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[54] **DETERGENT SOLVENT COMPOSITIONS**

[75] Inventors: **Francis J. Figiel**, Boonton; **Roland W. Anderson**, Sparta, both of N.J.

[73] Assignee: **Allied Chemical Corporation**, New York, N.Y.

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Primary Examiner—Herbert B. Guynn

Attorney, Agent, or Firm—Anthony J. Stewart; Jay P. Friedenson

[57] **ABSTRACT**

Compositions are provided which contain isopropylamine salts of a mixture of linear alkylbenzene sulfonic acids in which the alkyl groups contain 7 through 14 carbon atoms, a predominant amount of the mixture containing from 11 through 12 carbon atoms, from about 19 to about 24 numerical percent of linear alkylbenzene sulfonic acid salts having the benzene sulfonic acid group located on the two position of the alkyl group and an organic solvent which is preferably Stoddard Solvent or 1,1,2-trichloro-1,2,2-trifluoroethane or trichloromonofluoromethane. Such compositions have a high tolerance for water even in the presence of inorganic salts and are useful for solvent cleaning of textiles and machinery.

13 Claims, No Drawings

DETERGENT SOLVENT COMPOSITIONS

This invention relates to new detergent solvent compositions.

Solvent cleaning solutions widely used in the past have embodied one or more of a variety of volatile solvents which have the capacity for removing stains and soils from textiles, machinery and other objects, without wetting the object to be cleaned and thus avoiding the drying step in the case of textiles and the potential corrosion in the case of machinery, attendant upon aqueous cleaning methods.

The volatile solvent dry cleaning fluids, however, often proved less than satisfactory in failing to remove water soluble soils. To overcome this difficulty, small quantities of water are usually incorporated with the solvent cleaning fluid together fluids a water and oil soluble emulsifying detergent such a long branched-chain alkylbenzene slufonate, to form water-in-oil emulsions.

Such emulsions provide improved water soluble soil removal, but suffer from the drawback that only minor amounts of water can be incorporated while maintaining the water-in-oil character of the emulsion. Attempts at increasing the water content often produce either separation of the emulsion into two phases, water and oil, or inversion of the emulsion to an oil-in-water type emulsion. In either case, the advantages of the solvent type cleaning composition are lost, and the disadvantages of the aqueous cleaning agents reappear. Additionally, since such branched-chain alkylbenzene sulfonates are not completely biodegradable, their disposal after use adds to the stream pollution problem.

For a number of cleaning purposes, it is desirable to provide cleaning solvents having either a high initial water content or a high water tolerance, i.e., an ability to hold, in emulsion form, large quantities of water, either present in the solvent initially or absorbed into the solvent system from the object to be cleaned such as, for example, water-wet textiles or water-wet machinery and the like, to leave the object "dry" and substantially free of moisture. It is especially desirable that in the solvent cleaning of textile fabrics, machine parts and the like, high water tolerances be present in the detergent-containing solvent cleaning solvent.

Water tolerances can sometimes be achieved by the addition of large quantities of emulsifier to the solvent solution, but even this expedient has its drawbacks because of the expense of the emulsifier. In the emulsion systems provided in the past, it has only been possible to provide solvent cleaning solutions having adequate water tolerances by using amounts of the emulsifier which would be economically prohibitive.

It is therefore, an object of the present invention to provide an initially substantially anhydrous solvent cleaning emulsifier composition which is capable of tolerating and/or absorbing significantly larger proportions of water in relation to the amount of emulsifier present than has been possible in the past.

It is a further object of this invention to provide a water-in-oil emulsion having a high tolerance for water using no more than about 5 parts of emulsifier per 100 parts of solvent.

It is an ancillary object to provide as the detergent in these compositions, substances which are not only highly effective but also substantially completely biodegradable.

These and other objects are accomplished by the provision, in accordance with our invention, of compositions capable of forming stable emulsions with water, which compositions comprise from about 0.2 to about 91% by weight of a detergent having novel characteristics which detergent comprises a mixture of linear alkylbenzene sulfonic acid isopropylamine salts, the alkyl groups of which contain from 7 through 14 carbon atoms, a predominant amount and preferably at least 75 weight percent of the alkyl groups in the linear alkylbenzene isopropylamine salt containing 11 through 14 carbon atoms, from about 19 to about 24, preferably from about 20 to 23.5 and more preferably from about 21.5 to 23 numerical percent of the linear alkyl benzene sulfonic acid, isopropylamine salts having the benzene sulfonic acid group located on the two position (second carbon atom phenyl; 2ϕ) of the linear alkyl group; and at least 9 percent by weight of the composition being essentially an organic solvent selected from aliphatic and halogenated aliphatic hydrocarbons boiling between about 20° and about 200° C.

The water tolerance of our novel compositions may vary somewhat with the detergent used, (i.e. these mixtures alkyl aryl sulfonate salts in which the range of C_{11} and C_{12} alkyl group moieties varies and as the numerical percent of benzene sulfonic acid group located on the two position varies as indicated herein), with the concentration of the detergent present and also with the organic solvent used.

The relationship of weight percent of the detergent required in the compositions to emulsify the maximum amount of water that can be emulsified in the composition is relatively constant and is a ratio of about 1:4. In other words, about 25% of the detergent by weight of water emulsified in the composition is required to obtain maximum water tolerance in the composition. "About 25%" as used herein means 25% ± 7%. Larger percentages of the detergent while sometimes creating a small increase in stability generally do not increase water tolerance. For example it has been found that a maximum of 70% water by weight of composition can be emulsified when 25% of the detergent by weight of emulsified water is present in the composition when Stoddard Solvent is used as the organic solvent. When the solvent is selected from 1,1,2-trichloro-1,2,2-trifluoroethane, sym. and assym. tetrachlorodifluoroethane, trichloro-monofluoromethane and mixtures thereof the maximum amount of water which can be tolerated in the composition is about 10% and again this maximum amount is reached where the detergent is present in an amount of about 25 percent by weight of water in the composition. Further increases in detergent do not further increase water tolerance.

The relationship between the amount of detergent required to emulsify less than the maximum possible amount of water with the particular organic solvent if more detergent were used, to the amount of water which can be emulsified with the amount of detergent actually used is not necessarily a constant relationship. Thus 100 grams of a composition containing 0.5 weight percent of a detergent which is a mixture of the isopropylamine salts of a mixture of linear alkylbenzene sulfonic acids containing about 75 weight percent of linear alkylbenzene sulfonic acid salts having alkyl groups which are 11 or 12 carbon atoms in length and containing about 23 numerical percent linear alkylbenzene sulfonic acid salts having the sulfonic acid group on the second carbon atom in the alkyl chain in Stod-

dard Solvent will form a stable emulsion with up to 1 gram of water. A similar composition containing 2.0 weight percent of the detergent will form a stable emulsion with 3 to 5 weight percent of water. Similar results are obtained when a 1,1,2-trichloro 1,2,2-trifluoroethane sym. or assym. tetrachlorodifluoroethane, trichloromonofluoromethane or mixtures thereof are used. Increasing the weight percent of detergent increases the weight percent of water which can be emulsified until maximum water tolerance is reached with the particular solvent. For example, 2.5 weight percent of detergent in 1,1,2-trichloro-1,2,2,-trifluoroethane can emulsify up to 8% water.

In this specification, the percentages of the benzene sulfonic acid groups located on the two position of the linear alkyl group are by number (100 times the number of molecules having the benzene sulfonic acid group on the second carbon atom of the alkyl group divided by the total number of linear alkyl benzene sulfonic acid isopropylamine salt molecules in the mixture) and remaining percentages are by weight.

It is thus apparent that the effectiveness of the compositions of this invention with respect to water tolerance may vary and will depend not only on the concentration, the nature of the alkyl side chains of the mixture of linear alkylbenzene sulfonate salts and the percentage of benzene sulfonic acid groups located on the two position of the alkyl group, but also upon the organic solvent which serves as the oil phase of the resultant emulsion.

It has been found that the compositions of our invention possess certain valuable advantages over prior art compositions of U.S. Pat. No. 3,336,232, which are compositions of isopropylammonium dodecylbenzenesulfonate (Emcol P 10-59), a branched chain alkyl aryl sulfonate salt, in 1,1,2-trichloro-1,2,2-trifluoroethane. It has been found that our compositions comprising the isopropylamine salts of a mixture of linear alkylbenzene sulfonic acid, are substantially more effective than the compositions of U.S. Pat. No. 3,336,232.

When compared to the compositions of Canadian Pat. No. 582,455, which are the isopropylamine salts of dodecylbenzene sulfonic acid in Stoddard Solvent, it has been found that compositions of our invention comprising the isopropylamine salts of a mixture of linear alkylbenzene sulfonic acids are substantially more effective with respect to their water tolerance.

Further, it has been found that our compositions retain their emulsifying character even in the presence of inorganic salts, e.g., sodium chloride, to a surprising degree in view of the reported sensitivity to such salts of the compositions of U.S. Pat. No. 3,336,232.

Moreover, our compositions contain salts of linear alkylbenzene sulfonic acids which are completely biodegradable whereas the prior art compositions, since they contain a branched chain alkylbenzene sulfonate salt, are not completely biodegradable and hence, upon disposal after use, would contribute to the pollution problem.

Stoddard Solvent is a commercially available water white petroleum distillate having a boiling range between about 154°C. and about 202°C. and a flash point not lower than 100°F. (38°C.). (Dept. of Commerce Bulletin CS 3-28).

The detergent salts of the above compositions can be prepared by incrementally adding a linear alkylbenzene sulfonic acid mixture, which may contain up to about 10% free sulfuric acid, to a mixture of an organic solvent such as Stoddard Solvent or 1,1,2-trichloro-1,2,2-trifluoroethane with isopropylamine, preferably in a ratio of about 0.5 part of about 1 part by weight of solvent to 1 part by weight of amine, the amine being present in an amount at least substantially sufficient to neutralize both the sulfonic acids and the free sulfuric acid in the linear alkylbenzene sulfonic acid mixture, adding additional amine if the resulting mixture is acidic, and then heating or blowing air through the resultant mixture to volatilize excess amine. The resulting solution of isopropylamine salts of linear alkylbenzene sulfonic acids and isopropylamine sulfate is, at this point, substantially anhydrous, containing not more than about 3% water, usually between about 0.5 and 2.5%. This solution is a detergent concentrate suitable for sale and shipment in its concentrated form. Alternately, the salt may be prepared by addition of isopropylamine to a solution of the linear alkylbenzene sulfonic acids in the desired solvent.

The linear alkylbenzene sulfonic acid intermediates necessary for preparation of the detergent solvent compositions of this invention may be manufactured by sulfonating a mixture of linear alkyl benzenes which mixture contains from about 19 to about 24 numerical percent 2ϕ content, (the numerical percent of molecules having the benzene group located on the second carbon atom of the alkyl group). A predominant portion of the linear alkyl benzenes in the mixture in addition have alkyl groups with 11 or 12 carbon atoms.

The linear alkyl benzenes having the desired properties are generally obtained from petroleum fractionation or alternatively 2ϕ linear alkyl benzenes can be synthesized by known procedures.

For example, n-dodecyl alcohol (lauryl alcohol) is prepared by catalytic reduction of lauric acid or by the "alfol" process using air oxygenation of metal alkyls formed from ethylene using the Ziegler-Natta process. The n-dodecyl alcohol is then treated with HCl and $ZnCl_2$ to form 1-chloro-n-dodecane. The 1-chloro-n-dodecane is then treated with benzene and $AlCl_3$ by Friedel Crafts alkylation to form a product containing 2ϕ benzene sulfonate which can be removed from other reaction products by high efficiency fractionation.

The above detergent solution in solvent is useful per se as an emulsifier of, or additive to, various non-aqueous liquids, e.g., herbicide or insecticide sprays, gasoline, etc. It is capable of infinite dilution with additional solvent, or other conventional dry cleaning solvents and, in diluted form, is useful for a variety of applications, for example for textile dry cleaning, for scouring textiles to remove oily extruding and weaving lubricants, including graphite, from the fibers, for cleaning oil soluble and water soluble stains from machinery, glass and the like. The solutions have outstanding water tolerance even in extremely dilute solutions; solutions containing only about 0.20% by weight of the detergent mixture being capable of emulsifying up to 15 times as much water as the weight of detergent without breaking the water-in-oil emulsion or inverting it to an oil-in-water type. Detergent solutions containing 1% or more of detergent mixture are capable of emulsifying water in an amount of up to 100 times or more the weight of isopropylamine salts of the mixture of linear alkylbenzene sulfonic acids.

The high water tolerance of our solutions of isopropylamine salts of the mixture of linear alkylbenzene sulfonic acids is surprising since in the past it has not

been possible to prepare solutions of amine salts of detergent branched-chain alkylbenzene sulfonates in organic solvent capable of holding more than about 2–5 times as much water as the weight of the amine salt in the emulsion, and even less in the presence of inorganic salts.

The surprisingly high water tolerance of our composition appears to be due in part to the character of the detergent mixture, i.e., to the nature and mixture of the alkyl groups of the linear alkylbenzene sulfonic acids and in part to the combination of this mixture with a particular solvent.

Thus our solutions of isopropylamine salts of linear alkylbenzene sulfonic acids are substantially anhydrous (0.5–3% water) as prepared, and usually will be sold in anhydrous form, but may contain up to about 70% water when used to clean wet textiles or wet machines. After absorbing considerable moisture and salts during use, the solutions are still useful and will remain useful as long as the emulsifying character of the resulting emulsion persists. Our new compositions therefore contemplate not only the initially prepared substantially anhydrous solvent solutions but also solutions containing water contents short of enough to break the emulsion.

The compositions contemplated herein will consist essentially of the following (by weight):

from 0 to 70% of water

from 0.2 to 91% of linear alkyl benzene sulfuric acid isopropylamine salt detergent and

at least 9% of solvent.

These compositions may also contain up to 60 percent by weight of total detergent of isopropylamine salts of alkyl benzene sulfonic acids having a branched chain C_{11} to C_{15} alkyl group in a mixture with the linear alkyl benzene sulfonic acid salts, minor amounts of other detergents, textile lubricants brightening agents, water-proofing agents and the like adjuvants conventionally added to augment the performance of solvent cleaning solutions. For example, the compositions may contain small quantities of non-ionic and/or anionic surfactants such as polyethoxylated phenols, alkali metal salts of complex polyphosphoric ester acid anhydrides, ethoxylated alcohol sulfates and alpha olefin sulfonates.

As has been indicated above, our invention includes both the detergent concentrate and the diluted forms thereof.

The detergent concentrate, the form of which is suitable for shipment and sale to the ultimate user, will normally be substantially anhydrous, i.e., it may contain from 0 to about 3.0% water and may contain from about 50 to 90% by weight of the isopropylamine salts of the linear alkylbenzene sulfonic acids, the balance being essentially all organic solvent. Such compositions will vary from clear solutions to thick pastes.

Upon delivery to, and prior to use by, the ultimate user, these detergent concentrates usually will be diluted to the desired strength of detergent with organic solvent, water, and auxiliary agents of the type indicated above, as suits said ultimate users' purpose.

Generally, such diluted compositions will contain:

from about 0 to 10% of water

from about 0.2 to 57% detergent

and the balance essentially organic solvent. The amount of water will vary depending upon the ultimate use of the diluted emulsion, that intended for cleaning metals will contain a lesser amount (since the purpose here is mainly to remove oil soluble soils) while that intended for cleaning textiles will contain a larger amount of water (since the purpose here is to remove water soluble soils as well as oil soluble soils).

For example, as indicated in Example 6 below, a satisfactory solvent cleaning solution for laundering textiles materials may contain:

2.5% by weight of the isopropylamine salts of the linear alkylbenzene sulfonic salts

6% by weight of water

Balance essentially organic solvent, e.g., 1,1,2-trichloro-1,2,2-trifluoroethane.

The following specific examples further illustrate our invention. Parts and percentages are by weight except as otherwise noted.

EXAMPLE 1

A substantially anhydrous solution in Stoddard Solvent of isopropylamine salt of a mixture of linear alkylbenzene sulfonic acids is prepared as follows:

Into a 3 liter, three-neck flask equipped with thermometer, condenser, agitator, dropping funnel and cooling bath, are placed 146 parts by weight of Stoddard Solvent. The charge is cooled to 10°C. and agitated while 246 parts of isopropylamine, previously cooled to 10°C. are added. To this mixture, are added, in approximate 30 part portions, over a period of about 3 hours, while maintaining the mixture under agitation and at a temperature between 10°C. and about 25°C., 1003 parts of a mixture of linear alkylbenzene sulfonic acids of 89.3% active content, having the analysis shown below:

Formula I

	Percent by Weight
Linear alkylbenzene sulfonic acids	89.3
Sulfuric acid	7.5
Water	2.2
Free Oil (glycol method)	1.0
	100.0

The linear alkyl benzene sulfonic acids in the above composition has an alkyl carbon distribution from C_7 to C_{14} with 79.9 weight percent of such linear alkyl benzene sulfonic acids containing C_{11} and C_{12} groups, a molecular weight of about 237 and 22.6 numerical percent of the salts having the benzene sulfonic acid group located on the 2 position of the alkyl group.

The resulting solution is somewhat acidic and is adjusted to pH of 7.5 with 93.5 additional parts of isopropylamine. The reaction mass is heated to 35°–40°C. to flash off excess isopropylamine (b.p. 34°C.). The resulting alkylbenzene isopropylamine sulfonate solution has the following analysis:

Formula II

	Percent Solution	Percent Solids
Total Solids	88.8	
Active organic	88.8	
Alkylbenzene-isopropylamine sulfonate ("IPA Salt")	80.8	90.08
Isopropylamine sulfate	8.8	9.92
Stoddard solvent	9.2	
Water	2.0	

EXAMPLE 2

The substantially anhydrous Stoddard solvent solution of the alkylbenzene isopropylamine sulfonate of Example 1 is tested for water emulsifying properties by first diluting portions of the concentrate of Example 1 with sufficient additional Stoddard solvent to provide solutions of amine salts of linear alkylbenzene sulfonic acids (IPA salt) in amounts equivalent to 0.25 grams IPA salt/100 grams Stoddard solvent; 0.5/100; 0.6/100; 0.7/100; 1.0/100 and 2.0/100 representing concentrations of detergent in solvent customarily employed in the solvent cleaning industry. To each of the above solutions are added small amounts of water in 0.5 gram increments, which are quickly emulsified therein by the standard shaking test, i.e., placing 100 grams of solution in a 250 cc. graduated cylinder, adding thereto the indicated amount of water, shaking 20 times, and then allowing the shaken solutions to stand for 1–2 minutes and observing the resulting emulsion. Additional amounts of water are added in 0.5 gram increments until a point is reached at which the emulsion breaks or the test is discontinued. Results are shown in Table 1 below:

Table I

	Water Concentrations Tolerated Example Number					
	2a	2b	2c	2d	2e	2f
Stoddard solvent	100	100	100	100	100	100
IPA salt	0.25	0.50	0.6	0.7	1.00	2.00
Water-Highest amount yielding stable emulsion	4.5	10.0	13.5	14.5	100*	225*
Water-amount at emulsion break	5.0	10.5	14.0	15.0		
Ratio Maximum water: IPA in stable emulsion	18:1	20:1	22.5:1	20.7:1	100:1	112.5:1

*Test discontinued, emulsion still stable.

It is apparent from Table I above that the Stoddard solvent solutions of mixtures of linear alkylbenzene isopropylamine sulfonates of our invention are capable of tolerating water, to the extent of from 18 to over 100 times the weight of the IPA sulfonate in the solution, the amount varying directly with the IPA salt concentration in the solution.

EXAMPLE 3

A mixture of 408 parts of a mixture of linear alkylbenzene sulfonate acids containing about 80 weight percent of linear alkyl benzene sulfonic acids having a C_{11} or C_{12} alkyl group and containing about 22.6 numerical percent of 2ϕ linear alkyl benzene sulfonic acids (linear alkyl benzene sulfonic acids having the sulfonic acid group on the second carbon atom of the alkyl group), and 415 parts of 1,1,2-trichloro-1,2,2-trifluoroethane is cooled to about 10°C. To the solution which results, 78 parts of isopropylamine are added dropwise at a rate such that the temperature of the agitated mixture was maintained at below 20°C. An additional 6.0 parts of isopropylamine are required to adjust the pH of the mass to about 7.5. The mass was warmed to about 35°C. to remove unreacted isopropylamine.

The resultant composition weighs 903 parts and contains about 0.4% water and about 54% solids of which about 98% is the isopropylamine salt of the mixture of linear alkylbenzene sulfonic acids, the balance being isopropylamine sulfate.

The water emulsifying properties of the isopropylamine salt composition prepared in this example in 1,1,2-trichloro-1,2,2-trifluoroethane as solvent are determined in the manner described in Example 2 above. The results of these tests are set out in Table II below.

Table II

	Water Concentration of Emulsions				
Trichlorotrifluoroethane	99.07	98.15	96.30	94.45	92.60
IPA Salt Composition	0.93	1.85	3.70	5.55	7.40
IPA Salt Concentration, %	0.5	1.00	2.00	3.00	4.00
Max. Water in Emulsion	1.5	2.7	5.9	9.0	12.3
Water at Break	1.6	2.8	6.1	9.3	12.4
Ratio Water:LPA at Break	3.2:1	2.8:1	3.05:1	3.1:1	3.1:1

EXAMPLE 4

80 grams of a mixture of linear alkyl benzene sulfonic acids containing about 80 weight percent of linear alkyl benzene sulfonic acids having a C_{11} or C_{12} alkyl group and containing about 15.5 numerical percent of linear alkyl benzene sulfonic acids having the sulfonic acid group on the second carbon atom of the alkyl group are dissolved in 100 grams of 1,1,2-trichloro-1,2,2-trifluoroethane in a 400 ml beaker. The beaker is then cooled in an ice bath for about 10 minutes and 15 grams of isopropylamine are added with stirring below the surface of the solution. The mixture is then neutralized to pH 7 by adding drops of additional isopropylamine. 5 grams of the neutralized mixture are then introduced into a 250 ml beaker and 89 grams of 1,1,2-trichloro-1,2,2,-trifluoroethane are added to the 5 grams of mixture. 6 ml of distilled water are then stirred into the mixture in the 250 ml beaker. The resulting mixture is found to separate after about 1 day at 25°C.

EXAMPLE 5

The procedure of Example 4 is followed except to make a series of linear alkyl benzene sulfonic acid salts — 1,1,2-trichloro-1,2,2-trifluoroethane — water mixtures using a series on linear alkyl benzene sulfonic acids having 17, 21.5, 22.6, 23.0, 24.5, 32.0 and 36.4 numerical percent of the sulfonic acid groups located

on the second carbon atom (12 phenyl) of the alkyl group. The resulting mixtures are tested for stability at 20°C. as in Example 1. The results of such tests are shown in Table III below:

Table III

	% 2 Phenyl	Stability Time
1.	17	1 day
2.	21.5	60 days
3.	22.6	60 days
4.	23.0	60 days
5.	24.5	1 day
6.	32.0	6 hours
7.	36.4	1 hour

EXAMPLE 6

The procedure of Example 4 is repeated except an alkyl benzene sulfonic acid having 22.6 numerical of 2ϕ linear alkyl benzene sulfonic acids and trichloromonofluoromethane is used instead of trichlorotrifluoroethane. The resulting mixture is found to be stable for over 60 days.

EXAMPLE 7

To illustrate the use of the substantially anhydrous isopropylamine mixed salt solution in Stoddard solvent, as an emulsifier for petroleum fractions, 50 grams of White Oil, a colorless distillate of high boiling (330° to 390°C.) petroleum fractions, are placed in a container and to this oil is added slowly with rapid agitation a solution of 6.25 grams of the isopropylamine salt Stoddard solvent solution of Formula II of Example I, in 5 grams of distilled water, over a period of 2 to 3 minutes, then an additional 45 grams of distilled water are added to the resulting emulsion under rapid agitation. Dilution of the resulting emulsion to 10% concentration of White Oil produces a stable emulsion after about 5 minutes of agitation indicating the high emulsifying power of the IPA salt.

EXAMPLE 8

This example illustrates the use of our isopropylamine salt solution in the solvent cleaning of textiles containing sodium chloride.

A set of six 6 × 3 inches strips of cotton sheeting are weighed separately and then submerged in a 10% aqueous sodium chloride solution. The thoroughly wetted strips are removed and the excess salt solution removed by passing the wet strips through a clothes wringer. The squeezed strips are weighed. The difference between the wet weight and the dry weight is recorded as the salt solution pick-up from which the amount of salt picked up by the strip is calculated.

The strips are then placed in 100 ml. beakers with twenty times their weight of wash liquor which is a 4% solution of the isopropylamine salt of a mixture of linear alkylbenzene sulfonic acids in 1,1,2-trichloro-1,2,2-trifluoro-ethane prepared as described in Example 3 above (IPA). As a control, a 4% (solids strength) of Valclene 350 (a commercially available dry cleaning detergent mixture being a 35% solution of a complex higher alkyl-amine composition in a fluorocarbon) in 1,1,2-trichloro-1,2,2-trifluoroethane is used to wash one strip. Water is added to the wash liquor as indicated in the following table. The cloth is washed by stirring for 15 minutes. Thereafter, the cloth strips are put through a wringer and immediately weighed.

The washer strips are then rinsed in an amount of rinse liquor equivalent to twenty times the dry weight of the strip by stirring the strip immersed in the rinse liquor for 15 minutes. The rinsed strips are put through a wringer and weighed. The strips are dried in air and then reweighed to determine the amount of residual water.

The strips are then immersed in 100 ml. of distilled water and titrated with 0.1 N silver nitrate solution using potassium chromate as an indicator to determine residual sodium chloride.

The results of these tests are set out in the following table.

TABLE

Test	1	2	3	4	5	6
Detergent in Wash Solution	IPA	IPA	IPA	IPA	IPA	VALCLENE 350
Water added	0	0	0	9%[b]	9%[b]	9%[b]
Rinse solution	100% fluorocarbon[c]	100% fluorocarbon[c]	IPA + fluorocarbon[d]	100% fluorocarbon[c]	IPA + FC[d]	VALCLENE 350+ fluorocarbon
Salt solution pick-up - g.	2.42	2.13	2.25	2.40	2.40	2.20
NaCl pick-up - g.	0.242	0.053[a]	0.225	0.24	0.24	0.22
Residual after rinsing and drying						
Water - g.	0.38	0.35	0.35	0.30	0.35	0.30
Water - %	18.3	16.5	15.6	12.5	14.6	13.7
NaCl - g.	0.134	0.023	0.079	0.047	0.035	0.061
NaCl - %	55.4	43.5	35.1	19.6	14.8	27.8

[a] = salt solution for impregnating cloth was of 2.5% concentration
[b] = % water added to wash liquor
[c] = 1,1,2-trichloro-1,1,2-trifluoroethane
[d] = 4% isopropylamine salt in 1,1,2-trichloro-1,2,2-trifluoroethane

These data indicate the superiority of salt removal from cotton cloth by the IPA-solvent wash solution containing water (compare tests 4 and 5 with test 3). It also demonstrates the superiority, with respect to salt removal, of the compositions of this invention when compared to solvent cleaning with a known dry cleaning preparation (compare tests 4 and/or 5 with test 6).

EXAMPLE 9

In order to illustrate the insensitivity of the compositions of our invention to inorganic salts, e.g., sodium chloride, the following experiment is carried out.

A typical solvent cleaning solution (IPA) was prepared by mixing the following components,

4.6 parts of a solution of the isopropylamine salts of a mixture of linear alkylbenzene sulfonic acids prepared as described in Example 3 above and containing 2.5 parts of active organic solids,

89.4 parts of 1,1,2-trichloro-1,2,2-trifluoroethane.

6.0 parts of water,
in a separatory funnel. To this solution, 5 parts of 2.0% aqueous sodium chloride are added and the mixture is shaken 30 times. The mixture is permitted to stand for at least 4 hours and the layers which form are drawn off into graduated cylinders and the volumes recorded.

The cycle is repeated, after dilution of the oil layer to its original volume, with sufficient water, until no further emulsion forms on addition of the aqueous sodium chloride. The number of cycles which the detergent solution can withstand is a measure of the sensitivity of the solution to salts, the more cycles, the less sensitive.

For comparison, an analogous detergent solution containing 2.5 parts of Emcol P 10-59 branch chain alkyl benzene sulfonic acid isopropylamine salt (see U.S. Pat. No. 3,336,232) was tested similarly.

The results of these tests are set out in the table.

TABLE

	Emcol P 10-59	IPA
Original Volume (ml)	69	68
1st cycle		
NaCl solution (ml)	5	5
Oil layer (ml)	62.5	69
Aqueous layer (ml)	10.0	2.4
2nd cycle		
Water added	6.5	0
NaCl solution (ml)	5	5
Oil solution (ml)	61.0	68.0
Aqueous layer (ml)	8.0	5.0
3rd cycle		
Water added (ml)	8.0	0
NaCl solution added (ml)	no emulsion	5.0
Oil layer (ml)	—	70.0
Aqueous layer (ml)	—	3.0
4th cycle		
Water added (ml)	—	0.0
NaCl solution added (ml)	—	5.0
Oil layer (ml)	—	72.0
Aqueous layer (ml)	—	0.0
5th cycle		
Water added (ml)	—	0.0
NaCl solution added (ml)	—	5.0
Oil layer (ml)	—	no emulsion

These data indicate the excellent emulsifying power of the compositions of our invention since they were able to retain their water emulsifying power in the presence of sodium chloride for at least four cycles. The prior art composition, compared with our composition, under identical condition loses its emulsifying character after only two cycles.

In the above Table, discrepancies in the volume stated are accountable by losses due to handling of the solutions containing the volatile solvent mixtures.

What is claimed is:

1. A detergent solvent composition comprising from about 0.2 to about 91% by weight of composition of a detergent comprising a mixture of linear alkylbenzene sulfonic acid isopropylamine salts, the alkyl groups of which contain from 7 through 14 carbon atoms, a predominant amount of the alkyl groups in said linear alkylbenzene isopropylamine salts containing 11 through 12 carbon atoms, from about 19 to about 24 numerical percent of said linear alkylbenzene sulfonic acid isopropylamine salts having the benzene sulfonic acid group located on the two position of the linear alkyl group; and at least 9 percent by weight of said composition being essentially an organic cleaning solvent selected from the group consisting of Stoddard solvent; 1,1,2-trichloro-1,2,2-trifluoroethane; sym. or assym. tetrachlorodifluoroethane; trichloromonofluoromethane; and mixtures thereof.

2. A composition as described in claim **1** wherein the organic solvent is Stoddard Solvent, the composition additionally comprises up to about 70% by weight of water and contains at least 25 percent of said detergent by weight of water when about 70 weight percent water is present in the composition.

3. A composition as described in claim **1** wherein the solvent is selected from the group consisting of 1,1,2-trichloro-1,2,2-trifluoroethane, trichloromonofluoromethane and mixtures thereof, the amount of water in the composition being at most 10% and the amount of detergent being at least about 25 percent by weight of water in the composition when about 10 weight percent water is present in the composition.

4. A composition as described in claim **1** wherein the detergent consists essentially of linear alkylbenzene sulfonic acid isopropylamine salts, at least 75 weight percent of said linear alkylbenzene sulfonic acid salts containing alkyl groups having 11 through 12 carbon atoms.

5. A composition as described in claim **1** in which from about 20 to about 23.5 numerical percent of the isopropylamine salts have the benzene sulfonic acid group located on the two position of the linear alkyl group.

6. A composition as described in claim **1** in which from about 21.5 to 23 numerical percent of the isopropylamine salts have the benzene sulfonic acid group located on the two position of the linear alkyl group.

7. A composition as described in claim **3** in which the solvent is 1,1,2-trichloro-1,2,2-trifluoroethane.

8. The composition as described in claim **1** wherein said composition is substantially anhydrous.

9. The composition as described in claim **1** wherein the composition contains from about 0 to about 3.0 weight percent water, from about 50 to about 90 weight percent of said linear alkyl benzene sulfonic acid isopropylamine salts, the balance being said organic solvent.

10. The composition as described in claim **1** wherein the composition contains from about 0 to about 10 weight percent of water and 0.2 to about 57 weight percent of linear alkyl benzene sulfonic acid isopropylamine salts.

11. A composition as described in claim **1** wherein the amount of water in the composition is at most 10 weight percent and the amount of detergent being at least about 25 percent by weight of water in the composition when about 10 weight percent water is present in the composition.

12. A detergent solvent composition comprising from about 0.2 to about 91 percent by weight of composition of a detergent comprising a mixture of linear alkyl benzene sulfonic acid isopropyl amine salts, the alkyl groups of which contain from 7 through 14 carbon atoms, a predominant amount of the alkyl groups in said linear alkyl benzene isopropyl amine salts containing 11 through 12 carbon atoms, from about 19 to about 24 numerical percent of said linear alkyl benzene sulfonic acid isopropyl amine salts having the benzene sulfonic acid group located on the two position of the linear alkyl group; and at least 9 percent by weight of said composition being essentially organic solvent selected from the group consisting of Stoddard solvent; 1,1,2-trichloro-1,2,2-trifluoroethane; trichloromonofluoromethane and mixtures thereof.

13. A process for cleaning comprising washing an object with a detergent solvent composition comprising

from about 0.2 to about 91% by weight of composition of a detergent comprising a mixture of linear alkylbenzene sulfonic acid isopropylamine salts, the alkylbenzene groups of which contain from 7 through 14 carbon atoms, a predominant amount of the alkyl groups in said linear alkylbenzene isopropylamine salts containing 11 through 12 carbon atoms, from about 19 to about 24 numerical percent of said linear alkylbenzene sulfonic acid isopropylamine salts having the benzene sulfonic acid group located on the two position of the linear alkyl group; and at least 9 percent by weight of said composition being essentially an organic solvent selected from the group consisting of Stoddard solvent; 1,2,2-trichloro-1,2,2-trifluoroethane; sym. or assym. tetrachlorodifluoroethane; trichloromonofluoromethane; and mixtures thereof.

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