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3,522,186

ABRASIVE LIQUID DETERGENT COMPOSITIONS
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8 Claims

ABSTRACT OF THE DISCLOSURE

Liquid detergent compositions suitable for cleaning hard surfaces which are capable of supporting particulate materials, e.g. abrasives; said detergent compositions contain tetrapotassium pyrophosphate, water-soluble soap, diethanol amides, water and a rheological modifier selected from the group of methanol and ethanol.

This invention relates to abrasive liquid detergent compositions adapted for cleaning hard surfaces. More particularly, this invention relates to abrasive liquid detergent compositions of improved stability which have yield values of from about 10 to about 200 dynes per square centimeter.

There has been an increasing demand for abrasive, liquid detergent compositions adapted for cleaning hard surfaces. These liquid detergent compositions are provided in convenient form and are specially formulated for this particular cleaning application. To obtain optimum cleaning and consumer acceptance, these detergent compositions must be homogeneous and easily pourable. These compositions should maintain their homogeneity during ordinary storage periods, e.g., four months, and should be stable at both elevated and depressed temperatures. The composition should not separate into layers and the abrasives should not precipitate on standing for protracted periods of time.

Liquid detergent compositions containing potassium pyrophosphate, alkali metal soap and ethanol amides are known (see U.S. Pat. 3,234,138). An abrasive or other particulate material can be added to this system. However, when the system is subjected to variations in temperature and a protracted storage period, these liquid detergent compositions separate into two layers. As these liquid detergent compositions separate, at least a portion of the particulate material is precipitated which creates an unfavorable aesthetic impression and detracts from the efficacy of the detergent composition.

Accordingly, it is an object of this invention to provide abrasive liquid detergent compositions which are stable for protracted periods of time at both depressed and elevated temperatures. A further object of this invention is to provide stable, abrasive liquid detergent compositions in which the particulate material does not precipitate. Yet another object of this invention is the modification of combinations of tetrapotassium pyrophosphate, alkali metal soap and ethanol amide with a rheological modifier to provide liquid detergent systems which exhibit Bingham plastic properties. It is another object of this invention to provide abrasive, liquid detergent compositions in convenient form.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter. It should be understood however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art. All parts, percentages and ratios set forth herein are by weight.

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It has, surprisingly, been discovered, according to the present invention, that the foregoing objects are obtained with a liquid detergent composition consisting essentially of

- (A) a liquid portion, said liquid portion having a yield value of from about 10 to about 200 dynes per square centimeter and consisting essentially of by weight of said liquid portion,
 - (1) from about 10% to about 20% of tetrapotassium pyrophosphate;
 - (2) from about 4% to about 10% of a water-soluble soap wherein the cation of said soap is selected from the group consisting of sodium, potassium and ammonium, and wherein the acyl chains of said soap contain from about 8 to about 18 carbon atoms;
 - (3) from about 4% to about 10% of diethanol amides having acyl chains containing from about 10 to about 16 carbon atoms;
 - (4) from about 45% to about 85% water;
 - (5) from about 0.25% to about 1.5% of a rheological modifier selected from the group consisting of methanol and ethanol; and
- (B) particulate material; said particulate material being suspended in said liquid portion in an amount of from about 5 to about 50 parts of particulate material per 100 parts of said liquid portion, said particulate material having a specific gravity of from about 0.5 to about 3.0 and particle diameters ranging from about 1 to 200 microns.

The tetrapotassium pyrophosphate is added to the detergent composition of this invention as a cleaning aid and as a pH buffer. It has been found that at least about 10% by weight of the liquid portion of the detergent composition should be comprised of tetrapotassium pyrophosphate to insure adequate cleaning. The use of more than 20% tetrapotassium pyrophosphate does not give rise to proportionally increased cleaning and presents some stability problems. To maximize stability and optimize the cleaning characteristics of these detergent compositions, from about 14% to about 18% tetrapotassium pyrophosphate is utilized.

Other detergency builders may be substituted in minor amounts for tetrapotassium pyrophosphate in the practice of this invention. These builder salts include the sodium and potassium salts of triphosphosphate, ethane-1,1-hydroxy-1,1-diphosphonate, ethylenediaminetetraacetates and nitrilotriacetates. The sodium salts of these builders are considerably less soluble than the potassium salts and, therefore, should be used sparingly in this invention to prevent precipitation of part of the builder component.

The water-soluble soaps are added to the composition of this invention because of their excellent cleaning characteristics. These soaps also act as solubilizing agents and as suspending agents in the compositions of this invention. The liquid detergent compositions of this invention contain from about 4% to about 10% of water-soluble soap and, preferably, from about 5% to about 8% of water-soluble soap. The cations of the water-soluble soap utilized in this invention can be selected from the group of cations consisting of sodium, potassium and ammonium. The potassium and ammonium soaps are generally more soluble than the sodium soaps and are, therefore, preferred. The acyl chains of said soap contain from about 8 to about 18 carbon atoms and, preferably, from about 10 to about 16 carbon atoms.

A specially desirable combination of soaps suitable for use in this invention contains 20% potassium soap derived from coconut oil and 80% potassium soap derived from tallow. The compositions of the hydrolyzed

coconut oil and tallow utilized in this invention, in parts by weight, are approximately as follows:

	Parts by weight	
	Coconut	Tallow
Caprylic acid.....	8.2	-----
Capric acid.....	7.0	-----
Lauric acid.....	48.0	-----
Myristic acid.....	17.5	2.0
Palmitic acid.....	8.8	32.5
Stearic acid.....	2.0	14.5
Oleic acid.....	6.0	48.3
Linoleic acid.....	2.5	2.7

The diethanol amide utilized in the detergent compositions of this invention acts both as a cleaning agent and as a suspending agent. From about 4% to about 10% diethanol amide is utilized in this invention. In a preferred embodiment, from about 5% to about 8% of diethanol amide is incorporated into the liquid detergent composition. The acyl chains of the diethanol amides contain from about 10 to about 16 carbon atoms. These acyl chains can be derived from naturally occurring glycerides such as coconut oil or palm oil, or they can be derived synthetically, e.g., by the oxidation of petroleum or by hydrogenation of carbonmonoxide by the Fischer-Tropsch process. It is preferred that these amides contain only slight amounts or no free amine.

Water is present in the compositions of this invention in amounts ranging from about 45% to about 85% by weight of the liquid portion. Preferably, the liquid portion should contain from about 65% to about 75% water.

When the hereinbefore described components are mixed together a two-phase, grainy, turbid emulsion is formed. The continuous phase is apparently comprised primarily of water and tetrapotassium pyrophosphate while the discrete phase is comprised primarily of neat sope, which is a mixture of soap and diethanol amide as hereinbefore described. The continuous phase is extremely watery and does not orient or rigidify either the discrete phase or the composition as a whole. Additionally, this composition is capable of suspending only small amounts of particulate material. When this composition is subjected to ordinary storage conditions, the emulsion splits into two visible, distinct layers and can only be recombined by vigorous shaking. When the emulsion splits, the particulate material precipitates and creates an aesthetically unfavorable impression.

These problems are solved by the addition of from about 0.25% to about 1.5% by weight of the liquid portion, preferably from about 0.75% to about 1.25%, of a rheological modifier selected from the group consisting of methanol and ethanol. Methanol is the preferred rheological modifier in the practice of this invention.

The limits on the amount of rheological modifier, set forth above, must be adhered to strictly to obtain optimum results in this invention. If less than 0.25% of the rheological modifier is utilized in the composition of this invention, the composition remains as a two-phase, grainy, turbid emulsion which is incapable of suspending the desired amounts of insoluble, particulate material. If more than 1.75% of the rheological modifier is utilized, the composition of this invention becomes a one-phase system which will support only minimal amounts of insoluble particulate material. When the rheological modifier is utilized within these limits, however, the composition of this invention appears to be homogeneous and is capable of suspending the desired amounts of particulate material. Maximum stability and optimum suspending characteristics are obtained when the rheological modifier is utilized in amounts within the hereinbefore delineated preferred range.

After the addition of the rheological modifier in the hereinbefore described essential amounts, the compositions can be stored for protracted periods without sep-

aration into layers. Additionally, the composition exhibits a substantial yield value which ranges from about 10 to about 200 dynes per square centimeter, preferably from 50 to 100 dynes per square centimeter. Because of this substantial yield value, large amounts of particulate material can be suspended in this composition. The rheological modifier also clarifies the composition of this invention.

Although not wishing to be bound by any particular theory, it is believed that the particular rheological modifiers hereinbefore described, solubilize a portion of the neat sope (the discrete phase) into the continuous phase. The presence of neat sope in the continuous phase increases the viscosity of that phase and also rigidifies and orients the composition as a whole. The resultant detergent composition has Bingham plastic characteristics; that is, when this composition is subjected to a constantly increasing force, it will not flow until a definite yield point is reached. Because of the resistance to flow of these compositions, they advantageously support particulate material and prevent it from precipitating.

The insoluble particulate material utilized in this invention can comprise abrasives, bactericides or other insoluble particulate matter having particle diameters ranging from about 1 to about 200 microns and a specific gravity of from about 0.5 to about 3.0. It is preferred that the particle diameters of the insoluble, particulate material range between about 2 to about 60 microns. The preferred specific gravity is from about 1.0 to about 2.8.

The abrasives, which can be utilized in this invention, include pumice, pumicite, talc, silica sand, china clay, bentonite, diatomaceous earth, whiting and feldspar. Quartz is the most preferred abrasive compound. Bactericides which can be utilized herein include trifluoromethyl-dichlorocarbaniide and diphenyl bismuth acetate.

The abrasive compounds or other insoluble, particulate materials are thoroughly mixed into the liquid portion of the detergent composition as hereinbefore described. The particulate material will remain suspended in this liquid portion over protracted storage periods. Additionally, the liquid portion will not separate into layers during such storage.

In the practice of this invention, from about 5 parts to about 50 parts of particulate material per 100 parts of the liquid portion can be suspended in said liquid portion. Preferably, from about 8 parts to about 20 parts of particulate material per 100 parts of the liquid portion are included in this liquid detergent composition to obtain maximum benefits of cleaning and stability.

Materials which make the composition of this invention more attractive or more effective may be added if they do not significantly alter the excellent physical properties of this composition. The following are mentioned merely by way of example: soluble sodium carboxymethylcellulose, a tarnish inhibitor such as benzotriazole or ethylenethiourea, sodium alkyl benzenesulfonate wherein the alkyl chain contains from about 10 to about 16 carbon atoms, brighteners, fluorescers, dyes and perfumes.

The abrasive, liquid detergent compositions of this invention are specially formulated for cleaning hard surfaces such as floors, kitchen appliances and kitchen and bathroom fixtures. These compositions can be diluted with water for light cleaning jobs, or for the heavier cleaning jobs, they can be used in the undiluted form.

The following examples merely serve to illustrate the invention in specific detail and when read in conjunction with the foregoing description will aid in determining the full scope of the present invention. The examples are merely illustrative and are not intended to restrict this invention.

EXAMPLE I

The liquid portion of an abrasive, liquid detergent composition was formulated containing, by weight of the liquid portion, 17.6% tetrapotassium pyrophosphate, 7.7%

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lauric diethanol amide, 7.7% potassium soap, 20% of which was derived from coconut oil and 80% of which was derived from tallow, and the balance of the liquid portion was water. The amide, soap and water were first thoroughly mixed and then the tetrapotassium pyrophosphate was added. After mixing the liquid portion for several minutes, 10 parts of quartz per 100 parts of the liquid portion were added and thoroughly mixed into the liquid portion. The quartz had particle diameters of from about 2 to about 60 microns in size and a specific gravity of about 2.65. The product was turbid and opaque.

This composition was allowed to stand on a laboratory bench for about 20 hours. At that time, separate layers in the composition were noticeable. The upper layer, about 10% of the composition, was a clear, liquid while the lower layer was grainy, turbid and opaque.

1.1 percent by weight of the liquid portion of methanol was added to the layered detergent composition described above and the composition was again thoroughly mixed. The composition appeared to be more homogeneous than the original liquid portion described above. The composition, however, remained opaque.

The composition containing methanol was then stored for five months at a constant temperature of 80° F. The product was stable and homogeneous except for a clear, liquid layer at the top of the product comprising less than 1% of the total composition. This layer was barely detectable. At the end of one month, no phase separation could be discerned. The product was opaque and homogeneous. It was especially suited for cleaning hard surfaces.

EXAMPLE II

The liquid portions of abrasive, liquid detergent compositions were prepared in accordance with the procedure described in Example I and contained the following components:

	Percent by weight	
	Composition 1	Composition 2.6
Tetrapotassium pyrophosphate.....	17.6	17.6
Amid (see Example I).....	5.5	5.5
Sodium soap ¹	5.5	5.5
Potassium toluene sulfonate.....	1.1	1.1
Methanol.....		1.1
Water to 100%.....		

¹ Derived 80% from tallow and 20% from coconut oil.

Ten parts of quartz as described in Example I per 100 parts of the respective liquid portions were thoroughly mixed into the compositions. The compositions were smooth, homogeneous and opaque.

These compositions were maintained at 80° F. for four weeks. At this time, it was found that composition 1 had split into two distinct layers. The top layer comprised about 30% of the composition and was clear. The bottom layer comprised about 70% of the composition and was grainy, opaque and turbid.

Composition 2 was a smooth, homogeneous, opaque product. There was no evidence of layering. This composition was especially suited for cleaning hard surfaces.

EXAMPLE III

The liquid portion of an abrasive, liquid detergent composition was prepared according to the procedure set forth in Example I:

	Percent by weight
Tetrapotassium pyrophosphate	17.6
Potassium tallow soap hydrogenated to an iodine value of 40.4	5.5
Amide (see Example I)	5.5
Methanol	1.1
Water	Balance

Ten parts of quartz as described in Example I were then added to this liquid portion per 100 parts of the liquid portion. The resulting composition was smooth, homogeneous and opaque.

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The composition was frozen solid at a temperature of about 0° F. and maintained in a frozen state for one day. It was then warmed to 80° F. and stored at a constant temperature of 80° F. for two weeks. No separation was noticeable and no quartz abrasive settled to the bottom of the container.

Another sample was stored at 80° F. for four weeks without being frozen first. No layering was noticeable. The composition was smooth, opaque and homogeneous. It was especially suited for cleaning hard surfaces.

EXAMPLE IV

Other compositions are prepared in accordance with the procedure of Example I containing the following components:

	Percent by weight	
	Composition 1	Composition 2
Tetrapotassium pyrophosphate.....	17.6	17.6
Ammonium soap derived from coconut oil.....	5.5	5.5
Amide (see Example I).....	5.5	5.5
Ethanol.....	1.1	1.1
Methanol.....		1.1
Water to 100%.....		

Ten parts of quartz abrasive as described in Example I are added to the above-described liquid portion. These abrasive, liquid detergent compositions are stable for long periods of time and especially suited for cleaning hard surfaces.

The foregoing description of the invention has been presented describing certain operable and preferred embodiments. It is not intended that the invention should be so limited since variations and modifications thereof will be obvious to those skilled in the art, all of which are within the spirit and scope of this invention.

What is claimed is:

1. A liquid detergent composition consisting essentially of:

(A) an aqueous portion, said aqueous portion having a yield value of from about 10 to about 200 dynes per square centimeter and consisting essentially of, by weight of the aqueous portion,

(1) from about 10% to about 20% of tetrapotassium pyrophosphate;

(2) from about 4% to about 10% of water-soluble fatty acid soap wherein the cation of said soap is selected from the group consisting of sodium, potassium and ammonium and wherein the acyl chains of said soap contain from about 8 to about 18 carbon atoms;

(3) from about 4% to about 10% of fatty acid diethanol amides having acyl chains containing from about 10 to about 16 carbon atoms;

(4) from about 45% to about 85% water;

(5) from about 0.25% to about 1.5% of a rheological modifier selected from the group consisting of methanol and ethanol; and

(B) water-insoluble particulate material selected from the group consisting of bactericides and abrasives, said particulate material being suspended in said aqueous portion in an amount of from about 5 to about 50 parts of particulate material per 100 parts of said aqueous portion, said particulate material having a specific gravity of from about 0.5 to about 3 and particulate diameters ranging from about 1 micron to about 200 microns.

2. The liquid detergent composition of claim 1 wherein the tetrapotassium pyrophosphate comprises from about 14% to about 18% by weight of said liquid portion.

3. The liquid detergent composition of claim 1 wherein the water-soluble soap comprises from about 5% to about 8% of said liquid portion; wherein the cation of said soap is selected from the group consisting of potassium and ammonium; and wherein the chain length of

the acyl group is from about 10 to about 16 carbon atoms.

4. The liquid detergent composition of claim 1 wherein the diethanol amide comprises from about 5% to about 8% by weight of said liquid portion.

5. The liquid detergent composition of claim 1 wherein water comprises from about 65% to about 75% of said liquid portion.

6. The liquid detergent composition of claim 1 wherein the rheological modifier comprises from about 0.75% to about 1.25% of said liquid portion.

7. The liquid detergent composition of claim 1 wherein the rheological modifier is methanol.

8. The liquid detergent composition of claim 1 wherein the particulate material is suspended in said liquid portion in an amount of from about 8 to about 20 parts of particulate material per 100 parts of said liquid portion, said particulate material having a specific gravity

of from about 1.0 to about 2.8 and particle diameters ranging from about 2 microns to about 60 microns.

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