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LAUNDRY DETERGENT COMPOSITIONS CONTAINING A PERBORATE AND A PEROXYMONOPERSULFATE

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ABSTRACT OF THE DISCLOSURE

Solid laundry detergent compositions containing an anionic or non-ionic detergent; an alkaline builder, preferably a phosphate such as sodium tripolyphosphate or tetrasodium pyrophosphate; and 1.5 to 30 weight percent of a mixture of sodium perborate and a water-soluble peroxymonosulfate, in which mixture the weight ratio of peroxymonosulfate active oxygen:perborate active oxygen is from 1:8 to 1:1.

BACKGROUND OF THE INVENTION

It has long been known to include sodium perborate in solid home laundry detergent compositions to impart some bleaching properties to the composition. The amount of sodium perborate used is generally rather small since its intended function is not to remove heavy stains in a single wash, but rather to provide just sufficient bleaching in each wash to prevent or retard the build-up of colored impurities which, in the absence of a bleaching agent, tend to accumulate on the fabric during many washings. The loss of whiteness due to the accumulation of such impurities may not be noticeable over one or two washings, but over the life of the fabric an initially white fabric often acquires a gray or yellowish cast. Most detergent products contain optical brighteners which tend to cover up these colored impurities, but eventually the level of impurities becomes sufficient so that a visibly less white fabric results. By having present a small amount of sodium perborate in the detergent composition, enough bleaching is provided in each wash to prevent or greatly retard the build-up of colored impurities so that substantially the original whiteness may be retained over many washings. The presence of sodium perborate also is beneficial in assisting to maintain the original shade of color in the fabrics.

Any bleaching agent incorporated into a laundry detergent composition must be one which will not damage the fabric or its colors and it must be compatible with the usual optical brighteners whose presence in such compositions is generally desirable. Various types of bleaching agents have been proposed, but only those which are peroxygen compounds and contain active oxygen satisfy these requirements. Other bleaching compounds, particularly those containing active chlorine, tend to degrade many fabrics and react with some to cause "yellowing." The most preferred peroxygen compounds proposed for use in detergent compositions are the sodium perborates and the water-soluble peroxymonosulfates, particularly potassium peroxymonosulfate in the form of its triple salt with potassium bisulfate and potassium sulfate.

Although most home laundry washing is done at 120–130° F., it would be preferable to have a detergent bleach product that would be effective over a wider temperature range, e.g., from room temperature to 160° F. or higher. The above mentioned potassium peroxymonosulfate triple salt product costs about twice as much as sodium perborate tetrahydrate and has only about half the active oxygen content of the latter. Nevertheless, based on bleaching

performance at equal cost, both agents give somewhat similar bleaching results although the triple salt product gives substantially superior results at temperatures below about 160° F. to those obtained with sodium perborate. At temperatures above 160° F., the perborate is equal to or superior to the triple salt product in performance at an equal cost basis.

Commercially available peroxygen products comprising peroxymonosulfates, particularly the potassium peroxymonosulfate triple salt, are usually highly acidic and react with the alkaline builders commonly employed in detergent compositions and therefore interfere with efficient detergency. Acidic additives would neutralize part of the alkaline builders. This is a distinct disadvantage characteristic of such peroxymonosulfate products. A distinct disadvantage of perborate bleaching agents is that their effectiveness is markedly lowered as the washing temperature is lowered. Many proposals have been made involving the use of sodium perborate in conjunction with so called "promoters" whose function is to promote the bleaching activity of the perborate, particularly at the relatively low temperatures used in home laundry operations where automatic washers are employed. Such promoters are quite expensive. Insofar as is known to applicant, no simple inexpensive and practically effective method has been heretofore proposed for improving the bleaching activity resulting from the use of either of the above type peroxygen compounds.

Obviously, it would be highly desirable to have available for fabric laundering uses, particularly in home laundering operations employing automatic washers, detergent compositions which include a bleaching component which would provide more effective bleaching than presently used perborate/detergent compositions provide and over a relatively wide range of temperatures, including room temperatures, and which would minimize the amount of acidic materials added to the detergent composition. The present invention provides such detergent compositions.

SUMMARY OF THE INVENTION

The invention of this application provides improved solid laundry detergent compositions comprising an anionic or a non-ionic detergent, preferably the former, an alkaline builder, preferably of the sodium tripolyphosphate and/or tetrasodium pyrophosphate type; and from 1.5 to 30, preferably 3 to 15, weight percent of a mixture of a sodium perborate, preferably sodium perborate tetrahydrate, and a water-soluble peroxymonosulfate, preferably the triple salt of potassium peroxymonosulfate with potassium bisulfate and potassium sulfate of the formula $2KHSO_5 \cdot KHSO_4 \cdot K_2SO_4$, in which mixture the weight ratio of peroxymonosulfate active oxygen to perborate active oxygen is 1:8 to 1:1.

DETAILED DESCRIPTION AND PREFERRED EMBODIMENTS

Except for the mixture of sodium perborate and peroxymonosulfate used therein, the solid laundry detergent compositions of the invention will be composed of those materials which are normally incorporated in detergent compositions of this general type. These will include as essentials an organic anionic or non-ionic detergent and a water-soluble alkaline builder.

Any of the anionic detergents commonly employed in formulating solid laundry detergent compositions may be employed in formulating the compositions of the invention. Included are the common water-soluble soaps such as the sodium and potassium salts of the higher fatty acids, e.g., acids derived from tallow, lard, coconut oil and other animal and vegetable oils, and various synthetically produced fatty acids. Preferably, however, the

anionic detergent will be a sodium, potassium, ammonium or an alkylolammonium alkyl glyceryl ether sulfonate, alkyl sulfate, alkyl monoglyceride sulfate or sulfonate, alkylpolyethenoxy ether sulfate, acyl sarcosinate, alkylbenzene sulfonate or an alkyl phenol polyethenoxy sulfonate, in which compounds any alkyl or acyl group will be a long chain group containing from 10 to 20 carbon atoms. Specific examples of such compounds are sodium dodecylbenzenesulfonate and sodium lauryl sulfate; the sodium and potassium fatty acid monoglyceride sulfates; triethenolamine dodecylbenzene sulfonate; and the sodium and potassium salts of alkyl phenol polyethenoxy sulfonates.

Examples of non-ionic organic detergents which can be used in formulating the detergent compositions of the invention, alone or in admixture with anionic detergents such as those indicated above, are the condensates of ethylene oxide with alkyl phenols wherein the alkyl group contains 6 to 12 carbon atoms and in which condensates the ethylene oxide is present in a molar ratio to the alkyl phenol in the range of 10:1 to 45:1; the condensation products of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylene-diamine; the condensation products of ethylene oxide with a long chain (8 to 18 carbon atoms) alcohol, e.g., lauryl alcohol; and the C_{10}–C_{18} alkyl dimethyl or diethyl amine oxides.

The water-soluble inorganic alkaline builder component of the detergent composition may be any of the alkaline builders commonly employed in detergent compositions of this general type. They include the alkali metal carbonates, borates, phosphates and silicates, specific examples of which are sodium carbonate, borax, tetrasodium pyrophosphate, sodium tripolyphosphate, potassium tripolyphosphate, sodium hexametaphosphate, and sodium mono- and diortho-phosphates. The phosphate builders, particularly sodium tripolyphosphate and tetrasodium pyrophosphate are generally preferred. The alkaline builder component should generally be present in proportions sufficient to yield wash solutions having an alkalinity within the range pH 8.5 to 10 when the detergent composition is employed in the usual amounts in home laundering operations, which amounts generally will provide a concentration of the organic detergent in the wash solution of from around 0.02 to 0.5% by weight.

The detergent compositions of the invention most generally also will contain an inert filler such as sodium sulfate. The composition will also generally and preferably contain an optical brightener and an anti-soil-redeposition agent such as carboxymethylcellulose. Still other adjuvants may also be present such as suds builders, suds depressors, etc. Heavy metal ion sequesterants such as the alkali metal and ammonium aminopolycarboxylates, e.g., the sodium, potassium and triethanolammonium salts of ethylenediaminetetraacetic acid, N-(2-hydroxyethyl)-ethylenediaminetriacetic acid, nitrilotriacetic acid, and diethylenetriamine pentaacetic acid, can beneficially be included since they tend to stabilize the perborate and peroxymonosulfate components against decomposition due to the presence of heavy metal ion impurities.

The sodium perborate component of the composition of the invention may be any of the known forms of sodium perborate, the most common of which is represented by the formula $NaBO_3 \cdot xH_2O$ in which x is 1, 3 or 4. However, other sodium perborates such as those disclosed in Young U.S. Pat. 2,491,789 may also be used. The most common of the sodium perborates is sodium perborate tetrahydrate, $NaBO_3 \cdot 4H_2O$, and its use is generally preferred because it is the cheapest of the sodium perborates and gives excellent results.

The peroxymonosulfate component of the present compositions may be any of the solid reasonably stable water-soluble solid peroxymonosulfates. Potassium peroxymonosulfate, particularly in its triple salt form,

$$2KHSO_5 \cdot KHSO_4 \cdot K_2SO_4,$$

is generally preferred because it is the cheapest and most stable of the peroxymonosulfates and gives excellent results. The above triple salt compound and its preparation are described in D'Addieco et al. U.S. Pat. 3,141,139.

The invention contemplates the use as the bleaching component in the detergent composition a mixture of a sodium perborate and a water-soluble peroxymonosulfate in specific proportions. Taylor U.S. Pat. 2,996,350 discloses the use of mixtures of a peroxymonosulfate and a perborate for applications where manganese ions, e.g., present as impurities in the water employed, are encountered. The purpose for the perborate in such mixtures is simply to overcome the discoloration which may be induced by such manganese ions. Only relatively small amounts or proportions of perborate are required and suggested for this purpose. For the purposes of the present invention, the proportions of the perborate in the sodium perborate peroxymonosulfate mixture are much higher than those suggested in the patent. Thus, in accordance with the invention, the weight ratio of peroxymonosulfate active oxygen:perborate active oxygen will range from 1:8 to 1:1, the preferred ratios being from 1:6 to 3:4. On a compound weight basis using the preferred potassium peroxymonosulfate triple salt compound and sodium perborate tetrahydrate, the above ratios correspond to 1:4 to 2:1, preferably 1:3 to 3:2.

Since the usual commercially available peroxymonosulfate products are highly acidic, the use of proportions thereof greater than the maximum amount indicated by the above ratios would mean that a substantial portion of the peroxymonosulfate would undesirably react with the needed builder of the composition. Furthermore, such high proportions of the peroxymonosulfate are clearly undesirable from an economic standpoint, since, in accordance with the invention, essentially the same or better results can be achieved by employing less costly mixtures containing the two peroxygen compounds in the proportions within the range set forth above. On the other hand, the employment of the peroxymonosulfate in the mixture of peroxygen compounds in proportions less than set forth above would substantially reduce the bleaching effectiveness of the mixture. When using the two types of peroxygen compounds in the proportions specified, enhanced bleaching will result over the full range of temperatures that are usable in home laundry operations, e.g., from room temperature to 160° F., the mixture will not react with or neutralize any significant amount of the needed alkaline builder, and the bleaching effectiveness of the perborate will be significantly enhanced without any increase in cost while the bleaching by the peroxymonosulfate will be either enhanced or at least not diminished.

The invention is illustrated by the following examples in which all amounts expresed as percentages or parts are by weight and all percentages of "Bleach Additives" are based upon the total weight of the detergent composition, excluding such "additives." All bleaching data reported in the examples were obtained employing standard launderometer trials using ten minute runs and 335 ml. of wash liquor. Fabric samples were 7 x 14" swatches of 78 x 78 cotton print cloth (4 yds./lb.) which had been scoured with a 4% solution of caustic soda at 180° F. for 3 hours then laundered once with a solution of the detergent formulation shown in Example 1 without "Bleach Additivies." The base whitenesses of the fabrics were in the 64 to 74% blue reflectance range. All whitenesses were measured using a Hunter Reflectometer with a blue filter for which magnesium oxide gave a blue reflectance of 100%. Unless indicated otherwise, the sodium perborate employed was a commercial sodium perborate tetrahydrate containing about 10% active oxygen and the peroxymonosulfate employed was the commercial triple salt $2KHSO_5 \cdot KHSO_4 \cdot K_2SO_4$ product containing about 4.7% active oxygen. For convenience purposes, the peroxymonosulfate and the sodium perborate were added to the launderometer cans as aliquots of aqueous solutions,

respectfully, containing 1% of the above potassium peroxymonosulfate triple salt product and 2% sodium perborate tetrahydrate.

In the tabulations shown in the examples, the abbreviation "PMS" is used to mean the above commercial peroxymonosulfate triple salt product containing about 4.7% active oxygen. "Perborate" is used to mean sodium perborate tetrahydrate containing about 10% active oxygen.

EXAMPLE 1

The launderometer tests of this example were carried through 10 washes at 140° F. using a stock detergent solution containing the following materials at the concentrations indicated below.

Component:	Concentration, grams/liter
Linear alkyl benzene sulfonate (Na salt)	2.2
Sodium triployphosphate	5.5
Carboxymethylcellulose	0.1
Sodium sulfate	1.7
Sodium silicate (42° Bé.)	0.5

Sufficient amount of the stock solution was added to each wash solution to provide in the latter a concentration of the detergent composition of 0.18%. The launderometer test results as follows:

Bleach additive	Total gain in whiteness	Gain in whiteness du to bleaching	Percent increase over bleaching response from perborate alone
None	2.6		
6.7% Perborate	4.1	1.5	
3.3% PMS	4.6	2.0	33
3.3% Perborate plus 1.7% PMS	4.7	2.1	40

The above data show that the use of the PMS product and the sodium perborate tetrahydrate in a weight ratio of 1:2 improves the bleaching response as compared to the response obtained using either of the two bleaching agents alone at an equal cost level. Without the activating effect of the two compounds upon each other, it would have been expected that the gain in bleaching response for the mixture would have been half-way between 1.5 and 2.0, i.e., only a 17% increase over the bleaching response obtained when the perborate was used alone, instead of the 40% found.

EXAMPLE 2

These launderometer washing tests were carried out under the same conditions described in Example 1 except that sodium silicate was omitted from the detergent composition employed and only 8 launderometer washes were used. The results were:

Bleach additive	Total gain in whiteness	Gain in whiteness due to bleaching	Percent increase over bleaching response from perborate alone
None	4.4		
7.0% Perborate	6.3	1.9	
3.5 PMS	6.5	2.1	10.5
3.5% Perborate plus 1.8% PMS	6.9	2.5	32

The above data show a distinct advantage in using the mixture of perborate and PMS product which resulted in a 32% increase in the bleaching response over that obtained when using the perborate alone. This is a surprising increase indicating that the two bleaching agents, when used together, activate each other, since without such mutual activation the gain in whiteness due to bleaching to have been expected when using the mixture would have been only 2.0, representing an increase of only 5.3% instead of the 32% found.

EXAMPLE 3

In this example, the detergent composition employed provided a linear long chain akylbenzene sulfonate (sodium salt) and sodium tripolyphosphate at concentrations, respectively, of 0.23 gram and 0.57 gram/liter of the wash solution, together with the amounts of sodium perborate tetrahydrate and the PMS product indicated in the following tabulation. Eight washes were employed at 140° F. The results were:

Bleach additive	Total gain in whiteness	Gain in whiteness due to bleaching	Percent increase over bleaching response from perborate alone
None	3.0		
30% Perborate	6.7	3.7	
15% PMS	6.7	3.7	0
22% Perborate [a] plus 3.7% PMS [a]	6.8	3.8	2.7
15% Perborate [b] plus 7.5% PMS [b]	7.5	4.5	22
7.4% Perborate [c] plus 11.1% PMS [c]	7.1	4.1	11

[a] Wt. ratio of PMS product:perborate tetrahydrate=1:6.
[b] Wt. ratio of PMS product:perborate tetrahydrate=1:2.
[c] Wt. ratio of PMS product:perborate tetrahydrate=3:2.

Without mutual activation, a gain in whitness due to bleaching of 3.7, i.e., 0% increase over the bleaching response from perborate alone, would have been expected. Note that of the three ratios compared, the 1:2 PMS/perborate tetrahydrate ratio was optimum, 3:2 was inferior but still effective and 1:6 was virtually without effect.

EXAMPLE 4

In this example, the basic detergent composition employed was a commercial solid home laundry detergent composition whose detergent component was about 20% dodecylbenzene sulfonate (sodium salt) and whose alkaline builder was primarily molecularly dehydrated sodium phosphates. The composition also included sodium sulfate filler, sodium silicate, a small amount of carboxymethylcellulose which served as an anti-soil-redeposition agent, a small amount of the usual optical brightener and about 8% water. In the launderometer tests, the commercial composition was employed in the wash water at a concentration of 0.24% to which was added the amounts of the stock solutions of sodium perborate and potassium peroxymonosulfate triple salt in amounts required to provide the amounts thereof reported below.

A series of ten launderometer washes were carried out at temperatures of 100° F., 120° F., 140° F. and 160° F. The results were:

Bleach additive	Total gain in whiteness	Gain in whiteness due to bleaching	Percent increase over bleaching response from perborate alone
At 100° F.			
None	5.1		
10% Perborate	6.3	1.2	
5% PMS	7.3	2.2	83
5% Perborate plus 2.5% PMS	7.5	2.4	100
At 120° F.			
None	4.1		
10% Perborate	6.4	2.3	
5% PMS	7.6	3.5	52
5% Perborate plus 2.5% PMS	7.5	3.4	48
At 140° F.			
None	5.5		
10% Perborate	8.7	3.2	
5% PMS	9.6	4.1	28
5% Perborate plus 2.5% PMS	9.9	4.4	38
At 160° F.			
None	8.0		
10% Perborate	11.5	3.5	
5% PMS	12.5	4.5	29
5% Perborate plus 2.5% PMS	12.5	4.5	29

Note that over the temperature range 100–160° F., the gain in whiteness due to bleaching from a 1:2 mixture of PMS/sodium perborate tetrahydrate was substantially the same as or greater than the gain in whiteness due to bleaching from PMS alone, and was substantially greater than the gain in whiteness due to bleaching from perborate alone. At these temperatures, the whiteness gain to have been expected without mutual activation would have been half-way between those obtained with each of the peroxygen compounds alone, i.e., about 42% at 100° F., 26% at 120° F., 14% at 140° F. and 14% at 160° F.

In launderometer trials at 70 to 75° F., the mixture exhibited no mutual activation, but the mixture or PMS alone gave higher gains in whiteness than did perborate alone. Thus, mixtures as described should have better utility over a wide range of laundry washing temperatures than the perborate additive alone.

EXAMPLE 5

The detergent composition employed in the launderometer wash tests for this example was the same as that employed in Example 4. The two bleach additives were used at relatively low levels in the ten launderometer washes employed at 130° F. The results were:

Bleach additive	Total gain in whiteness	Gain in whiteness due to bleaching	Percent increase over bleaching response from perborate alone
None	4.8		
2.5% Perborate	6.2	1.4	
1.25% PMS	6.4	1.6	14
1.25% Perborate plus 0.625% PMS	6.8	2.0	43

The above results show, at the relatively low level of bleaching additive employed, the same activating effects of the two agents when employed together that was shown in the preceding examples.

EXAMPLE 6

The launderometer wash tests of this example were carried out using swatches of the same fabric used in the preceding examples except that they had been stained with a tea-coffee mixture so as to have base whitenesses in the range 58 to 62%. Five launderometer washes were employed at both 130° F. and 115° F., using the detergent composition of Example 4. The results were as follows:

Bleach additive	Total gain in whiteness	Gain in whiteness due to bleaching	Percent increase over bleaching response from perborate alone
130° F.			
None	4.4		
10% Perborate	9.7	5.3	
5% PMS	10.9	6.5	23
2.5% Perborate plus 2.5% PMS	11.2	6.8	28
115° F.			
None	3.6		
10% Perborate	5.8	2.2	
5% PMS	7.2	3.6	64
2.5% Perborate plus 2.5% PMS	6.8	3.2	45

The above results show that a 1:1 mixture of PMS/sodium perborate tetrahydrate (1:2 ratio of active oxygen) gave a greater than expected increase in the bleaching response at both of the above temperatures. Note that the cost of the additive mixture was only about three-quarters of the cost of either the PMS or the perborate alone. If there had been no activation, one would have expected less than a 10% increase in bleaching response over perborate alone at 115° F., and an actual decrease at 130° F., respectively, instead of the 45% and 28% values found.

EXAMPLE 7

The following components were dry blended to give a detergent composition containing 2.5% of the PMS product and 2.5% sodium perborate tetrahydrate.

Component:	Parts
Sodium alkylbenzene sulfonate	22
Sodium tripolyphosphate	55
Sodium metasilicate	5
Carboxymethylcellulose	1
Sodium sulfate	12
Sodium perborate tetrahydrate	2.5
PMS product	2.5

A sample of the above composition sealed in a glass jar was found to be free-flowing after 4 days at 90° F., after which time it had lost only 4.3% of its original active oxygen content.

EXAMPLE 8

A detergent composition generally similar to that employed in Example 4 was prepared containing 5% by weight of a 1:1 mixture of the PMS compound and sodium perborate monohydrate; and, a similar composition was prepared except that it contained 5% of a 1:1 mixture of the PMS product and sodium perborate tetrahydrate.

Samples of both of the above compositions lost less than 2% of their active oxygen after standing in sealed jars for 4 weeks at 90° F., after which time both compositions remained free-flowing.

EXAMPLE 9

The PMS product employed in the above examples, i.e., the triple salt $2KHSO_5 \cdot KHSO_4 \cdot K_2SO_4$ product containing about 4.7% active oxygen, is strongly acidic since a 0.1% solution thereof in water has a pH of 3.1. When a 0.1% solution of the PMS product was titrated with a 1% solution of sodium tripolyphosphate builder, it was found that 1.0 g. of PMS compound neutralized 1.2 g. of the phosphate builder based on the quantity of titrant needed to reach pH 8.5. Based on pH 8.9, 1.0 g. of PMS compound would neutralize 3.3 g. of the phosphate builder. Normal home laundry detergent products operate at pH 8.5 to 10. If, however, two grams of sodium perborate tetrahydrate is dissolved in one liter of water containing 1 gram of the PMS product, the pH of the solution is raised from 3.1 to 9.7. This shows that the use of mixtures of the PMS product and sodium perborate in a preferred ratio in detergent compositions containing sodium tripolyphosphate alkaline builder will not result in a significant neutralization of the builder when the solid detergent composition is dissolved in water.

EXAMPLE 10

The following components were dry blended to give a free-flowing detergent composition for launderometer tests.

Component:	Parts
Sodium alkylbenzene sulfonate	44
Sodium tripolyphosphate (90% active)	55
Tetrasodium pyrophosphate decahydrate	40
Carboxymethylcellulose	1.9
Sodium metasilicate	10
Sodium sulfate	40

The wash solutions for the launderometer tests contained 0.24% of the above composition and aliquots of the stock solutions of the PMS product and/or sodium perborate tetrahydrate were added to 335 ml. of the wash solution to give the percentages of bleach additives listed. Ten

launderometer tests were employed at 130° F., and the results were as follows:

Bleach additive	Total gain in whiteness	Gain in whiteness due to bleaching	Percent increase over bleaching response from perborate alone
None	5.1		
10% Perborate	8.5	3.4	
5% PMS	9.5	4.4	29
5% Perborate (a) plus 2.5% PMS (a)	10.9	5.8	71
2.5% Perborate (b) plus 2.5% PMS (b)	9.7	4.6	35

Again, note the superiority of the 1:2 and 1:1 mixtures, (a) and (b), of PMS/sodium perborate tetraborate over either PMS or perborate alone. If there were no mutual activation, one would have expected only a 15% increase for the 1:2 mixture and actually a decrease, i.e., a lower gain in whiteness than the 3.4 for perborate alone, for the 1:1 mixture. The 1:1 mixture is only about three-fourths as costly as the PMS alone.

EXAMPLE 11

As in Example 10, the following materials were dry-blended.

Component:	Parts
A condensate of monylphenol with 40 moles of ethylene oxide	10
Sodium tripolyphosphate	12
Tetrasodium pyrophosphate decahydrate	10
Sodium metasilicate	2.5
Carboxymethylecellulose	0.4
Sodium sulfate	9.0

Following the procedure in Example 10, the results shown below were obtained:

Bleach additive	Total gain in whiteness	Gain in whiteness due to bleaching	Percent increase over bleaching response from perborate alone
None	4.3		
10% Perborate	8.2	3.9	
5% PMS	8.5	4.2	7.7
5% Perborate plus 2.5% PMS	8.4	4.1	5.1
2.5% Perborate plus 2.5% PMS	8.6	4.3	10

Though the activation of the additives were not as striking using this non-ionic detergent as compared with the anionic detergents, it is seen that the bleach additive mixtures do give some improvement over perborate alone and they avoid the use of highly acidic bleach additive.

In the detergent compositions of the invention, the anionic or non-ionic organic detergent component will generally constitute from 10 to 30%, preferably 15 to 25%, of the total weight of the composition. The alkaline builder, which is preferably sodium tripolyphosphate or a mixture thereof with tetrasodium pyrophosphate, will generally constitute from 25 to 75%, preferably 35 to 55%, of the composition weight, and will be sufficient to impart a pH of about 8.5% to 10 to the solution formed when the composition is employed at concentrations usual in home laundering practices. The mixture of the peroxymonosulfate compound and sodium perborate will generally constitute from 1.5 to 30% of the composition weight, the preferred amounts being 3 to 15%. Inert fillers such as sodium sulfate, when used, will generally total about 10 to 30% of the composition weight, while the small amounts of adjuvants such as optical brighteners, perfumes, etc., will generally total no more than about 3%. Some water will generally be present, but the water content seldom will exceed about 15%, and preferably will not exceed about 10%.

I claim:

1. A solid laundry detergent composition consisting essentially of 10 to 30% by weight of a water-soluble anionic or non-ionic organic detergent, 25 to 75% by weight of a water-soluble inorganic alkaline builder and 1.5 to 30% by weight of a mixture of a water-soluble peroxymonosulfate and a sodium perborate in the weight ratio of peroxymonosulfate active oxygen:perborate active oxygen of from 1:8 to 1:1.

2. A composition according to claim **1** wherein the detergent is an anionic detergent, the alkaline builder consisting esesntially of sodium tripolyphosphate and the peroxymonosulfate consisting essentially of a triple salt compound of the formula $2KHSO_5 \cdot KHSO_4 \cdot K_2SO_4$.

3. A composition according to claim **1** wherein the detergent consists essentially of an alkylbenzene sulfonate having a 10–20 carbon alkyl group, the builder consists essentially of sodium tripolyphosphate, the peroxymonosulfate consists essentially of a triple salt compound of the formula $2KHSO_5 \cdot KHSO_4 \cdot K_2SO_4$, and the perborate is sodium perborate tetrahydrate.

4. A composition according to claim **1** wherein the detergent comprises an alkylbenzene sulfonate having a 10–20 carbon alkyl group, the builder comprises sodium tripolyphosphate, the peroxymonosulfate comprises a triple salt of the formula $2KHSO_5 \cdot KHSO_4 \cdot K_2SO_4$, and the perborate is sodium perborate monohydrate.

5. A composition according to claim **1** wherein the weight ratio of peroxymonosulfate active oxygen:perborate active oxygen is from 1:6 to 3:4.

6. A composition according to claim **2** wherein the weight ratio of peroxymonosulfate active oxygen:perborate active oxygen is from 1:6 to 3:4.

7. A composition according to claim **3** wherein the weight ratio of peroxymonosulfate active oxygen:perborate active oxygen is from 1:6 to 3:4.

8. A composition according to claim **4** wherein the weight ratio of peroxymonosulfate active oxygen:perborate active oxygen is from 1:6 to 3:4.

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