

1

2,861,956

LIQUID DETERGENT COMPOSITIONS

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The present invention relates to liquid detergents, particularly liquid household detergents, and to a method of producing same.

An object of the invention is to provide a liquid detergent capable of producing a voluminous stable foam.

Another object of the invention is to provide a liquid detergent having a proper balance of foaming and detergent properties which render it eminently useful for washing dishes and glassware.

A further object of the invention is to provide a liquid detergent combining the property of resistance to the formation of curd in hard water with mildness towards the skin.

A further object of the invention is to provide a liquid detergent which is stable against deterioration during storage and use.

A still further object of the invention is to provide an efficient and economical liquid detergent having in combination all of the highly advantageous properties mentioned above.

Other objects and advantages of the present invention will appear from the detailed description hereinafter set forth.

To the accomplishment of the foregoing and related objects, the invention comprises the features hereinafter disclosed, and particularly pointed out in the claims, the following description setting forth in detail some of the various forms in which the principle may be applied.

In accordance with the present invention, liquid detergents having the above highly advantageous properties are prepared by mixing together in the proportions hereinafter indicated a low molecular weight aliphatic alcohol, water and a water-soluble salt of a sulfated condensation product of about 1 to about 5 mols of ethylene oxide with 1 mol of a C₁₀- to C₁₈- aliphatic alcohol. More specifically, these liquid detergents are prepared by mixing together the above three components, with or without a higher aliphatic alcohol and/or a water soluble or water dispersible fatty acid alkanolamide, in the following proportions to make 100% by weight:

	Percent
A water soluble salt selected from the group consisting of sodium, potassium and alkanolamine salts of the sulfated condensation product of about 1 to about 5 mols of ethylene oxide with 1 mol of a C ₁₀ - to C ₁₈ -aliphatic alcohol	20-80
An aliphatic alcohol containing from 1 to 5 carbon atoms	0-30
An aliphatic alcohol containing from 12 to 14 carbon atoms	0-20
A water soluble or water dispersible fatty acid alkanolamide such as disclosed in Patent 1,981,792 to Orelup and 2,353,081 to Robinson	0-20
Water	Balance

Still more specifically, these liquid detergents are prepared by mixing together the following components in the indicated proportions to make 100% by weight:

2

	Percent
A water soluble salt selected from the group consisting of sodium, potassium and alkanolamine salts of the sulfated condensation product of about 1 to about 5 mols of ethylene oxide with 1 mol of a C ₁₀ - to C ₁₈ -aliphatic alcohol	40-60
An aliphatic alcohol containing from 1 to 5 carbon atoms	5-20
An aliphatic alcohol containing from 12 to 14 carbon atoms	5-10
A water soluble or water dispersible fatty acid alkanolamide such as disclosed in Patent 1,981,792 to Orelup and 2,353,081 to Robinson	5-15
Water	Balance

For a more complete understanding of the present invention reference is made to the following specific examples.

EXAMPLE I

Methanol, water and the triethanolamine salt of the sulfated condensation product of 1 mol of ethylene oxide with 1 mol of dodecyl alcohol were mixed together in the proportions of 20%, 20% and 60% by weight, respectively. This resulted in the production of a clear liquid detergent which on agitation formed a voluminous stable lather.

EXAMPLE II

A liquid detergent was prepared by mixing together the following components in the indicated proportions by weight.

	Percent
Triethanolamine salt of the sulfated condensation product of 1 mol of Lorol with 1 mol of ethylene oxide	60
Lauric acid ethanolamide	6
Ethanol	14
Water	20

On agitation, this detergent produced a voluminous lather which was somewhat more stable than that produced by the detergent of Example I.

"Lorol" is a technical grade of lauryl alcohol, i. e. it is predominately lauryl alcohol containing a mixture of other straight-chain, even-numbered-carbon alcohols having from 10 to 18 carbon atoms.

EXAMPLE III

A liquid detergent was prepared by mixing together the following materials in the indicated proportions by weight:

	Percent
Triethanolamine salt of the sulfated condensation product of 1 mol of Lorol with 1 mol of ethylene oxide	60
Methanol	30
Lauric acid monoethanolamide	6
Water	4

The clear amber liquid thus obtained was evaluated from the standpoint of lathering in the following manner.

One teaspoonful of the detergent was added to two liters of tap water (approximately 100 p. p. m. hardness) at 40° C. in an 8¼ quart oval dishpan. After adding 100 cc. of Wesson oil to the resulting solution, it was agitated by placing the hand with the fingers spread into the dishpan and moving the hand back and forth just as the housewife does. This was done until 50 cycles had been completed. As a result of this agitation, a very voluminous and stable lather was produced which was reduced to a thin layer of bubbles after a period of 1 hour and 20 minutes. A commercial liquid detergent having the same content of active material was subjected

to the same test and it produced a foam which subsided to the same level in a period of 1 hour.

The liquid detergent prepared in accordance with this example and the above-mentioned commercial detergent were subjected to the Ross-Miles lather test and the following results were obtained:

Sample	50 p. p. m.		300 p. p. m.	
	At Once	5 Min.	At Once	5 Min.
Commercial liquid detergent.....cm.	17.3	17.3	17.8	17.7
Liquid detergent prepared in accordance with this example.....cm.	20.7	20.7	19.9	19.9

These data demonstrate that the liquid detergent prepared in accordance with this example is superior to the commercial detergent from the standpoint of lather volume and stability.

The Ross-Miles lather test was applied to a sample of the product produced in accordance with this example after storage for 5½ months. The following results were obtained:

Sample	50 p. p. m.		300 p. p. m.	
	At Once	5 Min.	At Once	5 Min.
Stored sample prepared in accordance with this example.....cm.	20.2	20.0	20.1	19.8

The results of this test indicate that after storage for an extended period of time there is no deterioration of the lathering characteristics of the liquid detergent.

EXAMPLE IV

A liquid detergent was prepared by mixing together the following components in the indicated proportions by weight.

	No. 1, percent
Triethanolamine salt of the sulfated condensation product of 5 mols of ethylene oxide with 1 mol of Lorol	60
Diethyl carbinol.....	20
Water	20

When subjected to the above described dishpan test, this liquid detergent produced a relatively stable voluminous foam.

EXAMPLE V

Liquid detergents were prepared by mixing the following components in the indicated proportions by weight.

	Triethanolamine salt of the sulfated condensation product of 5 mols of ethylene oxide with 1 mol of Lorol	Lauryl alcohol	Methanol	Ethanol (95%)
No. 1.....	Percent 60	Percent 20	Percent 20	Percent 20
No. 2.....	Percent 60	Percent 20	Percent 20	Percent 20

The resulting liquid detergents were very clear light amber solutions of low viscosity. Both of these solutions gave excellent results in the dishpan test.

EXAMPLE VI

A liquid detergent was prepared by blending together the following materials in the indicated proportions by weight.

Triethanolamine salt of the sulfated condensation product of Lorol with 5 mols of ethylene oxide.....	55
Lauryl alcohol.....	9
Methanol	23
Water	13

This product was subjected to the dishpan test described in Example III and was found to yield a voluminous stable lather.

EXAMPLE VII

Lorol, water, methanol and the triethanolamine salt of the sulfated condensation product of 5 mols of ethylene oxide with 1 mol of Lorol were mixed together in the proportions of about 5%, 15%, 20% and 60% by weight, respectively. The resulting liquid detergent mixture was subjected in a concentration of 0.2% to the Ross-Miles lather test with the following results:

Distilled Water		50 p. p. m.		300 p. p. m.	
At Once	5 Mins.	At Once	5 Mins.	At Once	5 Mins.
Cm. 11.9	Cm. 11.8	Cm. 11.1	Cm. 11.0	Cm. 15.3	Cm. 15.3

The data listed in the above table show that there is little difference in the lather values of the liquid detergent when employed in distilled or hard water. Moreover, they demonstrate that the action of this product is not adversely affected by hard water.

EXAMPLE VIII

A series of liquid detergents was prepared from the following materials in the indicated proportions by weight.

Triethanolamine salt of the sulfated condensation product of 3 mols of ethylene oxide with 1 mol of tridecyl alcohol	Lauryl acid ethanolamide	Methanol	Ethanol	Isopropanol	Water
Percent 54	Percent 6	Percent 30	Percent 30	Percent 30	Percent 10
54	6	30	30	30	10
54	6	30	30	30	10

The resulting products were subjected to the herein-after described modified dishpan test with the following results:

Sample #	No Oil		50 cc. Crisco		50 cc. Lard	
	Inst.	5 Mins.	Inst.	5 Mins.	Inst.	5 Mins.
Methanol.....	Inches 4	Inches 2¾	Inches 1¾	Inches 1	Inches 2¾	Inches 1¾
Ethanol.....	II 4	2¾	1¾	1¾	3	1¾
Isopropanol.....	III 4	2¾	1¾	1¾	3¾	1¾

It will be observed from these data that a voluminous lather was obtained; that ethanol and isopropanol were superior to methanol; and that ethanol was the best of the three alcohols used.

EXAMPLE IX

A liquid detergent was prepared by mixing together the

5

following components in the indicated proportions by weight:

	Percent
The sodium salt of the sulfated condensation product of 3 mols of ethylene oxide with 1 mol of a C ₁₃ -aliphatic alcohol.....	60
Methanol	30
Fatty acid ethanolamide.....	6
Distilled water	4

The resulting product was a light yellow liquid which, on being subjected to the dishpan test described in Example III using water containing 100 parts per million hardness, produced a voluminous stable lather, even in the presence of 50 cc. of lard or Wesson oil.

The preceding example was repeated substituting the triethanolamine salt for the sodium salt and a more voluminous and more stable foam was produced, thus demonstrating the superiority of the triethanolamine salt over the sodium salt.

EXAMPLE X

Liquid detergents were prepared by blending the following components in the indicated proportions by weight:

(a)

Triethanolamine salt of the sulfated condensation product of 3 mols of ethylene oxide with 1 mol of tridecyl alcohol, percent	Methanol, percent	Lauric Acid Ethanolamide, percent	Water, percent
60	30	6	4

(b)

Sodium salt of the sulfated condensation product of 3 mols of ethylene oxide with 1 mol of tridecyl alcohol, percent	Methanol, percent	Lauric Acid Ethanolamide, percent	Water, percent
60	30	6	4

The above products were subjected to the modified dishpan test hereinafter described and the following results were obtained:

Sample	Crisco (44 g.)		Lard (44 g.)	
	Inst., Inches	5 Mins., Inches	Inst., Inches	5 Mins., Inches
(a).....	1.25	0.87	1.25	1
(b).....	1.25	1	1.75	1.37
Commercial Detergent.....	0.87	0.75	1.12	1

The foregoing results clearly demonstrate the superiority of the detergents prepared by the above method over that of the commercial detergent from the standpoint of foam volume.

EXAMPLE XI

A series of liquid detergents were prepared by mixing the following components in the indicated proportions by weight.

Triethanolamine salt of the sulfated condensation product of 5 mols of ethylene oxide with 1 mol of a tridecyl alcohol..... percent.....	60	55.5	54
Fatty acid ethanolamide.....do.....	6	2.8	6
Methanol.....do.....	30	27.8	30
Water, distilled.....do.....	4	13.9	10

All of these detergents were clear amber liquids which, 75

6

on being subjected to a temperature of about 0° C. for 5 hours, showed no signs of turbidity.

The salts of the sulfated condensation products of ethylene oxide with the C₁₀- to C₁₈-aliphatic alcohols serve as detergents, lathering, emulsifying, and surface active materials; the lower aliphatic alcohols as viscosity controlling agents; the higher aliphatic alcohols as lather stabilizers; the fatty acid alkanolamides as lather producers and lather stabilizers, and the water as a solvent or carrier for the other components.

The liquid detergents of the instant invention are useful as windshield cleaning compositions and as household detergents, particularly for washing dishes, glassware, windows, and ceramic articles.

The liquid detergents of the instant invention are characterized by possessing the following combination of properties:

- (1) The ability to produce a voluminous stable foam
- (2) A proper balance of lathering and detergent properties
- (3) Resistance to the formation of precipitates in hard water
- (4) The ability to efficiently cut grease from dishes containing same without having a deleterious action on the human skin
- (5) Stability against deterioration during storage and use

The production of a voluminous stable lather is quite essential since lather plays a very important role in the removal of oils and fats from smooth surfaces such as are encountered in dishwashing (J. Soc. Dyers Colorists 68, pages 57-9, 1952). In addition, a voluminous lather is highly desirable since a poorly lathering detergent has very little consumer appeal for household use.

A proper balance of lathering and detergent properties is important since a material may have excellent lathering properties without having satisfactory detergent properties and vice versa. Moreover, the housewife is accustomed to judge the detergency of a product by its lathering properties and, therefore, she uses this as a criterion to determine whether sufficient detergent has been added to the water to effect the desired cleansing action. Thus, in order to ensure the best results with a given detergent, it is quite important, as far as the housewife is concerned, that optimum cleaning coincides or substantially coincides with optimum lathering.

The resistance to the formation of precipitates in hard water is highly desirable since such precipitates consume the detergent and remove it from the scene of the action. Thus, if the detergent does not possess this desirable property, an excessive amount of detergent will be required to carry out a given cleaning operation unless the hardness is counteracted by the addition of water softening or calcium sequestering agents.

The provision of a liquid detergent having the property of removing grease from smooth articles such as dishes without having a deleterious effect on the human skin is extremely important to the housewife for obvious reasons.

The importance of providing a liquid detergent which is stable to change in detergency and ability to produce a stable voluminous lather is also self-evident.

The Ross-Miles lather test used in evaluating the liquid detergents described herein is described in an article by John Ross and G. D. Miles, entitled "An Apparatus for Comparison of Foaming Properties of Soaps and Detergents," which is reported in Oil and Soap, vol. 18, pages 99-102 (1941).

Description of modified dishpan test

One teaspoonful of the detergent was added to two liters of water (approximately 100 parts per million hardness) at 40° C. in a 4-gallon rectangular vessel which was 13 inches long, 9 inches wide and 8½ inches tall,

When desired, 44 grams of Crisco or lard was added. The product was then agitated by placing the hand with the fingers spread apart into the vessel and moving the hand back and forth until fifty cycles had been completed. At the end of this operation, the height of the foam was measured in inches to the nearest one-eighth inch up to two inches of suds and to the nearest one-fourth inch above two inches of suds.

What I claim is:

1. A liquid detergent composition comprising the following components in substantially the indicated proportions to make 100% by weight:

	Percent
A triethanolamine salt of a sulfated condensation product of about 1 mol ethylene oxide with 1 mol of a C ₁₀ - to C ₁₈ -aliphatic alcohol.....	40-60
An aliphatic alcohol containing from 1 to 5 carbon atoms	5-20
An aliphatic alcohol containing from 12 to 14 carbon atoms	5-10
Lauric acid ethanolamide	5-15
Water	Balance

2. A liquid detergent composition comprising the following materials in substantially the indicated proportions to make 100% by weight:

	Percent
A triethanolamine salt of a sulfated condensation product of about 5 mols of ethylene oxide with 1 mol of C ₁₀ - to C ₁₈ -aliphatic alcohol.....	40-60
An aliphatic alcohol containing from 1 to 5 carbon atoms	5-20
An aliphatic alcohol containing from 12 to 14 carbon atoms	5-10
Lauric acid ethanolamide	5-15
Water	Balance

3. A liquid detergent composition consisting of 60% by weight of the triethanolamine salt of the sulfated condensation product of 1 mol of lauryl alcohol with 1 mol of ethylene oxide, 6% by weight of lauric acid ethanolamide, 14% by weight of ethanol and 20% by weight of water.

4. A liquid detergent composition consisting of 60% by weight of the triethanolamine salt of the sulfated condensation product of 1 mol of lauryl alcohol with 1 mol of ethylene oxide, 30% by weight of methanol, 6% by weight of lauric acid monoethanolamide and 4% by weight of water.

5. A liquid detergent composition consisting of 55% by weight of the triethanolamine salt of the sulfated condensation product of lauryl alcohol with 5 mols of ethylene oxide, 9% by weight of lauryl alcohol, 23% by weight of methanol and 13% by weight of water.

6. A liquid detergent composition consisting of 54% by weight of the triethanolamine salt of the sulfated condensation product of 3 mols of ethylene oxide with 1 mol of tridecyl alcohol, 6% by weight of lauric acid ethanolamide, 30% by weight of ethanol and 10% by weight of water.

7. A liquid detergent composition consisting of 54% by weight of the triethanolamine salt of the sulfated condensation product of 3 mols of ethylene oxide with 1 mol of tridecyl alcohol, 30% by weight of isopropanol, 6% by weight of lauric acid ethanolamide and 10% by weight of water.

8. A liquid detergent composition comprising (1) from about 20 to about 80 percent by weight of a water-soluble salt of a sulfated condensation product of about 1 to about 5 mols of ethylene oxide with 1 mol of a C₁₀- to C₁₈-aliphatic alcohol, said salt being selected from the group consisting of the sodium, potassium and triethanolamine salts of said sulfated condensation product; (2) from about 5 to about 30 percent by weight of an aliphatic alcohol containing from 1 to 5 carbon atoms; (3) up to 20 percent by weight of an aliphatic alcohol containing from 12 to 14 carbon atoms; (4) up to 20 percent by weight of lauric acid ethanolamide; and (5) the balance to make 100 percent by weight of water; and at least one of components (3) and (4) is present in an amount of at least about 5 percent by weight.

9. The liquid detergent composition of claim 8, wherein the water-soluble salt of the sulfated condensation product is the triethanolamine salt.

10. The liquid detergent composition of claim 8, wherein the water-soluble salt of the sulfated condensation product is the potassium salt.

11. The liquid detergent composition of claim 8, wherein the water-soluble salt of the sulfated condensation product is the sodium salt.

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