

[54] **LIQUID OLEFIN SULFONATE DETERGENT**
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[58] Field of Search **252/536, 548, 555, 556;**
260/513 R

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[57] **ABSTRACT**

Liquid detergent formulations that are based on particular olefin sulfonates provide exceptional deterative performers that are homogeneous, clear and stable at low temperatures.

6 Claims, No Drawings

LIQUID OLEFIN SULFONATE DETERGENT

This invention relates to novel liquid detergent compositions and to a method for making liquid detergent compositions based on olefin sulfonates.

More particularly, this invention relates to built light duty olefin sulfonate liquid detergent compositions and to a method for providing homogeneous, clear, low temperature stable, liquid detergents based on alpha-olefin sulfonates and vinylidene-olefin sulfonates.

Detergents based on biodegradable alpha-olefin sulfonates and vinylidene-olefin sulfonates represent attractive alternatives to a general public who have become increasingly concerned with ecology and environmental conservation.

Heavy duty granular detergents based on said olefin sulfonates were recently described in U.S. Pat. No. 3,544,475.

To my knowledge, however, the art has neither described any homogeneous, clear liquid detergent compositions based on said olefins, nor has it even addressed itself to the problems of making light duty liquid detergent formulations based on said olefins.

I believe, therefore, that my invention represents a significant advancement in the field of liquid light duty detergents.

Surprisingly, my invention not only provides a liquid detergent that has improved oily-soil removing characteristics and better foam stability than active compounds known to the art such as the alpha-olefin sulfonates and alkylbenzene sulfonates, but my detergents possess the superior characteristics of being clear, homogeneous liquids that are stable with respect to separations of solids under conditions of low temperature storage, e.g., 30°F. to 40°F., and are stable with respect to gelling during formulation and/or storage.

Therefore, in accordance with my invention, the above-described liquid detergent composition is provided that consists essentially of a clear homogeneous liquid of:

- A. 19 to 30 wt. percent of an olefin sulfonate component;
- B. 8 to 15 wt. percent of an alcohol ether sulfate component;
- C. 3 to 7 wt. percent of a substituted fatty acid amide component;
- D. 1 to 8 wt. percent of a sulfonated hydrotrope component;
- E. 1 to 8 wt. percent of a monohydric water-miscible alcohol; and
- F. 32 to 68 wt. percent water.

Preferably, the olefin sulfonate component (A) is employed in an amount in the range of about 20 to 24 percent by weight thereof based on said detergent composition.

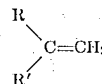
Said olefin sulfonate component (A) consists essentially of (1) alpha-olefin sulfonate and (2) vinylidene-olefin sulfonate which are employed in the form of the alkali metal salts, ammonium salts, or substituted ammonium salts, such as the sodium, potassium, ammonium and ethanolamine salts of the respective sulfonates, and mixtures thereof.

Said alpha-olefin sulfonate (1) is employed in an amount sufficient to provide in the range of about 7 to 60 wt. percent, preferably 30 to 60 wt. percent, based on the total weight of said olefin sulfonate component (A).

Said alpha-olefin sulfonate (1) consists essentially of C_{14} to C_{16} alpha-olefin sulfonates, and mixtures thereof, wherein the C_{14} alpha-olefin sulfonate is employed in an amount sufficient to provide in the range of about 50 to 100 wt. percent, based on the total weight of said alpha-olefin sulfonate (1) and the C_{16} alpha-olefin sulfonate is employed in an amount to provide in the range of about 0 to 50 wt. percent, preferably 0 to 20 wt. percent, based on the total weight of said alpha-olefin sulfonate (1).

The vinylidene-olefin sulfonate (2) is employed in an amount sufficient to provide in the range of about 40 to 93 wt. percent, preferably about 40 to 70 wt. percent, based on the total weight of said olefin sulfonate component (A).

The vinylidene-olefin sulfonate (2) consists essentially of sulfonates of C_{14} to C_{16} vinylidene olefin, and mixtures thereof, said vinylidene olefins being represented by the following formula:



wherein R and R' are independently alkyl groups and the total carbon atoms in said groups are in the range from 12 to 14. Further, when the said vinylidene-olefin sulfonate (2) contains 95 percent by weight or more C_{16} vinylidene-olefin sulfonate the total amount of said vinylidene-olefin sulfonate (2) should not exceed about 80 percent by weight of the total weight of said olefin sulfonate component (A).

It should also be noted that although said olefin sulfonate component (A) consists essentially of the above-described components, it need not be entirely pure and can contain small amounts, e.g., not more than 10 percent by weight of the total weight of the olefin sulfonate component (A) of sulfonated products of internal olefins, diolefins, olefins containing carbon atoms per molecule greater (such as C_{16} , C_{18} , and the like), or less (such as C_{12} , and the like) than the aforementioned components, mixtures thereof, and the like. A small quantity, of the order 1 to 5 percent, of unsulfonated oil may also be present in the olefin sulfonate component (A).

The alcohol ether sulfate component (B) can be represented by the following formula:



wherein R'' represents a C_{10} to C_{18} alkyl group, x is an integer of 2 to 5 and M represents a cation such as an alkali metal, e.g., sodium, potassium, and the like, ammonium, substituted ammonium, such as alkanolamine, e.g., ethanolamine, and the like, or admixtures thereof.

The above-described component (B) is a sulfated monohydric alcohol polyethoxylate and can be derived from synthetic alcohols, such as lauryl alcohol or natural alcohol, such as those from coconut oil, palm-kernel oil, and the like, or admixtures thereof. Said alcohol ether sulfate component (B) can be made conventionally by the condensation of 2 to 5 mols of ethylene oxide on to an aliphatic monohydric alcohol having in the range of about 10 to 18, preferably about 10 to 14, carbon atoms per molecule. The ethoxylated alcohol is sulfated and neutralized by known methods. Preferably,

bly, the alcohol ether sulfate component (B) comprises about 10 to 13 percent by weight of said detergent composition.

The substituted fatty acid amide component (C) comprises a fatty acid portion and a substituted amide portion. The fatty acid portion is derived from an aliphatic acid containing in the range of 10 to 18 carbon atoms per molecule. The fatty acid can be derived from a natural source, such as the fatty acids derived from coconut oil, palm-kernel oil, and the like, and mixtures thereof, or a synthetic acid, such as lauric, myristic, palmitic, linoleic, and the like, and mixtures thereof. The substituted acid amide is selected from fatty acid monoethanolamide, fatty acid monoisopropylamide, fatty acid diethanolamide, and fatty acid glycerylamide, and mixtures thereof. The substituted fatty acid amide component (C) preferably is employed in an amount to provide in the range of about 4 to 6 percent by weight thereof, based on the total weight of said detergent composition.

The sulfonated hydrotrope component (D) is selected from the alkali metal salts of xylene sulfonate, toluene sulfonate, benzene sulfonate, or admixtures thereof. Sodium xylene sulfonate is presently preferred. Preferably, said sulfonated hydrotrope component (D) is employed in an amount to provide in the range of about 2 to 6 percent by weight thereof, based on the total weight of said detergent composition.

The monohydric water-miscible alcohol component (E) preferably is employed in an amount to provide about 2 to 6 percent by weight thereof, based on the total weight of said detergent composition. Exemplary alcohols include ethanol, isopropanol, admixtures thereof, and the like.

Additionally, said detergent composition can contain the usual ingredients conventionally included in liquid detergents, such as coloring agents, perfumes, bactericides, suspending agents, and the like.

The water component (F) is preferably employed in an amount sufficient to provide about 45 to 61 percent by weight thereof, based on the total weight of said detergent composition. It should be understood that it is not necessary to add water per se as an individual component, but that the water can be supplied by using aqueous solutions of the heretofore mentioned components. For example, olefin sulfonate aqueous slurries, sulfonated hydrotrope aqueous solutions, and the like, are customarily employed.

It is recognized that components (B) through (F), above-described, are conventionally employed in liquid detergent formulations. This is advantageous since these components are already favorably recognized in the industry. Our novel compositions, therefore, employ heretofore established components in combination with select quantities of particular olefin sulfonates to provide a novel and surprising olefin sulfonate based liquid detergent composition.

The fact that my liquid detergent composition, above-defined, is stable with respect to separation of solids, even under conditions of low temperature storage, and stable with respect to gel formation during formulation and/or storage was completely unexpected. This is particularly true since I found that the C₁₄ and C₁₆ vinylidene-olefin sulfonates individually, or as admixtures, were not particularly compatible with water. Vinylidene C₁₆ olefin sulfonate was found to be practically insoluble in water and the vinylidene C₁₄ olefin

sulfonate still a definite slurry consistency at 40 percent concentration. That such vinylidene-olefin sulfonates could be employed to provide a homogeneous and clear liquid detergent composition, a composition I sought to prepare appeared to be seemingly impossible.

To add further discouragement to my development work, I found that when alpha-olefin sulfonates, such as above-mentioned, were admixed with the conventionally employed components (B) and (C), e.g., the alcohol ether sulfonates and the fatty acid alkanolamides, respectively, that a blob of gel immediately began to form which thickened upon the continued addition of the components. Quite obviously a clear homogeneous liquid detergent employing such a combination looked hopeless.

To even further complicate the problem, I additionally found that when components (B) through (F) were employed alone with a vinylidene-olefin sulfonate, as above-defined, the formulation became markedly less stable under low temperature storage.

Accordingly, it was with great surprise that I discovered that the vinylidene-olefin sulfonates, as above-defined, when employed together with the alpha-olefin sulfonates, as I have hereinbefore outlined, would provide a clear homogeneous detergent composition. Accordingly, all of the above-described problems were somehow dispelled by using my unique olefin sulfonate component (A).

In addition, other surprising results and unexpected advantages of my invention were also discovered. In the composition heretofore described as preferably, i.e., wherein the vinylidene-olefin sulfonate component (2) is employed in amounts of about 40 to 70 percent by weight thereof, based on the total weight of the olefin sulfonate component (A) the dishwashing performance of my liquid detergent composition is greater than one would expect from a straight line relationship between a 100 percent vinylidene-olefin sulfonate containing detergent and a 100 percent alpha olefin sulfonate containing detergent. Also the ability for considerable viscosity control in the final formulation by merely adjusting the percentages of the various components within the parameters hereinbefore defined was realized.

It should be further noted that smaller amounts than are conventionally used of the more expensive components, i.e., the alcohol ether sulfates and the substituted fatty acid amide components need be employed when they are used with the olefin sulfonate component (A) according to my invention. Further use of even lesser amounts of these components when employed according to my invention results in little or no loss in the performance of the detergent.

The deterative performance of the liquid detergent compositions of my invention is appreciably better than the deterativeness of identical detergents based on linear alkylbenzene sulfonates (LAS). The liquid detergent compositions of my invention also exhibit even more improved deterative performance with increasing water hardness. At the level of 150 ppm. hardness, for example, the liquid detergent compositions of my invention give about 25 percent better deterative performance than a liquid detergent employing LAS.

When the components, as herein outlined, are employed, the particular manner in which my detergent composition is formulated is not critical. For example,

the components can be admixed in any order that is convenient to the practitioner. It is presently preferred, however, to admix the olefin sulfonate component (A) with the alcohol component (E) and the sulfonated hydrotrope component (D) and at least a portion of the water (F) prior to admixing the alcohol ether sulfate component (B) and the substituted fatty acid amide component (C). Regardless of the order of mixing, however, the olefin sulfonate component (A) of this invention will surprisingly dissolve readily with the other components of the formulation to provide a clear homogeneous liquid detergent composition.

As an illustration of the foregoing discussion and description, and not to be interpreted as a limitation on the scope thereof, or on the materials herein employed, the following examples are presented.

EXAMPLES I-VIII

Although many formulations were made, the following detergent formulation, as reported in Table 1, is typical and exemplifies my novel light duty liquid detergent composition when the heretofore described components are employed in accordance with my invention. Typical examples are, therefore, recorded in Table 2 which demonstrate the results obtained by using the formulation reported in Table 1 with varying amounts of the olefin sulfonate component (A) of my invention. Likewise reported are typical examples that demonstrate the relative instability of other olefin sulfonate based formulations.

TABLE 1

FORMULATION	
Component	% By Weight
A. Olefin sulfonate ^(a)	23.0
B. Alcohol ether sulfate ^(a)	12.5
C. Substituted fatty acid amide ^(a)	4.8
D. Sulfonated aryl hydrotrope ^(a)	5.0
E. Water-miscible alcohol ^(a)	5.0
F. Water	49.7

^(a) Sodium salt - see Table 2

^(b) 60%, By weight C₁₄, 40%, by weight C₁₂, alcohol - 3 mol ethylene oxide adduct - ammonium salt

^(c) Coconut acid monoethanolamide

^(d) Sodium xylene sulfonate

^(e) Ethyl alcohol

TABLE 2

Example	Olefin Sulfonate Component (A), %, By Weight		Results		
	Alpha Olefin Sulfonate ^(a)	Vinylidene Olefin Sulfonate ^(b)	Viscosity, cps. at 25°C.	40°F. Storage Stability	Plates Washed ^(c)
1.	100	0	Gel	—	27
2.	75	25	Gel	—	31
3.	62.5	37.5	Partial Gel	—	—
4.	50	50	143	Stable	36
5.	30	70	90	Stable	37
6.	10	90	53	Stable	35
7.	5	95	—	Unstable ^(e)	—
8.	0	100	—	Unstable ^(e)	36

^(a) C₁₄ alpha-olefin sulfonate

^(b) 50/50 mixture, by weight, C₁₄ and C₁₆ vinylidene olefin sulfonate

^(c) Solids separate and, generally, separation is evident within 24 hours-48 hours

^(d) As reported by Anstett and Schuck, J. Am. Oil Chem. Soc. 43, 576(1964)

EXAMPLES IX-X

Similar experiments to those reported above were performed using a detergent formulation such as reported in Table 1. Accordingly, storage stable (at 40°F.) detergent compositions which were clear homogeneous liquids and did not gel during formulation or

storage were also made wherein the olefin sulfonate component (A) consisted of 93% C₁₄ vinylidene-olefin sulfonate and 7% C₁₄ alpha-olefin sulfonate. Another stable, clear homogeneous detergent composition was made wherein the olefin sulfonate component (A) consisted of 80% C₁₆ vinylidene olefin sulfonate and 20% C₁₄ alpha-olefin sulfonate.

The preceding examples can, of course, be repeated with similar success by substituting the generically and specifically described reactants and conditions of this invention for those employed in the examples. As will be evident to those skilled in the art, various modifications of this invention can be made or followed in light of the discussion and disclosure herein set forth without departing from the spirit or the scope thereof.

I claim:

1. A detergent composition consisting essentially of a clear homogeneous liquid of (A) 19 to 30 wt. percent of an olefin sulfonate component; (B) 8 to 15 wt. percent of an alcohol ether sulfate component; (C) 3 to 7 wt. percent of a substituted fatty acid amide component; (D) 1 to 8 wt. percent of a sulfonated hydrotrope component; (E) 1 to 8 wt. percent of a monohydric water-miscible alcohol; and (F) 32 to 68 wt. percent water; wherein said component (A) consists essentially of (1) 7 to 60 wt. percent of a C₁₄ alpha-olefin sulfonate, and (2) 93 to 40 wt. percent of a vinylidene-olefin sulfonate, wherein said vinylidene-olefin sulfonate (2) consists essentially of C₁₄ or C₁₆ vinylidene-olefin sulfonate, and admixtures thereof, provided however that the total amount of said vinylidene olefin sulfonate component (2) shall not exceed 80 wt. percent of said component (A) when said vinylidene-olefin sulfonate contains 95 wt. percent or more C₁₆ vinylidene-olefin sulfonate; wherein said component (B) is a sulfated 2 to 5 mole polyethoxylate of a monohydric C₁₀ to C₁₈ alcohol; wherein said component (C) is a fatty acid monoethanolamide, a fatty acid isopropanolamide, a fatty acid diethanolamide, or a fatty acid glyceryl amide and wherein the fatty acid portion is a C₁₀ to C₁₆ aliphatic acid, and admixtures thereof, and wherein said component (D) is an alkali metal salt of xylene sul-

fonate, toluene sulfonate, benzene sulfonate, or admixtures thereof.

2. The composition of claim 1 wherein said detergent composition consists essentially of 20 to 24 wt. percent of said component (A), 10 to 13 wt. percent of said component (B), 4 to 6 wt. percent of said component (D), 2 to 6

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wt. percent of said component (E), and 45 to 61 wt. percent of said component (F).

3. The composition of claim 1 wherein said component (A) consists essentially of 30 to 60 wt. percent of said alpha-olefin sulfonate and 70 to 40 wt. percent of said vinylidene-olefin sulfonate.

4. The composition of claim 3 wherein said vinylidene-olefin sulfonate consists essentially of C₁₄ vinylidene-olefin sulfonate.

5. The composition of claim 3 wherein said component (B) is a sulfated 2 to 5 mol ethoxylate of a C₁₀ to C₁₄ monohydric alcohol, said component (C) is a fatty

acid ethanolamide or fatty acid diethanolamide, wherein said component (D) is sodium xylene sulfonate, and wherein said component (E) is ethyl alcohol.

6. The composition of claim 2 wherein said component (B) is a sulfated 2 to 5 mol ethoxylate of a C₁₀ to C₁₄ monohydric alcohol, said component (C) is a fatty acid ethanolamide or fatty acid diethanolamide, wherein said component (D) is sodium xylene sulfonate, and wherein said component (E) is ethyl alcohol.

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