in the molecule and the content of said unsulfated fatty alcohol in said salt at said maximum development being in the range of about 12 to about 63 parts unsulfated higher fatty alcohols to 100 parts water-soluble salt.

9. That method of adjusting the detergent properties of a water-soluble salt of an alkyl sulfuric acid having eight to eighteen carbon atoms in the alkyl radical which consists in adjusting the unsulfated higher fatty alcohol content thereof to maximum development of said properties, the said fatty alcohol being saturated and containing 8 to 14 carbon atoms in the molecule and the content of said unsulfated fatty alcohol in said salt at said maximum development being in the range of about 12 to 50 parts unsulfated higher fatty alcohol to 100 parts water-soluble salt.

10. In the process of preparing a detergent of the alkyl sulfate type from higher alcohols obtained from an oil of the coconut oil type and

consisting predominantly of saturated alcohols having 8 to 14 carbon atoms per molecule, the step which comprises regulating the proportion of sulfating agent in the sulfation operation so as to obtain a final product containing from about 10 to about 22 parts higher unsulfated alcohol to 100 parts actual alkyl sulfate whereby a detergent of improved sudsing power is obtained.

11. In the process of preparing a detergent of the alkyl sulfate type from higher alcohols obtained from an oil of the coconut oil type and consisting predominantly of saturated alcohols having 8 to 14 carbon atoms per molecule, the step which comprises regulating the proportion of sulfating agent in the sulfation operation so as to obtain a final product containing from about 10 to about 17 parts higher unsulfated alcohol to 100 parts actual alkyl sulfate whereby a detergent of improved detergent power is obtained.

12. The process of improving the detergent properties of a water-soluble salt of alkyl sulfuric acid prepared by incomplete sulfation of higher alcohols obtained from an oil of the coconut oil type and containing in excess of 17 parts of such unsulfated alcohols consisting predominantly of saturated alcohols having 8 to 14 carbon atoms in the molecule to 100 parts said water-soluble salt, which comprises removing a portion of said unsulphated alcohols so that said water-soluble salt does not contain more than 17 parts or less than about 3 parts unsulfated alcohols to 100 parts said water-soluble salt in admixture therewith.

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