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DETERGENT COMPOSITIONS

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This invention relates to detergent compositions and more particularly to new detergent compositions which can be used at cool water temperatures and achieve the same cleaning levels generally associated with conventional laundering situations in which hot water is employed. The method of laundering with such new compositions also forms an embodiment of this invention.

Home laundering washes generally use water which has been heated up to a temperature range of between 110° and 150° F. The average temperature range is believed to be between 120° and 130° F. These high temperatures are employed because the synthetic detergent compositions which are most widely used at the present time are ineffective to clean soiled clothes at substantially lower temperatures, i.e., temperatures lower than 100° F. Thus, consumers are advised that the cleanest washes are generally obtained by using the hottest water available. It has not been overlooked that such laundering methods entail necessary disadvantages; for instance, the expense of heating water to the required temperatures. Another consequence of washing clothes in very hot water is that many fabrics are adversely affected by such high temperatures. Washing of woolens, for example, in hot water will cause excessive shrinkage and wrinkling, and otherwise adversely affect the "feel" of the fabrics. Among the new synthetic fibers being presently produced, only a few of them can safely be washed by conventional methods. Nylon, Dacron, silks and wash-wear fabrics such as Creslan, resin-treated cottons and fabrics made from Kodel polyester fibers are among those which are adversely affected when washed at hot water temperatures. It is also generally acknowledged that when these more sensitive materials and fabrics are washed at lower temperatures, women invariably add an excessive amount of the detergent composition in an attempt to compensate for the recognized inability of most detergent compositions to wash clothes as clean at cooler temperatures, i.e., below 100° F. The same general remarks are applicable towards dishwashing situations as well as other washing needs around a home where good cleaning results are known to require inordinately hot water.

Additionally, in many areas of the world clothes washing and other laundry tasks are commonly performed at temperatures below 100° F. using comparatively crude methods. At these cool water temperatures, as previously mentioned, the most commonly used synthetic detergent compositions have only moderate detergency power. As a result wastefulness is promoted for the reason that excess detergent material is then used in an effort to compensate for the detergent's limited cleaning power and to achieve a higher cleaning performance. It is a principal object of this invention to provide a detergent composition free of the foregoing described disadvantages. It is another object to provide a novel detergent composition that will clean as well in cool water as conventional compositions do at normally high washing temperatures, The term "cool water" as used herein is defined to mean water which is at a temperature ranging from about 40° F. to about 100° F. A yet further object is to provide a cool water detergent composition which, while providing exceptionally high detergency levels, will, nevertheless,

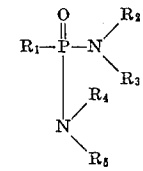
make it possible for consumers to make substantial savings both in their water heating expenses and by using a normal rather than an excess amount of detergent composition. Moreover, the invention has as its object to provide a new method of laundering soiled clothes and fabrics including woolens and synthetic fabrics that heretofore have generally required special attention and handling as well as specially designed "mild" detergent compositions.

Other objects will become apparent from the ensuing description of the present invention.

The present invention is based on the unexpected discovery of the cool water cleaning behavior of compositions containing the members of a class of compounds having the following general formula,

$$R_1P(O)(NR_2R_3)(NR_4R_5)$$

and structurally represented as



wherein R_1 is an alkyl radical containing from about 10 to 18 carbon atoms and wherein R_2, R_3 R_4 and R_5 are each selected from the group consisting of hydrogen and methyl, ethyl, propyl, isopropyl, 2-hydroxyethyl, 2-hydroxypropyl, 3-hydroxypropyl and 2,3-dihydroxypropyl radicals.

It has now been discovered that compositions containing the compounds just described possess exceptional cleaning power at the cool water temperatures defined above. Of the broad class of compounds, best results are obtained when the R_1 component contains between 12 and 16 carbon atoms and R_2, R_3, R_4 and R_5 are selected from hydrogen and methyl and ethyl radicals. A preferred embodiment regarding the outstanding cool water detergency levels involves compositions containing the compound in which R_1 is dodecyl, R_2 and R_4 are hydrogen, and R_3 and R_5 are methyl. Such a compound is technically named N,N'-dimethyl dodecylphosphonic diamide.

Examples of other compounds corresponding to the above description which are good actives for cool water detergent compositions are:

Dodecylphosphonic diamide
N,N'-dimethyl decylphosphonic diamide
Tetradecylphosphonic diamide
N,N'-dimethyl tetradecylphosphonic diamide
Hexadecylphosphonic diamide
N,N'-dimethyl hexadecylphosphonic diamide
N,N'-dimethyl octadecylphosphonic diamide
N,N'-diethyl dodecylphosphonic diamide
N,N'-diethyl tetradecylphosphonic diamide
N,N'-diethyl hexadecylphosphonic diamide
N,N'-diethyl octadecylphosphonic diamide
N,N-dimethyl N'N'-diethyl dodecylphosphonic diamide
N-methyl N'-ethyl dodecylphosphonic diamide
N,N'-bis(2-hydroxypropyl) dodecylphosphonic diamide
N,N'-diisopropyl tetradecylphosphonic diamide
N,N'-bis(2-hydroxyethyl) dodecylphosphonic diamide
N,N,N',N',-tetrakis(2-hydroxyethyl) dodecylphosphonic diamide

The long chain aliphatic substituent of the diamide compound can be obtained from synthetic or natural sources. A suitable natural source of the R_1 predominantly C_{12} component is the middle cut of distilled coconut fatty alcohol which also contains a mixture of various chain lengths; for example, 2% C_{10}, 66% C_{12}, 23%

C_{14} and 9% C_{16}. A convenient natural source of longer R_1 components is tallow fatty alcohol which consists of a mixture of various chain lengths, being approximately 66% C_{18}, 30% C_{16}, 2% C_{14} and minor percentages of others.

While the class of diamide compounds just described can be employed alone as cool water detergent compounds, more outstanding performances are obtained when the diamides are mixed with other ingredients which enhance the cleaning power of detergent compounds.

The present invention, therefore, contemplates detergent compositions consisting essentially of a water soluble inorganic alkaline builder salt or a water soluble organic alkaline sequestrant builder salt and a member of the class of diamide compounds having the general formula of $R_1P(O)(NR_2R_3)(NR_4R_5)$, wherein the radical substituents are as above described, which composition consists essentially of such a diamide and a builder salt or a mixture of builder salts in a ratio of diamide to total builder of about 4:1 to about 1:20. The preferred ratio of diamide to builder compounds is 1:1 to about 1:10. The ratios and percentages referred to in this invention are all by weight, unless otherwise noted.

The alkylphosphonic diamide compounds described above behave equally well in built granular or tablet detergent compositions as well as built liquid detergent compositions. Granular detergent compositions offering outstanding cool water washing performance can contain from 8 to 50% by weight of the diamide compound, the balance substantially being a selected builder material or mixtures of builders. Best results are obtained when 15% to 35% by weight of the diamide is used, with the balance essentially being the builder compounds.

Liquid detergent compositions prepared according to this invention can contain from 2% to 25% by weight of the diamide compound, preferably 8% to 18%, and the remainder comprising substantially a builder compound and a liquid medium vehicle as hereinafter more fully described.

Water-soluble inorganic alkaline builder salts which can be used in this invention alone or in admixture are alkali metal carbonate, borates, phosphates, polyphosphates, bicarbonates and silicates. Ammonium or substituted ammonium salts of these materials can also be used. Specific examples of suitable salts are sodium tripolyphosphate, sodium carbonate, sodium tetraborate, sodium and potassium pyrophosphate, sodium and ammonium bicarbonate, potassium tripolyphosphate, sodium hexametaphosphate, sodium sesquicarbonate, sodium orthophosphate and potassium bicarbonate. Such inorganic builder salts enhance the detergency of the subject alkylphosphonic diamides. The preferred inorganic alkaline builders in this invention are alkali metal tripolyphosphates and pyrophosphates.

Examples of suitable organic alkaline sequestrant builder salts used in this invention alone or in admixture are alkali metal, ammonium or substituted ammonium, aminopolycarboxylates, e.g., sodium and potassium ethylenediaminetetraacetate, sodium and potassium N-(2-hydroxyethyl)-ethylenediaminetriacetates, sodium and potassium nitrilotriacetates and sodium, potassium and triethanolammonium N-(2-hydroxyethyl)-nitrilodiacetates. Mixed salts of these polycarboxylates are also suitable. The alkali metal salts of phytic acid, e.g., sodium phytate are also suitable as organic alkaline sequestrant builder salts (see U.S. Patent 2,739,942).

The diamide compounds of the compositions of this invention may be used in combination with other detergent compounds such as anionic, nonionic and zwitterionic organic detergent surfactant compounds with very good detergency results. When it is desired to use the diamides of this invention in combination with another auxiliary detergent compound, the ratio of diamide to such other detergent compound is about 10:1 to 1:5. If for any reason, it is desired to use a diamide-supplemental detergent mixture as the active portion of a cleaning composition, the ratio of such a mixture to the builder salt should be within the previously prescribed range of 4:1 to 1:20. A composition prepared along these lines can contain from 4% to 50% of such a mixture and 5% to 85% of a builder salt selected from water soluble inorganic alkaline builder salts, water soluble organic sequestrant builder salts, and mixtures thereof.

Examples of suitable soap detergents which can be used along with the diamides if desired are the sodium, potassium, ammonium and alkylolammonium salts of higher fatty acids (C_{10}–C_{20}). Particularly useful are the sodium and potassium salts of the mixtures of fatty acids derived from coconut oil and tallow, i.e., sodium or potassium tallow and coconut soap. Examples of anionic organic non-soap detergents are: alkylglycerylethersulfonates; alkyl sulfates; alkyl monoglyceride sulfates or sulfonates; alkylpolyethenoxy ether sulfates; acylsarcosinates; acyl esters of isethionates; N-acyl-N-methyl taurides, alkylbenzenesulfonates; and alkylphenol polyethenoxy sulfonates. In these compounds the alkyl and acyl groups, respectively, contain 10 to 20 carbon atoms. They are used in the form of water soluble salts, the sodium, potassium, ammonium, and alkylolammonium salts, for example. Specific examples are: sodium lauryl sulfate; potassium N-methyl-N-lauroyl tauride; triethanolammonium dodecylbenzenesulfonate.

Examples of nonionic organic detergents which can be used in the compositions of this invention if desired are: polyethylene oxide condensates of alkylphenols wherein the alkyl group contains from 8 to 15 carbon atoms (e.g., t-octylphenol) and the ethylene oxide is present in a molar ratio of ethylene oxide to alkylphenol in the range of 8:1 to 20:1, condensation products of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylene diamine wherein the molecular weight of the condensation products ranges from 5000 to 11,000; the condensation products of from about 5 to 30 moles of ethylene oxide with one mole of a straight or branched chain aliphatic alcohol containing from 8 to 18 carbon atoms (e.g., lauryl alcohol); C_{10}–C_{18} alkyl di-(C_1–C_2 alkyl) amine oxides (e.g., dodecyldimethylamine oxide).

The zwitterionic synthetic detergent surfactant compounds which can be used are broadly described as derivatives of aliphatic quaternary ammonium compounds, in which the aliphatic radical can be straight chain or branched and wherein one of the alpihatic substituents contains from about 8 to about 18 carbon atoms and one contains an anionic water solubilizing group, e.g., carboxy, sulfo, or sulfato. Examples of compounds falling within this definition are: 3-(N,N-dimethyl-N-hexadecylammonio)-propane-1-sulfonate and 3-(N,N-dimethyl-N-hexadecylammonio)-2-hydroxypropane-1-sulfonate.

In a liquid detergent formulation the diamide and an auxiliary detergent surfactant can be combined in the ratio of diamide to said surfactant of about 5:1 to 1:5. A preferred ratio of diamide to surfactant is about 2.5:1 to 1:2. A sample liquid detergent composition based on a diamide-nonionic mixture in such porportions, can have the following compositions: from about 2% to 25% of the alkylphosphonic diamide compound, from about 2% to about 25% of a nonionic synthetic detergent, from about 5% to 25% of an alkaline inorganic builder salt or an alkaline organic sequestrant builder salt, from 0% to about 6% sodium silicate, and from about 2% to about 15% of an alkali metal arylsulfonate hydrotrope, the balance to 100% being water and miscellaneous ingredients. Percentages refer to weight percent of the total formulation unless otherwise indicated.

A granular detergent composition can contain as the active detergent portion of a mixture of diamide and an auxiliary detergent surfactant in the ratio of diamide to said surfactant of about 10:1 to 1:5. A preferred ratio of diamide to such other surfactant is about 2:1 to 1:3. A sample granular formulation can contain 4 to 50% of

the alkylphosphonic diamide, 4 to 50% of an anionic synthetic detergent, 8 to 85% of an inorganic alkaline builder salt, 0 to 30% sodium sulfate, and 0 to 10% sodium silicate, and the balance to 100% of water and miscellaneous ingredients.

The discovery that the compositions containing the diamide compounds described in this invention show exceptional cool water detergency was unpredictable in view of the fact that there is virtually no published theory or background information on the mechanics of cool water detergency. Moreover, conventional compositions containing compounds such as sodium dodecylbenzenesulfonate which are good hot water (130°–140° F.) detergent compounds show a minimum of cleaning activity in cool water. From the published literature one would be led to assume that the diamides of the invention should be, comparatively speaking, as poor as any other conventional detergent compounds when used in cool water; however, as has been discovered, the compositions containing alkylphosphonic diamides of this invention are far more effective in cool water than many of the commonly used commercially available detergent compositions are in hot water. It can, therefore, be seen that the structure of a given detergent compound effective in hot water has little or no relation to the effectiveness of such compounds in cool water.

It has also surprisingly been found that the compounds used in this invention exhibit good detergent properties when used with builders in wash water at very low concentrations. For example, it has been found that the cleaning ability of the preferred N,N-dimethyl dodecylphosphonic diamide at a level of .03% in the presence of 0.06% sodium tripolyphosphate builder in solution decreases only slightly as the concentration of the detergent compound in solution is substantially decreased from 0.03% to 0.01% and the builder stays constant at 0.06%. Compositions containing other common detergent compounds loose their effectiveness at such low concentrations.

It has also been found that the maximum detergency of the compositions of this invention is achieved when the pH of the washing solution, at cool water temperatures, is within the range of about 8 to about 12 with the preferred pH being 9.5 to 11.5. Using normal amounts of water for washing, the desired pH of the solution can be obtained by incorporating into the compositions of this invention a normal amount of silicate, i.e., up to about 8% by weight. The silicate acts as a buffer and also as a corrosion inhibitor.

The washing procedure in the laundering method of this invention can be practiced in a number of different ways so long as the essential detergent composition is used. Preferably the washing step is followed by rinsing and drying the fabrics. For example, the washing solution to be used in the washing step can be prepared by adding the granular or liquid detergent composition prepared according to this invention to a tub or automatic washer or any other container which contains cool water at a temperature ranging from about 40° F. to about 100° F. The detergent composition concentration in solution can range from about .05 to .50% by total weight, and should be added in sufficient amount to provide an alkylphosphonic diamide detergent compound concentration of at least 0.005%. The fabrics can be added to the container or washer before or after the washing solution is added. As is usual in a washing step, the fabrics are then agitated in the detergent solution. The period of time may vary, but it should be sufficient to obtain the maximum amount of cleaning. With an automatic agitator type washer, it has been found that good cleaning can be achieved using a washing cycle which ranges from 8 to 15 minutes.

After cleaning is achieved in the washing step, the washing liquor is then drained off or the fabrics are separated from the liquor and thereafter the fabrics are rinsed in substantially clean water. The fabrics can be rinsed as many times as desired in order to insure that all of the washing liquor is separated from them. Using an automatic washer, it has been found that about four spray rinses and one deep rinse is usually sufficient for this purpose. Between and after rinsing steps, the bulk of the rinse water is usually drawn from, or spun out of the fabrics. After rinsing, the fabrics can be dried by conventional means, using a machine dryer or simply hanging them on a line. Although rinsing and drying are usual and desirable steps, the important advantage of the invention is achieved in the washing step.

In the following described examples there will be mentioned two different methods of testing the effectiveness of the detergent compositions used. These tests will be described herein, and are termed, respectively, the Cloth Swatch Test, and the White Shirt Detergency Test.

CLOTH SWATCH TEST

In a Cloth Swatch Test the detergency effectiveness of the alkylphosphonic diamide compounds of this invention was determined by washing naturally soiled swatches (desized cotton print cloth) for 10 minutes in an aqueous solution of a detergent composition containing the diamide compound to be tested and a builder. (Washing conditions employed were as hereinafter specified.) After washing, rinsing and drying the amount of lipid soil remaining on the swatch was determined by extraction with organic solvent. By comparison with similar determinations of the amount of lipid soil in similarly soiled unwashed swatches, the percent soil removal by the washing treatment can be found. A Tergotometer was used for the washing operation. (Tergotometer testing is described in "Detergency Evaluation and Testing," by J. C. Harris, Interscience Publishers, Inc. (1954), page 60).

WHITE SHIRT DETERGENCY TEST

In addition to the Cloth Swatch Test described above, the detergency effectiveness of the alkylphosphonic diamide compounds utilized in compositions of this invention was evaluated by washing naturally soiled white dress shirts. Shirts carrying detachable collars and cuffs were worn by male subjects under ordinary conditions for two normal working days. Following wearing, the collars and cuffs were washed for 10 minutes in a small agitator-type machine using solutions of the detergent compositions to be evaluated. The washing conditions were as hereinafter specified.

After washing, collars and cuffs from the compositions to be evaluated were visually compared with similar pieces, similarly soiled, and washed in a standard detergent composition. The visual comparison was made by a group of five people who were unfamiliar with the structure and purpose of the test and who formed their judgments independently.

The combined data from the visual judgments were expressed on a scale such that a value of zero represents the cleaning ability of water alone and a value of 10 represents the cleaning ability of an excellent detergent composition used under optimum conditions. On this scale, a value of 5 represents a level of cleaning that is considered acceptable in household practice.

Having described the various methods of testing the cleaning effectiveness of the alkylphosphonic diamide compounds used in this invention, the following described examples will serve to illustrate their detergent power.

Example I

A White Shirt Detergency Test, previously described, was conducted using several commercially available detergent compounds in a formulation (containing the detergent compound to be tested and a builder) in comparison with the detergent compounds provided by this invention. The washing solution contained 0.03% detergent compound and 0.06% sodium tripolyphosphate. (No

fluorescers, bleaches or antiredeposition agents were used.) The washing solution had a pH of 10 and the water was 7 grains per gallon hardness maintained at 80° F. The detergent compounds used in this test were N,N'-dimethyl dodecylphosphonic diamide, one of the preferred compounds of this invention, dimethyldodecylamine oxide, sodium tetrapropylenebenzenesulfonate and sodium tallow alkyl sulfate.

TABLE I.—DETERGENCY RATINGS

[Based on scale of 1 to 10: washing at 80° F.]

Detergent surfactant:	Grade
N,N'-dimethyl dodecylphosphonic diamide	6.3
Dimethyldodecylamine oxide	5.2
Sodium tallow alkyl sulfate	3.2
Sodium tetrapropylenebenzenesulfonate	2.7

Under the test conditions the detergency effectiveness of N,N'-dimethyl dodecylphosphonic diamide in wash water of 80° F. was quite superior to the detergency effectiveness of dimethyldodecylamine oxide at 80° F. and was greatly superior to the detergency effectiveness of sodium tallow alkyl sulfate and sodium tetrapropylenebenzenesulfonate at 80° F. Moreover, the detergency effectiveness of N,N'-dimethyl dodecylphosphonic diamide in wash water of 80° F. was quite superior to the detergency effectiveness of sodium tetrapropylenebenzenesulfonate at 140° F. The respective ratings of the diamide (at 80° F.) and the sulfonate (at 140° F.) were 6.3 and 5, notwithstanding the very marked difference in the washing temperatures.

Similar comparative results are obtained if, in the White Shirt Detergency Test, an organic alkaline sequestrant builder salt, sodium ethylenediaminetetraacetate or potassium nitriloacetate, is used instead of the sodium tripolyphosphate.

Example II

Here a Cloth Swatch Test, previously described, was conducted under the following conditions: water at a temperature of 80° F. or 140° F. and 7 grains per gallon hardness, 0.03% detergent compound and 0.06% sodium tripolyphosphate builder concentration in the washing solution. No fluorescers, bleaches, or antiredeposition agents were used. The detergent washing solution had a pH of 10.

	Lipid removal based on cloth swatches	
	Percent removal	Washing solution temperature, ° F.
A. N,N'-dimethyl dodecylphosphonic diamide	63.2	80
B. Sodium tallow alkyl sulfate	66.0	140
C. Sodium tetrapropylenebenzene-sulfonate	64.0	140
D. Sodium tallow alkyl sulfate	56.9	80
E. Sodium N-methyl-N-oleoyl taurate	55.2	80
F. Sodium tetrapropylenebenzene-sulfonate	50.7	80

It can be seen that the diamide compound, A, of the present invention, exhibits superior lipid soil removing properties in cool water (80° F.) compared to the commonly used commercial detergent compounds. In water at 80° F., in this particular test, the diamides are about equal to commercial detergent compounds used in water at 140° F.

Substantially the same performance advantages are observed by the housewife when doing the home laundry in water ranging from 40° to 100° F., using conventional procedures. Woolens and synthetic fibers washed in the same manner are cleaned as efficiently when washed according to the process of this invention and using the compositions of this invention as they would be if they were washed in conventional detergent compositions at hot water temperatures, yet a minimum of shrinkage and wrinkling takes place and the feel of the wool is preserved to a greater extent.

While the compositions of this invention are outstandingly effective in water at a temperature ranging from 40° F. to 100° F. the preferred temperature range is about 60° F. to 100° F. Below about 60° F. it has been found that the granular detergent compositions of this invention are slow to dissolve, consequently it is preferred to use the liquid compositions at such lower temperatures.

The following compositions will illustrate the manner in which the invention can be practiced. Included are both liquid and granular formulations. It will be understood, however, that the examples are not to be construed as limiting the scope of conditions claimed hereinafter. These compositions are useful in automatic washers and conventional type washers as well as hand washing operations to cleanse fabrics.

SOLID

	Percent
N,N'-dimethyl dodecylphosphonic diamide	17.5
Sodium tripolyphosphate	50.0
Sodium xylenesulfonate	5.0
Fluorescent dye	.16
Sodium silicate ($Na_2O:SiO_2$=1:2.5)	7.9
Perfume	.2
Benzotriazole	.02
Sodium sulfate	14.22
Water	5.0

LIQUID

N,N'-dimethyl dodecylphosphonic diamide	12.0
Tetrapotassium pyrophosphate	20.0
Sodium silicate ($Na_2O:SiO_2$=1:1.6)	3.8
Potassium toluenesulfonate	8.5
Sodium carboxymethyl hydroxyethyl cellulose	.3
Fluorescent dye	.12
Perfume	.15
Benzotriazole	.02
Water	55.11

LIQUID

N,N'-dimethyl dodecylphosphonic diamide	22.0
Tetrapotassium pyrophosphate	19.0
Sodium silicate ($Na_2O:SiO_2$=1:1.6)	3.8
Potassium toluenesulfonate	8.5
Sodium carboxymethyl hydroxyethyl cellulose	.3
Perfume	.2
Benzotriazole	.02
Water and minor amounts of miscellaneous ingredients	46.18

SOLID

N,N'-dimethyl dodecylphosphonic diamide	35.0
Sodium tripolyphosphate	35.0
Sodium silicate ($Na_2O:SiO_2$=1:2.5)	6.0
Sodium toluenesulfonate	2.0
Sodium carboxymethyl cellulose	.3
Sodium sulfate	10.0
Water	11.0
Miscellaneous ingredients	Balance

SOLID

Sodium dodecylbenzenesulfonate	15.0
N,N'-dimethyl dodecylphosphonic diamide	20.0
Sodium tripolyphosphate	35.0
Sodium silicate ($Na_2O:SiO_2$=1:2.5)	6.0
Sodium toluenesulfonate	2.0
Sodium carboxymethyl cellulose	.3
Sodium sulfate	10.0
Water	11.0
Miscellaneous ingredients	Balance

LIQUID

N,N'-dimethyl dodecylphosphonic diamide	15.0
Dodecyldimethylamine oxide	6.0
Tetrapotassium pyrophosphate	20.0
Sodium silicate ($Na_2O:SiO_2$=1:1.6)	3.8
Potassium toluenesulfonate	8.5
Sodium carboxymethyl hydroxyethyl cellulose	.3
Perfume	.2
Benzotriazole	.02
Water and minor amounts of miscellaneous ingredients	46.18

SOLID

N,N'-dimethyl dodecylphosphonic diamide	6.0
3-(N,N'-dimethyl-N-hexadecyl ammonio) propane-1-sulfonate	18.0
Sodium tripolyphosphate	46.0
Sodium silicate ($Na_2O:SiO_2$=1:2.5)	6.0
Sodium toluenesulfonate	2.0
Sodium carboxymethyl cellulose	.3
Sodium sulfate	10.0
Water	11.0
Miscellaneous ingredients	Balance

It will be appreciated that the diamide compounds used in the present invention can be incorporated into other liquid or granular detergent compositions with suitable adjustments being made in the other components.

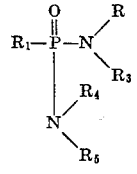
Materials which are considered normal and desirable additives in liquid or granule detergent compositions can also be added to the compositions of this invention without substantially modifying the basic characteristics of the diamide detergent surfactants. For example, a tarnish inhibitor such as benzotriazole or ethylene thiourea may be added in amounts up to about 1%. Fluorescers, perfume, color, antiredeposition agents, thickening agents, opacifiers, and blending or viscosity control agents, while not essential in the compositions of this invention, may also be added.

The diamide compounds used in the compositions of this invention have been found not only to have excellent cool water detergency characteristics but they also possess good warm or hot water detergency properties.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.

What is claimed is:

1. A cleaning and detergent composition having superior cool water washing ability consisting essentially of a detergent compound having the following general formula



wherein R_1 is an alkyl radical containing from about 10 to 18 carbon atoms and wherein R_2, R_3, R_4 and R_5 are each selected from the group consisting of hydrogen and methyl, ethyl, propyl, isopropyl, 2-hydroxyethyl, 2-hydroxypropyl, 3-hydroxyproply, and 2,3-dihydroxypropyl radicals, and at least one builder material selected from the group consisting of sodium tripolyphosphate, sodium carbonate, sodium tetraborate, sodium pyrophosphate, sodium bicarbonate, sodium hexametaphosphate, sodium sesquicarbonate, sodium orthophosphate, sodium ethylenediaminetetraacetate, sodium N-(2-hydroxyethyl)-ethylene-diaminetriacetate, sodium nitrilodiacetate, sodium phytate and the corresponding potassium, ammonium and substituted ammonium salts, the ratio of said detergent compound to said builder material being in the range of about 4:1 to about 1:20.

2. The detergent composition of claim **1** wherein R_1 contains from 12 to 16 carbon atoms, R_2 and R_4 are hydrogen and R_3 and R_5 are methyl radicals.

3. The detergent composition of claim **1** which provides a pH in aqueous solution of from about 8 to about 12.

4. The detergent composition of claim **1** wherein the ratio of said detergent compounds to said builder is 1:1 to 1:10.

5. The composition of claim **1** wherein the builder material is sodium tripolyphosphate.

6. The composition of claim **1** wherein the builder material is potassium pyrophosphate.

7. The composition of claim **1** wherein the builder material is sodium ethylenediaminetetraacetate.

8. The composition of claim **1** wherein the builder material is potassium nitrilotriacetate.

9. The detergent composition of claim **2** in which R_1 is dodecyl.

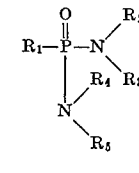
10. The detergent composition of claim **3** wherein the preferred pH range is between about 9.5 and 11.5.

11. A detergent composition for use in cool water washing situations consisting essentially of N,N'-dimethylalkylphosphonic diamide wherein the alkyl radical contains from 10 to 18 carbon atoms and a detergent builder salt which is sodium tripolyphosphate, the ratio of said diamide to said builder salt being in the range of about 4:1 to about 1:20.

12. The detergent composition of claim **11** wherein the alkyl radical is dodecyl.

13. A built detergent composition providing cool water washing levels comparable or superior to conventional detergent compositions at hot water temperatures consisting essentially of 4 to 50% of a mixture of an N,N'-dimethylalkylphosphonic diamide in which the alkyl radical contains from 10 to 18 carbon atoms and an organic detergent surfactant selected from the group consisting of sodium dodecylbenzenesulfonate, dodecyldimethylamine oxide, and 3-(N,N'-dimethyl-N-hexadecyl ammonio) propane-1-sulfonate, the ratio of the diamide to said organic detergent surfactant being in the range of 10:1 to 1:5 and from 5 to 85% of a builder salt which is sodium tripolyphosphate.

14. A method of laundering comprising the step of washing fabrics in cool water, said water having a temperature ranging from about 40° F. to about 100° F., and containing a detergent composition consisting essentially of a detergent compound having the following general formula:



wherein R_1 is an alkyl radical containing from about 10 to 18 carbon atoms and wherein R_2, R_3, R_4 and R_5 are each selected from the group consisting of hydrogen and methyl, ethyl, propyl, isopropyl, 2-hydroxyethyl, 2-hydroxypropyl, 3-hydroxypropyl, and 2,3-dihydroxypropyl radicals, and at least one builder material selected from the group consisting of sodium tripolyphosphate, sodium carbonate, sodium tetraborate, sodium pyrophosphate, sodium bicarbonate, sodium hexametaphosphate, sodium sesquicarbonate, sodium orthophosphate, sodium ethylenediaminetetraacetate, sodium N-(2-hydroxyethyl)-ethylenediaminetriacetate, sodium nitrilotriacetate, sodium N-(2-hydroxyethyl)-nitrilodiacetate, sodium phytate, and the corresponding ammonium and substituted ammonium salts, the ratio of said detergent compound to said builder material being in the range of about 4:1 to about 1:20.

15. The method of claim 14 in which the detergent compound is N,N'-dimethyl alkylphosphonic diamide wherein the alkyl radical ranges from 12 to 16 carbon atoms.

16. The method of claim 14 in which the detergent compound is N,N'-dimethyl dodecylphosphonic diamide.

17. The method of claim 14 wherein the wash water is preferably at a temperature between about 60° F. and 90° F.

18. The method of claim 14 wherein the pH of the washing solution is from about 8 to about 12.

19. The method of claim 14 wherein the pH of the washing solution is from about 9.5 to 11.5.

No references cited.

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