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[54] **TRANSPARENT LIQUID DETERGENT COMPOSITION**

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[51] **Int. Cl.** **C11d 1/18**

[58] **Field of Search** ..... 252/556, 546, 555, 558, 252/559, DIG. 14

[56] **References Cited**

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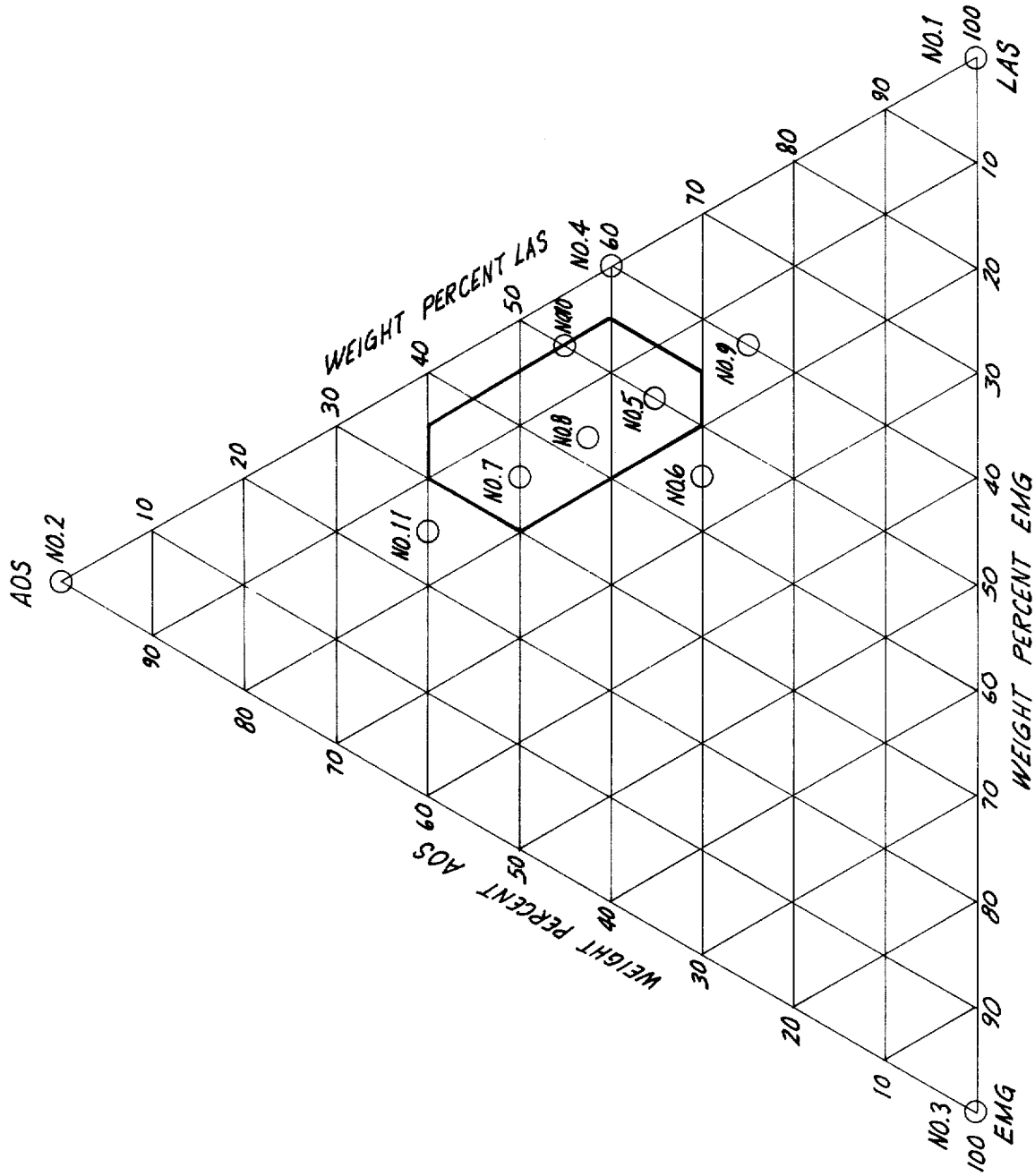
Attorney, Agent, or Firm—Woodhams, Blanchard and Flynn

[57] **ABSTRACT**

A liquid detergent composition containing more than 25% (by weight; the same shall apply hereinafter) of a surfactant and a nitrilotriacetic acid salt. The surfactant comprises a mixture of 30 to 55% of a straight chain alkylbenzene sulfonate, 30 to 60% of an α-olefin sulfonate and 5 to 20% of polyoxyethylene alkyl- or alkylphenyl ether. The weight ratio of the nitrilotriacetic acid salt to the surfactant is in the range of from about 0.1 to 3:1.

6 Claims, 1 Drawing Figure


AOS
NO.2
10
20
30
40
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60
70
80
90
WEIGHT PERCENT LAS
NO.4
NO.10
NO.9
NO.5
NO.8
NO.7
NO.6
NO.11
NO.1
100
LAS
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20
30
40
50
60
70
80
90
WEIGHT PERCENT EMG
NO.3
100
EMG
90
80
70
60
50
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30
20
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WEIGHT PERCENT AOS

TRANSPARENT LIQUID DETERGENT COMPOSITION

BACKGROUND OF THE INVENTION

1. Field Of The Invention

This invention relates to a liquid detergent composition. More particularly, this invention relates to a concentrated liquid detergent composition having excellent solution stability and containing a special proportion of a surfactant mixture and a water-soluble salt of nitrilotriacetic acid.

2. Description Of The Prior Art

In conventional liquid detergents, particularly heavy duty detergents, the compatibility of a builder component with a deterging surfactant is poor and, therefore, the builder content should necessarily be reduced extremely in amount and products of satisfactory deterging power cannot be obtained. Further, due to lower solubility, sodium salts cannot be used as components of the liquid detergent compositions and, accordingly, more expensive potassium salts have been used.

SUMMARY OF THE INVENTION

After intensive investigations of liquid detergent compositions, we have discovered that a composition comprising a mixture of (A) a surfactant mixture of special proportions of three components and (B) water-soluble salt of nitrilotriacetic acid, has an excellent deterging power and solution stability. The present invention has been accomplished on the basis of this discovery.

BRIEF DESCRIPTION OF DRAWING

The drawing is triangular plot illustrating the results tabulated in Table 4.

DETAILED DESCRIPTION OF THE INVENTION

This invention provides a liquid detergent composition containing more than 25 % (all percentages herein are by weight, unless otherwise noted) of a mixture of (*A*) surfactant and (*B*) water-soluble salt of nitrilotriacetic acid. The surfactant (*A*) comprises a mixture of 30 - 55% of straight chain alkylbenzene sulfonate, 30 - 60% of α-olefin sulfonate and 5 - 20% of polyoxyethylene alkyl- or alkylphenyl ether. The weight ratio of nitrilotriacetic acid salt (*B*) to surfactant (*A*) is in the range of from about 0.1 to 3:1, i.e., $B/A=(0.1-3.0)/1$ (parts by weight), preferably in the range of $B/A=(0.2-1.0)1$.

The surfactant (*A*) contained in the liquid detergent composition of the present invention is a mixture of anionic surfactant and nonionic surfactant. The anionic surfactant is a mixture of (1) straight chain alkylbenzene sulfonate in which the alkyl has an average number of carbon atoms in the range of 10 to 14 and (2) α-olefin sulfonate having an average number of carbon atoms in the range of 14 to 18. The anionic surfactant is an alkali metal salt such as sodium or potassium, ammonium salt or an alkanolamine salt such as mono-, di- or triethanolamine. The nonionic surfactant is a polyoxyethylene alkyl ether containing an alkyl group having from 8 to 18 carbon atoms and 4 to 14 oxyethylene units, or a polyoxyethylene alkylphenyl ether containing an alkyl group having from 8 to 12 carbon atoms and 6 to 12 oxyethylene units.

The liquid detergent composition consists essentially of an aqueous solution of a mixture of

A. one part by weight off surfactant consisting essentially of 30 - 55% of straight chain alkylbenzene sulfonate, 30 - 60% of α-olefin sulfonate and 5 - 20% of polyoxyethylene alkyl-or alkylphenyl ether and

B. about 0.1 - 3 parts by weight, preferably 0.2 - 1 part by weight, per one part of (A), of a salt of nitrilotriacetic acid, such as an alkali metal salt such as sodium or potassium, ammonium salt or an alkanolamine salt such as mono-, di- or triethanolamine, salt of nitrilotriacetic acid. The liquid detergent composition contains at least 25% of the sum of components (A) plus (B), mixed in the weight ratio specified above. The upper limit of the amount of components (A) plus (B) in the liquid detergent composition is the amount at which all ingredients remain dissolved in the aqueous solution. This will vary depending on the particular components used but, in general, the maximum amount of components (A) plus (B) is from 40 to 50 percent. The liquid detergent composition has an excellent solution stability at a high concentration above 25% at both low and high temperatures (i.e., it is transparent at -5°C) and it demonstrates a great detergency performance.

The liquid detergent composition may be either a light duty detergent or a heavy duty detergent. The latter may contain one or more inorganic builders such as sodium orthophosphate, sodium pyrophosphate, sodium silicate, sodium carbonate, sodium metaborate or borax in an amount which does not damage the solution stability of the composition. The amount of inorganic builder in the heavy duty liquid detergent composition can be from 2 to 25%.

As optional ingredients in both light duty and heavy duty detergents, there can be used small amounts of an alkali metal, ammonium or amine salt of citric acid, gluconic acid, tartaric acid or malic acid and potassium pyrophosphate.

For increasing solution stability, there can optionally be incorporated in the liquid detergent composition small amounts of a solubilizer or a solvent such as an alkali metal salt, ammonium salt or an amine salt of p-toluene sulfonic acid, xylene sulfonic acid, ethylbenzene sulfonic acid or cumene sulfonic acid; or methanol, ethanol, propyl alcohol, propylene glycol, glycerol, methylcellosolve, ethylcellosolve, butyl-cellosolve, phenylcellosolve or ethylcarbitol.

Also, anticorrosive agent, dye, perfume, fluorescent dye, enzyme, defoaming agent, foam inhibitor and germicide can optionally be incorporated in the composition.

It will be understood that the present invention does not relate to any discovery concerning the above-mentioned optional ingredients and that these ingredients can be used, if desired, in the amounts conventionally used in the art.

The invention will be further described by reference to the following illustrative examples.

EXAMPLE 1

The solubilities of sodium straight chain alkylbenzene sulfonate (an average of 12 carbon atoms in the alkyl group; hereinafter referred to as LAS), sodium α-olefin sulfonate (having an average of 16 carbon atoms; hereinafter referred to as AOS) and polyoxyethylene(8)lauryl ether (hereinafter referred to an EMG) in water and also the solubility of sodium nitrilo-

tri-acetate (hereinafter referred to as NTA) in these aqueous solutions were examined.

1. Amount (%) of NTA soluble in respective 20% aqueous solutions of the named surfactants:

Table 1

Surfactant	LAS	AOS	EMG
NTA	3	8	5

(note) Amount of NTA dissolved at 35°C and which stayed dissolved in the form of a transparent solution after being maintained at room temperature (20 – 25°C) for 24 hours.

more soluble in water than AOS. NTA is fairly soluble in AOS, even though AOS is less soluble in water than LAS. The solubility of NTA in EMG at room temperature is between those of LAS and AOS, even though EMG is fairly soluble in water. The stability of a mixed solution of EMG and NTA is excellent.

4. The temperatures at which there occurred white turbidity in the respective solutions containing 20% of LAS, AOS or EMG and 5% of NTA were examined to obtain the results shown in Table 4 and in the accompanying drawing.

TABLE 4

Test No. / Component	1	2	3	4	5	6	7	8	9	10	11
LAS	20	0	0	12	10	9	7	8.5	12	10	5
AOS	0	20	0	8	7	6	10	8.5	5	9	12
EMG	0	0	20	0	3	5	3	3	3	1	3
NTA	5	5	5	5	5	5	5	5	5	5	5
Sodium metasilicate	5	5	5	5	5	5	5	5	5	5	5
sodium xylene sulfonate	5	5	5	5	5	5	5	5	5	5	5
Water	Balance										
Turbidity temperature	25°C separation	12.5°C	25°C separation	0°C	below −5°C	above 25°C	−5°C	−5°C	0°C	below −5°C	5°C

2. The temperatures at which there occurred white turbidity in the respective aqueous solutions containing 20% of the named surfactants and 5% of NTA:

Table 2

Surfactant	LAS	AOS	EMG
Temperature	25°C (separation)	12.5°C	No turbidity even at −5°C

(Note) The temperature at which white turbidity of the respective solutions, formed by dissolving the ingredients at 35°C, is caused by stepwise temperature reduction at a rate of 2.5°C/12 hours.

3. The temperatures at which there occurred white turbidity in the respective 20% aqueous solutions of the named surfactants:

Table 3

Surfactant	LAS	AOS	EMG
Temperature	2.5°C	12.5°C	No turbidity even at −5°C

The results shown in Tables 1 — 3 suggest that NTA is difficulty soluble in LAS, even though LAS is far

Table 4 and the accompanying drawing show clearly that said turbidity temperature is below −5°C if the composition contains 30 – 55% of LAS, 30 – 60% of AOS and 5 – 20% of EMG as shown in Tests No. 5, 7, 8 and 10. On the other hand, if LAS, AOS or EMG is used alone (No. 1, 2 and 3), said temperature is above 12.5°C. Further, if LAS is less than 30% (No. 11) or if AOS is less than 30% (No. 9) or if EMG is less than 5% (No. 4) or more than 20% (No. 6), the synergistic effect on the turbidity temperature of mixing the three components of LAS/AOS/EMG is not satisfactory and turbidity is caused at a temperature above 0°C.

EXAMPLE 2.

Comparative tests of the detergency performance of liquid detergent compositions according to the present invention (Table 5, Detergents I – IV) and known liquid detergent compositions (A) and (B) were carried out.

Known liquid detergent compositions:

	(A)	(B)
Potassium straight chain alkylbenzenesulfonate (average of 12 carbon atoms in the alkyl group)	10%	20%
Potassium pyrophosphate	20	
Potassium metasilicate	3	
Potassium metaxylene sulfonate	7	
Ethanol		10
Urea		7
Water	balance	balance

Table 5

Detergent / Component	I	II	III	IV	Control (A)	Control (B)
Surfactant Constituents						
LAS	10%	10%	8%	10%		
AOS	8	8	8	8		

Table 5 – Continued

Detergent Component	I	II	III	IV	Control (A)	(B)
Polyoxyethylene (8.8) nonylphenyl ether	2	2	4	2		
Total Surfactant	20%	20%	20%	20%		
NTA	10	10	10	15		
Sodium metasilicate		5	5			
Water	re-mainder	re-mainder	re-mainder	re-mainder		
Detergency* (%)	66	77	79	76	69	40

(Note) *Detergency:
Cloths were washed in a Terg-O-Tometer and the reflectivities were measured, from which the detergencies were calculated.

Six pieces of stained cloth were used in each test. The average detergency for four pieces, excluding the highest and the lowest one, was determined. The stained cloth was prepared by charging 1.6 g of a staining powder (comprising 6% of oleic acid, 6% of refined beef tallow, 8% of refined lanolin, 8% of carbon black and 72% of bentonite) and 40 pieces of white mixed Tetron (polyester)/cotton cloth (Tetron/cotton=60/40, 50 × 10 cm^2) in a 2 liter vessel, and agitating the contents for one hour, rubbing both sides of the cloths each 5 times and ironing out. The deterging conditions were 25°C, 72 ppm (Ca^{++}/Mg^{++}=2/1) hard water and 0.2% concentration.

Liquid detergent compositions I through IV of the present invention demonstrated detergent performances superior to those of known liquid detergent compositions (A) and (B) in both light and heavy duty detergents.

EXAMPLES 3 - 4

Additional examples of liquid detergent compositions according to the present invention are shown in Table 6

Table 6

Example Detergent components	3	4
LAS	11%	11%
AOS	7	7
Polyoxyethylene(8)lauryl ether	2	
Polyoxyethylene(9)nonylphenyl ether		2
NTA	7	7
Sodium metasilicate	5	5
Sodium xylene sulfonate	5	5
Water	remain-der	remain-der

They are both transparent liquids stable at −5°C and having excellent detergency performances.

The embodiments of the invention in which an exclusive property or privelege is claimed are defined as follows:

1. A transparent, stable, liquid detergent composition comprising an aqueous solution of

A. as essentially the only organic surfactant components in the detergent composition, a three component surfactant consisting essentially of

1. from about 30 to about 55 percent by weight of straight chain alkylbenzene sulfonate
2. from about 30 to about 60 percent by weight of α-olefin sulfonate, and
3. from about 5 to about 20 percent by weight of polyoxyethylene alkyl- or alkylphenyl ether;

B. from about 0.1 to 3.0 parts by weight, per one part of constituent A, or water-soluble salt of nitrilotriacetic acid;

the composition containing at least 25 percent by weight of the sum of constituents A and B.

2. A liquid detergent composition according to claim 1, in which said straight chain alkylbenzene sulfonate has in the alkyl group an average number of carbon atoms in the range of 10 to 14.

3. A liquid detergent composition according to claim 2, in which the α-olefin sulfonate has an average number of carbon atoms in the range of 14 to 18.

4. A liquid detergent composition according to claim 3, in which said ether is selected from the group consisting of (a) polyoxyethylene alkyl ether containing from 4 to 14 oxyethylene units and in which the alkyl group has from 8 to 18 carbon atoms, and (b) polyoxyethylene alkylphenyl ether containing from 6 to 12 oxyethylene units and in which the alkyl group has from 8 to 12 carbon atoms.

5. A liquid detergent composition according to claim 1 and additionally containing from 2 to 25 percent by weight of inorganic builder salts.

6. A liquid detergent composition according to claim 1, in which the weight ratio of nitrilotriacetic acid salt (*B*) to constituent (*A*) is in the range of $B/A=(0.2-1.0)/1$.

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