Patented Nov. 1, 1949

2,486,921

UNITED STATES PATENT OFFICE

2,486,921

DETERGENT COMPOSITION

David R. Byerly, Wyoming, Ohio, assignor to The Procter and Gamble Company, Ivorydale, Ohio, a corporation of Ohio

No Drawing. Application October 16, 1944, Serial No. 558,961

5 Claims. (Cl. 252—138)

1

This invention relates to cleansing agents and more particularly concerns compositions having markedly improved characteristics rendering them suitable as all-purpose, hard water detergent agents for use both in the household where mildness is desirable and in the laundry where heavy-duty performance is required.

An object of the present invention is to provide a general purpose household detergent composition having superior performance in hard water.

Another object is to provide a synthetic detergent composition that will suds and clean in hard water as well as, or better than, heavy-duty or other detergent compositions of the prior art at a comparable cost.

A further object is to provide a heavy-duty economical detergent composition that will not precipitate as an insoluble curd in hard water either in washing or in rinsing, and will be especially suitable for use in automatic washing machines.

A still further object is to provide a detergent composition which combines the properties of heavy-duty performance, resistance to the formation of curd in hard water, with the property of unusual mildness toward the skin.

Other objects and advantages of the present invention will appear from the detailed description hereinafter set forth.

It has already been suggested to combine synthetic detergents with various phosphates to produce detergent compositions for specific uses, but as far as I am aware no one prior to my invention has discovered the particular combination of substances and proportions that result in a composition combining mildness, stability against deterioration during storage and use, high detergent power, balanced sudsing and detergent efficiency, economy in use, and superior performance in hard water.

As described more fully hereinafter, compositions of my invention comprise essentially a synthetic detergent resistant to the hardness imparting constituents of hard water and from two to five times its weight of an alkali metal tripolyphosphate. Of outstanding interest and of particular value are compositions containing as the synthetic detergent ingredient water-soluble salts of higher aliphatic sulfuric acids containing from eight to eighteen carbon atoms in the alkyl radical and of monoglyceride sulfuric acids of fatty acids having ten to eighteen carbon atoms, which salts have pronounced detergent power in aqueous solution.

In contrast to some of the compositions of

2

the prior art, for example those containing synthetic detergent and orthophosphate, the compositions of the present invention do not form undesirable flocculent precipitates when the same are added to hard water. Precipitates such as those resulting from such prior art compositions collect on the fabrics being washed and render the same dingy or discolored in appearance and are as undesirable as soap curd precipitates formed on addition of soap to hard water.

There are other phosphate-synthetic detergent compositions of the prior art which are free from the undesirable characteristic of forming insoluble compounds with the ingredients imparting hardness to the water during the washing procedure, but which possess another outstanding defect which exhibits itself in the rinsing operation. That is, in the rinsing of fabrics in hard water which have been previously washed with compositions containing synthetic detergent and pyrophosphate, for example, a precipitate of crystalline nature forms and tends to adhere to the cloth being rinsed and to form deposits thereon which render the cloth dingy in appearance, harsh to the feel, and irritating to the skin. Any detergent composition that forms in the rinsing operation this characteristic precipitate with salts of the hard water is highly unsuited for use in certain new automatic type washing machines, in which the clothes are not only laundered but also rinsed and partially dried automatically, because of the tendency of the precipitate to filter out on the clothes as the rinse water is drawn off. The alkali metal tripolyphosphate-detergent compositions of the present invention do not form such a precipitate either on addition to hard water or during the subsequent rinsing of clothes in hard water and therefore they offer an excellent solution to an important problem relative to the use of automatic washers in hard water territories.

Other compositions of the prior art do not have desired stability during use and tend to break down and lose their sudsing and detergent efficiency. Because of this characteristic, synthetic detergent compositions containing metaphosphates, for example, are unsatisfactory for home laundry use where several batches of clothes are successively washed in the same solution.

Aside from the consideration relative to performance, there are other important requirements of a detergent composition which is designed for use in the laundry. One is its economy in use. In order that a synthetic detergent composition may be comparable with other laundry soaps in cost, it is desirable to add a substance which will en-

hance the detergent power of the detergent and at the same time satisfactorily lower the cost. An alkali metal tripolyphosphate is such a material.

Balanced sudsing and detergent power, to which reference has previously been made, is another important characteristic often given relatively minor consideration in the preparation and use of detergent compositions. Although it is not known by the average housewife, sudsing and detergent power are not wholly dependent on each other. In other words, it is entirely possible to produce a composition that will suds profusely but will not clean adequately, or one that will clean adequately but will not suds to the degree usually associated with efficient cleansing. As far as the average housewife is concerned, however, the two characteristics are believed to go hand in hand, and the most readily available test the housewife has for judging whether sufficient detergent has been added to the water for cleansing is by the sudsing characteristics of the solution. If a profuse, stable suds is formed, then it is assumed that there is sufficient detergent for cleansing. Such judgment will result in optimum results with the detergent being employed only when maximum cleansing is coincident with maximum sudsing. Many synthetic detergent compositions of the prior art containing alleged enhancing agents do not have balanced sudsing and detergent characteristics, because when a sufficient amount of enhancing agent has been added to the synthetic detergent to give a composition that will be competitive with heavy-duty laundry soaps in cost, then the sudsing and detergency balance is upset and the composition is either wastefully used because of inadequate suds or is used in insufficient amount for adequate cleansing because of profuse suds. In the compositions of the present invention, that is, those compositions containing from two to five times as much alkali metal tripolyphosphate as synthetic detergent, one will find an efficient, economical, heavy-duty cleansing agent with balanced sudsing and detergent properties.

Many of the alleged enhancing agents of the prior art cannot be employed in sufficiently large amount to give a product competitive with heavy-duty laundry soaps because of the highly alkaline character of the enhancing agents and the attendant detrimental action on the sensitive colors of fabrics and irritating effect on the skin. I have discovered in this connection the surprising fact that although an alkali metal tripolyphosphate is more alkaline than alkyl sulfate detergents, mixtures of these two materials as covered herein are less irritating to the skin than the synthetic detergent without the added tripolyphosphate salt. Patch tests on the skin following a recognized patch test technique support this assertion.

In view of all the conditions that have to be met in economy, sudsing and detergent performance, mildness, etc., I have found that it is necessary to use with the synthetic detergent from two to five times its weight of alkali metal tripolyphosphate.

The invention will be more clearly understood from the following examples in which parts shown are by weight.

Example 1.—50 parts of a commercial synthetic detergent containing as the active ingredient about 40% sodium alkyl sulfate derived from the higher alcohols obtained by the reduction of coconut oil are mixed with 50 parts of sodium tripolyphosphate. In this mixture the amount by weight of sodium tripolyphosphate is about 2½ times the amount by weight of the alkyl sulfate. The composition is an excellent all-purpose detergent agent characterized by balanced sudsing and detergent power and heavy-duty cleansing performance with mildness toward colored fabrics and the skin.

Example 2.—An efficient heavy-duty cleansing composition which is mild toward colored fabrics and the skin in aqueous cleansing solutions may be prepared in the same manner as in Example 1 except that a commercial synthetic detergent containing about 35% of the sodium salt of the sulfuric acid ester of coconut oil monoglyceride is employed.

Example 3.—To 30 parts of the alkyl sulfate detergent employed in Example 1 are added 12 parts of a mixture consisting essentially of about 20% sodium cetyl sulfate and 80% sodium stearyl sulfate (the sodium alkyl sulfate derived from "Stenol") and 72 parts by weight sodium tripolyphosphate. The alkyl sulfate and the tripolyphosphate are in the ratio of 1:3. The composition thus prepared is outstandingly effective in cleansing and sudsing and has a balanced sudsing and detergent action which is unequaled, as far as I am aware, by any synthetic detergent composition of comparable cost.

Example 4.—50 parts of a commercial synthetic detergent paste containing about 28% sodium alkyl sulfate derived from the higher alcohols obtained by the reduction of coconut oil, about 68% water and the balance unsulfated material and inorganic salt are mixed with 45 parts sodium tripolyphosphate. The composition has balanced sudsing and detergent power and is especially suited as an all-purpose cleansing agent for use in the household.

The above examples are not to be construed as limiting the scope of the instant invention and have been made a part of the specification merely for the purpose of exemplifying the manner of preparing preferred compositions coming within the scope of the invention.

I have shown above that my invention comprises essentially a synthetic detergent resistant to lime, magnesia, etc. compounds contained in hard water and from two to five times its weight of an alkali metal tripolyphosphate, the term "alkali metal" being used herein and in the claims to include ammonium as well as the true alkali metals such as sodium and potassium for example. The various synthetic sulfate and sulfonate detergents well known in the art are particularly useful in the practice of my invention, and of outstanding interest in this connection are the water-soluble salts of high molecular aliphatic sulfuric acid esters such as the alkali metal salts of sulfuric acid esters of normal primary aliphatic alcohols having twelve to eighteen carbon atoms, particularly those whose principal active ingredient is a water-soluble salt of lauryl sulfuric acid or oleyl sulfuric acid. Specific examples are the sodium alkyl sulfate obtained from the mixed higher alcohols produced by the reduction of coconut oil, palm kernel oil or other oils of the coconut oil group (a group of tropical nut oils characterized by their high content of combined fatty acids having ten to fourteen carbon atoms) or the sodium alkyl sulfate derived from the higher alcohols of sperm oil.

In addition to the alkyl sulfates above mentioned, water-soluble salts of other aliphatic sul-

furic acids having pronounced detergent power may be converted into detergent compositions of the present invention by the addition thereto of alkali metal tripolyphosphate in the proportions set forth. Thus, for example, water-soluble salts of sulfuric acid esters of higher fatty acid monoglycerides (e. g. sodium salt of the coconut oil fatty acid monoester of 1,2-dihydroxy propane-3-sulfuric acid ester) and of the sulfated higher fatty acid alkylolamides (e. g. sodium salt of sulfated coconut oil fatty acid ethanolamide) may be employed.

Synthetic detergents having a true sulfonate group and possessing a substantial power to wash and cleanse in aqueous solution, such as water-soluble salts of higher mono-fatty acid esters of 1,2-dihydroxy propane-3-sulfonic acid (sodium salt of the coconut oil fatty acid monoester of this sulfonic acid is a specific example) will find use in the practice of the invention. Also, water-soluble salts of higher fatty acid monoesters of lower molecular weight hydroxy alkyl sulfonic acids (e. g. oleic acid ester of the sodium salt of isethionic acid) and of the higher fatty acid amides of lower molecular amino alkyl sulfonic acids (e. g. ammonium salt of oleic acid amide of N-methyl taurine) may be employed. Likewise, heavy-duty detergents may be prepared from synthetic detergents such as the water-soluble salts of the higher alcohol esters of sulfocarboxylic acids (e. g. sodium salt of the lauryl alcohol ester of sulfoacetic acid), higher alkylated benzene sulfonic acids (e. g. potassium salt of the sulfonic acid derived from the condensation product of benzene and a chlorinated kerosene fraction containing predominantly twelve carbon atoms per molecule) and ethers of high molecular alcohols and lower hydroxy sulfonic acids (e. g. monolauryl ether of 1,2-dihydroxy propane-3-sodium sulfonate).

Specific reference to the above detergents is given only for the purpose of illustrating the various types of detergent compounds which can be converted into an all-purpose household washing and cleansing composition by the addition of two to five times their weight of alkali metal tripolyphosphate, and I do not wish to be limited thereto. Although I have pointed out that the higher aliphatic sulfuric acid esters are of particular value and of outstanding interest in the preparation of detergents of this invention, the invention is to be understood as being sufficiently broad to cover the use of all sulfate and sulfonate synthetic detergents which are resistant to the calcium and magnesium salts of hard water and which have sufficient detergent power to be classed as cleansing or laundering agents. In this connection it is to be observed from the preceding description that all of the synthetic detergents above mentioned contain a high molecular alkyl radical, it being understood that the term "alkyl" is used here and in the appended claims to include an unsaturated as well as a saturated open chain monovalent radical.

The invention is not limited to any particular method of mixing the alkali metal tripolyphosphate with the synthetic detergents and it may be incorporated in the detergent in any of the forms in which detergents are manufactured, such as paste, flake, powdered, and spray dried forms. The polyphosphate may be mechanically mixed in, crutched into the detergent in the form of a slurry, or it may be added to a solution of the detergent. Although such ready-for-use mixtures may be manufactured and may be preferable for many purposes, it is likewise within the scope of my invention to add the alkali metal tripolyphosphates to the water prior to the adding of the detergent or vice versa, or to add both the tripolyphosphate and the detergent simultaneously but separately to the water.

While the cleansing agent of the composition of the present invention comprises essentially a mixture of a detergent of the class herein described with a tripolyphosphate, it will be appreciated that the incorporation in the mixture of additional ingredients commonly used with cleansing agents, such as soap, perfume, inorganic salt, etc., is contemplated as part of the instant invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A cleansing and laundering composition characterized by balanced sudsing and detergent power, heavy-duty cleansing performance, stability against deterioration during storage and use, resistance toward the curd-forming ingredients of hard water during washing and rinsing, and mildness toward colored fabrics and the skin, consisting essentially of a mixture of a water-soluble, alkali metal salt of an organic sulfuric reaction product having in its molecular structure a higher molecular alkyl radical having 8 to 18 carbon atoms and a radical selected from the group consisting of sulfonic acid and sulfuric acid ester radicals, the said salt having pronounced detergent power in aqueous solution, and sodium tripolyphosphate, the amount by weight of sodium tripolyphosphate being from two to five times the amount by weight of the water-soluble, alkali metal salt.

2. A cleansing and laundering composition characterized by balanced sudsing and detergent power, heavy-duty cleansing performance, stability against deterioration during storage and use, resistance toward the curd-forming ingredients of hard water during washing and rinsing, and mildness toward colored fabrics and the skin, consisting essentially of a mixture of a water-soluble, alkali metal salt of a higher aliphatic sulfuric acid ester having 8 to 18 carbon atoms in the alkyl radical and having pronounced detergent power in aqueous solution, and sodium tripolyphosphate, the amount by weight of sodium tripolyphosphate being from two to five times the amount by weight of the water-soluble, alkali metal salt.

3. A cleansing and laundering composition characterized by balanced sudsing and detergent power, heavy-duty cleansing performance, stability against deterioration during storage and use, resistance toward the curd-forming ingredients of hard water during washing and rinsing, and mildness toward colored fabrics and the skin, consisting essentially of a mixture of a water-soluble, alkali metal salt of the sulfuric acid esters of higher alcohols obtained by the reduction of an oil of the coconut oil group and sodium tripolyphosphate, the amount by weight of sodium tripolyphosphate being from two to five times the amount by weight of the water-soluble, alkali metal salt.

4. A cleasing and laundering composition characterized by balanced sudsing and detergent power, heavy-duty cleansing performance, stability against deterioration during storage and use, resistance toward the curd-forming ingredients of hard water during washing and rinsing, and mildness toward colored fabrics and the skin, consisting essentially of a mixture of water-solu-

ble, alkali metal alkyl sulfates containing predominantly 12 to 18 carbon atoms in the alkyl radicals and sodium tripolyphosphate, the amount by weight of sodium tripolyphosphate being from two to five times the weight of the said mixture of the water-soluble, alkali metal alkyl sulfates.

5. A cleansing and laundering composition as claimed in claim 1, in which the water-soluble, alkali metal salt of an organic sulfuric reaction product is a water-soluble, alkali metal salt of coconut oil monoglyceride sulfuric acid.

DAVID R. BYERLY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,159,381	Jochum et al.	May 23, 1939
2,296,767	Caryl	Sept. 22, 1942
2,382,165	MacMahon	Aug. 14, 1945
2,383,502	Quimby	Aug. 28, 1945
2,396,278	Lind	Mar. 12, 1946

FOREIGN PATENTS

Number	Country	Date
547,688	Great Britain	Sept. 7, 1942
551,616	Great Britain	Mar. 3, 1943
781,142	France	Feb. 18, 1935