Sept. 22, 1964 J. H. WILSON 3,150,098

LIQUID DETERGENT

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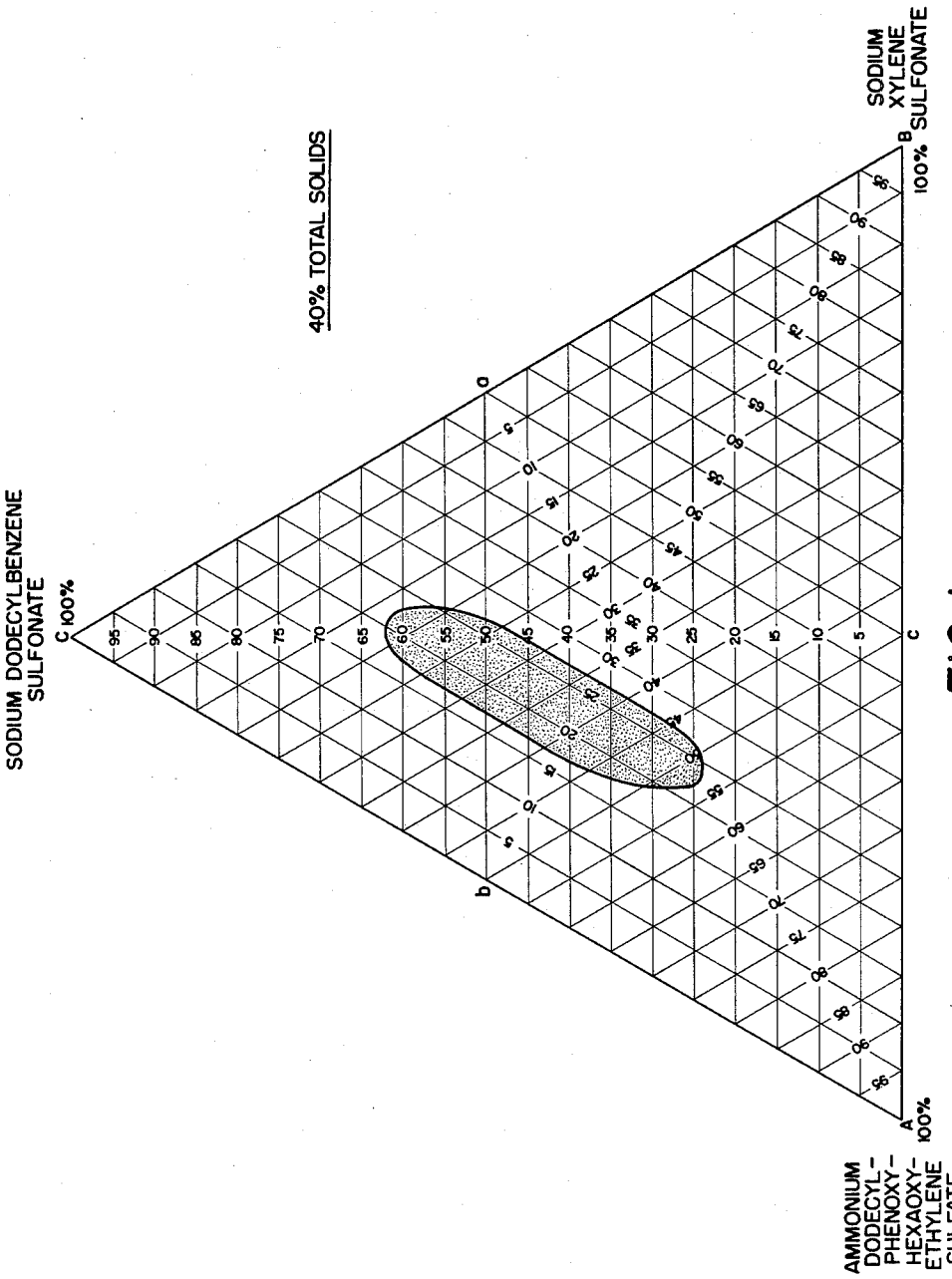


FIG. 1.

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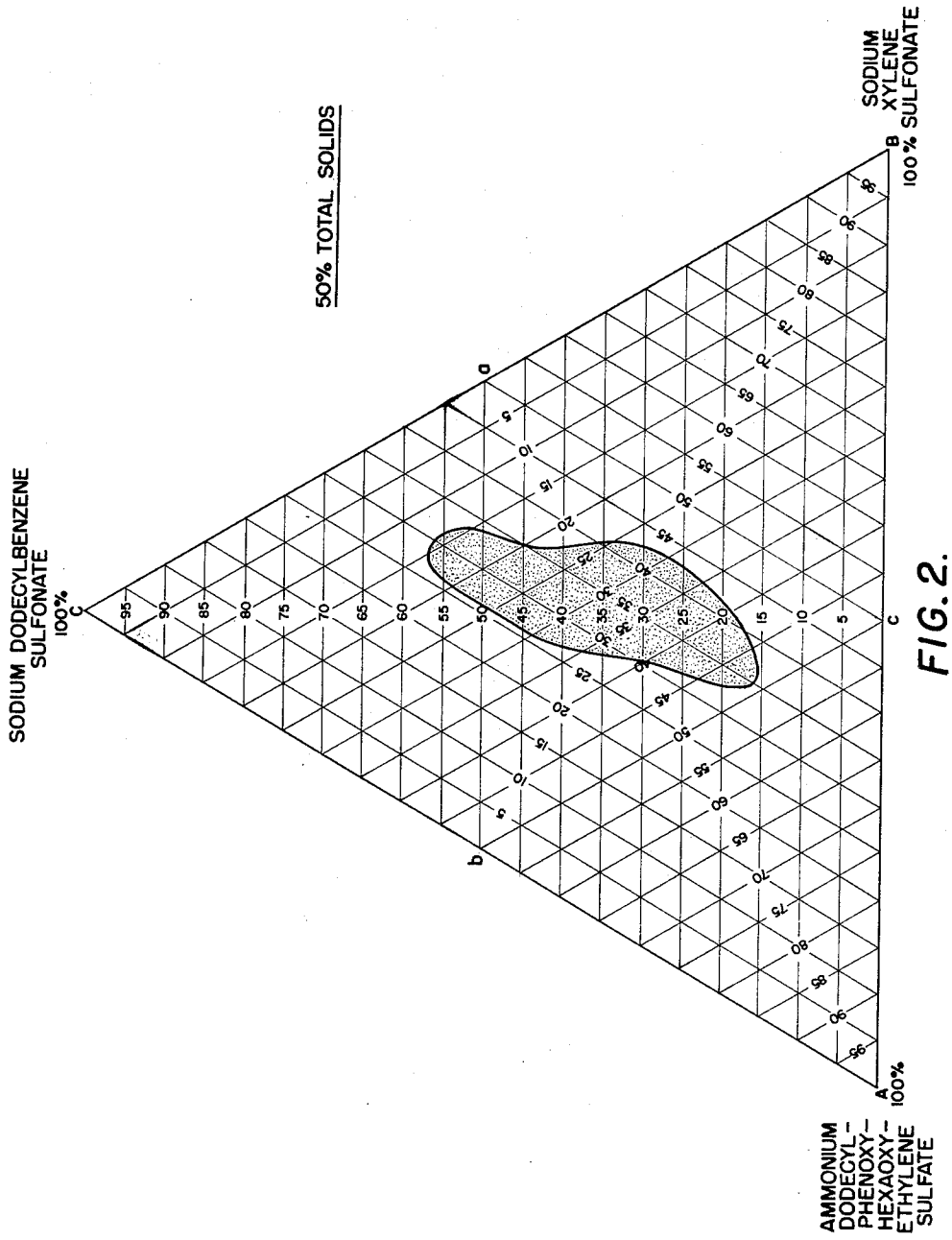


FIG. 2.

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3,150,098

LIQUID DETERGENT

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12 Claims. (Cl. 252—152)

The present invention pertains to detergent compositions, and more particularly to liquid detergent compositions.

Heretofore, various light duty liquid detergent compositions have been proposed, light duty liquid detergents being especially adapted for the cleansing of dishes and fine fabrics whereas heavy duty liquid detergents are especially designed for the cleansing of heavily soiled cotton fabrics and other fabrics. These light duty liquid detergent compositions, however, suffer from one or more serious disadvantages. For example, some of them are not homogeneous and hence they must be shaken prior to usage in order to obtain uniform dosages of the compositions. Other light duty liquid detergent compositions are homogeneous at room temperature, but they have a very high cloud point so that they lose their homogeneity when stored at a temperature only slightly below room temperature or lower. Some light duty liquid detergents are not clear and hence they do not present an appealing appearance to the user. While some heretofore known light duty liquid detergents may be clear and homogeneous and also have a relatively low cloud point, they are nevertheless either too thick because of their high viscosity or too thin because of their low viscosity. Such high viscosity compositions are difficult to pour from the containers, they set up in the containers, and they disperse slowly in the wash water. The low viscosity compositions, on the other hand, are so thin that they run down the outside of the neck of the container during pouring. Also they give the impression that they are without substance or not sufficiently concentrated so that the consumer tends to overuse the compositions.

Accordingly, the objects of the present invention are to provide light duty liquid detergent compositions which are uniform, homogeneous and preferably clear; which clear compositions have a relatively low cloud point so that they remain clear when stored at a temperature substantially below room temperature; and which have a medium viscosity so that they are neither too thin nor too thick.

In the drawings, FIGURES 1 and 2 are triangular coordinate plots wherein the stippled areas are the relative amounts of the essential components making up typical total solids content of the light duty liquid detergent compositions of the invention.

The problem of providing light duty liquid detergent compositions which will meet all of the above objects of the invention proved to be very difficult. The problem was only solved by discovering that such detergent compositions can be made, provided they are formulated from certain components, a critical minimum number of essential components, specific relative amounts of essential components, and limited total amounts thereof.

The light duty liquid detergent compositions of the invention which will meet all of the above objects of the invention are aqueous solutions of at least three essential components. One component is an anionic surfactant which is an alkali metal, e.g., sodium, potassium, or ammonium, alkylbenzene slufonate, or phenylpolypropylene sulfonate disclosed in U.S. Patent No. 2,477,383 to Lewis, containing an average of from 12 to an average of 15 carbon atoms in the alkyl group. The preferred sulfonate is sodium dodecylbenzene sulfonate. Another

component is an alkali metal, e.g., sodium, potassium, or ammonium, alkylphenoxy-polyoxyethylene sulfate, another anionic surfactant. These well known materials are sulfamic acid treated condensates of one mole of an alkylphenol with an average of four to six moles of ethylene oxide where the alkyl group contains from 9 to 12 carbon atoms. The preferred sulfate is ammonium dodecylphenoxy-hexaoxyethylene sulfate. The remaining essential component is an alkali metal short chain alkylaryl sulfonate, such as sodium, potassium, and ammonium toluene sulfonate, and xylene sulfonate.

These essential materials generally make up the total solids content of the aqueous solution. The total solids content lies in the range of from about 40% to about 50% by weight of the composition. The relative amounts of these three essential materials in the total solids content of the aqueous solution is such as to be sufficient to give the light duty detergent compositions a medium viscosity of from about 150 centipoises to about 625 centipoises at 80° F. (Brookfield Viscosimeter—No. 2 spindle—30 r.p.m.) and a cloud point of the clear compositions of less than 50° F., and preferably less than 40° F. Suitable relative amounts by weight of the preferred essential materials in the total solids content of the compositions are illustrated in FIGURES 1 and 2 of the drawings wherein they fall within the stippled areas of the figures. The stippled area in FIGURE 1 represents liquid detergent compositions of the invention which contain 40% by weight total solids, and the stippled area in FIGURE 2 represents liquid detergent compositions of the invention which contain 50% by weight total solids.

The liquid detergent compositions are readily prepared by dissolving the solids components thereof in water, or in a water-alcohol solution. Agitation and heating, of course, increase the rate of dissolution of the components and the rate of production of the compositions.

The light duty, liquid detergent compositions of the invention will be further illustrated by the following typical examples. The viscosities were determined at 80° F. using a Brookfield Viscosimeter—No. 2 spindle—30 r.p.m.

Example 1

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 40% total solids content
Sodium dodecylbenzene sulfonate	16	40
Ammonium dodecylphenoxy-hexaoxyethylene sulfate	16	40
Sodium xylene sulfonate	8	20
Water	60	

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.-75° F.).	Clear homogeneous liquid.
Viscosity (centipoises)	425.
Cloud point	44.

Example 2

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 40% total solids content
Sodium dodecylbenzene sulfonate	20	50
Ammonium dodecylphenoxy-hexaoxyethylene sulfate	12	30
Sodium xylene sulfonate	8	20
Water	60	

Example 2—Continued

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.).	Clear homogeneous liquid.
Viscosity (centipoises)	310.
Cloud point (° F.)	47.

Example 3

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 40% total solids content
Sodium dodecylbenzene sulfonate	24	60
Ammonium dodecylphenoxy-hexaoxyethylene sulfate	8	20
Sodium xylene sulfonate	8	20
Water	60	

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.).	Clear homogeneous liquid.
Viscosity (centipoises)	195.
Cloud point (° F.)	34.

Example 4

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 40% total solids content
Sodium dodecylbenzene sulfonate	22	55
Ammonium dodecylphenoxy-hexaoxyethylene sulfate	10	25
Sodium xylene sulfonate	8	20
Water	60	

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.)	Clear homogeneous liquid.
Viscosity (centipoises)	230
Cloud point (° F.)	40.

Example 5

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 40% total solids content
Sodium dodecylbenzene sulfonate	12	30
Ammonium dodecylphenoxy-hexaoxyethylene sulfate	20	50
Sodium xylene sulfonate	8	20
Water	60	

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.)	Clear homogeneous liquid.
Viscosity (centipoises)	452.
Cloud point (° F.)	36.

Example 6

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 40% total solids content
Sodium dodecylbenzene sulfonate	10	25
Ammonium dodecylphenoxy-hexaoxyethylene sulfate	21	52.5
Sodium xylene sulfonate	9	22.5
Water	60	

Example 6—Continued

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.).	Clear homogeneous liquid.
Viscosity (centipoises)	570.
Cloud point (° F.)	26.

Example 7

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 40% total solids content
Sodium dodecylbenzene sulfonate	10	25
Ammonium dodecylphenoxy-hexaoxyethylene sulfate	20	50
Sodium xylene sulfonate	10	25
Water	60	

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.).	Clear homogeneous liquid.
Viscosity (centipoises)	300.
Cloud point (° F.)	25.

Example 8

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 50% total solids content
Sodium dodecylbenzene sulfonate	17.5	35
Ammonium dodecylphenoxy-hexaoxy-ethylene sulfate	17.5	35
Sodium xylene sulfonate	15	30
Water	50	

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70°F.–75°F.).	Clear homogeneous liquid.
Viscosity (centipoises)	330.
Cloud point (° F.)	15.

Example 9

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 50% total solids content
Sodium dodecylbenzene sulfonate	26.5	53
Ammonium dodecylphenoxy-hexaoxy-ethylene sulfate	8.5	17
Sodium xylene sulfonate	15	30
Water	50	

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.).	Clear homogeneous liquid.
Viscosity (centipoises)	320.
Cloud point (° F.)	29.

Example 10

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 50% total solids content
Sodium dodecylbenzene sulfonate	15	30
Ammonium dodecylphenoxy-hexaoxy-ethylene sulfate	15	30
Sodium xylene sulfonate	20	40
Water	50	

Example 10—Continued

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.).	Clear homogeneous liquid.
Viscosity (centipoises)	170.
Cloud point (° F.)	38.

Example 11

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 50% total solids content
Sodium dodecylbenzene sulfonate	10	20
Ammonium dodecylphenoxy-hexaoxy-ethylene sulfate.	22.5	45
Sodium xylene sulfonate	17.5	35
Water	50	

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.).	Clear homogeneous liquid.
Viscosity (centipoises)	185.
Cloud point (° F.)	8.

It will be noted that all of Examples 1 through 7 fall within the stippled area in FIGURE 1 and that all of Examples 8 through 11 fall within the stippled area of FIGURE 2. All of the above examples are clear homogeneous liquids at room temperature; they all have a viscosity of from about 150 centipoises to about 625 centipoises at 80° F.; and they all have a cloud point of less than about 50° F. and many have a cloud point less than about 40° F. All of the compositions in the examples give excellent results in dishwashing tests and in washing tests on fine fabrics.

The total solids content of the liquid detergent compositions of the invention must be from about 40% to about 50% by weight of the composition, because liquid detergent compositions having a total solids content outside of this range did not have all of the desired properties and hence did not meet all of the objects of the invention. For example, compositions having 20% and 30% by weight total solids were either gelled or separated into layers, and if they were clear homogeneous liquids at room temperature, then they were either too thin or too thick because of their excessively low or excessively high viscosity, or they had a high cloud point over 50° F. Not only must the total solids content of the liquid detergent compositions be carefully controlled within these limits, but also the relative amounts of the three essential components in the total solids content must be carefully controlled. For example, compositions lying outside of the stippled areas in FIGURES 1 and 2 also did not meet all of the objects of the invention in that they were pastes or they separated into layers, and if they were clear homogeneous liquids, then they were too thin or too thick because of their excessively low or excessively high viscosity, or they had a cloud point over 50° F.

While the liquid detergent compositions of the invention have a critical minimum number of essential components, it is possible to incorporate other components therein. Such additives must be used in compatible amounts where clear homogeneous compositions are involved, and can include materials such as nonionic detergents, other anionic detergents, inorganic salts, perfumes, dyes, and the like. Where uniform compositions are involved, however, the additives can include opacifying agents, such as a polystyrene latex. Typical examples of such uniform, opaque compositions are set forth below.

Example 12

LIQUID DETERGENT FORMULATION

Components:	Percent by weight of the composition
Ammonium dodecylbenzene sulfonate	17.1
Ammonium dodecylphenoxy-hexaoxyethylene sulfate	11.9
Sodium xylene sulfonate	7
Lauric diethanolamide	6
Polystyrene latex	0.8
Ethanol	2.8
Water	54.4

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.)	Uniform opaque liquid
Viscosity (centipoises)	187

Example 13

LIQUID DETERGENT FORMULATION

Components:	Percent by weight of the composition
Sodium dodecylbenzene sulfonate	17.4
Ammonium dodecylphenoxy-hexaoxyethylene sulfate	11.9
Sodium xylene sulfonate	7
Lauric diethanolamide	6
Polystyrene latex	0.8
Water	56.9

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.)	Uniform opaque liquid
Viscosity (centipoises)	211

Example 14

LIQUID DETERGENT FORMULATION

Components:	Percent by weight of the composition
Sodium dodecylbenzene sulfonate	17.4
Ammonium dodecylphenoxy-hexaoxyethylene sulfate	11.9
Sodium xylene sulfonate	7
Lauric diethanolamide	6
Polystyrene latex	0.8
Ethanol	2.8
Water	54.1

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.)	Uniform opaque liquid
Viscosity (centipoises)	200

Other modifications of the liquid detergent formulations coming within the scope of the invention are as follows:

Example 15

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 40% total solids content
Sodium dodecylbenzene sulfonate	10	25
Ammonium dodecylphenoxy-hexaoxy-ethylene sulfate	20	50
Sodium toluene sulfonate	10	25
Water	60	

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.)	Clear homogeneous liquid.
Viscosity (centipoises)	625.
Cloud point (° F.)	44.

Example 16

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 50% total solids content
Sodium dodecylbenzene sulfonate	18.5	37
Ammonium dodecylphenoxy-hexaoxyethylene sulfate	12.5	25
Sodium xylene sulfonate	16.0	32
Condensation product of 1 mole of dodecylphenol and 10 moles (average) of ethylene oxide	3.0	6
Water	50.0	

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.)	Clear homogeneous liquid.
Viscosity (centipoises)	330.
Cloud point (° F.)	16.

Example 17

LIQUID DETERGENT FORMULATION

Components	Percent by weight of the composition	Relative percent by weight of 50% total solids content
Sodium dodecylbenzene sulfonate	18.0	36
Ammonium dodecylphenoxy-hexaoxyethylene sulfate	14.5	29
Sodium xylene sulfonate	15.5	31
Sodium lauroxyhydroxy-propane sulfonate	2.0	4
Water	50.0	

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.)	Clear homogeneous liquid.
Viscosity (centipoises)	190.
Cloud point (° F.)	20.

Example 18

LIQUID DETERGENT FORMULATION

Components:	Percent by weight of the composition
Ammonium dodecylbenzene sulfonate	17.14
Ammonium nonylphenoxy-tetraoxyethylene sulfate	11.87
Lauric diethanolamide	10.00
Sodium xylene sulfonate	7.00
Ethanol	2.80
Water	51.19

PROPERTIES OF FORMULATION

Liquid characteristics at room temperature (70° F.–75° F.)	clear homogeneous liquid
Viscosity (centipoises)	150
Cloud point (° F.)	32

Various other modifications and changes may be made in the invention disclosed herein without departing from the spirit thereof, and accordingly it will be understood that the invention is to be limited only within the scope of the appended claims.

I claim:

1. A uniform, light duty, liquid detergent composition consisting essentially of an aqueous solution of from about 40% to about 50% by weight total solids content, which solids content consists essentially of about 15 to about 63% by weight of an alkylbenzene sulfonate having an alkyl group averaging from 12 to 15 carbon atoms, about 13 to about 53% by weight of an alkylphenoxy-polyoxyethylene sulfate having an alkyl group of from 9 to 12 carbon atoms and containing from 4 to 6 oxyethylene groups, and about 17 to about 43% by weight of a short chain alkylaryl sulfonate; the relative amounts of said total solids components being adjusted to give the composition uniformity and a viscosity of from about 150 centipoises to about 625 centipoises at 80° F., the cationic portions of said three components being selected from the group consisting of Na, K and NH_4.

2. A uniform, light duty, liquid detergent composition consisting essentially of an aqueous solution of from about 40% to about 50% by weight total solids content, which solids content consists essentially of about 15 to about 63% by weight of sodium dodecylbenzene sulfonate, about 13 to about 53% by weight of ammonium dodecylphenoxy-hexaoxyethylene sulfate, and about 17 to about 43% by weight of a sodium xylene sulfonate; the relative amounts of said total solids components being adjusted to give the composition uniformity and a viscosity of from about 150 centipoises to about 625 centipoises at 80° F.

3. A clear, homogeneous, light duty, liquid detergent composition consisting essentially of an aqueous solution of from about 40% to about 50% by weight total solids content, which solids content consists essentially of about 15 to about 63% by weight of sodium dodecylbenzene sulfonate, about 13 to about 53% by weight of ammonium dodecylphenoxy-hexaoxyethylene sulfate, and about 17 to about 43% by weight of a sodium xylene sulfonate; the relative amounts of said total solids components being adjusted to give the composition a viscosity of from about 150 centipoises to about 625 centipoises at 80° F. and a cloud point of less than 50° F.

4. A clear, homogeneous, light duty, liquid detergent composition consisting essentially of an aqueous solution of from about 40% to about 50% by weight total solids content, which solids content consists essentially of sodium dodecylbenzene sulfonate, ammonium dodecylphenoxy-hexaoxyethylene sulfate, and sodium xylene sulfonate; the relative amounts of said total solids components lying within the stippled areas of FIGURES 1 and 2 and being selected so that the composition has a viscosity of from about 150 centipoises to about 625 centipoises at 80° F. and a cloud point of less than 50° F.

5. A clear, homogeneous, light duty, liquid detergent composition consisting essentially of an aqueous solution of about 40% by weight total solids content, which solids content consists essentially of sodium dodecylbenzene sulfonate, ammonium dodecylphenoxy-hexaoxyethylene sulfate, and sodium xylene sulfonate; the relative amounts of said total solids components lying within the stippled area of FIGURE 1 and being selected so that the composition has a viscosity of from about 150 centipoises to about 625 centipoises at 80° F. and a cloud point of less than 50° F.

6. A clear, homogeneous, light duty, liquid detergent composition consisting essentially of an aqueous solution of about 50% by weight total solids content, which solids content consists essentially of sodium dodecylbenzene sulfonate, ammonium dodecylphenoxy-hexaoxyethylene sulfate, and sodium xylene sulfonate; the relative amounts of said total solids components lying within the stippled area of FIGURE 2 and being selected so that the composition has a viscosity of from about 150 centipoises to about 625 centipoises at 80° F. and a cloud point of less than 50° F.

7. A clear, homogeneous, light duty, liquid detergent composition consisting essentially of an aqueous solution of about 40% by weight total solids content, which solids content consists essentially of about 60% by weight sodium dodecylbenzene sulfonate, about 20% by weight ammonium dodecylphenoxy-hexaoxyethylene sulfate, and about 20% by weight sodium xylene sulfonate; said composition having a viscosity of about 195 centipoises at 80° F. and a cloud point of about 34° F.

8. A clear, homogeneous, light duty, liquid detergent composition consisting essentially of an aqueous solution of about 40% by weight total solids content, which solids content consists essentially of about 25% by weight

sodium dodecylbenzene sulfonate, about 52.5% by weight ammonium dodecylphenoxy-hexaoxyethylene sulfate, and about 22.5% by weight sodium xylene sulfonate; said composition having a viscosity of about 570 centipoises at 80° F. and a cloud point of about 26° F.

9. A clear, homogeneous, light duty, liquid detergent composition consisting essentially of an aqueous solution of about 40% by weight total solids content, which solids content consists essentially of about 25% by weight sodium dodecylbenzene sulfonate, and about 50% by weight ammonium dodecylphenoxy-hexaoxyethylene sulfate, and about 25% by weight sodium xylene sulfonate; said composition having a viscosity of about 300 centipoises at 80° F. and a cloud point of about 25° F.

10. A clear, homogeneous, light duty, liquid detergent composition consisting essentially of an aqueous solution of about 50% by weight total solids content, which solids content consists essentially of about 35% by weight sodium dodecylbenzene sulfonate, about 35% by weight ammonium dodecylphenoxy-hexaoxyethylene sulfate, and about 30% by weight sodium xylene sulfonate; said composition having a viscosity of about 380 centipoises at 80° F. and a cloud point of about 15° F.

11. A clear, homogeneous, light duty, liquid detergent composition consisting essentially of an aqueous solution of about 50% by weight total solids content, which solids content consists essentially of about 20% by weight sodium dodecylbenzene sulfonate, about 45% by weight

ammonium dodecylphenoxy-hexaoxyethylene sulfate, and about 35% by weight sodium xylene sulfonate; said composition having a viscosity of about 185 centipoises at 80° F. and a cloud point of about 8° F.

12. A uniform, light duty, liquid detergent composition consisting essentially of an aqueous solution of about 17% by weight of alkali metal dodecylbenzene sulfonate, about 12% by weight ammonium dodecylphenoxyhexaoxyethylene sulfate, about 7% by weight sodium xylene sulfonate, about 6% by weight lauric diethanolamide, and about 1% by weight polystyrene latex; said composition having a viscosity of about 200 centipoises at 80° F.

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