

1

3,156,655

HEAVY DUTY LIQUID DETERGENT COMPOSITION

Willard M. Bright, Ridgewood, N.J., assignor to Lever Brothers Company, New York, N.Y., a corporation of Maine

No Drawing. Filed Aug. 2, 1960, Ser. No. 46,897

8 Claims. (Cl. 252-109)

The present invention relates to cleansers, and more particularly to liquid detergent compositions.

Until recently washday products were sold primarily in particulate form, such as powders, flakes, granules, beads, and the like. Among the major drawbacks to such washday products are the difficulty in obtaining uniform specific gravity of the particles so that measured amounts of the products will have constant detergent power and the likelihood of wastage due to spilling of an opened carton containing the particulate product.

Recently particulate washday products have been replaced to a large extent by liquid detergent products. While liquid detergent compositions do not suffer from the major drawbacks of particulate detergent compositions, they nevertheless introduce problems of their own. Thus, while it is relatively easy to prepare a light duty liquid detergent composition which is homogeneous and hence appealing to the consumer, such products are only useful for light duty work, such as the cleaning of dishes. When one attempts to prepare heavy duty liquid detergent compositions, it is difficult to obtain products which have homogeneity, because the components of the compositions have a great tendency to separate out from the liquid medium.

While some homogeneous heavy duty liquid detergent compositions have been successfully prepared heretofore, they too suffer from at least two serious drawbacks. For example, some homogeneous heavy duty liquid detergent compositions are only homogeneous because of their high viscosity. The high viscosity, however, renders them difficult to pour and wasteful so that the product tends to adhere to the cap of the container used as a measuring cup or to cling to the inner walls of the container. Moreover, most homogeneous heavy duty liquid detergent compositions generally have high sudsing power so that they cause "suds-lock," especially in a front loading or horizontal washing machine, which is injurious to the motor of the machine.

There is provided in accordance with the present invention a liquid detergent composition which does not suffer from these drawbacks mentioned above. The product of the invention is a liquid detergent composition which is substantially homogeneous, is readily pourable, and has heavy duty detergent properties. It is also a low sudsing or intermediate sudsing product so that "suds-lock" is avoided.

The product of the invention contains seven essential components in order to achieve these highly desirable properties. One component is water which serves as a dissolving, suspending, or emulsifying medium for the remaining components in the composition.

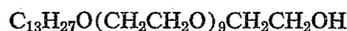
Two further components constitute a synthetic organic nonionic non-soap detergent mixture. This mixture is used in an amount from about 7% to about 10% by weight of the composition.

One such suitable mixture contains as one component thereof from about 5% to about 9% by weight of an alkyl phenol-ethylene oxide condensate having an alkyl group containing from nine to twelve carbon atoms and containing nine to fifteen oxyethylene units. Typical examples thereof include dodecyl phenol condensed with an average of ten moles of ethylene oxide sold commercially as

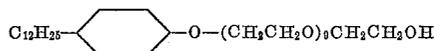
2

"Sterox DJ," nonyl phenol condensed with an average of nine moles of ethylene oxide sold commercially as "Igepal CO-630," nonyl phenol condensed with an average of ten moles of ethylene oxide sold commercially as "Tergitol NPX," and dodecyl phenol condensed with an average of fifteen moles of ethylene oxide. The remaining component of this mixture is from about 1% to about 3% by weight of a polyoxyalkylene alkanol having the empirical formula $\text{HO}-(\text{C}_2\text{H}_4\text{O})_a(\text{C}_3\text{H}_6\text{O})_b(\text{C}_2\text{H}_4\text{O})_c\text{H}$ where b is an integer from 26 to 30 and a plus c is an integer such that the molecule contains from 0% to 20% of ethylene oxide. Typical examples thereof include "Pluronic L-61" where b is an integer from 26 to 30 and a plus c is an integer such that the molecule contains from 10% to 20% of ethylene oxide and "Pluronic L-60" where b is an integer from 26 to 30 and a plus c is zero so that the molecule contains 0% or no ethylene oxide. This mixture will impart detergent and low sudsing properties to the liquid product.

Another suitable synthetic organic nonionic non-soap detergent mixture is as follows. This mixture contains from about 5% to about 7.5% by weight of a tridecyloxy-polyethoxyethanol having the formula



This component is prepared by condensing tridecyl alcohol with an average of ten moles of ethylene oxide and is sold commercially as "Sterox AJ-100." The remaining component of this mixture is from about 1% to about 3% by weight of either the above mentioned dodecylphenoxy-polyethoxyethanol having the formula



sold as "Sterox DJ" or the above mentioned polyoxyalkylene alkanol having the empirical formula



where b is an integer from 26 to 30 and a plus c is an integer such that the molecule contains from 0% to 20% of ethylene oxide as exemplified by the above "Pluronic L-60" and "Pluronic L-61." This mixture will impart detergent and intermediate sudsing properties to the liquid product.

Another component of the liquid products imparts heavy duty detergent and sequestering properties thereto. This component is potassium pyrophosphate which is present in the liquid product in an amount from about 18% to about 30%, and preferably from about 20% to about 25% by weight.

The remaining three essential components of the liquid product function as ternary solubilizers or stabilizing agents for the other components in the aqueous medium. One of these solubilizers is an interpolymer of vinyl methyl ether and maleic anhydride. The specific viscosity of a 1% solution of the interpolymer in 2-butanone is from 0.8 to 3.5, and preferably from 1.2 to 1.8. The liquid product contains from about 1% to about 3% by weight of the interpolymer which is present in the final product as an alkali metal salt thereof in view of the alkali in the composition.

Another solubilizer is an alkali metal soap of a fatty acid having at least ten carbon atoms, namely an alkali metal caprate, laurate or oleate. The alkali metal oleate can be used as the pure soap or as a mixed soap from fats and oils containing large amounts of oleic acid, such as tallow fatty acid soap and peanut oil fatty acid soap. In general, it is preferred to use the potassium soaps rather than the sodium soaps. The soaps are present in the composition in an amount from about 1% to about 4% by weight. These soaps can be added to the liquid product either as soaps or can be formed in situ by adding

3

the fatty acid or mixed fatty acids and then saponifying with the alkali present in the product.

The remaining solubilizer is sodium xylene sulfonate which is used in an amount of from about 2% to about 6% by weight.

If desired, the liquid product of the invention can contain various compatible adjuvants which do not destroy the basic characteristics of the composition. For example, the product can contain builders, such as alkali metal silicates, which also function as corrosion inhibitors. In general, the product would contain about 3% by weight of sodium or potassium silicate. Other suitable compatible adjuvants include very small amounts of fluorescent

4

2-butanone is 1.2-1.8. The miscellaneous ingredients are very small amounts of impurities, dyes, colorants, etc.

Various embodiments of the composition of the invention are illustrated by the examples set forth below in Table II. All nine of the examples in Table II were substantially homogeneous, that is, there was either no separation of the components at all or only very slight separation of the components after storing the compositions for two weeks at room temperature and at 125° F. Also all nine of the examples in Table II were readily pourable and had heavy duty properties. They were further characterized by being either low sudsing or intermediate sudsing so that "suds-lock" was avoided.

Table II

Examples	1	2	3	4	5	6	7	8	9
Sterox DJ	7	7	7	2	2	5		2.5	
Pluronic L-61	2	2	3			2			2
Pluronic L-60				6	6		2		
Sterox AJ-100							7	7.5	
Dodecyl phenol condensed with an average of 15 moles of ethylene oxide									7
Potassium Pyrophosphate	25	20	25	20	20	20	20	20	20
Sodium Pyrophosphate		5		5	5	5	5	5	5
PVM/MA	2	2	2	2	2	2	2	2	2
Capric Acid				2					
Lauric Acid					2				
Oleic Acid	2	2	2			2	2		2
Tallow Fatty Acids	1	1				1	1	2	1
Potassium Hydroxide	2.28	2.55	2.1	1.82	1.73	2.3	2.3	2	2.28
Sodium Silicate (Na ₂ O:SiO ₂ ratio of 1:2.5)		3		3	3				
Water and Miscellaneous	56.72	53.45	56.9	56.18	56.27	58.7	56.7	57.0	56.72

dyes, colorants, perfumes and soil suspending agents, such as sodium carboxymethylcellulose.

The composition of the invention is readily prepared by merely mixing together the components thereof in the aqueous medium.

The composition must contain the essential components mentioned above in order to impart thereto substantial homogeneity, heavy duty properties, pourability and controlled sudsing. Not only must these components be present, but also they must be used in the approximate amounts set forth above.

This is readily demonstrated by the examples set forth below in Table I wherein various essential components were omitted from some formulations and wherein other soaps were used, such as potassium myristate and potassium stearate. All of the seven products set forth in Table I below were not substantially homogeneous in that they were unstable after two weeks storage at room temperature and at 125° F., and generally marked separation of these products into layers was observed immediately upon completion of the formulations.

Table I

Examples	A	B	C	D	E	F	G
Sterox DJ	9	7	7	9	7	2	2.5
Pluronic L-61	1	2	2	1	2		
Sterox AJ-100						6	7.5
Potassium Pyrophosphate	25	25	25	25	25	20	25
Sodium Pyrophosphate				2		5	
PVM/MA	2					2	2
Sodium Xylene Sulfonate		7			3.5	2	2
Capric Acid				2			
Myristic Acid						2	
Stearic Acid							2
Oleic Acid			4.66		2.33		
Tallow Fatty Acids			2.34		1.17		
Potassium Hydroxide	1.5	0.09	1.82	2.2	0.91	1.82	1.9
Sodium Silicate (Na ₂ O:SiO ₂ ratio of 1:2.5)						3	
Water and Miscellaneous	61.5	58.91	57.18	58.8	59.09	56.18	57.1

In the examples of Table I above, Sterox DJ, Sterox AJ-100 and Pluronic L-61 have been identified hereinabove. PVM/MA is an abbreviation for the interpolymer of vinyl methyl ether and maleic anhydride wherein the specific viscosity of a 1% solution of the interpolymer in

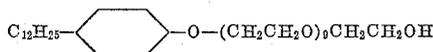
plus from about 1% to about 3% by weight of a polyoxyalkylene alkanol having the empirical formula



where b is an integer from 26 to 30 and a plus c is an

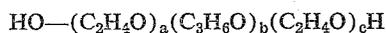
5

integer such that the molecule contains from 0% to 20% of ethylene oxide and (B) from about 5% to about 7.5% by weight of a tridecyloxy polyethoxyethanol having the formula $C_{13}H_{27}O(CH_2CH_2O)_9CH_2CH_2OH$ plus from about 1% to about 3% by weight of a material selected from the group consisting of (a) a dodecylphenoxy polyethoxyethanol having the formula



and (b) a polyoxyalkylene alkanol having the empirical formula $HO(C_2H_4O)_a(C_3H_6O)_b(C_2H_4O)_cH$ where b is an integer from 26 to 30 and a plus c is an integer such that the molecule contains from 0% to 20% of ethylene oxide, (2) from about 18% to about 30% by weight of potassium pyrophosphate, (3) from about 1% to about 3% by weight of an alkali metal salt of an interpolymers of vinyl methyl ether and maleic anhydride, (4) from about 1% to about 4% by weight of an alkali metal soap selected from the group consisting of caprate, laurate and oleate, and (5) from about 2% to about 6% by weight of sodium xylene sulfonate; the alkali metal cations of components (3) and (4) being selected from the group consisting of sodium and potassium.

2. A substantially homogeneous, readily pourable, heavy duty liquid detergent composition consisting essentially of an aqueous emulsion of (1) from about 7% to about 10% by weight of a synthetic organic nonionic non-soap detergent mixture, said mixture being made up of from about 5% to about 9% by weight of an alkyl phenol-ethylene oxide condensate having an alkyl group containing from nine to twelve carbon atoms and containing nine to fifteen oxyethylene units plus from about 1% to about 3% by weight of a polyoxyalkylene alkanol having the empirical formula



where b is an integer from 26 to 30 and a plus c is an integer such that the molecule contains from 0% to 20% of ethylene oxide, (2) from about 18% to about 30% by weight of potassium pyrophosphate, (3) from about 2% to about 3% by weight of an alkali metal salt of an interpolymers of vinyl methyl ether and maleic anhydride, (4) from about 1% to about 4% by weight of an alkali metal soap selected from the group consisting of caprate, laurate and oleate, and (5) from about 2% to about 6% by weight of sodium xylene sulfonate; the alkali metal cations of components (3) and (4) being selected from the group consisting of sodium and potassium.

3. A composition as defined by claim 2 wherein the potassium pyrophosphate is present in an amount from about 20% to about 25% by weight.

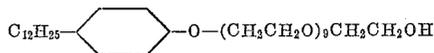
4. A composition as defined by claim 2 which also contains about 3% by weight of an alkali metal silicate.

5. A substantially homogeneous, readily pourable, heavy duty liquid detergent composition consisting essentially of an aqueous emulsion of (1) from about 7% to about 10% by weight of a synthetic organic nonionic non-soap detergent mixture, said mixture being made up of from about 5% to about 7.5% by weight of a tridecyloxy polyethoxyethanol having the formula



6

plus from about 1% to about 3% by weight of a material selected from the group consisting of (a) a dodecylphenoxy polyethoxyethanol having the formula

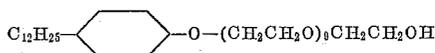


and (b) a polyoxyalkylene alkanol having the empirical formula $HO(C_2H_4O)_a(C_3H_6O)_b(C_2H_4O)_cH$ where b is an integer from 26 to 30 and a plus c is an integer such that the molecule contains from 0% to 20% of ethylene oxide, (2) from about 18% to about 30% by weight of potassium pyrophosphate, (3) from about 2% to about 3% by weight of an alkali metal salt of an interpolymers of vinyl methyl ether and maleic anhydride, (4) from about 1% to about 4% by weight of an alkali metal soap selected from the group consisting of caprate, laurate and oleate, and (5) from about 2% to about 6% by weight of sodium xylene sulfonate; the alkali metal cations of components (3) and (4) being selected from the group consisting of sodium and potassium.

6. A composition as defined by claim 5 wherein the potassium pyrophosphate is present in an amount from about 20% to about 25% by weight.

7. A composition as defined by claim 5 which also contains about 3% by weight of an alkali metal silicate.

8. A substantially homogeneous, readily pourable, heavy duty liquid detergent composition consisting essentially of an aqueous emulsion of (1) about 7% by weight of dodecylphenoxy polyethoxyethanol having the formula



(2) about 2% by weight of a polyoxyalkylene alkanol having the empirical formula



where b is an integer from 26 to 30 and a plus c is an integer such that the molecule contains from 10% to 20% of ethylene oxide (3) about 20% by weight of potassium pyrophosphate, (4) about 5% by weight of sodium pyrophosphate, (5) about 2% by weight of an alkali metal salt of an interpolymers of vinyl methyl ether and maleic anhydride, (6) about 2% by weight of an alkali metal oleate, (7) about 1% by weight of an alkali metal soap of tallow fatty acids, and (8) about 2% by weight of sodium xylene sulfonate; the alkali metal cations of components (5), (6) and (7) being selected from the group consisting of sodium and potassium.

References Cited in the file of this patent

UNITED STATES PATENTS

2,560,839	Ayo et al. -----	July 17, 1951
2,621,169	Robinette et al. -----	Dec. 9, 1952
2,859,182	Carroll -----	Nov. 4, 1958
2,894,921	Jones -----	July 14, 1959
2,913,417	Weeks -----	Nov. 17, 1959

FOREIGN PATENTS

783,585	Great Britain -----	Sept. 25, 1957
799,421	Great Britain -----	Aug. 6, 1958

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,156,655

November 10, 1964

Willard M. Bright

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Columns 3 and 4, Table II, first column, below line 9, insert -- Sodium Xylene Sulfonate --, and insert the numeral "2" all the way across the table in each column; column 4, line 49, for "penol-ethylene" read -- phenol-ethylene --; column 5, line 16, for "postassium" read -- potassium --.

Signed and sealed this 13th day of April 1965.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents