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HEAVY DUTY LIQUID DETERGENT COMPOSITION

Frank E. Carroll, Glen Rock, N. J., assignor to Lever Brothers Company, New York, N. Y., a corporation of Maine

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5 Claims. (Cl. 252—137)

The present invention relates to detergent compositions and more particularly to homogeneous heavy duty liquid detergent compositions.

Many detergent compositions have heretofore been prepared, but they have primarily been in a powdered form and thereby have many disadvantages enumerated below. Powdered detergent compositions are generally prepared by spray drying or drum drying which are costly operations. When used in washing, the powdered detergent compositions must be dissolved to form dilute aqueous washing solutions. This step of dissolving or dispersing the powdered detergent compositions in the wash water is time consuming. Frequently the powdered detergent compositions are difficultly dispersed, since they may tend to form lumps. Powdered detergent compositions, moreover, tend to vary greatly in density unless particular care is taken in their preparation. Such a variation in density makes it difficult to determine the exact amount thereof to be employed during washing. In addition, powdered detergent compositions may be difficult to dispense, since they sometimes clog the orifices of a dispenser. Also powdered detergent compositions have a tendency to cake at high humidities upon standing in their opened containers. Moreover, powdered detergent compositions being normally sold in cardboard containers are subject to spillage and waste in the event an opened container is accidentally knocked over. Furthermore, their dustiness may be bothersome, especially to persons who suffer from dust allergies.

All of these disadvantages of powdered detergent compositions can be obviated by employing liquid detergent compositions. While light duty liquid detergent compositions have been prepared, they have proved to be suitable only for dishwashing and the cleaning of fine fabrics. Light duty liquid detergent compositions are unsatisfactory for washing heavily soiled cotton fabrics, since such compositions have inadequate soil removal characteristics. Heavy duty liquid detergent compositions, on the other hand, have excellent soil removal characteristics and are ideally suited for the washing of heavily soiled cotton fabrics and other fabrics. However, it has proved rather difficult to prepare homogeneous heavy duty liquid detergent compositions.

Heavy duty liquid detergent compositions may contain one or more synthetic detergents and a polyphosphate in an aqueous medium. However, the presence of a considerable amount of polyphosphate in these compositions causes the synthetic detergents to separate from solution at room temperature, thereby making the product commercially unattractive. Hence, the major problem of preparing homogeneous heavy duty liquid detergent compositions involves the discovery of means for preventing the synthetic detergents from separating out of solution at room temperature or below in the presence of a considerable amount of polyphosphate.

In attemptying to solve this problem compositions were prepared containing a synthetic anionic nonsoap detergent and a polyphosphate in an aqueous medium to which were added various solubilizing agents. More specifically, compositions were prepared containing a potassium alkylaryl sulfonate and tetrapotassium pyrophosphate in an aqueous medium to which were added either an alkali metal aryl sulfonate or at least one alkylolamide as prospective solubilizing agents for the anionic detergent in an effort to obtain a homogeneous heavy duty liquid detergent composition. However, the alkali metal aryl sulfonate did not prove to be a solubilizing agent for the potassium alkylaryl sulfonate in the presence of a considerable amount of tetrapotassium pyrophosphate nor did the alkylolamides.

This is clearly illustrated in Examples 1 through 6 in Table I below wherein the components of the composition are given in percent by weight. In these examples a typical potassium alkylaryl sulfonate was employed, i. e., potassium phenyl polypropylene sulfonate containing 12 carbon atoms in the alkyl chain. The alkali metal aryl sulfonate used as a prospective solubilizing agent was a commercial sodium xylene sulfonate. The alkylolamides were lauric isopropanolamide or lauric diethanolamide or a mixture of the two.

TABLE I

Example No.	1	2	3	4	5	6
Potassium Phenyl Polypropylene Sulfonate (C_{12} alkyl)	10.0	10.0	10.0	10.0	10.0	10.0
Tetrapotassium Pyrophosphate	20.0	20.0	20.0	20.0	20.0	20.0
Water	63.5	66.8	66.2	63.0	63.0	63.0
Sodium Xylene Sulfonate (Commercial)	6.5	-----	-----	-----	-----	-----
Lauric Isopropanolamide	-----	3.2	-----	3.2	7.0	-----
Lauric Diethanolamide	-----	-----	3.8	3.8	-----	7.0
Liquid Characteristics at Room Temperature (70–75° F.)	(1)	(2)	(2)	(2)	(2)	(2)

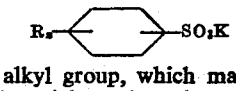
[1] Two layers, pasty solids floating on top of liquid. Partial separation.
[2] Two layers, pasty solids floating on top of liquid. Complete separation.

From a study of the above examples it can be seen

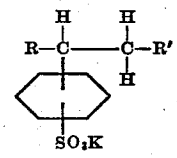
readily that the heavy duty liquid detergent compositions containing a potassium alkylaryl sulfonate and tetrapotassium pyrophosphate in an aqueous medium in the presence of an alkali metal aryl sulfonate or at least one alkylolamide were heterogeneous. The potassium alkylaryl sulfonate separated out from solution in the presence of tetrapotassium pyrophosphate even when the composition contained an alkali metal aryl sulfonate or at least one alkylolamide. At room temperature these liquid detergent compositions were in the form of two layers with pasty solids of potassium alkylaryl sulfonate floating on top of the liquid.

It was found, however, in accordance with the invention that when both an alkali metal aryl sulfonate and at least one alkylolamide were used together in the heavy duty liquid detergent compositions containing a potassium alkylaryl sulfonate and tetrapotassium pyrophosphate or pentapotassium tripolyphosphate in an aqueous medium that heavy duty liquid detergent compositions could be obtained which were homogeneous at room temperature. The homogeneous heavy duty liquid detergent compositions of the present invention therefore consist essentially of an aqueous solution of from about 7% to about 16%, and preferably about 10% of a potassium alkylaryl sulfonate, from about 4% to about 12% total, and preferably about 7% total of one or more alkali metal aryl sulfonates, from about 27% to about 10%, and preferably about 20%, of tetrapotassium pyrophosphate or pentapotassium tripolyphosphate, and from about 2% to about 15% total and preferably from about 4% to about 7% total, of at least one alkylolamide or an ethylene oxide condensation product thereof.

The potassium alkylaryl sulfonates have the general formula



where R is an alkyl group, which may be saturated or unsaturated and straight or branched chain, having from 1 to 15 carbon atoms, at least one R having 8 to 15 carbon atoms, x is a number from 1 to 5, and may be an average number. Suitable potassium alkylaryl sulfonates include, for example, potassium tertiary-octylbenzene sulfonate, potassium keryl benzene sulfonates obtained by condensing kerosene with benzene and sulfonating the product, potassium nonylbenzene sulfonate, potassium nonyltoluene sulfonate, potassium dodecyltoluene sulfonate, potassium dodecylbenzene sulfonate, and the potassium phenyl polypropylene sulfonates, described in U. S. Patent No. 2,477,383 to Lewis, which are sulfonated phenyl alkanes in which the alkyl carbon at the benzene ring is tertiary:



where R and R' taken together with the remainder of the polypropylene radical form an alkyl group having an average molecular weight corresponding to from about 12 to about 15 carbon atoms. The potassium alkylaryl sulfonate anionic detergent is used in the composition to supply a portion of the foaming and wetting action necessary in a heavy duty liquid detergent product designed for household use.

The polyphosphate, i. e., tetrapotassium pyrophosphate or pentapotassium tripolyphosphate, is employed in the composition to supply the heavy duty detergent feature of the liquid, and impart good soil removal properties thereto. As the amount of polyphosphate is increased, the amount of potassium alkylarylsulfonate is decreased.

The alkali metal aryl sulfonate or mixtures thereof totaling from about 4% to about 12%, and preferably about 7%, include the following sodium or potassium aryl sulfonates: toluene sulfonate, tetralin sulfonate, ethylbenzene sulfonate, isopropylbenzene sulfonate, orthoxylene sulfonate, meta-xylene sulfonate, a mixture of 80% toluene sulfonate and 20% ethylbenzene sulfonate, a mixture of 61% ortho-xylene sulfonate and 39% isopropylbenzene sulfonate, a mixture of 15% ortho-xylene sulfonate, 70% meta-xylene sulfonate, and 15% para-xylene sulfonate, a mixture of 47% toluene sulfonate plus 53% of a mixture of 15% ortho-xylene sulphonate, 70% meta-xylene sulfonate, and 15% para-xylene sulfonate, a mixture of 22% ortho-xylene sulfonate, 53% meta-xylene sulfonate, 5% para-xylene sulfonate, 18% ethylbenzene sulfonate, and 2% toluene sulfonate, and a mixture of from about 1% to about 10% toluene sulfonate plus from about 99% to about 90% of a mixture of 22% ortho-xylene sulfonate, 53% meta-xylene sulfonate, 5% para-xylene sulfonate, 18% ethylbenzene sulfonate, and 2% toluene sulfonate. The alkali metal aryl sulfonate is employed in the heavy duty liquid detergent composition to aid in solubilizing the potassium alkylaryl sulfonate in the presence of a considerable amount of the polyphosphate and other inorganic materials. The alkali metal aryl sulfonate also solubilizes the alkylolamides which are either insoluble in water or incompatible with aqueous solutions of polyphosphates. There is no advantage in adding more of the alkali metal aryl sulfonate than is necessary for its solubilizing effect, since this material appears to contribute nothing to the detergent and dish-washing characteristics of the heavy duty liquid detergent composition.

The alkylolamide may be either a monoalkylolamide or a dialkylolamide. Typical examples of suitable alkylolamides are lauric isopropanolamide, lauric diethanolamide, coconut monoethanolamide, capric diethanolamide, tallow diethanolamide, and the monoethanolamide of 1:1 mixture of caprylic and capric acids. The alkylolamides act as solubilizers in conjunction with the alkali metal aryl sulfonate to prevent the separating out from solution of the potassium alkylaryl sulfonate.

It was found that not all alkylolamides are suitable for use in the composition of this invention. For example, myristic monoethanolamide or myristic monoisopropanolamide in 7% amounts as the alkylolamide component of the composition causes the compositions to be opaque solids at room temperature rather than clear homogeneous liquids. Also it was found that sulfonated higher fatty acid amides or polyether alkylene compounds were not suitable for use in lieu of an alkylolamide as a solubilizer, since compositions prepared containing 7% of these compounds separated into two layers at room temperature and hence were not homogeneous.

Other suitable alkylolamides which may also be employed include ethylene oxide condensation products thereof, for example, the condensation product of one mole of lauric monoethanolamide with one mole of ethylene oxide and the condensation product of one mole of lauric isopropanolamide with one mole of ethylene oxide. All of the above alkylolamides may be used either singly or in suitable mixtures.

The remaining component of the heavy duty liquid detergent composition is water which serves as a solvent for the components thereof.

If desired, the liquid detergent composition may contain minor portions of an alkali, such as potassium hydroxide, to neutralize any excess acid impurities present in the components of the composition. In addition, minor portions of compatible perfumes, dyes, optical brighteners and other desirable adjuvants may be added to the composition.

TABLE II

Example No.	7	8	9	10	11	12	13	14	15	16
Potassium Phenyl Polypropylene Sulfonate (C_{12} alkyl).	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0.
Tetrapotassium Pyrophosphate	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0.
Sodium Xylene Sulfonate (Commercial)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5g	6.5	6.5.
Water	56.5	56.5	56.5	56.5	56.5	56.5	56.5	59.5	58.5	59.5.
Lauric Isopropanolamide	7.0		3.2							4.0.
Lauric Diethanolamide		7.0	3.8						5.0	
Coconut Monoethanolamide				7.0						
Monoethanolamide of a 1:1 mixture of caprylic and capric acids.					7.0					
Tallow Diethanolamide						7.0		4.0		
Capric Diethanolamide							7.0			
Liquid Characteristics at Room Temperature (70–75° F.)	Clear homogeneous liquid.	Clear homogeneous liquid.	Clear homogeneous liquid.	Clear homogeneous liquid.	Clear homogeneous liquid.	Clear homogeneous liquid.	Clear homogeneous liquid.	Clear homogeneous liquid.	Clear homogeneous liquid.	Clear homogeneous liquid.
Liquid Characteristics After Storage for 16 hours at 40° F.	Opaque solid.	do	Viscous opaque liquid.	Viscous opaque liquid.	do	Opaque liquid.	do	Opaque liquid.	Cloudy homogeneous liquid.	Solids separate.
Characteristics of liquid Stored at 40° F. and then reexposed to Room Temperature for 6 hours.	Opaque liquid.		Clear homogeneous liquid.	Clear liquid containing suspended undissolved solids.		Clear liquid in 2 hours.		Clear liquid in 3 hours.	Clear liquid in ½ hour.	Clear homogeneous liquid.
Cloud Point (° C.)		−6	−5		−12		−8		+3	+6.
Clear Point (° C.)		0			−3		−1		+11	+21.

In the above examples a typical potassium alkylaryl sulfonate, i. e., potassium phenyl polypropylene sulfonate having 12 carbon atoms in the alkyl chain, was utilized. The polyphosphate employed was tetrapotassium pyrophosphate although it will be appreciated that pentapotassium tripolyphosphate in an equal amount could also have been utilized with the same results. A typical alkali metal aryl sulfonate was employed, namely a commerical sodium xylene sulfonate. Various alkylolamides, either monoalkylolamides or dialkylolamides or mixtures thereof, were utilized.

These examples clearly illustrate that when a typical potassium alkylaryl sulfonate anionic detergent and a tetrapotassium pyrophosphate are suspended in an aqueous medium in the presence of a suitable alkali metal aryl sulfonate and at least one alkylolamide in the correct proportions set forth above that heavy duty liquid detergent compositions are produced which are clear and homogeneous at room temperature. The detergent compositions in many instances are even clear homogeneous liquids after storage for 16 hours at 40° F. In other instances the compositions when stored for 16 hours at 40° F. became opaque solids or opaque liquids or actually separated into a solid phase. However, when these compositions were reexposed to room temperature for a number of hours they again became clear homogeneous liquids or opaque liquids or clear liquids containing suspended undissolved solids. In no instance did the compositions separate out into two or more layers upon reexposure to room temperature.

A comparison of Examples 7 through 16 containing both an alkali metal aryl sulfonate and at least one alkylolamide with Examples 1 through 6 wherein the compositions contained only an alkali metal aryl sulfonate or at least one alkylolamide readily shows that the presence of both an alkali metal aryl sulfonate and at least one alkylolamide is necessary in order to prevent separation of the potassium alkylaryl sulfonate in the presence of a considerable amount of tetrapotassium pyrophosphate. As noted above pentapotassium tripolyphosphate can be used in lieu of the pyrophosphate with comparable results being obtained.

Examples 17 and 18 in Table III below show that an alkali metal toluene sulfonate or an alkali metal tetralin sulfonate may be substituted in an equal amount for an alkali metal xylene sulfonate in the compositions of this invention. In this table also the amounts of the components are presented in percent by weight of the total composition.

TABLE III

Example No.	17	18
Potassium Phenyl Polypropylene Sulfonate (C_{12} alkyl).	10.0	10.0.
Tetrapotassium Pyrophosphate	20.0	20.0.
Sodium Toluene Sulfonate		6.8.
Sodium Tetralin Sulfonate	6.7	
Water	56.3	56.2.
Lauric Isopropanolamide	3.2	3.2.
Lauric Diethanolamide	3.8	3.8.
Liquid Characteristics at Room Temperature (70–75° F.).	Clear homogeneous liquid.	Clear homogeneous liquid.
Liquid Characteristics After Storage for 16 hours at 40° F.	Viscous Opaque liquid.	Viscous Opaque liquid.
Characteristics of Liquid Stored at 40° F. and then reexposed to Room Temperature for 1 hour.	Clear homogeneous liquid.	Clear homogeneous liquid.
Cloud Point (° C.)	−2.	+1.

In Examples 17 and 18 wherein sodium toluene sulfonate or sodium tetralin sulfonate were substituted for sodium xylene sulfonate as the alkali metal aryl sulfonate in the composition, the compositions were clear homogeneous liquids at room temperature. They became viscous opaque liquids after storage for 16 hours at 40° F. and again became clear homogeneous liquids upon reexposure to room temperature for one hour.

Examples 19 and 20 in Table VI below show that an ethylene oxide condensation product of an alkylolamide may be used in conjunction with an alkali metal aryl sulfonate to solubilize the potassium alkylaryl sulfonate in the presence of a considerable amount of the polyphosphate.

TABLE IV

Example No.	19	20
Potassium Phenyl Polypropylene Sulfonate (C_{12} alkyl).	10.0	10.0.
Tetrapotassium Pyrophosphate	20.0.	20.0.
Sodium Xylene Sulfonate (Commercial)	6.5	6.5.
Water	56.5	56.5.
Condensation product of one mole of lauric monoethanolamide with one mole of ethylene oxide.	7.0	
Condensation product of one mole of lauric isopropanolamide with one mole of ethylene oxide.		7.0.
Liquid Characteristics at Room Temperature (70–75° F.).	Clear homogeneous liquid.	Clear homogeneous liquid.
Liquid Characteristics After Storage for 16 hours at 40° F.	Opaque liquid.	Opaque liquid.
Characteristics of liquid stored at 40° F. and then reexposed to Room Temperature for 2 hours.	Clear liquid.	Clear liquid.

The detergency and sudsing properties of these compositions are clearly illustrated by the following standardized dishwashing test. The test involved the washing of specially soiled dishes with an aqueous solution of the liquid detergent composition and counting the dishes which were washed before the suds disappeared. The temperature of the wash water containing the liquid detergent composition was 115° F. The aqueous wash water solutions were prepared by mixing 10 gram and 30 gram portions of the composition of Example 15 in six quarts of water of 120 p. p. m. hardness. When 10 grams of the composition of Example 15 was employed in the test, 19 dishes were washed before the suds disappeared, while a 30 gram portion of the composition of Example 15 in the wash water enabled more than 43 dishes to be washed before the suds disappeared. It will be appreciated that other typical examples of the compositions of this invention set forth above would give comparable results in this test.

The soil removal properties of the homogeneous heavy duty liquid detergent compositions of this invention are shown by the following test. The soil removal test consisted of washing eight cotton test cloths artificially soiled with vacuum cleaner dust in a Terg-O-Tometer in water having a hardness of 180 p. p. m. (⅔ calcium ⅓ magnesium) using 0.26% concentration of the product to be tested. The wash period was for 20 minutes at a temperature of 120° F. The reflectance of the test cloth was measured by means of a Hunter Reflectometer before washing and after washing. The gain in reflectance of the soiled test cloths was used as a measure of the amount of soil removed from the cloth.

This test was applied to a simple system of organic detergents without a polyphosphate (Composition A), an aqueous solution of a polyphosphate (Composition B), and a heavy duty liquid detergent composition of the invention (Composition C). The results of this test and the percent by weight of the components of these compositions are set forth below.

Compositions	A	B	C
Potassium Pheny Polypropylene Sulfonate (C_{12} alkyl)	10.0	------	10.0
Sodium Xylene Sulfonate (Commercial)	6.5	------	6.5
Lauric Isopropanolamide	3.2	------	3.2
Lauric Diethanolamide	3.8	------	3.8
Tetrapotassium Pyrophosphate	------	20.0	20.0
Water	73.7	80.0	56.5

Composition	Percent Concentration	Hunter Reflectometer Measurement	
		Before Washing	After Washing
A	0.26	30	50
B	0.26	30	56
C	0.26	30	59

The tendency of polyphosphate detergents to corrode aluminum may be inhibited by the addition to the homogeneous heavy duty liquid detergent compositions of an amount up to about 8% on a solids basis of a water-soluble alkali metal silicate, such as sodium or potassium silicate. When a water-soluble alkali metal silicate is added to the composition, the pH thereof must be adjusted to about 11.4 or above by the addition of free alkali, such as potassium hydroxide, to keep the silicate in solution. Typical alkali metal silicates include the sodium or potassium silicates having the following alkali to silica ratios: 1:3.92, 1:3.45, 1:2.4, 1:1.8, 1:2.5, and 1:2,0.

A typical composition in percent by weight containing an alkali metal silicate is set forth in Example 21.

Example 21

Potassium phenyl polypropylene sulfonate (C_{12} alkyl)	10.0.
Tetrapotassium pyrophosphate	20.0.
Sodium xylene sulfonate (commercial)	7.5.
Lauric isopropanolamide	3.2.
Lauric diethanolamide	3.8.
Potassium silicate (30%) (K_2O:SiO_2 of 1:3.92)	12.0.
Water plus potassium hydroxide (pH 12.1)	43.5.
Percent silicate solids in composition	3.6.
Liquid characteristics at room temperature	Clear homogeneous liquid.

Further modifications of the compositions of the invention showing other variations in components and the amounts thereof are set forth below. In all of these examples the compositions were clear homogeneous liquids at room temperature.

TABLE V

Example No.	22	23	24	25	26	27	28	29
Potassium Dodecylbenzene Sulfonate	16	10	10	10	6.7	15	10	10
Tetrapotassium Pyrophosphate	10	10	20	20	25.5	10	15	15
Lauric Diethanolamide	3.8	3.8	2	15	2.7	3.8	3.8	3.8
Lauric Isopropanolamide	3.2	3.2	------	------	2.3	3.2	3.2	3.2
Sodium Xylene Sulfonate (Commercial)	8	4	6.5	6.5	7	8	7.5	7.5
Water + KOH to pH 12	59	66.5	61.5	48.5	53.3	60	57.8	58
Sodium Silicate(Na_2O:SiO_2 of 1:2.5)	------	2.5	------	------	2.5	------	------	------
Potassium Silicate (K_2O:SiO_2 of 1:3.92)	------	------	------	------	------	------	2.7	7.5
Total	100	100	100	100	100	100	100	100

Examples 30–41

To the following base formula there were added varying amounts of alkali metal aryl sulfonates as indicated below to form clear homogeneous heavy duty liquid detergent compositions which were still homogeneous after three or more months' storage at room temperature (70° F.).

Components:	Percent by weight
Potassium dodecylbenzene sulfonate	10.
Lauric diethanolamide	3.8.
Lauric isopropanolamide	3.2.
Tetrapotassium pyrophosphate	20.
Sodium silicate (Na_2O:SiO_2 of 1:2.5)	2.5.
Alkali metal arylsulfonate	As indicated below.
Water+KOH to pH 12.2	Sufficient amount to make components total 100%.
Total	100.

Example 30 contained 5.5% of sodium toluene sulfonate.

Example 31 contained 5.5% of sodium ethylbenzene sulfonate.

Example 32 contained 5.5% of sodium ortho-xylene sulfonate.

Example 33 contained 7% of sodium isopropylbenzene sulfonate.

Example 34 contained 5.5% of sodium meta-xylene sulfonate.

Example 35 contained 7.5% of sodium tetralin sulfonate.

Example 36 contained 5.5% total of a mixture of 80% sodium toluene sulfonate and 20% sodium ethylbenzene sulfonate.

Example 37 contained 5.5% total of a mixture of 61% sodium ortho-xylene sulfonate and 39% sodium isopropylbenzene sulfonate.

Example 38 contained 6% total of a mixture of 15% sodium ortho-xylene sulfonate, 70% sodium meta-xylene sulfonate, and 15% sodium para-xylene sulfonate.

Example 39 contained 6% total of a mixture of 47% sodium toluene sulfonate plus 53% of a mixture of 15% sodium ortho-xylene sulfonate, 70% sodium meta-xylene sulfonate, and 15% sodium para-xylene sulfonate.

Example 40 contained 7% total of a mixture of 22% sodium ortho-xylene sulfonate, 53% sodium meta-xylene sulfonate, 5% sodium para-xylene sulfonate, 18% sodium ethylbenzene sulfonate, and 2% sodium toluene sulfonate.

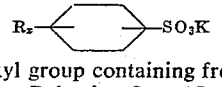
Example 41 contained 7% total of a mixture of 10% sodium toluene sulfonate plus 90% of a mixture of 22% sodium ortho-xylene sulfonate, 53% sodium meta-xylene sulfonate, 5% sodium para-xylene sulfonate, 18% sodium ethylbenzene sulfonate, and 2% sodium toluene sulfonate.

This application is a continuation-in-part of applicant's copending application Serial No. 580,712, filed April 26, 1956, now abandoned, which in turn is a continuation-in-part of applicant's application Serial No. 538,773, filed October 5, 1955, also now abandoned.

Various modifications and changes other than those set forth herein may be made in the composition of this invention 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 homogeneous heavy duty liquid detergent composition consisting essentially of an aqueous solution of from about 7% to about 16% of a potassium alkylaryl sulfonate having the general formula



where R is an alkyl group containing from 1 to 15 carbon atoms, at least one R having 8 to 15 carbon atoms, and x is a number from 1 to 5; from about 4% to about 12% total of alkali metal arylsulfonate selected from the group consisting of toluene sulfonate, tetralin sulfonate, ethylbenzene sulfonate, isopropylbenzene sulfonate, ortho-xylene sulfonate, meta-xylene sulfonate, a mixture of 80% toluene sulfonate and 20% ethyl benzene sulfonate, a mixture of 61% ortho-xylene sulfonate and 39% isopropylbenzene sulfonate, a mixture of 15% ortho-xylene sulfonate, 70% meta-xylene sulfonate, and 15% paraxylene sulfonate, a mixture of 47% toluene sulfonate plus 53% of a mixture of 15% ortho-xylene sulfonate, 70% meta-xylene sulfonate, and 15% para-xylene sulfonate, a mixture of 22% ortho-xylene sulfonate, 53% meta-xylene sulfonate, 5% paraxylene sulfonate, 18% ethylbenzene sulfonate, and 2% toluene sulfonate, and a mixture of from about 1% to about 10% toluene sulfonate plus from about 99% to about 90% of a mixture of 22% ortho-xylene sulfonate, 53% meta-xylene sulfonate, 5% para-xylene sulfonate, 18% ethylbenzene sulfonate, and 2% toluene sulfonate; from about 27% to about 10% of a potassium polyphosphate selected from the group consisting of tetrapotassium pyrophosphate and pentapotassium tripolyphosphate; and from about 2% to about 15% total of at least one compound selected from the group consisting of lauric isopropanolamide, lauric diethanolamide, coconut monoethanolamide, capric diethanolamide, tallow diethanolamide, the monoethanolamide of a 1:1 mixture of caprylic and capric acids, the condensation product of one mole of lauric monoethanolamide with one mole of ethylene oxide, and the condensation product of one mole of lauric isopropanolamide with one mole of ethylene oxide.

2. A homogeneous heavy duty liquid detergent composition as set forth in claim 1 wherein the potassium alkylaryl sulfonate is potassium phenyl polypropylene sulfonate having 12 carbon atoms in the alkyl chain.

3. A homogeneous heavy duty liquid detergent composition as set forth in claim 1 containing an amount up to about 8% on a solids basis of a water-soluble alkali metal silicate having an alkali to silica ratio of from 1:1.8 to 1:3.92, said composition having a pH of at least about 11.4.

4. A homogeneous heavy duty liquid detergent composition as set forth in claim 1, wherein the amount of potassium alkylaryl sulfonate is about 10%, the total amount of alkali metal arylsulfonate is about 7%, the amount of potassium polyphosphate is about 20%, and the total amount of the alkylolamide compounds is from about 4% to about 7%.

5. A homogeneous heavy duty liquid detergent composition as set forth in claim 3, wherein the silicate is a potassium silicate.

References Cited in the file of this patent

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,859,182 November 4, 1958

Frank E. Carroll

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Columns 5 and 6, Table II, Example 14, third item, for "6.5g" read -- 6.5 --; same table, Example 16, lines 6 to 10 inclusive, insert leaders; Table III, Example 18, line 4, insert leaders; Table IV, Example 20, line 5, insert leaders, column 7, line 57, for "Pheny" read -- Phenyl --.

Signed and sealed this 17th day of March 1959.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,859,182 November 4, 1958

Frank E. Carroll

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, after line 75, and before TABLE II, in columns 5 and 6, the following two paragraphs were inadvertently omitted and should be inserted as part of the Letters Patent -

> The homogeneous heavy duty liquid detergent composition of this invention is prepared by mixing the components thereof together in the aqueous medium. Heat may be conveniently utilized during the mixing of the components to increase the rate of dissolution thereof.
>
> Illustrative examples of the homogeneous heavy duty liquid detergent composition of this invention are presented below in Examples 7 through 16 of Table II. In this table the amount of the components in the compositions is expressed in percent by weight of the total composition.

Signed and sealed this 1st day of September 1959.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents