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LIQUID DETERGENT COMPOSITION

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The present invention relates to new liquid synthetic detergents, and more particularly to single phase, clear, concentrated liquid detergents of the alkyl aryl sulfonate type.

Detergent compositions comprising alkyl aryl sulfonate salts admixed with substantial proportions of sodium sulfate or other inorganic builders have previously been proposed for use in dilute aqueous solutions having total solids contents in the order of about 1% to 2%. However, for certain purposes it is highly desirable to prepare concentrated liquid preparations of a clear, single phase nature and having on the order of at least 20% solids. Towards this end it has previously been proposed to utilize an aqueous alcoholic solvent to facilitate solution of the aforesaid solid compositions in concentrated form. Nevertheless, efforts to prepare such concentrates containing inorganic salts have resulted in the production of cloudy products which immediately, or on standing, separate into more than one phase by depositing solids or forming more than one liquid layer. It is believed that these undesirable results are usually obtained as a result of a saturation or salting-out effect on the part of the inorganic builders present, however, elimination of such builders from alkyl aryl sulfonate salt compositions to produce a salt-free material capable of forming more concentrated clear solutions results in the production of a product having poor detergency and foaming qualities, particularly when used in soft water.

The surprising discovery has now been made that it is possible to prepare alkyl aryl sulfonate salts in the form of clear, single phase liquid concentrates having therein certain inorganic salts which impart excellent detergency and foaming characteristics to washing solutions made from such concentrates.

In accordance with the present invention, the clear, single phase concentrated liquid detergent product consists essentially of a water soluble detergent selected from the group consisting of alkali metal, ammonium and ethanalamine salts of sulfonated higher alkyl aryl hydrocarbons and a foam and detergency improving inorganic salt builder selected from the group consisting of magnesium chloride, magnesium sulfate, and calcium chloride, said foam and detergency improving inorganic salt being present in an amount within a range from a small but effective amount sufficient to substantially improve the foaming and detergency characteristics of washing solutions made from said concentrate up to any amount which is insufficient to cause phase separation of the liquid detergent concentrate, and said sulfonated detergent and said inorganic salt builder together being at least about 20% by weight in a selective liquid solvent therefor comprising a mixture of a low molecular weight aliphatic alcohol and water.

The water soluble higher alkyl aryl sulfonate salt of the present invention may be mononuclear or polynuclear in structure. More particularly the aromatic nucleus may be derived from benzene, toluene, xylene, phenol, cresols, naphthalene, etc. The alkyl substituent on the aromatic

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nucleus may vary widely, as long as the desired detergent power of the active ingredient is preserved. While the number of sulfonic acid groups present on the nucleus may vary it is usual to have one such group present in order to preserve as much as possible a balance between the hydrophilic and hydrophobic portions of the molecule.

More specific examples of suitable alkyl aromatic sulfonate detergents are water soluble salts of the higher alkyl aromatic sulfonates. The higher alkyl substituent on the aromatic nucleus may be branched or straight-chain in structure; it comprises moreover such groups as decyl, dodecyl, keryl, pentadecyl, mixed long-alkyls derived from long-chain fatty materials, cracked paraffin wax olefins, polymers of lower monoolefins, etc. Preferred examples of this class are the higher alkyl mononuclear aryl sulfonate salts wherein the alkyl group is about 8 to about 15, and preferably 12 carbon atoms. More particularly, it is preferred to use the higher alkyl benzene sulfonate salts wherein the higher alkyl group is about 12 carbon atoms. For example, propylene may be polymerized to the tetramer and condensed with benzene in the presence of a Friedel-Crafts catalyst to yield essentially the dodecyl benzene derivative which is suitable for sulfonation and neutralization to the desired sulfonate salts.

The cationic portion of the water soluble alkyl aryl sulfonate salt of the present novel compositions may be alkali metal such as sodium, potassium and lithium, or may be ammonium or ethanalamine, e.g. mono-, di- or triethanalamine, or mixtures of any of these materials.

The foam and detergency improving salts of the present invention consist of magnesium chloride, magnesium sulfate, and calcium chloride. Except for these salts, the present novel liquid concentrates must be substantially free of inorganic salts, or phase separation occurs. Thus for example, if compositions are prepared containing about 50% or more total solids, phase separation is likely to occur in the final product if the composition contains sodium sulfate in an amount greater than about 1% of the amount of alkyl aryl sulfonate salt present in the composition. It is not fully understood why the particular inorganic builders of the present invention do not exhibit the same undesirable solubility properties, but it may be related to an integration of their mutual solubility in alcohol and water and compatibility with the organic detergent in concentrated solution. In any event, the present novel liquid concentrates may be prepared by utilizing the aforesaid water soluble salts in the anhydrous form or in the hydrated condition, such as Epsom salts for example.

It has been found that mixtures of water and a lower monohydric alcohol may suitably be employed as solvents for the present concentrates. Suitable alcohols are the saturated lower monohydric alcohols such as ethanol, isopropanol and n-propanol. It is preferred, however, to employ ethanol because of its high degree of water solubility and its lack of undesirable odor.

The order of mixing of the various components is not critical and normally it will suffice to merely agitate at room temperature the solvent to be used while adding the solid components in any order.

The present compositions may be prepared having a total solids content ranging from about 20% to 65% by weight and higher, and preferably in the order of about 25% to 60%. Although the novel inorganic builder may be present in an amount within the range from a small but effective amount sufficient to substantially improve the foaming and detergency characteristics of washing solutions made from said concentrate up to any amount which is insufficient to cause phase separa-

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tion of said concentrate, as the amount of such builder added to an aqueous-alcoholic concentrate of water-soluble alkyl aryl sulfonate salt is increased within the aforesaid range there is a marked improvement in the foaming and detergency characteristics of the mixture when diluted for use, particularly in soft water. This improvement is particularly notable until the amount of inorganic builder reaches about 10% by weight of the detergent sulfonate present. As the content of inorganic builder is further increased within the solubility limits of a clear, single phase product, there is a continued improvement in these properties, however the improvement corresponding to each added increment of inorganic builder is not nearly as large as that exhibited at the lower ratios. Furthermore, it becomes increasingly difficult to prepare single phase concentrates of high solids contents when high proportions of inorganic salt are utilized, such as above about 25% by weight of the detergent sulfonate solids. Thus it is desirable that the aforesaid novel inorganic builder be present in an amount from at least 5% up to 100% by weight of amount of detergent sulfonate employed, usually about 5 to 25% and preferably 10% thereof. The particular solvent mixture to be used is primarily a function of the total solids content, the ratio of inorganic salt builder to detergent sulfonate, and the particular alcohol employed in the final composition. For example, the preparation of clear, single phase concentrates having the preferred ratio of inorganic salt builder to detergent sulfonate and a total solids content near the upper end of the preferred range thereof may be effected by use of a solvent comprising ethanol and water in a ratio between about 2:1 and 4:5, whereas similar compositions having a total solids content near the lower end of the preferred range may be prepared using a solvent comprising ethanol and water in a ratio between about 2:1 and 1:5.

The following examples are additionally illustrative of the nature of the invention and it will be understood that the invention is not limited thereto. All parts are by weight unless otherwise specified.

EXAMPLE I

A formulation containing following is prepared:

	Parts
Sodium alkyl aryl sulfonate ¹	50.0
MgCl ₂ ·6H ₂ O	5.0
Ethanol	25.0
Water	20.0

¹The alkyl aryl sulfonate salt consists of 97.47% of the sodium salt of a sulfonated alkyl benzene wherein the alkyl group is a propylene tetramer, 0.26% of alcohol insoluble material which is principally sodium sulfate, and a balance of water.

After about 18 hours' storage at 48° F. the concentrate is clear and there is no evidence of separation into more than one liquid phase nor of any salt separation. Likewise after storage at room temperature for more than 6 months the concentrate is still a clear, uniform, single phase product.

EXAMPLE II

A clear, single phase composition consists of:

	Parts
Sodium alkyl aryl sulfonate (same as Example I) ..	25.0
CaCl ₂ ·2H ₂ O	2.5
Ethanol	32.5
Water	40.0

In practical dishpan tests wherein a small amount of liquid detergent is added to a dishpan of water at 110° F. and greased dishes are washed by hand in order to establish the number of plates which may be washed before there is a complete disappearance of foam, the following results are obtained. In each of these tests, the amount of concentrate used is such that each dishpan holds

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the same amount of a solution containing 0.05% of the sodium alkyl aryl sulfonate in soft water at about 110° F. The number of greased plates washed by the sodium alkyl aryl sulfonate alone (Test A) is taken as a standard of 100%.

Foam endurance in dishwashing, percent

	A Alkyl Aryl Sulfonate Salt of Example I	B Composition of Example I	C Composition of Example II
Run I.....	100	265	300
Run II.....	100	-----	-----

The data of run I are not strictly comparable with those of Run II because different sets of greased plates are used for each run.

EXAMPLE III

Another composition having excellent detergency and foaming properties consists of:

	Parts
Sodium alkyl aryl sulfonate (same as Example I) ..	30.3
MgCl ₂ ·6H ₂ O	3.0
Ethanol	33.3
Water	33.3

This composition comprises a single phase system of satisfactory stability under normal conditions of storage and household use.

EXAMPLE IV

An improved clear, single phase liquid detergent is prepared by mixing the following ingredients in the proportions shown:

	Parts
Alky aryl sulfonate salt ¹	30.0
Epsom salts	1.5
Ethanol	20.0
Water	49.5

¹The alkyl aryl sulfonate salt consists of the lithium salt of sulfonated alkyl toluene wherein the alkyl group is a paraffinic hydrocarbon derived from kerosene and contains about 10 to 15 carbon atoms.

Clear single phase compositions may also be prepared by employing, in the place of the lithium salt of the alkyl aryl sulfonate the ammonium salt thereof.

EXAMPLE V

A clear single phase composition comprises:

	Parts
Alkyl aryl sulfonate salt ¹	20.0
MgCl ₂ ·6H ₂ O	1.0
Isopropanol	15.0
Water	64.0

¹The alkyl aryl sulfonate salt is the triethanolamine salt of sulfonated decyl benzene. In the place of the triethanolamine salt, the potassium salt may be employed. The isopropanol may be replaced by n-propanol.

It is obvious to one skilled in the art that various adjuvant materials may be used in conjunction with the present compositions. Thus it is contemplated to prepare such compositions containing perfumes, germicides, oxidizing agents, bleaches, coloring materials, fluorescent materials, corrosion inhibitors, metal treating and agents, emollients, and cosmetic agents.

The term "consisting essentially of" as used in the definition of the ingredients present in the composition claimed is intended to exclude the presence of other materials in such amounts as to interfere substantially with the properties and characteristics possessed by the composition set forth but to permit the presence of other materials in such amounts as not substantially to affect said properties and characteristics adversely.

Although the present invention has been described with reference to particular embodiments and examples, it

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will be apparent to those skilled in the art that variations and modifications of this invention can be made and that equivalents can be substituted therefor without departing from the principles and true spirit of the invention.

Having thus described the invention, what is claimed is:

1. A clear, single phase, concentrated liquid detergent composition consisting essentially of a water soluble detergent salt selected from the group consisting of alkali metal, ammonium and ethanolamine salts of sulfonated higher alkyl mononuclear aryl hydrocarbons and a foam and detergency improving inorganic salt selected from the group consisting of magnesium chloride, magnesium sulfate and calcium chloride, said inorganic salt being present in an amount from about 5% to about 100% of the weight of said sulfonated hydrocarbon but insufficient to cause phase separation of said liquid detergent composition, and said sulfonated detergent and inorganic salt together being at least 20% by weight in a selective liquid solvent therefor comprising a mixture of a low molecular weight aliphatic alcohol and water in a ratio between about 2:1 and 1:5.

2. A clear, single phase, concentrated liquid detergent composition as set forth in claim 1 wherein said detergency improving inorganic salt is magnesium chloride.

3. A clear, single phase, concentrated liquid detergent composition as set forth in claim 1 wherein said low molecular weight aliphatic alcohol is ethanol.

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4. A clear, single phase, concentrated liquid detergent composition consisting essentially of sodium alkyl benzene sulfonate wherein said alkyl radical contains from about 8 to 15 carbon atoms and a foam and detergency improving inorganic salt selected from the group consisting of magnesium chloride, magnesium sulfate and calcium chloride, said inorganic salt being present in an amount from about 5% to about 100% of the weight of said sulfonate but insufficient to cause phase separation of said liquid detergent composition, and said sulfonated detergent and inorganic salt together being about 25% to 60% by weight in a selective liquid solvent therefor comprising a mixture of ethanol and water in a ratio between about 2:1 and 1:5.

5. A clear, single phase, concentrated liquid detergent composition as set forth in claim 4 wherein said water soluble detergent salt is sodium dodecyl benzene sulfonate.

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