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3,256,198

COMPOSITIONS CONTAINING AN OXYGEN RELEASING COMPOUND AND AN ORGANIC CARBONATE

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The present invention relates to novel compositions containing oxygen-releasing compounds, and more particularly relates to washing and/or sanitizing compositions containing bleaching agents with or without detergent agents. The present invention further relates to improved bleaching and/or laundering compositions, containing oxygen-releasing agents and which are useful, for example, in bleaching and/or laundering operations or in the removal of stains from textile materials.

Detergent compositions containing an oxygen-releasing compound, for example, an inorganic per-salt, such as an alkali metal perborate or percarbonate, or a peroxide, such as urea peroxide, have been disclosed heretofore as useful for bleaching and sanitizing purposes. Although such compositions provide a satisfactory bleaching action when they are used in water which is at or near the boiling point, (e.g., 95° C.—100° C.), the bleaching activity is unsatisfactory when the water is at lower temperatures, that is, temperatures below 75° C. Detergent and/or sanitizing compositions containing oxygen-releasing compounds thus have the disadvantage of being unsatisfactory for many uses, such as the washing and/or bleaching of textiles and fabrics which cannot withstand higher temperatures, that is, temperatures above about 70° C. Compositions containing these oxygen-releasing compounds are also unsatisfactory in that they cannot be efficiently employed in modern automatic washing machines and laundering devices utilizing water at relatively low temperatures, such as 50° C. to 70° C.

Such disadvantages have been recognized and the prior art indicates that attempts have been made to formulate compositions containing oxygen-releasing compounds, such as per-salts and peroxides with the goal of providing more effective bleaching and sanitizing activity at temperatures as low as 50° C., usually between 50° C. and 75° C.

Examples of prior art compositions are the following: U.S. Patent 2,898,181, issued August 4, 1959, discloses certain carboxylic acid amides such as acetamide and acrylamide in washing compositions containing inorganic per-salts and surfactants, to promote or accelerate the release of oxygen from the inorganic per-salt; U.S. Patent 2,955,905, issued October 11, 1960, discloses the addition of certain esters such as the benzoyl ester of alkali metal phenolsulfonates and glucose penta-acetate, as oxygen-releasing promoters, to washing compositions, containing inorganic per-salts; German Patent 1,018,181, published July 8, 1955, discloses the addition of certain compounds such as malonitrile or ethylene dicyanide in compositions containing inorganic per-salts; and German Patent 1,038,693, published November 22, 1956, discloses certain carboxylic anhydrides such as benzoic anhydride and phthalic anhydride in compositions containing sodium perborate to promote or accelerate the release of oxygen therefrom.

However, compositions containing the promoter compounds of the above-mentioned patents have certain disadvantages in that they either do not bleach efficiently in water at temperatures of between 50° C. and 75° C. or tend to render such compositions unstable, that is, cause a loss of available oxygen from the inorganic per-salts, when the compositions are stored under normal storage conditions for periods of from 1 week to several months. Compositions which have lost available oxygen are usually inefficient or ineffective for bleaching and washing purposes.

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It has presently been found, however, that compositions containing oxygen-releasing compounds and certain hereinafter defined organic carbonates will effectively and economically bleach and whiten textiles and fabrics in water at temperatures as low as 40° C. when used under standard laundering conditions. Additionally, compositions containing these organic carbonates are stable for prolonged periods of time under ordinary storage conditions.

Accordingly, it is one object of the present invention to provide novel compositions containing oxygen-releasing compounds.

It is another object of the present invention to provide storage-stable bleaching compositions containing an oxygen-releasing agent.

It is a further object of this invention to provide stable bleaching and/or detergent compositions containing an oxygen-releasing compound which compositions are capable, when employed in water at temperatures as low as 50° C., of good bleaching activity and oxygen-releasing properties.

Still further objects and advantages of this invention are disclosed in or will become apparent from the following description and the appended claims.

The present invention provides a composition comprising a mixture of an oxygen-releasing compound, for example, an organic or an inorganic per-salt, and an organic compound having the formula:



where R is selected from like or dissimilar organic radicals, at least one of such radicals being characterized in that its corresponding alcohol (ROH) has a pK_a, below about 11.7. Such compositions can be readily formulated as bleaching and/or sanitizing agents which are effective under a wide variety of conditions when used with water at temperatures of from about 50° C. to 100° C. The preferred compositions are generally stable with respect to loss of available oxygen for prolonged periods of time, that is, for periods up to six months or longer.

In the above formula, R may be any of a wide variety of like or dissimilar organic radicals provided that one or both of the organic radicals has or forms a corresponding alcohol, e.g., ROH (where R has the significance herein defined), which alcohol is characterized in having a pK_a of below about 11.7. Thus, in the above formula, R may represent like or dissimilar organic radicals whose corresponding alcohols are characterized in having a pK_a below about 11.7 and such alcohols usually have a pK_a between about 11.7 and about 5.0. On the other hand, R may represent dissimilar organic radicals, where the corresponding alcohol of only one radical is characterized in having a pK_a between about 11.7 and 5.0.

The term pK_a is well known, and the pK_a of a compound is defined as the negative logarithm of the dissociation constant of the compound. Organic radicals whose corresponding alcohols are characterized in having a pK_a below about 11.7 include substituted or unsubstituted branched chain aliphatic radicals, and substituted or unsubstituted aromatic radicals. Organic carbonates falling within the scope of Formula I in which R represents at least one of such organic radicals have been found to be particularly advantageous when employed in the compositions of this invention. Such organic carbonates have limited but effective water-solubility, e.g., from about 0.01 to about 5.0 grams per 100 grams of water and are somewhat more soluble in alkaline wash solutions. The carbonates are stable, and effectively promote the bleaching activity of compositions containing oxygen-releasing compounds when such compositions are dissolved in water.

In the organic carbonates falling within the scope of

Formula I, the organic radical R may represent any of a wide variety of substituted or unsubstituted branched chain aliphatic groups or radicals. Examples of unsubstituted branched chain aliphatic groups or radicals include isopropyl, isobutyl, sec butyl, t-butyl, iso-amyl, isohexyl, isononyl, isodecyl, 2-ethylhexyl, 2-propylamyl, 2-butylamyl, etc., groups or radicals. The substituents of the substituted branched chain aliphatic groups or radicals may include, halogen atoms sulfo-, nitro-, carboxy-, methoxy-, carbethoxy-, amino-, etc. substituted branched chain aliphatic groups or radicals. The branched chain aliphatic radicals preferably contain from 3 to about 10 carbon atoms in the aliphatic group. Although such radicals may contain more than 10 carbon atoms, organic carbonates containing them often have limited solubility in water.

Examples of unsubstituted aromatic radicals which may be represented by R in Formula I may be phenyl, pyridyl, benzyl, alpha- and beta-naphthyl, quinolyl, anthryl, phenanthryl, benzquinolyl and the like. The substituents of substituted aromatic radicals include, for example, halo-, nitro-, sulfo- and alkyl-substituted groups or radicals and the alkyl substituted groups or radicals may contain from about 1 to 20 carbon atoms in the alkyl group.

As noted hereinbefore, R in Formula I is an organic radical and preferably represents one of the hereinbefore described branched chain aliphatic radicals or aromatic radicals. In carbonates having at least one such preferred radical, R in Formula I may also represent, in certain instances, not more than one straight chain unsubstituted aliphatic radical including, for example, alkyl radicals such as methyl, ethyl, n-propyl, n-butyl, n-amyl, n-hexyl, n-heptyl, n-octyl, etc., groups or radicals.

Illustrative examples of some specific carbonates falling within the scope of Formula I which may be advantageously employed in the compositions of this invention include:

Mono-phenyl, mono-isopropyl carbonate
 Mono-phenyl, mono-t-butyl carbonate
 Mono-t-octyl, mono-sec. butyl carbonate
 Mono-phenyl, mono-naphthyl carbonate
 Mono-naphthyl, mono-isoamyl carbonate
 Mono-phenyl, mono-ethylhexyl carbonate
 Mono-methyl, mono-ethylhexyl carbonate
 Mono-ethyl, mono-phenyl carbonate
 Mono-ethyl, beta-naphthyl, carbonate
 Mono-methyl, mono-para-nitrobenzyl carbonate
 Di-para-nitrobenzyl carbonate
 Mono-para-nitrobenzyl, mono-ethylhexyl carbonate
 Mono-isopropyl, mono-ethylhexyl carbonate
 Di-isopropyl carbonate
 Di-iso-amyl carbonate
 Di-ethylhexyl carbonate
 di-beta-naphthyl carbonate

Compounds falling within the scope of Formula I which are preferred in the compositions of this invention include:

Di-ortho-tolyl carbonate
 Di-para-tolyl carbonate
 Di-phenyl carbonate
 Bis-ortho-methoxyphenyl carbonate
 Di-isobutyl carbonate

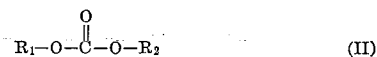
The organic carbonates suitable for use in the compositions of this invention may be prepared by any of several methods described on pages 483 through 487 of "Synthetic Organic Chemistry" by Romeo B. Wagner and Harry D. Zook published by John Wiley and Sons, New York, in 1953, provided that organic carbonates within the scope of Formula I are formed.

The suitable organic carbonates as herein defined may be mixed, preferably in the solid state, with a wide variety of organic and/or inorganic oxygen-releasing compounds

to provide the compositions of this invention. Examples of organic oxygen-releasing compounds include organic peroxides, such as urea peroxide, benzoyl peroxide, methyl ethyl ketone peroxide and the like. Examples of inorganic oxygen-releasing compounds include inorganic peroxides, such as alkaline earth metal peroxides, for example, calcium, magnesium, zinc and barium peroxides. Other suitable inorganic peroxides include alkali metal carbonate peroxides, such as sodium carbonate peroxide and alkali metal pyrophosphate peroxides, such as sodium pyrophosphate peroxide. Particularly suitable inorganic oxygen-releasing compounds include inorganic per salts, such as metal and ammonium persulfates, perchlorates, and perborates. Of these per salts, water-soluble alkali metal (for example, sodium, potassium, etc.) persulfates and perborates are preferred, and alkali metal perborates, especially sodium and potassium perborates, are particularly preferred.

The ingredients of the compositions of this invention may be present in various proportions depending upon whether the composition is to be used as a bleaching composition, a washing composition, or both. However, in most instances, such compositions contain either an organic or an inorganic oxygen-releasing compound and from about 0.1 to about 2 mols, per mol of the oxygen-releasing compound, of the useful organic carbonates.

In one embodiment of this invention, the compositions comprise a mixture of an inorganic per salt, such as an alkali metal perborate and from about 0.1 to about 2.0 mols, per mol of perborate, of an organic carbonate having the formula:



where R_1 is a branched chain aliphatic radical having from 3 to about 10 carbon atoms in the aliphatic group or an aromatic radical, and R_2 is an aliphatic or an aromatic radical.

Preferred organic carbonates falling within the scope of Formula II are organic carbonates in which R_1 is a branched chain aliphatic radical containing from about 3 to about 10 carbon atoms in the aliphatic group. Also preferred are organic carbonates in which R_1 in Formula II is an aromatic radical. Other preferred organic carbonates are compounds in which both R_1 and R_2 in Formula II are branched chain aliphatic radicals having from about 3 to about 10 carbon atoms in the aliphatic group. Organic carbonates which are additionally preferred are carbonates in which R_1 and R_2 in Formula II are both aromatic radicals.

In a preferred embodiment of this invention, the compositions comprise sodium perborate and from about 0.1 to about 2.0 mols, per mol of sodium perborate, of di-ortho-tolyl carbonate, di-para-tolyl carbonate, diphenyl carbonate, bis(ortho-methoxy-phenyl) carbonate, or di-isobutyl carbonate or mixtures of these carbonates. Such compositions are stable in the dry state during storage and are useful as commercial laundry bleaches and/or for bleaching textiles, and generally will effectively bleach textile and other materials in water at temperatures as low as 50° C.

The amount of any of the organic carbonates which may be employed in the compositions may vary within the above ranges and will depend upon a number of factors such as, for example, the particular organic carbonate employed and the temperature of the water in which it is intended to use the composition. Generally, aromatic organic carbonates (e.g., organic carbonates in which R in Formula I is an aromatic radical) may be employed in ranges of from about 0.1 to about 1.5, preferably 0.5 to 1.5 mols, per mol of oxygen-releasing agent. On the other hand, organic carbonates falling within the scope of Formula I in which R is a branched chain aliphatic radical are usually employed in ranges of from about 1.0 to about 2.0 mols, per mol of oxygen-releasing agent. Usually when the compositions are to be used in water

at temperatures between about 70° C. and 85° C., smaller amounts of organic carbonates are required than when the compositions are employed in water at temperatures between about 55° C. and 70° C.

The compositions of the present invention may also contain, in addition to an oxygen-releasing compound and the useful carbonates, a variety of inorganic compounds of a class different from the inorganic oxygen-releasing compounds, and which are incapable of undergoing an oxidation reduction reaction with the oxygen-releasing compound. Examples of such different inorganic compounds include water-soluble, alkali metal inorganic salts, preferably those inorganic salts which are employed as detergent builders. Illustrative of such salts are tri-alkali metal phosphates such as tri-sodium phosphate and tri-potassium phosphate; di-alkali metal hydrogen phosphates such as di-sodium hydrogen phosphate and di-potassium hydrogen phosphate; alkaline water soluble, molecularly dehydrated, alkali metal phosphate salts such as alkali metal pyrophosphates, for example, tetrasodium pyrophosphate and tetrapotassium pyrophosphate, and the alkali metal tripolyphosphate such as sodium tripolyphosphate ($\text{Na}_3\text{P}_3\text{O}_{10}$) and potassium tripolyphosphate; alkaline water soluble alkali metal metaphosphates such as sodium hexametaphosphate; water soluble, alkali metal silicates such as sodium silicates having an Na_2O to SiO_2 mol ratio of from about 1:1 to about 1:3.6, preferably about 1:1 to 1:1.35, and the corresponding potassium silicates; water-soluble alkali metal borates such as calcined sodium tetraborate or borax; water-soluble alkali metal carbonates or bicarbonates such as sodium or potassium carbonate or bicarbonate, and the like.

The inorganic or detergent builder salts can be used alone or in various combinations with each other or with water-soluble neutral, inert inorganic diluents which may also have some detergent building properties, for example, water-soluble neutral inert alkali metal salt diluents such as neutral alkali metal sulfates or chlorides, for example, sodium sulfate or sodium chloride.

The proportions of the aforementioned alkaline or neutral salts which may be employed in the compositions of this invention can be varied considerably, depending upon the end use of the composition. However, when used, such salts comprise in excess of about 40% and up to about 90% by weight of the dried solids content of the composition. Of this, the alkaline alkali metal salts usually comprise about 10% to about 95% of the total salts other than the oxygen-releasing compounds, and the inert diluent neutral salts usually comprise about 90% to about 5% of the total salts other than the oxygen-releasing compounds and organic carbonates.

Although the compositions of this invention may comprise an oxygen-releasing compound, the useful organic carbonates and the above-mentioned alkaline salts or combinations thereof with inert diluent neutral salts, the compositions may also contain, alone or in combination with the above-described salts, relatively minor amounts, usually less than 20% by weight, preferably 1 to 15% by weight, on a solids basis, of an organic compound, preferably an organic surface active agent such as a foam-in agent, emulsifier, detergent, surfactant, or the like.

Examples of organic surface active agents include anionic surfactants such as sulfated and sulfonated alkyl, aryl, and alkyl-aryl hydrocarbons and alkali metal salts thereof, for example, sodium salts of long chain alkyl sulfates, sodium salts of alkyl naphthalene sulfonic acids, sodium salts of sulfonated abietenes, sodium salts of alkylbenzene sulfonic acids, particularly those in which the alkyl group contains from 8-24 carbon atoms, sodium salts of sulfonated mineral oils and sodium salts of sulfosuccinic acid esters such as sodium dioctyl sulfosuccinate.

Examples of non-ionic surfactants include products formed by condensing one or more alkylene oxides of 2 to 4 carbon atoms, such as ethylene oxide or propylene oxide, preferably ethylene oxide alone or with other

alkylene oxides, with a relatively hydrophobic compound, such as a fatty alcohol, fatty acid, sterol, a fatty glyceride, a fatty amine, an aryl amine, a fatty mercaptan, a tall oil, etc. Non-ionic surface active agents also include those products produced by condensing one or more relatively low alkyl alcohol amines (such as methanolamine, ethanolamine, propanolamine, etc.) with a fatty acid, such as lauric acid, palmitic acid, tall oil fatty acid, abietic acid, etc. to produce the corresponding amide. Other typical examples of these categories of the anionic and nonionic surface active agents are described in "Surface Active Agents" by Schwartz and Perry, Interscience Publishers, New York, in 1949, and "The Journal of American Oil Chemists Society," volume 34, No. 4, pages 170-216 (April 1957).

The various ingredients employed in the compositions of this invention can be used in various proportions depending upon whether the composition is to be used as a bleaching composition, a detergent composition, or the like. However, when all four types of ingredients hereinbefore described are used, the compositions preferably contain on a dry basis from about 1% to about 40% by weight of the oxygen-releasing compound, preferably an alkali metal perborate, and from about 0.1 to about 2.0 mols, per mol of said oxygen-releasing compound, of the useful organic carbonates, from about 0.05 to about 15% of organic surface active agent, and the remainder consisting substantially of the alkaline inorganic metal salts and/or the inert diluent salts different from the oxygen-releasing compound. In the case of aqueous compositions, the ingredients are normally present in the compositions on the same solids basis, but the compositions may contain from 50% to 99% by weight of water.

In a preferred embodiment of this invention, the compositions comprise on a solids basis from about 3 to about 15% by weight of sodium perborate, from about 0.5 to about 1.5 mols, per mol of sodium perborate, of the preferred organic carbonate such as di-ortho-tolyl carbonate, or di-phenyl carbonate or di-isobutyl carbonate, from about 10 to about 60% by weight of sodium tripolyphosphate or a mixture of such phosphate and sodium silicate and the remainder consisting essentially of sodium sulphate. Such compositions are useful as bleaching and/or washing compositions in commercial laundering operations.

In another preferred embodiment of this invention, the compositions comprise on a solid basis from about 3% to 15% by weight of sodium perborate, from about 0.5 to about 1.5 mols, per mol of perborate, of any of the preferred organic carbonates, from about 1.0 to about 20% by weight of an an-ionic wetting agent such as a sodium alkyl benzene sulfonate wherein the alkyl radical has from about 8 to about 24 carbon atoms, preferably sodium dodecylbenzene sulfonate and the remainder consisting substantially of sodium sulfate. Such compositions are useful as household bleaches and/or sanitizers.

In still another preferred embodiment of this invention, the compositions comprise from about 3 to about 15% by weight of sodium perborate, from about 0.5 to about 1.5 mols, per mol of perborate, of any of the preferred carbonates of this invention and the remainder consisting substantially of sodium carbonate or mixtures thereof with sodium tripolyphosphate. These compositions are useful as washing and/or sanitizing agents, particularly in cleaning and sanitizing food processing equipment and containers.

In most instances, the proportions and kind of ingredients in the formulation employed will depend upon the purposes for which the formulation or composition is being used, that is, whether it is being used for bleaching, sanitizing, laundering, etc. Regardless of the use involved, however, the compositions containing the oxygen-releasing compound and any of the organic carbonates herein defined have definite properties of bleaching and sanitizing in aqueous solutions at temperatures well below

the boiling point of water, and these compositions in the dry state also have a tendency to retain their available oxygen content under ordinary storage conditions for prolonged periods of time, that is, for periods up to 6 months and longer.

A further understanding of the compositions of this invention and processes for preparing the same will be obtained from the following specific examples which are intended to illustrate the invention but not to limit the scope thereof, parts and percentages being by weight unless otherwise indicated.

Example I

Dry mixed compositions containing the following ingredients in the percentages given in Table I were prepared by homogeneously blending the ingredients:

TABLE I

Ingredient	Composition Number									
	1	2	3	4	5	6	7	8	9	10
Sodium perborate.....	8.0	4.0	4.0	8.0	4.0	6.0	6.0	6.0	6.0	6.0
Di-ortho-tolyl carbonate.....	14.0					8.5				
Di-para-tolyl carbonate.....		7.0					8.5			
Di-phenyl-carbonate.....			6.0					8.0		
Bis(ortho-methoxyphenyl) carbonate.....				12.0					8.0	
Di-isobutyl carbonate.....					8.0					12.0
Sodium tripolyphosphate.....	40.0	40.0	30.0	40.0	40.0	40.0	25.0	40.0	40.0	40.0
Sodium sulfate.....	38.0	34.0	30.0		30.0	33.0	24.0	36.0		20.0
Sodium carbonate.....			30.0	30.0	18.0		12.0		36.0	12.0
Sodium silicate.....			0				12.0			10.0
Sodium dodecylbenzene sulfonate.....	0	15.0	0	10.0	0	12.5	12.5	10.0	10.0	0

The bleaching activity of compositions 1 through 10 was determined by dissolving 0.35 gram of each composition in 1 liter of water in separate cylindrical receptacles. The receptacles were provided with a mechanical agitator and the solutions therein were agitated and maintained at a temperature of about 60° C. Solutions of compositions 2, 3 and 5 had an available oxygen concentration of 10 parts per million; solutions of compositions 1 and 4 had an available oxygen content of 20 parts per million and solutions 6 through 10 had an available oxygen content of 15 parts per million. The solutions of the compositions contained a mol ratio of sodium perborate to organic carbonate of approximately 1:1.

Twenty 5" x 5" swatches of unbleached, naturally yellowed muslin were analyzed for reflectance (*Rd*) and (*a*) and (*b*) color values on a Gardner Automatic Color Difference Meter described hereinafter. Two swatches were then placed in each of 10 receptacles containing one of the dissolved compositions and washed for 10 minutes. After this period, the swatches were dried, pressed, and again analyzed on the Gardner Automatic Color Difference Meter. The reflectance ΔRd (brightening) and bleaching efficiency $\Delta(a)$ and $\Delta(b)$ were calculated by subtracting the readings before and after the washing operation. The loss or consumption of available oxygen was also determined for each solution. The results are summarized in Table II.

TABLE II

Composition Number	Loss of Available Oxygen, Percent ¹	ΔRd ²	$\Delta(a)$ ³	$\Delta(b)$ ³
1.....	84	+9.0	-0.4	-3.1
2.....	84	+7.6	-0.2	-1.9
3.....	82	+8.4	-0.3	-2.8
4.....	76	+6.4	-0.2	-2.2
5.....	72	+6.1	-0.2	-1.6
6.....	84	+8.4	-0.4	-3.0
7.....	82	+8.0	-0.3	-2.2
8.....	84	+8.2	-0.3	-3.0
9.....	74	6.8	-0.3	-2.4
10.....	72	6.2	-0.2	-1.9

¹ Determined by iodometric titration of spent wash solutions.

² Positive values indicate degree of increase in reflectance or brightening.

³ Negative values indicate the degree of color disappearance or bleaching.

The Gardner Automatic Color Difference Meter is a tristimulus colorimeter, that is, it contains 3 photocells which measure (1) reflectance (*Rd*); (2) green to red color, (*a*); and (3) blue to yellow color (*b*).

The above values for loss, or consumption, of available oxygen are significant when compared with similar compositions which differed only in that the compositions contained no organic carbonates. Such compositions lost less than 10% available oxygen under similar test conditions. Also, such compositions did not bleach or brighten muslin swatches to any appreciable extent when subjected to the above conditions at 60° C.

Example II

The bleaching acceleration or promotion properties of this invention are further indicated by the following dye-bleaching experiments.

To two liters of a standard borate-carbonate (pH 10) aqueous buffer solution there was added the following:

0.920 grams of "Orange II" [p(2-hydroxy-1-naphthylazo)-benzenesulfonic acid]-sodium salt.

To separate 100 milliliter portions of this solution, there was added 0.25 gram of the compositions 1 through 10 of Example I, respectively. The solutions were maintained at 60° C. The initial color concentration was determined in a Bausch and Lomb spectrophotometer by measuring the absorption maximum at 483 millimicrons. Spectrophotometric readings were recorded initially and at 20, 60 and 160 minutes. The results are tabulated in Table III. The rate of bleaching, or rate of disappearance, of the dye color from the solution indicates the bleach promotion activity of the compositions of this invention.

TABLE III

Composition Number	Dye Concentration, Percent of Original (Time in minutes)			
	0	20	60	160
1.....	100	36	23	12
2.....	100	55	42	28
3.....	100	37	29	24
4.....	100	52	44	31
5.....	100	80	62	45
6.....	100	30	19	9
7.....	100	51	38	27
8.....	100	39	28	22
9.....	100	50	41	31
10.....	100	75	59	41
Dye solution only.....	100	100	100	100

These results indicate that the compositions of this invention effectively promote the bleaching of standard dyes when in solution in 60° C. On the other hand, when compositions similar to compositions 1 through 10 but differing only in that they did not contain an organic carbonate were evaluated under the above conditions, more than 75% of the color was retained in the solutions after 160 minutes.

Example III

5 g. samples of compositions identical to those described in Example I were stored in open glass vials in a humidity cabinet maintained at 90° F. and a relative humidity of 85% for 8 days. Available oxygen determinations were conducted on a portion of these samples every second day.

The results are given in the following table:

TABLE IV

Composition Number	Loss of Available Oxygen (percent)			
	2 days	4 days	6 days	8 days
1.....	1	2	4	6
2.....	0	1	2	5
3.....	0	1	3	4
4.....	0	2	3	4
5.....	0	2	3	4
6.....	0	2	3	4
7.....	0	1	2	3
8.....	0	1	3	4
9.....	0	2	3	5
10.....	0	2	3	4

By way of contrast, when compositions similar to compositions 1 through 10 were prepared using prior art compounds such as acrylamide, acetamide, malonitrile, benzoic anhydride, phthalic anhydride, and glucose penta-acetate in place of the organic carbonates of compositions 1 through 10, such compositions containing the prior art compounds lost at least 35% of available oxygen after 8 days of storage under the above conditions. Moreover, when compositions containing these prior art compounds were evaluated for bleaching activity under the conditions described in Examples I and II, their bleaching activity was significantly below the bleaching activity of the compositions 1 through 10 when tested at temperatures as low as 60° C.

Surprisingly and unexpectedly, it has been found that organic carbonates, in which R in Formula I represents two organic radicals whose corresponding alcohols (ROH) are characterized in having a pK_a above about 11.7, are usually inefficient or ineffective in promoting the bleaching activity of, or the release of oxygen from, oxygen-releasing compounds.

Example IV

Dry mixed compositions containing the following ingredients in parts by weight given in Table V were prepared by homogeneously blending the ingredients:

TABLE V

Ingredient (parts by weight)	Composition Number									
	11	12	13	14	15	16	17	18	19	20
Sodium perborate.....	8.0	4.0	4.0	8.0	4.0	6.0	6.0	6.0	6.0	6.0
Di-ortho-tolyl carbonate.....	14.0					8.5				
Di-para-tolyl carbonate.....		7.0					8.5			
Di-phenyl carbonate.....			6.0					8.0		
Bis(ortho-methoxyphenyl) carbonate.....				12.0					8.0	
Di-isobutyl carbonate.....					8.0					12.0
Sodium dodecylbenzene sulfonate.....						1.0	1.5	2.0	1.5	1.0

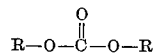
Compositions 11 through 20 were separately dissolved in water to form separate solutions having a concentration of 10 milligrams/100 cc. and were evaluated for bleaching activity using the procedures and temperature described in Examples I and II, and for stability using the procedure of Example III. In all instances, the compositions bleached and brightened unbleached muslin and rapidly decolorized dye solutions. Additionally, no compositions lost more than 7% available oxygen when subjected to the procedures described in Example III.

When a sodium perborate solution was evaluated in concentrations identical to the sodium perborate concentrations in the solutions of Examples 11 through 20,

no significant bleaching activity took place when evaluated according to the methods above-described.

What is claimed is:

1. A composition consisting essentially of a mixture of (1) an oxygen-releasing compound selected from the group consisting of an organic peroxide and an inorganic per-salt, and (2) from about 0.1 to about 2.0 mols, per mol of said oxygen-releasing compound, of an organic carbonate having the formula:



wherein at least one R is an organic radical such that its corresponding alcohol of the formula ROH has a pK_a below 11.7 and the other R is a radical selected from the group consisting of (a) an unsubstituted branched chain aliphatic radical having from about 3 to about 10 carbon atoms in the aliphatic group, (b) a substituted branched chain aliphatic radical having from about 3 to about 10 carbon atoms in the aliphatic group and selected from the group consisting of nitro-, and methoxy-substituted branched chain aliphatic radicals, (c) an unsubstituted aromatic radical selected from the group consisting of phenyl, benzyl, alpha-naphthyl, and beta-naphthyl radicals, and (d) a substituted aromatic radical selected from the group consisting of phenyl, benzyl, alpha-naphthyl, and beta-naphthyl radicals having nitro-, or alkyl groups as substituents thereon, said alkyl group containing from about 1 to 20 carbon atoms.

2. The composition of claim 1 wherein said oxygen-releasing compound is an alkali-metal perborate and each R is the same organic radical.

3. A composition consisting essentially of a mixture of sodium perborate and from about 0.5 to about 1.5 mols, per mol of said perborate, of di-ortho-tolyl carbonate.

4. A composition consisting essentially of a mixture of sodium perborate and from about 0.5 to about 1.5 mols, per mol of said perborate, of di-para-tolyl carbonate.

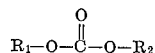
5. A composition consisting essentially of a mixture of sodium perborate and from about 0.5 to about 1.5 mols, per mol of said perborate, of diphenyl carbonate.

6. A composition consisting essentially of a mixture of sodium perborate and from about 1.0 to about 2.0 mols, per mol of said perborate, of bis(ortho-methoxyphenyl) carbonate.

7. A composition of matter consisting essentially of a mixture of sodium perborate and from about 1.0 to about

2.0 mols, per mol of said perborate, of di-isobutyl carbonate.

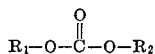
8. A composition consisting essentially of a mixture of (1) from about 1% to about 40% by weight of an oxygen-releasing compound selected from the group consisting of organic peroxides and inorganic peroxides, (2) from about 0.1 to about 2.0 mols, per mol of said oxygen-releasing compound, of an organic carbonate having the formula:



wherein R_1 and R_2 are selected from the group consisting

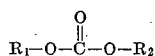
of (a) an unsubstituted branched chain aliphatic radical having from about 3 to about 10 carbon atoms in the aliphatic group, (b) a substituted branched chain aliphatic radical having from about 3 to about 10 carbon atoms in the aliphatic group and selected from the group consisting of nitro-, and methoxy-substituted branched chain aliphatic radical, (c) an unsubstituted aromatic radical selected from the group consisting of phenyl, benzyl, alpha-naphthyl, and beta-naphthyl radicals and (d) a substituted aromatic radical selected from the group consisting of phenyl, benzyl, alpha-naphthyl, and beta-naphthyl radicals having nitro-, or alkyl groups as substituents thereon, said alkyl group containing from about 1 to 20 carbon atoms; at least one of said R's being characterized in that its corresponding alcohol of the formula ROH has a pK_a below about 11.7, and (3) from about 40% to about 90% by weight of a detergent builder salt selected from the group consisting of alkali metal phosphates, alkali metal silicates having an alkali metal oxide to silica mol ratio of from about 1:1 to about 1:3.6, alkali metal borates, alkali metal carbonates, alkali metal bicarbonates, alkali metal sulfates and mixtures thereof, said salt being further characterized in being incapable of undergoing an oxidation-reduction reaction with said oxygen-releasing compound.

9. A composition consisting essentially of a mixture of (1) from about 1% to about 40% by weight of an alkali metal perborate, (2) from about 0.1 to about 2.0 mols, per mol of said alkali metal perborate, of an organic carbonate having the formula:



wherein R_1 and R_2 are selected from the group consisting of (a) an unsubstituted branched chain aliphatic radical having from about 3 to about 10 carbon atoms in the aliphatic group, (b) a substituted branched chain aliphatic radical having from about 3 to about 10 carbon atoms in the aliphatic group and selected from the group consisting of nitro-, and methoxy-substituted branched chain aliphatic radical, (c) unsubstituted aromatic radical selected from the group consisting of phenyl, benzyl, alpha-naphthyl, and beta-naphthyl radicals and (d) a substituted aromatic radical selected from the group consisting of phenyl, benzyl, alpha-naphthyl, and beta-naphthyl radicals having nitro-, or alkyl groups as substituents thereon, said alkyl group containing from about 1 to 20 carbon atoms; at least one of said R's being characterized in that its corresponding alcohol of the formula ROH has a pK_a below about 11.7, and (3) from about 1% to about 20% by weight of a non-soap synthetic organic detergent selected from the group consisting of non-soap synthetic anionic surface active agents and non-soap synthetic non-anionic surface active agents.

10. A composition consisting essentially of a mixture of (1) from about 1% to about 40% by weight of an alkali metal perborate, (2) from about 0.1 to about 2.0 mols, per mol of said perborate of an organic carbonate having the formula:



wherein R_1 and R_2 are selected from the group consisting of (a) an unsubstituted branched chain aliphatic radical having from about 3 to about 10 carbon atoms in the aliphatic group, (b) a substituted branched chain aliphatic radical having from about 3 to about 10 carbon atoms in the aliphatic group and selected from the group consisting of nitro-, and methoxy-substituted branched chain aliphatic radical, (c) an unsubstituted aromatic radical selected from the group consisting of phenyl,

benzyl, alpha-naphthyl, and beta-naphthyl, phenanthryl, and benzquinolyl radicals and (d) a substituted aromatic radical selected from the group consisting of phenyl, benzyl, alpha-naphthyl, and beta-naphthyl radicals having nitro- or alkyl groups as substituents thereon, said alkyl group containing from about 1 to 20 carbon atoms, (3) from about 40% to about 90% by weight of a detergent builder salt selected from the group consisting of water-soluble, alkali metal phosphates, alkali metal silicates having an alkali metal oxide to silica mol ratio of from about 1:1 to about 1:3.6, alkali metal borates, alkali metal sulfates, alkali metal carbonates, alkali metal bicarbonates, and mixtures thereof, and (4) from about 1% to about 20% by weight of a non-soap synthetic organic detergent selected from the group consisting of non-soap synthetic anionic surface active agents and non-soap synthetic nonionic surface active agents, said builder salt further characterized as being incapable of undergoing an oxidation-reduction reaction with said perborate.

11. A composition consisting essentially of a mixture of (1) from about 1% to about 40% by weight of sodium perborate, (2) from about 0.1 to about 2.0 mols, per mol of sodium perborate, of an organic carbonate selected from the group consisting of di-ortho-tolyl carbonate, di-para-tolyl carbonate, di-phenyl carbonate, bis-ortho-methoxyphenyl carbonate, and di-isobutyl carbonate, and (3) from about 40% to about 90%, based on the total weight of said mixture, of a detergent builder salt selected from the group consisting of sodium tripolyphosphate, sodium sulfate, sodium carbonate, sodium silicate, and mixtures thereof.

12. A composition consisting essentially of a mixture of (1) from about 1% to about 40% by weight of sodium perborate, (2) from about 0.1 to about 2.0 mols, per mol of sodium perborate, of an organic carbonate selected from the group consisting of di-ortho-tolyl carbonate, di-para-tolyl carbonate, di-phenyl carbonate, bis-ortho-methoxyphenyl carbonate, and di-isobutyl carbonate, and (3) from about 0.05% to about 15% by weight of a sodium alkyl benzene sulfonate wherein the alkyl radical has from about 8 to about 24 carbon atoms.

13. A composition consisting essentially of a mixture of (1) from about 1% to about 40% by weight of sodium perborate, (2) from about 0.1 to about 2.0 mols, per mol of sodium perborate, of an organic carbonate selected from the group consisting of di-ortho-tolyl carbonate, di-para-tolyl carbonate, di-phenyl carbonate, bis-ortho-methoxyphenyl carbonate, and di-isobutyl carbonate, (3) from about 40% to about 90% by weight of a detergent builder salt selected from the group consisting of sodium tripolyphosphate, sodium sulfate, sodium carbonate, sodium silicate, and mixtures thereof, and (4) from about 0.05 to about 15% by weight of a sodium alkyl benzene sulfonate wherein the alkyl radical has from about 8 to about 24 carbon atoms.

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