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CLEAR LIQUID DETERGENT PACKAGE

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ABSTRACT OF THE DISCLOSURE

A detergent package comprising a transparent, plastic container and a clear, stable liquid detergent composition therein consisting essentially of about 10 to 60% by weight of a C_{10} to C_{20} alkyl sulphonate solubilized in an aqueous liquid vehicle which may include up to 15% by weight of urea, C_2 to C_3 alkanol and/or sulphonated hydrotrope as a solubilizing agent.

The present invention relates to a product comprising a clear or transparent plastic container containing a clear, stable alkane sulfonate liquid detergent composition useful, for example, for washing dishes and laundry.

Manufacturers of detergents intended for use in washing dishes and soiled clothing have recognized the commercial advantage of packaging them in a form that is convenient for purchasers to use. Historically heavy duty laundry products have largely been spray dried particles sold in carboard cartons. It would, however, be desirable to prepare detergent compositions in the form of pourable liquids and sell them in suitable reclosable containers. In practice it is highly desirable to prepare dish washing and laundry compositions in pourable liquid form at concentrations so that the user can employ approximately the same volume of liquid detergent as the amount of spray dried detergents which they are accustomed to using. At the necessary concentrations to accomplish this purpose it becomes difficult to dissolve or stably suspended the active ingredients in water. The result is that particles on storing would tend to settle to the bottom of the container where they would agglomerate or cake so that resuspension is difficult if not impossible. Solution of this problem by formulating a more dilute composition is impracticable since the composition would become too dilute for practical purposes such as the necessity of using much larger volumes of liquid detergent to get the same washing power to which consumers were accustomed when using spray dried products. In addition freight costs become very high because of the weight and bulk of the more dilute compositions. Some progress has been made in formulating more stable suspensions with less tendency for suspended particles to settle and cake on storage, but these products are opaque liquids.

Liquid dish washing and light duty alkyl aryl sulfonate and alkyl sulfate laundry detergents have been proposed which detergents vary from clear to opaque appearance. In general, where clear compositions have been obtained, they were relatively dilute solutions, or remained clear over only a limited temperature range near normal room temperatures so that at lower temperatures, such as are encountered even in temperature climates in winter, the products become cloudy, or they contained relatively high proportions of solubilizers that made them expensive and less efficient. While the precipitation of ingredients from solution as temperature drops may not adversely affect performance of the liquid detergent, consumers consider the development of cloudiness as a result of such precipitation a defect especially in a normally clear product. This phenomenon has caused manufacturers to package opaque and unstable liquids in dark colored glass bottles and opaque plastic containers so as to conceal the packaged liquid from the view of purchasers, or to color the liquid so as to make the precipitate less noticeable in clear containers.

Some shampoo compositions have been formulated which are clear liquids with fairly acceptable stability at temperatures down to about the freezing point of water which has enabled them to be sold in clear glass containers. While clear liquids packaged in clear glass present an attractive appearance on the shelf of the market where they are sold, glass containers have the disadvantages of relatively high weight.

The present invention provides a product which avoids or overcomes the difficulties and problems of the prior art in that a liquid alkane sulfonate detergent composition, which is formulated to be clear and stable down to a preselected low temperature, is packaged in clear plastic containers. This combination provides an attractive, lightweight package on the shelves of markets where it is sold and in the homes of users. The concentration of active ingredients in the liquid detergent can be in the range employed for packaged spray dried detergents sold in cartons and the ratio of the weight of the plastic container to the weight of the liquid contents is not significantly different from the ratio of the weight of the carton to the weight of the powdered contents. The plastic containers, moreover, are practically unbreakable when dropped from heights normally encountered in household use.

Liquid detergent compositions for use in the present invention contain an alkane sulfonate detergent dissolved in water and may be formulated to include an alkyl ether sulfate detergent, a foam booster, a solubility promoter, and a viscosity regulator.

The alkane sulfonates useful in the present invention are usually mixed secondary alkyl sulfonates having from about 10–20 carbon atoms per molecule, preferably 13–18 and most desirably 13–15. These secondary alkane sulfonates are uniquely suitable for the present invention because of their high solubility in water compared to alkyl aryl sulfonates and other sulfuric acid reaction products heretofore used for dish washing and laundry detergent compositions. This makes it possible to formulate clear, stable liquids of high active ingredient content that give a sparkling appearance in the clear plastic containers. These sulfonates are preferably prepared by subjecting a cut of paraffin, corresponding to the chain lengths specified above, to the action of sulfur dioxide and oxygen in accordance with the well-known sulfoxidation process. The product of this reaction is a secondary sulfonic acid which is then neutralized with a suitable base to provide the water soluble secondary alkyl sulfonate for use in the present invention. Similar usable secondary alkyl sulfonates may be obtained by other methods, e.g., by the sulfochlorination method in which chlorine and sulfur dioxide are reacted with paraffins in the presence of actinic light, the resulting sulfonyl chlorides being hydrolyzed and neutralized to form the secondary alkyl sulfonates.

It is preferable to include an alkyl ether sulfate in the composition represented by the formula:

$$RO(C_2H_4O)_nSO_3X$$

in which R is a primary or secondary alkyl group that may be straight or branched having from 10 to 18 carbon atoms, preferably 12 to 14, X is a suitable cation, as hereinafter defined, and n is a number from 1 to 10, preferably 3 to 6. These detergents can be produced by sulfating the corresponding ether alcohol and then neutralizing the resulting sulfuric acid ester thereof.

The cation of the paraffin sulfonate and alkyl ether sulfate may be an alkali metal, an alkaline earth metal (e.g. magnesium), ammonium or lower amine (including alkylolamines). It is preferred to use the sodium salt of the paraffin sulfonic acid and an ammonium salt of the alkyl ether sulfuric acid ester.

The best performance of the liquid detergent compositions containing alkane sulfonates and alkyl ether sulfates is obtained when the ratio of the proportion by weight of alkane sulfonate to alkyl ether sulfate is within the range of 10:1 to 1:1, preferably about 6:1 to 4:1.

In general the content of synthetic detergent will be within the range of 10–60%, advantageously about 15–40%, and preferably about 20–35%.

Foam boosters which may be used include non-ionic surface active agents such as higher alcohols, ether alcohols, ethoxylated phenols, and higher fatty acid amides.

The higher alcohols and ether alcohols which may be used as foam builders in the present invention are represented by the formula:

$$RO(C_2H_4O)_nH$$

exemplifications of which include decoxytriethoxyethanol, lauroxytetraethoxyethanol, tetradecoxypentaethoxyethanol, hexadecoxynonaethoxyethanol and octadecoxyheptaethoxyethanol among the general class illustrated, and referring to the formula in which R represents an alkyl group that may be straight or branched having from 10 to 18 carbon atoms and *n* is a number from 0 to 10, preferably 3 to 6. In the case of higher ether alcohols, the preferred chain length for the alkyl group is from C_{10}–C_{14} when *n* has a value from 3–6 as preferred.

It is preferred that the liquid detergent composition contain a higher fatty acid alklolamide material in sufficient amount to set as a suds builder. Its presence results in a product which exhibits high foaming power in use, particularly in the stability of the foam generated during dish washing or laundering operations. It should not be employed in an amount sufficient to destroy the desired physical properties. The acyl radical of the alkylolamide is selected from the class of fatty acids having 8 to 18 carbon atoms and each alkylol group usually has up to 3 carbon atoms. It is preferred to use the monoethanolamides of lauric and myristic acids but diethanolamides and isopropanolamides as well as monoethanolamides of fatty acids having about 10 to 14 carbon atoms in the acyl radical are satisfactory. Examples are capric, lauric, myristic and coconut monoethanolamides, diethanolamides and isopropanolamides and mixtures thereof. There may be employed also the alkylolamides which are substituted by additional alkylol groups, suitable examples may be the above amides condensed with one or two moles of ethylene oxide.

The non-ionics may be present in the formula up to about 15% by weight of the product, preferably up to about 4% of alcohol ether and up to about 8% of fatty acid alkylolamide, and the ratio of detergent to non-ionic may be from 10:1 to 1:1.

The composition may include at least one solubility promoter in amounts up to about 10%. Suitable promoters include hydrotropic substances such as lower aliphatic alcohols, urea and the alkali metal organic sulfonated (including sulfated) salts having a lower alkyl group up to about 6 carbon atoms. The preferred sulfonated hydrotropes are alkyl aryl sulfonates having up to 3 carbon atoms in the lower alkyl group, e.g., the sodium and potassium xylene, toluene, ethylbenzene and isopropyl benzene (cumene) sulfonates. Sulfonates made from xylene include orthoxylene sulfonate, metaxylene sulfonate, paraxylene sulfonate and ethyl-benzene sulfonate. Commercial xylene sulfonates usually contain metaxylene sulfonate as the main ingredient. Analysis of typical commercial xylene sulfonate products shows about 40–50% metaxylene sulfonate, 10–35% orthoxylene sulfonate and 15–30% paraxylene sulfonate with 0–20% ethyl-benzene sulfonate. Any suitable isomeric mixture, however, may be employed. Sodium cumene sulfonate and sodium xylene sulfonate are preferred lower alkyl aryl sulfonates to use in the compositions of the present invention. It is also permissible to use suitably lower alkyl sulfate salts having about 5 to 6 carbon atoms in the alkyl group such as alkali metal n-amyl and n-hexyl sulfates.

Lower aliphatic alcohols may also be used as a viscosity regulator, particularly if it is used together with urea. The lower aliphatic alcohols used in the compositions of the invention, either alone or in combination with the hydrotropic substance, are preferably lower alcohols having two or three carbon atoms, including ethanol, propanol, isopropanol and propylene glycol, and in general ethyl alcohol will be used.

The solubility promoter and viscosity regulator will advantageously be chosen to complement each other and so that together they act as a viscosity and clarity control system.

The viscosity and clarity control system useful in the liquid detergent composition of the invention comprises urea, a lower aliphatic alcohol, and optionally a water soluble hydrotropic substance such as those described above which are effective in promoting the compatibility of the ingredients in the liquid product and can be substituted for part of the urea or alcohol. The use of the viscosity and clarity control system imparts superior low temperature clarity of the liquid detergent composition and provides control of the viscosity of the product over a wider range for any particular concentration of active ingredients.

The exact proportions of urea, lower alcohol, and optionally hydrotropic substance best suited for any particular composition may be determined by the formulator by conventional tests. The weight content of this viscosity and control system based upon the total composition will vary from 2.5–15% and preferably from 6% to 13%. Within that range, the urea and the alcohol will vary within the ranges of 0.5 to 5.0%, preferably 1% to 4%; and 2 to 10%, preferably 5% to 8%, respectively. It is desirable to maintain the ratio of urea to alcohol within the range of 1:1.5 to 1:3 parts by weight, most preferably, at about 1:2.5 when using an active ingredient content above about 30% by weight, preferably 35–45% including alkylolamide or the like. Varying amounts of hydrotrope such as xylene sulfonate or the like may be added or substituted in part for the alcohol or urea so as to form a ternary system with special properties such as to markedly increase the viscosity to greater levels. The amount should be selected by formulation so as to maintain a satisfactory viscosity and cloud point and maintain other desirable properties. Generally, the hydrotrope may constitute up to about 50% by weight of the total viscosity and control system.

The liquid detergents used in the present invention may also contain any of the additives heretofore used in other liquid detergent compositions such as sequestrants, e.g., salts of ethylenediamine tetraacetic acid, such as the sodium and potassium salts, and salts of hydroxy ethyl ethylene diamine triacetate. It is desirable in some cases to tint or color the liquid detergent composition and any suitable dyes may be used for this purpose and it is to be understood that "clear" applies to colored as well as water-white compositions. Perfume may also be added to these compositions to give them a pleasant odor.

Water is used as the liquid vehicle for the liquid detergent compositions of the present invention. It will vary in proportion from about 50% to 90%, depending upon the content of the other ingredients of the composition.

The clear plastic containers used in this invention are made from suitable plastics including polyvinyl chloride, polystyrene and compounds, propylene modified polyvinyl chloride, acrylic multipolymers, nitrile-rubber-modified acrylonitrile-methyl acrylate copolymers (such as Barex produced by Sohio), methacrylonitrile-styrene mixtures (such as Lopac produced by Monsanto) and biaxially oriented polypropylene (such as produced by Phillips Petroleum). The plastics, as well as the detergent compositions, may be tinted as well as water-white and a water-white container may be used with water-white or tinted compositions and vice versa.

Although the present invention has been described and illustrated with reference to certain specific ingredients for the clear liquid detergent and plastics for the container, these are to be considered as illustrative of and not as limitations on the present invention. All proportions are given hereinabove in percentages by weight of the entire composition unless otherwise indicated.

What is claimed is:

1. A detergent package consisting essentially of in combination a clear plastic container and a body of clear, stable liquid detergent composition therein, said detergent composition consisting essentially of 10% to 60% by weight of a water-soluble mixed secondary alkyl sulfonate salt having from about 10 to 20 carbon atoms in the molecule and selected from the group consisting of alkali metal, alkaline earth metal, ammonium and lower amine salts, solubilized in an aqueous liquid vehicle containing from 0 to 15% by weight of a solubility promoter selected from the group consisting of urea, C_2–C_3 lower alkanols, alkyl benzene sulfonates containing up to three carbon atoms in the alkyl group, lower alkyl sulfate salts having 5 to 6 carbon atoms in the alkyl group, and mixtures thereof.

2. A package as set forth in claim **1** in which said detergent composition contains a mixture of said alkyl sulfonate salt and an alkyl ether sulfate represented by the formula $RO(C_2H_4O)_nSO_3X$ wherein R is a primary or secondary alkyl having 10 to 18 carbon atoms, *n* is 1 to 10, and X is selected from the group consisting of alkali metal, alkaline earth metal, ammonium, and lower amine, the weight ratio of said alkyl sulfonate to said alkyl ether sulfate being in the range of 10:1 to 1:1.

3. A package as set forth in claim **2** in which the detergent composition includes in addition up to 15% by weight of a nonionic foam booster selected from the group consisting of alkanols represented by the formula $RO(C_2H_4O)_nH$ in which R is an alkyl group having 10 to 18 carbon atoms and *n* is a number from 0 to 10, and mono- and diethanolamides and isopropanolamides of a C_8–C_{18} fatty acid.

4. A package as set forth in claim **3** in which said solubility promoter is a mixture of 0.5 to 5% by weight of urea and 2 to 10% by weight of said lower alkanol, the weight ratio of urea to lower alkanol being within the range of 1:1.5 to 1:3.

5. A package as set forth in claim **1** in which the clear water-white plastic container is made from a plastic selected from the group consisting of polyvinyl chloride, polystyrene, propylene modified polyvinyl chloride, acrylic polymers, nitrile-rubber-modified acrylonitrile-methyl acrylate copolymers, methacrylonitrile-styrene mixtures, and biaxially oriented propylene.

6. A product as set forth in claim **4** in which the control system includes an alkali metal organic sulfonated or sulfated salt.

7. A product as set forth in claim **1** in which the clear plastic container is polyvinyl chloride.

8. A product as set forth in claim **1** in which the clear plastic container is nitrile-rubber-modified acrylonitrile-methyl acrylate copolymer.

9. A product as set forth in claim **1** in which the clear plastic container is a mixture of methacrylonitrile and styrene.

References Cited

UNITED STATES PATENTS

3,211,660	10/1965	Marion et al.	252—Dig. 15
2,366,027	12/1944	Henke	252—554
2,920,045	1/1960	Hearn et al.	252—Dig. 14
3,527,707	9/1970	McAteer et al.	252—554
3,540,577	11/1970	Trementozzi et al.	206—84
3,674,374	7/1972	Zoki et al.	252—552

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252—552; Dig. 14