(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 822 183 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.02.1998 Bulletin 1998/06

(51) Int. Cl.[6]: **C07C 407/00**, C07C 409/24, C11D 3/39

(21) Application number: **96202168.9**

(22) Date of filing: **31.07.1996**

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU NL PT SE

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(54) A process for forming a peracid and a composition comprising said peracid

(57) The present invention relates to a process for forming a peracid which comprises the step of reacting in aqueous medium an alpha mono alkylated carboxylic acid and/or an alpha mono alkoxylated carboxylic acid with hydrogen peroxide or a water-soluble source thereof. Further disclosed are compositions comprising an alpha mono alkylated percarboxylic acid and/or alpha mono alkoxylated percarboxylic acid and compositions comprising an alpha mono alkylated carboxylic acid and/or alpha mono alkoxylated carboxylic acid and hydrogen peroxide or a water-soluble source thereof .

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Description

Technical field

The present invention relates to a process for forming peracids (percarboxylic acids), and to compositions comprising said peracids or precursor thereof. The compositions according to the present invention are particularly suitable to be used in various applications such as in laundry applications, as hard-surface cleaners, as carpet cleaners, as denture cleaners, as cleaning compositions or as disinfecting compositions in general.

Background

A great variety of cleaning compositions have been described in the art. Indeed, compositions comprising hydrogen peroxide, and/or water-soluble sources thereof, including peracids, are known. In order to provide such compositions comprising peracids, it is common practice to use peracid precursors instead of peracids. Peracids are not commonly commercially available, and if available they may not be used satisfactorily, as said peracids are not stable and tend to decompose dramatically during storage, this even before their incorporation into a composition. Compositions containing such peracids can be provided by a variety of methods employing reactions between hydrogen peroxide or a water-soluble source thereof and the corresponding peracid precursors, i.e., the corresponding acids. However, obtaining peracids at significant levels involves reacting the corresponding acids with hydrogen peroxide or a source thereof at high levels. Thus, there is a need for improved processes for forming peracids, and aqueous compositions comprising the same. Particularly, formulators are looking for a process which delivers higher yield of peracids.

It is therefore an object of the present invention to provide an improved process for producing peracids.

We have now found that this object is met by reacting, in an aqueous medium, hydrogen peroxide or a water-soluble source thereof with an alpha mono alkylated or alpha mono alkoxylated carboxylic acid. Indeed, it has been found that a higher yield of peracid is achieved when using an alpha mono alkylated or alpha mono alkoxylated carboxylic acid, as the peracid precursor, as compared to the corresponding non-substituted carboxylic acid. In other words, it has been found that a process for forming peracids which comprises the step of reacting an alpha mono alkylated or alpha mono alkoxylated carboxylic acid with hydrogen peroxide or a water-soluble source thereof in an aqueous medium leads to preparation of peracid-containing compositions comprising a higher amount of peracid, starting from a given amount of the peracid precursor.

An advantage of a process according to the present invention is that it allows for great flexibility in formulating and provides peracid-containing compositions suitable to be used in the most efficient manner by the consumer. Indeed, such peracid-containing composition can be a raw material composition, or can be a fully formulated detergent composition comprising additional ingredients such as those commonly used in the detergent field.

A further advantage of the present invention is that cost effective peracid-containing compositions are provided which incorporate a higher amount of peracids, starting from a given amount of the corresponding precursors. Also, an advantage associated with the compositions obtainable according to a process of the present invention is that such compositions, especially when formulated in the form of an emulsion, not only incorporate a higher amount of a peracid, starting from a given amount of the precursor, but also allow to provide a finished product having improved stability during storage, i.e., the rate of decomposition of peracids contained therein is reduced.

The production of peracids from hydrogen peroxide and organic carboxylic acids is known in the art. WO 93/0516 discloses a process for the preparation of a dilute aqueous solution comprising a hydroxyaliphatic peroxycarboxylic acid having no more than 7 carbon atoms in which in a first step a concentrated aqueous solution of said peroxycarboxylic acid precursor, i.e., a hydroxyaliphatic carboxylic acid, is mixed with a concentrated hydrogen peroxide solution in presence if necessary of a strong acid as a catalyst, in a second step the mixture is stored until the concentration of said peroxycarboxylic acid has approached its maximum; then the mixture is diluted in water. WO 93/0516 discloses that said hydroxyaliphatic carboxylic acid may be a monocarboxylic acid or preferably a dicarboxylic acid. No alpha mono alkylated or alpha mono alkoxylated carboxylic acids are disclosed.

EP-A- 024 219 discloses a process for the manufacture of diluted compositions of aliphatic carboxylic peracids by reacting dicarboxylic acids of from 3 to 5 carbon atoms with a concentrated solution of hydrogen peroxide (60% to 90%). No alpha mono alkylated or alpha mono alkoxylated carboxylic acids are disclosed.

WO 91/13058 discloses a process for providing diluted solution of a lower aliphatic peracid, wherein the initial concentration of the lower aliphatic acid (e.g. acetic acid) in the reaction mixture is preferably 25% to 70% by weight and the initial concentration of hydrogen peroxide in said medium is preferably 15% to 30% by weight. No alpha mono alkylated or alpha mono alkoxylated carboxylic acids are disclosed.

BE-A-864 135 discloses a continuous process of manufacturing a peracid involving the reaction of hydrogen peroxide with a carboxylic acid in an aqueous medium containing a mineral acid, like sulfuric acid, said hydrogen peroxide being added to the reaction mixture in several stages so as to limit everywhere the concentration in hydrogen peroxide.

BE-A- 864 135 teaches that the carboxylic acids used are preferably nonsubstituted monocarboxylic acids having at least 2 but less than 6 carbon atoms. No alpha mono alkylated or alpha mono alkoxylated carboxylic acids are disclosed.

EP-A-700 902 discloses a process for the manufacture of aqueous compositions comprising peracids wherein said process comprises the step of forming said peracids by reacting the corresponding anhydrides with a concentrated hydrogen peroxide solution comprising at least 3 moles of said hydrogen peroxide per molar equivalent of said corresponding anhydride.

Summary of the invention

The present invention encompasses a process for forming a peracid, said process comprising the step of reacting in an aqueous medium an alpha mono alkylated carboxylic acid and/or alpha mono alkoxylated carboxylic acid with hydrogen peroxide or a water-soluble source thereof. In a preferred embodiment said process further comprises a step where at least one additional ingredient, other than water, said hydrogen peroxide or a water-soluble source thereof and said alpha mono alkylated carboxylic acid and/or alpha mono alkoxylated carboxylic acid, is provided.

The present invention also encompasses a peracid-containing composition obtainable by a process as described herein comprising an alpha mono alkylated percarboxylic acid and/or alpha mono alkoxylated percarboxylic acid as well as an aqueous composition comprising an alpha mono alkylated carboxylic acid and/or an alpha mono alkoxylated carboxylic acid, and hydrogen peroxide or a water-soluble source thereof.

Detailed description of the invention

The process for forming a peracid

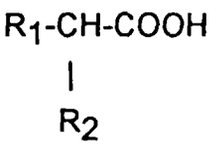
The process of the present invention is a process for forming a peracid, said process comprises the step of reacting in an aqueous medium an alpha mono alkylated carboxylic acid and/or alpha mono alkoxylated carboxylic acid with hydrogen peroxide or a water-soluble source thereof.

As a first essential element, the process of the present invention requires the use of an alpha mono alkylated or alpha mono alkoxylated carboxylic acid or mixtures thereof. This alpha mono-substituted carboxylic acid is a peracid precursor which allows to obtain the desired peracid by reaction in an aqueous medium with hydrogen peroxide or a water-soluble source thereof. Perhydrolysis is the reaction which occurs when the peracid precursor is combined in an aqueous reaction medium, preferably an acidic aqueous medium, with hydrogen peroxide or a water-soluble source thereof. During this reaction the hydroxyl group of the carboxylic function is replaced by a perhydroxide anion (OOH-) to form the corresponding peracid.

In the present invention the alpha mono alkylated/alkoxylated carboxylic acid which is perhydrolyzed to obtain the corresponding peracid may be an alpha mono alkylated or alpha mono alkoxylated monocarboxylic acid an alpha mono alkylated or alpha mono alkoxylated polycarboxylic acid like an alpha mono alkylated or alpha mono alkoxylated dicarboxylic acid or mixtures thereof.

By "alpha mono alkylated or alpha mono alkoxylated carboxylic acid" it is meant herein a carboxylic acid being mono-substituted with an alkyl or alkoxy group on the carbon atom in alpha position with respect to the carboxylic group or groups. In the case of a polycarboxylic acid, at least one carboxylic function of the acid is alkylated or alkoxylated in its alpha position.

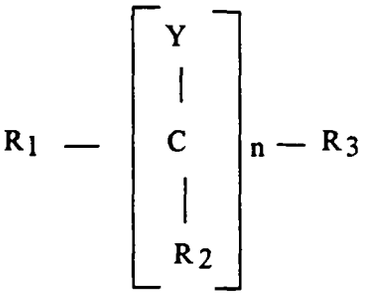
Suitable alpha mono alkylated or alpha mono alkoxylated monocarboxylic acids to be used herein have the following formula:



wherein R1 is an alkyl group of from 1 to 26 carbon atoms, preferably from 2 to 18 and more preferably from 2 to 14 and wherein R2 is an alkyl or alkoxy group of from 1 to 14 carbon atoms, preferably from 1 to 8.

Preferred alpha mono alkylated or alpha mono alkoxylated monocarboxylic acids to be used herein are 2-methyl propionic acid, 2-ethyl propionic acid, 2-methyl hexanoic acid, 2-methyl octanoic acid, 2-methoxy octanoic acid, 2-methyl lauric acid, 2-ethyl lauric acid, 2-ethoxy lauric acid, 2-propyl lauric acid or mixtures thereof.

Suitable alpha mono alkylated or alpha mono alkoxylated polycarboxylic acids to be used herein have the following formula :



wherein R1 and R3 are each H or an alkyl group of from 1 to 26 carbon atoms, preferably from 2 to 18 and more preferably from 2 to 14; R2 is H or an alkyl or alkoxy group of from 1 to 14 carbon atoms, preferably from 1 to 8; wherein n is an integer of from 2 to 20, preferably from 2 to 12; Y is H or a carboxylic group, wherein Y and R2 each have the same or different representations when repeated in a given molecular formula, and wherein at least two Y in a molecule are a carboxylic group and at least one R2 in alpha position with respect to at least one of said carboxylic group is an alkyl or alkoxy group of from 1 to 14 carbon atoms.

Examples of alpha mono alkylated or alpha mono alkoxylated polycarboxylic acids to be used herein are alpha mono alkylated or alpha mono alkoxylated succinic acid, alpha mono alkylated or alpha mono alkoxylated glutaric acid, alpha mono alkylated or alpha mono alkoxylated adipic acid, and alpha mono alkylated or alpha mono alkoxylated pimelic acid.

Preferred alpha mono alkylated or alpha mono alkoxylated polycarboxylic acids to be used herein are 2-methyl adipic acid, 2-methyl succinic acid, 2-methoxy succinic acid, 2,3-dimethyl succinic acid, 2-methyl pimelic acid, 2-ethoxy pimelic acid, 2,6-dimethyl pimelic acid, 2-ethyl glutaric acid, 2-methyl glutaric acid, 2,4-dimethyl glutaric acid, or mixtures thereof.

As a second essential element, the process of the present invention requires the use of hydrogen peroxide or a water-soluble source thereof, or mixtures thereof.

As used herein a hydrogen peroxide source refers to any compound which produces hydrogen peroxide when said compound is in contact with water. Suitable water-soluble sources of hydrogen peroxide for use herein include percarbonates, perborates, and persulfates and mixtures thereof. Hydrogen peroxide is most preferred for use herein.

By "aqueous medium" it is meant herein that the reaction is conducted in presence of water. The amount of water used depends on the end product desired and is at the discretion of the process operator. It is often convenient to provide the required amount of water either directly when contacting the peracid precursor and hydrogen peroxide or a water-soluble source thereof, or in a subsequent step so as to provide an aqueous composition that has a peracid concentration of from 0.005% to 50% by weight of the total composition as defined herein before. The dilution step which may be required is conducted at or around ambient temperature. The dilution water solution often has a temperature of from 5°C to 25°C. In a preferred embodiment, it is desirable to effect the dilution soon after the point at or near which the maximum peracid concentration has been obtained. The compositions obtainable according to the process of the present invention can be monitored as described hereinafter. Indeed, it is possible according to the process of the present invention to attain a peracid concentration which is at or near a maximum in a period between 5 and 48 hours, starting from the moment where the alpha monosubstituted carboxylic acid is mixed with a solution of hydrogen peroxide or a water-soluble source thereof.

Typically, the alpha mono alkylated carboxylic acid and/or alpha mono alkoxylated carboxylic acid is reacted with hydrogen peroxide or a water-soluble source thereof, in a molar ratio of said precursor of peracid (i.e., alpha mono alkylated carboxylic acid and/or alpha mono alkoxylated carboxylic acid) to said hydrogen peroxide or a water-soluble source thereof of from 0.5 to 20, preferably of from 1 to 10 and more preferably 1 to 5.

In the embodiment where a solution of hydrogen peroxide or a water-soluble source thereof is used in the process of the present invention said solution comprises from 0.5% to 90% by weight of hydrogen peroxide or a water-soluble source thereof or mixtures thereof, preferably from 1% to 70%, and more preferably from 2% to 40%.

Typically, in the process according to the present invention the peracid precursor is reacted with hydrogen peroxide or a water-soluble source thereof in presence of an aqueous solution of a strong acid or mixtures thereof. By "strong acid" it is meant herein an acid having its first pka below 3, preferably below 2 and more preferably below 1. Said aqueous solution of strong acids may serve as the reaction aqueous medium and as a catalyst. Said strong acids include

mineral acids and/or organic sulphonic acid. Preferred strong acids to be used herein are sulphuric acid, phosphonic acid and/or methane sulphonic acid.

In the process according to the present invention said aqueous solution of a strong acid or mixtures thereof, comprises from 90% to 98% by weight of said strong acid, more preferably from 95% to 98% and most preferably from 97% to 98%. Accordingly, the present process is typically conducted in the acidic range at a pH below 8, preferably from 0 to 6, more preferably from 0 to 4, most preferably from 0 to 2.

By using such aqueous solution of a strong acid it is possible to enable the reaction to occur at a convenient rate without the use of elevated reaction temperature. The temperature at which the present process is conducted also depends on the concentration of the solution of hydrogen peroxide or a water-soluble source thereof used. For example, if a solution of hydrogen peroxide is used at a concentration of 36%, the reaction is preferably conducted at room temperature, e.g., 25°C or higher. For convenience, coupled with safety considerations, the reaction temperature is maintained in many embodiments in the range which is from 0°C to 40°C, preferably 5°C to 30°C, more preferably at ambient temperature 20°C-25°C.

An advantage associated with the process of the present invention is that a higher yield of peracids is obtained even without the use of elevated reaction temperatures.

By "yield" it is to be understood herein the percentage of peracid obtained calculated with respect to the corresponding peracid precursor, i.e., the alpha mono alkylated or alpha mono alkoxylated carboxylic acid. The following equation is applied to calculate said yield:

(peracid concentration / corresponding precursor peracid concentration) * 100 = % yield

In that equation the concentrations may be expressed in mole/liter.

A suitable test method to evaluate peracid available oxygen (often abbreviated to Avox) is by chromatography as described in F. Di Furia et. alt., Gas-liquid chromatography method for determination of peracids, Analyst, vol. 109, August 1984, p. 985-987; or ibidem vol. 113, May 1988, p. 793-795.

Indeed, it has surprisingly been found that a higher yield of peracid is provided with the present process starting from a given amount of an alpha mono alkylated or alpha mono alkoxylated carboxylic acid and reacting it with a solution of hydrogen peroxide or a water-soluble source thereof, as compared to the same process wherein the peracid precursor used is the corresponding alpha non-substituted carboxylic acid (e.g., glutaric acid or succinic acid) instead of said alpha mono alkylated or alpha mono alkoxylated carboxylic acid (e.g., 2,4-dimethyl glutaric acid or 2-methyl succinic acid respectively).

The process of the present invention allows the formulation of not only compositions containing only the peracid, i.e., raw material aqueous compositions, but also fully formulated aqueous detergent compositions, i.e., compositions incorporating further ingredients commonly used in the detergent field.

Accordingly, the process of forming said peracid may further comprise a step where at least one additional ingredient, other than water, hydrogen peroxide or a water-soluble source thereof and said alpha mono alkylated carboxylic acid and/or alpha mono alkoxylated carboxylic acid is provided .

The additional ingredient provided is selected from the group consisting of surfactants, soil suspending agents, builders, chelants, bleach activators, radical scavengers, pigments, enzymes, dye transfer inhibitors, solvents, buffering agents, suds suppressing agents, photobleaching agents, brighteners, dyes, perfumes and the like, and mixtures thereof. Depending on the intended end use of the aqueous compositions according to the process of the present invention, different combinations of these optional ingredients may be provided in the process herein. Preferred suitable optional ingredients are described in more detail hereinafter.

In one embodiment of the present invention the peracid-containing compositions may be provided in the form of an emulsion. Accordingly, the process for forming peracids according to the present invention may further comprise additional steps so as to provide aqueous peracid-containing compositions being in the form of an emulsion. In these aqueous compositions, the peracids are emulsified by means of a surfactant system of at least two different surfactants, i.e., at least a hydrophobic surfactant having an HLB below 11 and at least one hydrophilic surfactant having an HLB above 11. Indeed, the two different surfactants must have different HLB values (hydrophilic lipophilic balance), and preferably the difference in value of the HLBs of said two surfactants is at least 1, preferably at least 3, in order to obtain stable emulsions.

Accordingly, the present invention encompasses a process for manufacturing an aqueous peracid-containing composition, wherein the peracid is emulsified by a surfactant system comprising at least a hydrophilic surfactant having an HLB above 11 and at least a hydrophobic surfactant having an HLB below 11, said process comprising the following steps:

In one step a peracid is formed according to the present invention, as herein before described, i.e., by reacting in an aqueous medium an alpha mono alkoxylated carboxylic acid and/or alpha mono alkylated carboxylic acid with hydrogen peroxide or a water-soluble source thereof.

In another step, a hydrophobic mixture is prepared which comprises at least said hydrophobic surfactant. The hydrophobic mixture preferably further comprises other hydrophobic ingredients which are to be formulated in the composition such as perfumes, solvents, enzymes, bleach activators, polymers and the peracid, if it is hydrophobic.

In yet another step, a hydrophilic mixture is prepared which comprises at least water and said hydrophilic surfactant. The hydrophilic mixture preferably further comprises other hydrophilic ingredients which are to be formulated in the composition such as dyes, hydrophilic optical brighteners, builders, chelants, buffering agents and the peracid, if it is hydrophilic.

Indeed, in the process of the present invention the peracid formed is mixed in the hydrophobic mixture or in the hydrophilic mixture depending on its respective feature, i.e., hydrophilic or hydrophobic.

Naturally, these three steps can be performed in any order.

Finally, in a subsequent step of the process according to the present invention, the hydrophobic mixture and said hydrophilic mixture are mixed together.

Preferred surfactants to obtain aqueous emulsions are the hydrophobic nonionic surfactants and hydrophilic nonionic surfactants. The hydrophobic nonionic surfactants to be used herein have an HLB below 11, preferably below 10, more preferably below 8 and the hydrophilic surfactants have an HLB above 11, preferably above 12, more preferably above 13.

Suitable nonionic surfactants for use herein include alkoxylated fatty alcohols preferably, fatty alcohol ethoxylates and/or propoxylates. Indeed, a great variety of such alkoxylated fatty alcohols are commercially available which have very different HLB values (hydrophilic lipophilic balance). The HLB values of such alkoxylated nonionic surfactants depend essentially on the chain length of the fatty alcohol, the nature of the alkoxylation and the degree of alkoxylation. Hydrophilic nonionic surfactants tend to have a high degree of alkoxylation and a short chain fatty alcohol, while hydrophobic surfactants tend to have a low degree of alkoxylation and a long chain fatty alcohol. Surfactant catalogues are available which list a number of surfactants including nonionics, together with their respective HLB values.

Suitable chemical processes for preparing the nonionic surfactants for use herein include condensation of corresponding alcohols with alkylene oxide, in the desired proportions. Such processes are well-known to the man skilled in the art and have been extensively described in the art. As an alternative, a great variety of alkoxylated alcohols suitable for use herein is commercially available from various suppliers. Examples of adequate nonionic surfactant systems would comprise a hydrophobic nonionic surfactant with for instance an HLB of 6, such as a Dobanol ^{R} 23-2 and a hydrophilic nonionic surfactant with for instance an HLB of 15, such as a Dobanol ^{R} 91-10. Another suitable nonionic surfactant system comprises a Dobanol ^{R} 23-6.5 (HLB about 12) and a Dobanol ^{R} 23 (HLB below 6).

Apart from hydrophobic and hydrophilic surfactants being nonionic surfactants any other type of surfactants known in the art and able to form emulsions may be used according to the present invention.

Other suitable hydrophilic surfactants to be used in the present invention may be anionic surfactants in particular sulfonate and sulfate surfactants. The like anionic surfactants are well-known in the art and have found wide application in commercial detergents. These anionic surfactants include the C8-C22 alkyl benzene sulfonates (LAS), the C8-C22 alkyl sulfates (AS), unsaturated sulfates such as oleyl sulfate, the C10-C18 alkyl alkoxy sulfates (AES) and the C10-C18 alkyl alkoxy carboxylates. The neutralizing cation for the anionic synthetic sulfonates and/or sulfates is represented by conventional cations which are widely used in detergent technology such as sodium, potassium or alkanolammonium.

Other surfactants may be used herein which should however not significantly alter the weighted average HLB value of the overall emulsion. Depending on their HLB value said surfactants would be added either in the hydrophilic mixture or in the hydrophobic mixture of the process of the present invention.

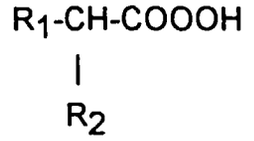
Compositions comprising said peracid

The present invention also encompasses an aqueous composition comprising a peracid, which is obtainable by the process described hereinbefore.

Thus, the compositions according to the present invention comprise an alpha mono alkylated or alpha mono alkoxylated percarboxylic acid or mixtures thereof.

The alpha mono alkylated/alkoxylated percarboxylic acid to be used herein may be an alpha mono alkylated or alpha mono alkoxylated monopercarboxylic acid, an alpha mono alkylated or alpha mono alkoxylated polypercarboxylic acid or mixtures thereof.

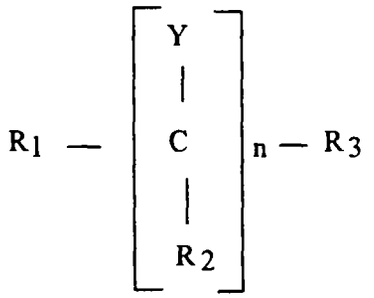
Suitable alpha mono alkylated or alpha mono alkoxylated monopercarboxylic acids to be used herein have the following formula:



wherein R1 is an alkyl group of from 1 to 26 carbon atoms, preferably from 2 to 18 and more preferably from 2 to 14 and wherein R2 is an alkyl or alkoxy group of from 1 to 14 carbon atoms, preferably from 1 to 8.

Preferred alpha mono alkylated or alpha mono alkoxylated monopercarboxylic acids to be used herein are 2-methyl perpropionic acid, 2-ethyl perpropionic acid, 2-methyl perhexanoic acid, 2-methyl peroctanoic acid, 2-methoxy peroctanoic acid, 2-methyl perlauric acid, 2-ethyl perlauric acid, 2-ethoxy perlauric acid, 2-propyl perlauric acid or mixtures thereof.

Suitable alpha mono alkylated or alpha mono alkoxylated polypercarboxylic acids to be used herein have the following formula :



wherein R1 and R3 are each H or an alkyl group of from 1 to 26 carbon atoms, preferably from 2 to 18 and more preferably from 2 to 14; R2 is H or an alkyl or alkoxy group of from 1 to 14 carbon atoms, preferably from 1 to 8; wherein n is an integer of from 2 to 20, preferably from 2 to 12; Y is H or a percarboxylic group (-COOOH), wherein Y and R2 each have the same or different representations when repeated in a given molecular formula, and wherein at least two Y in a molecule are a percarboxylic group and at least one R2 in alpha position with respect to at least one of said percarboxylic group is an alkyl or alkoxy group of from 1 to 14 carbon atoms.

Preferred alpha mono alkylated or alpha mono alkoxylated polypercarboxylic acids to be used herein are 2-methyl peradipic acid, 2-methyl persuccinic acid, 2-methoxy persuccinic acid, 2,3-dimethyl persuccinic acid, 2-methyl perpimelic acid, 2-ethoxy perpimelic acid, 2,6-dimethyl perpimelic acid, 2-ethyl perglutaric acid, 2-methyl perglutaric acid, 2,4-dimethyl perglutaric acid, or mixtures thereof.

The compositions according to the present invention comprise from 0.005% to 50% by weight of the total composition of mono alkylated or alpha mono alkoxylated percarboxylic acid or mixtures thereof, or mixtures thereof, preferably from 0.01% to 30%, and more preferably from 0.01% to 20%. In the embodiment wherein the compositions according to the present invention are obtained according to the process above, said compositions may further comprise a hydrogen peroxide or a source thereof which has not reacted to form the corresponding peracid, when added in excess. Generally, the compositions according to the present invention may comprise from 0.5% to 90%, preferably from 1% to 70% and more preferably from 2% to 40% of the total composition of hydrogen peroxide or a water-soluble source thereof or mixtures thereof. Said compositions may be used as a raw material composition in applications such as hard-surface cleaning, toilet bowl cleaning, carpet cleaning, laundry applications, denture cleaning and/or in disinfection applications.

The compositions according to the present invention may be raw material aqueous compositions incorporating said peracid or fully formulated aqueous detergent compositions, i.e., compositions incorporating further ingredients commonly used in the detergent field.

Accordingly, the compositions according to the present invention may comprise optional ingredients such as surfactants, soil suspending agents, builders, chelants, bleach activators, radical scavengers, pigments, enzymes, dye transfer inhibitors, solvents, buffering agents, suds suppressing agents, photobleaching agents, brighteners, dyes, perfumes and the like, or mixtures thereof.

The compositions according to the present invention deliver good stain removal performance, especially on bleachable stains. Indeed, said compositions are particularly useful as laundry detergent, as laundry pretreaters, i.e., compositions which are dispensed and left to act onto fabrics before they are washed, or as laundry additives to be used

together with detergents to boost their performance. Said compositions may also be particularly suitable as dishwashing compositions to be used either in the dishwashing machines or by hand, as carpet cleaners to be used either by direct application onto the carpets or in carpet cleaning machines, as toilet bowl cleaners, as hard surface cleaners, as denture cleaners, or as disinfectant products.

In one embodiment the compositions according to the present invention are in the form of an emulsion. In said emulsions said alpha mono alkylated or alkoxylated percarboxylic acid is emulsified by a surfactant system comprising at least a hydrophilic surfactant having an HLB above 11 and at least a hydrophobic surfactant having an HLB below 11, as described hereinbefore.

An advantage associated with an emulsion obtainable according to the process of the present invention described hereinbefore is that said emulsion comprises a higher amount of peracid, starting from a given amount of alpha mono alkylated or alpha mono alkoxylated carboxylic acid and that the decomposition rate of said peracid is reduced during storage, i.e., improved stability is achieved. By "improved stability" it is to be understood herein that the time required to obtain half of the initial concentration of peracids in a given composition being in the form of an emulsion is greater than the time required to obtain half of the initial concentration of peracids in the same composition but which is not in the form of an emulsion. Peracid concentration can be measured as per the article mentioned hereinabove.

Accordingly, the emulsions according to the present invention preferably comprise from 0.5% to 20%, by weight of the total emulsion, of hydrogen peroxide or a water-soluble source thereof, more preferably from 2% to 15%, and most preferably from 3% to 10%. Preferred emulsions according to the present invention comprise from 0.005% to 15%, by weight of the total emulsion, of said peracid or mixtures thereof, more preferably from 0.01% to 10%, and most preferably from 0.01% to 5%.

The emulsions according to the present invention comprise from 1% to 50 % by weight of the total emulsion, of the hydrophilic and hydrophobic surfactants or mixtures thereof, preferably from 2% to 40% and more preferably from 3% to 30%. The emulsions comprise at least from 0.1, % by weight of the total emulsion, of the hydrophobic surfactant, preferably at least 1% and more preferably at least 2%, and at least from 0.1 %, by weight of the total emulsion of the hydrophilic surfactant, preferably at least 1% and more preferably at least 2%.

In a preferred embodiment of the emulsions of the present invention, the emulsifying system meets the equation:

$$HLB(X) = \frac{weight\%A}{100} \times HLB(A) + \frac{weight\%B}{100} \times HLB(B) \text{ and weight } \%A + weight\%B = 100\%;$$

where HLB (X) refers to the HLB of the ingredient to emulsify, if several ingredients are present to emulsify X refers to the all of them (weighted average based on % of each ingredient in the formula), HLB (A) refers to the HLB of the hydrophilic surfactant, or mixtures thereof, and HLB (B) refers to the HLB of the hydrophobic surfactant, or mixtures thereof.

Compositions comprising an alpha mono alkylated or alkoxylated carboxylic acid, as a peracid precursor

The present invention also encompasses a composition comprising an alpha mono alkylated or alkoxylated carboxylic acid or mixtures thereof, as described hereinbefore, and hydrogen peroxide or a water-soluble source thereof.

Typically, said compositions of the present invention comprise from 0.01% to 60% by weight of the total composition of an alpha mono alkylated or alpha mono alkoxylated carboxylic acid or mixtures thereof, preferably from 0.1% to 40%, more preferably from 0.5% to 30% and most preferably from 2% to 25%.

Any source of hydrogen peroxide known to those skilled in the art may be used herein. Suitable sources of hydrogen peroxide include percarbonates, perborates, peroxides/hydroperoxides, persilicates, persulphates and mixtures thereof.

Suitable organic and inorganic peroxides/hydroperoxides for use herein include diacyl and dialkyl peroxides/hydroperoxides such as dibenzoyl peroxide, t-butyl hydroperoxide, dilauroyl peroxide, dicumyl peroxide and mixtures thereof.

Suitable preformed peroxyacids for use herein include diperoxydodecandioic acid DPDA, magnesium perphthalatic acid, perlauric acid, perbenzoic acid, diperoxyazelaic acid and mixtures thereof.

Typically, the compositions of the present invention comprise from 0.5% to 90% by weight of the total composition of a hydrogen peroxide or a water-soluble source thereof or mixtures thereof, preferably from 1% to 70% and more preferably from 2% to 40%.

An advantage associated with such compositions of the present invention is that they deliver excellent stain removal performance especially on bleachable stains like coffee, tea and the like, due to the formation in situ of peracid corresponding to the carboxylic acid used therein. Indeed the present invention provides compositions delivering excellent stain removal at lower peracid precursor levels.

The compositions may comprise any optional ingredients known to those skilled in the art such as the ones mentioned herein.

Optionals

The compositions according to the present invention may comprise up to 50% by weight of the total composition of a surfactant or mixtures thereof, preferably from 0.01% to 30% and more preferably from 0.1% to 25%. Surfactants for use herein are well-known in the art and include anionic, nonionic, amphoteric, zwitterionic and cationic surfactants and mixtures thereof. The surfactants suitable for use herein are compatible with hydrogen peroxide and sources thereof. They also contribute to the cleaning performance of a composition comprising said combination.

Particularly suitable anionic surfactants to be used herein include water-soluble salts or acids of the formula $ROSO_3M$ wherein R is preferably a C_6-C_{24} hydrocarbyl, preferably an alkyl or hydroxyalkyl having a C_{10}-C_{20} alkyl component, more preferably a C_{12}-C_{18} alkyl or hydroxyalkyl, and M is H or a cation, e.g., an alkali metal cation (e.g., sodium, potassium, lithium), or ammonium or substituted ammonium (e.g., methyl-, dimethyl-, and trimethyl ammonium cations and quaternary ammonium cations, such as tetramethylammonium and dimethyl piperdinium cations and quaternary ammonium cations derived from alkylamines such as ethylamine, diethylamine, triethylamine, and mixtures thereof, and the like).

Other suitable anionic surfactants to be used herein include alkyl-diphenylether-sulphonates and alkyl-carboxylates. Other anionic surfactants can include salts (including, for example, sodium, potassium, ammonium, and substituted ammonium salts such as mono-, di- and triethanolamine salts) of soap, C_9-C_{20} linear alkylbenzenesulfonates, C_8-C_{22} primary or secondary alkanesulfonates, C_8-C_{24} olefinsulfonates, sulfonated polycarboxylic acids prepared by sulfonation of the pyrolyzed product of alkaline earth metal citrates, e.g., as described in British patent specification No. 1,082,179, C_8-C_{24} alkylpolyglycolethersulfates (containing up to 10 moles of ethylene oxide); alkyl ester sulfonates such as $C_{14\text{-}16}$ methyl ester sulfonates; acyl glycerol sulfonates, fatty oleyl glycerol sulfates, alkyl phenol ethylene oxide ether sulfates, paraffin sulfonates, alkyl phosphates, isethionates such as the acyl isethionates, N-acyl taurates, alkyl succinamates and sulfosuccinates, monoesters of sulfosuccinate (especially saturated and unsaturated C_{12}-C_{18} monoesters) diesters of sulfosuccinate (especially saturated and unsaturated C_6-C_{14} diesters), acyl sarcosinates, sulfates of alkylpolysaccharides such as the sulfates of alkylpolyglucoside (the nonionic nonsulfated compounds being described below), branched primary alkyl sulfates, alkyl polyethoxy carboxylates such as those of the formula $RO(CH_2CH_2O)_kCH_2COO\text{-}M^+$ wherein R is a C_8-C_{22} alkyl, k is an integer from 0 to 10, and M is a soluble salt-forming cation. Resin acids and hydrogenated resin acids are also suitable, such as rosin, hydrogenated rosin, and resin acids and hydrogenated resin acids present in or derived from tall oil. Further examples are given in "Surface Active Agents and Detergents" (Vol. I and II by Schwartz, Perry and Berch). A variety of such surfactants are also generally disclosed in U.S. Patent 3,929,678, issued December 30, 1975 to Laughlin, et al. at Column 23, line 58 through Column 29, line 23 (herein incorporated by reference).

Preferred anionic surfactants for use in the compositions herein are the alkyl benzene sulfonates, alkyl sulfates, alkyl alkoxylated sulfates, and mixtures thereof.

Suitable nonionic surfactants to be used herein are fatty alcohol ethoxylates and/or propoxylates which are commercially available with a variety of fatty alcohol chain lengths and a variety of ethoxylation degrees. Indeed, the HLB values of such alkoxylated nonionic surfactants depend essentially on the chain length of the fatty alcohol, the nature of the alkoxylation and the degree of alkoxylation. Surfactant catalogues are available which list a number of surfactants, including nonionics, together with their respective HLB values.

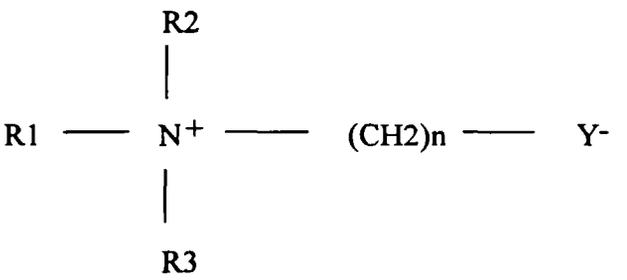
Suitable chemical processes for preparing the nonionic surfactants for use herein include condensation of corresponding alcohols with alkylene oxide, in the desired proportions. Such processes are well-known to the man skilled in the art and have been extensively described in the art. As an alternative, a great variety of alkoxylated alcohols suitable for use herein is commercially available from various suppliers.

Accordingly, suitable nonionic surfactants for use herein are Dobanol ^{R} 91-2.5 (HLB= 8.1; R is a mixture of C9 and C_{11} alkyl chains, n is 2.5 and m is 0), or Lutensol ^{R} TO3 (HLB=8; R is a C_{13} alkyl chains, n is 3 and m is 0), or Lutensol ^{R} AO3 (HLB=8; R is a mixture of C_{13} and C_{15} alkyl chains, n is 3 and m is 0), or Tergitol ^{R} 25L3 (HLB= 7.7; R is in the range of C_{12} to C_{15} alkyl chain length, n is 3 and m is 0), or Dobanol ^{R} 23-3 (HLB=8.1; R is a mixture of C_{12} and C_{13} alkyl chains, n is 3 and m is 0), or Dobanol ^{R} 23-2 (HLB=6.2; R is a mixture of C_{12} and C_{13} alkyl chains, n is 2 and m is 0), or Dobanol ^{R} 45-7 (HLB=11.6; R is a mixture of C_{14} and C_{15} alkyl chains, n is 7 and m is 0) Dobanol ^{R} 23-6.5 (HLB=11.9; R is a mixture of C_{12} and C_{13} alkyl chains, n is 6.5 and m is 0), or Dobanol ^{R} 25-7 (HLB=12; R is a mixture of C_{12} and C_{15} alkyl chains, n is 7 and m is 0), or Dobanol ^{R} 91-5 (HLB=11.6; R is a mixture of C_9 and C_{11} alkyl chains, n is 5 and m is 0), or Dobanol ^{R} 91-6 (HLB=12.5 ; R is a mixture of C_9 and C_{11} alkyl chains, n is 6 and m is 0), or Dobanol ^{R} 91-8 (HLB=13.7 ; R is a mixture of C_9 and C_{11} alkyl chains, n is 8 and m is 0), Dobanol ^{R} 91-10 (HLB=14.2 ; R is a mixture of C_9 to C_{11} alkyl chains, n is 10 and m is 0), or mixtures thereof. Preferred herein are Dobanol ^{R} 91-2.5 , or Lutensol ^{R} TO3, or Lutensol ^{R} AO3, or Tergitol ^{R} 25L3, or Dobanol ^{R} 23-3, or Dobanol ^{R} 23-2, or mixtures thereof. These

Dobanol^{R} surfactants are commercially available from SHELL. These Lutensol^{R} surfactants are commercially available from BASF and these Tergitol ^{R} surfactants are commercially available from UNION CARBIDE.

Other nonionic surfactants include fatty acid C_6-C_{24} alkanolamides, C_6-C_{20} polyethylglycol ethers, polyethylene glycol with molecular weight 1000 to 80000 and glucose amides and alkyl pyrrolidones.

Suitable amphoteric surfactants to be used herein include betaine and sulphobetaine surfactants, derivatives thereof or mixtures thereof. Suitable betaine and sulphobetaine surfactants to be used herein are the betaine/sulphobetaine and betaine-like detergents wherein the molecule contains both basic and acidic groups which form an inner salt giving the molecule both cationic and anionic hydrophilic groups over a broad range of pH values. Some common examples of these detergents are described in U.S. Pat. Nos. 2,082,275, 2,702,279 and 2,255,082, incorporated herein by reference. Preferred betaine and sulphobetaine surfactants herein are according to the formula



wherein R1 is an alkyl radical containing from about 1 to about 24 carbon atoms, preferably from 8 to 18, and more preferably from 12 to 14, wherein R2 and R3 contain from 1 to 3 carbon atoms, and preferably 1 carbon atom, wherein n is an integer from 1 to 10, preferably from 1 to 6 and more preferably is 1, Y is selected from the group consisting of carboxyl and sulfonyl radicals and wherein the sum of R1, R2 and R3 radicals is from 14 to 24 carbon atoms, or mixtures thereof.

Examples of particularly suitable betaine surfactants include C12-C18 alkyl dimethyl betaine such as coconutbetaine and C10-C16 alkyl dimethyl betaine such as laurylbetaine. Coconutbetaine is commercially available from Seppic under the trade name of Amonyl 265®. Laurylbetaine is commercially available from Albright & Wilson under the trade name Empigen BB/L®.

Other suitable amphoteric surfactants to be used herein include amine oxides having the following formula $R_1R_2R_3NO$ wherein each of R1, R2 and R3 is independently a saturated substituted or unsubstituted, linear or branched alkyl groups of from 1 to 30 carbon atoms, preferably of from 6 to 30 carbon atoms, more preferably of from 10 to 20 carbon atoms, and most preferably of from 8 to 18 carbon atoms. Preferred amine oxides for use herein are for instance natural blend C8-C10 amine oxides as well as C12-C16 amine oxides commercially available from Hoechst. Suitable short chain amine oxides to be used according to the present invention are amine oxides having the following formula $R_1R_2R_3NO$ wherein R1 is a C6 to C10 alkyl group, preferably a C8 to C10 alkyl group and wherein R2 and R3 are independently substituted or unsubstituted, linear or branched alkyl groups of from 1 to 4 carbon atoms, preferably of from 1 to 3 carbon atoms, and more preferably are methyl groups. R1 may be a saturated linear or branched alkyl group. Preferred short chain amine oxides for use herein are for instance natural blend C8-C10 amine oxides available from Hoechst.

Suitable cationic surfactants to be used herein include derivatives of quaternary ammonium, phosphonium, imidazolium and sulfonium compounds. Preferred cationic surfactants for use herein are quaternary ammonium compounds wherein one or two of the hydrocarbon groups linked to nitrogen are a saturated, linear or branched alkyl group of 6 to 30 carbon atoms, preferably of 10 to 25 carbon atoms, and more preferably of 12 to 20 carbon atoms, and wherein the other hydrocarbon groups (i.e. three when one hydrocarbon group is a long chain hydrocarbon group as mentioned hereinbefore or two when two hydrocarbon groups are long chain hydrocarbon groups as mentioned hereinbefore) linked to the nitrogen are independently substituted or unsubstituted, linear or branched, alkyl chain of from 1 to 4 carbon atoms, preferably of from 1 to 3 carbon atoms, and more preferably are methyl groups. The counterion used in said quaternary ammonium compounds is selected from the group of methyl sulfate, or methylsulfonate, and the like. Particularly preferred cationic surfactants to be used herein are trimethyl quaternary ammonium compounds like myristyl trimethylsulfate, cetyl trimethylsulfate and/or tallow trimethylsulfate. Such trimethyl quaternary ammonium compounds are commercially available from Hoechst, or from Albright & Wilson under the trade name EMPIGEN CM®.

Suitable zwitterionic surfactants contain both cationic and anionic hydrophilic groups on the same molecule at a relatively wide range of pH's. The typical cationic group is a quaternary ammonium group, although other positively charged groups like phosphonium, imidazolium and sulfonium groups can be used. The typical anionic hydrophilic groups are carboxylates and sulfonates, although other groups like sulfates, phosphonates, and the like can be used.

A generic formula for some preferred zwitterionic surfactants is

$$R_1\text{-}N^+(R_2)(R_3)R_4X^-$$

wherein R_1 is a hydrophobic group; R_2 and R_3 are each C_1-C_4 alkyl, hydroxy alkyl or other substituted alkyl group which can also be joined to form ring structures with the N; R_4 is a moiety joining the cationic nitrogen atom to the hydrophilic group and is typically an alkylene, hydroxy alkylene, or polyalkoxy group containing from 1 to 4 carbon atoms; and X is the hydrophilic group which is preferably a carboxylate or sulfonate group. Preferred hydrophobic groups R_1 are alkyl groups containing from 8 to 22, preferably less than 18, more preferably less than 16 carbon atoms. The hydrophobic group can contain unsaturation and/or substituents and/or linking groups such as aryl groups, amido groups, ester groups and the like. In general, the simple alkyl groups are preferred for cost and stability reasons.

Other specific zwitterionic surfactants have the generic formulae:

$$R_1\text{-}C(O)\text{-}N(R_2)\text{-}(C(R_3)_2)_n\text{-}N(R_2)_2{}^{(+)}\text{-}(C(R_3)_2)_n\text{-}SO_3{}^{(-)}$$

or

$$R_1\text{-}C(O)\text{-}N(R_2)\text{-}(C(R_3)_2)_n\text{-}N(R_2)_2{}^{(+)}\text{-}(C(R_3)_2)_n\text{-}COO^{(-)}$$

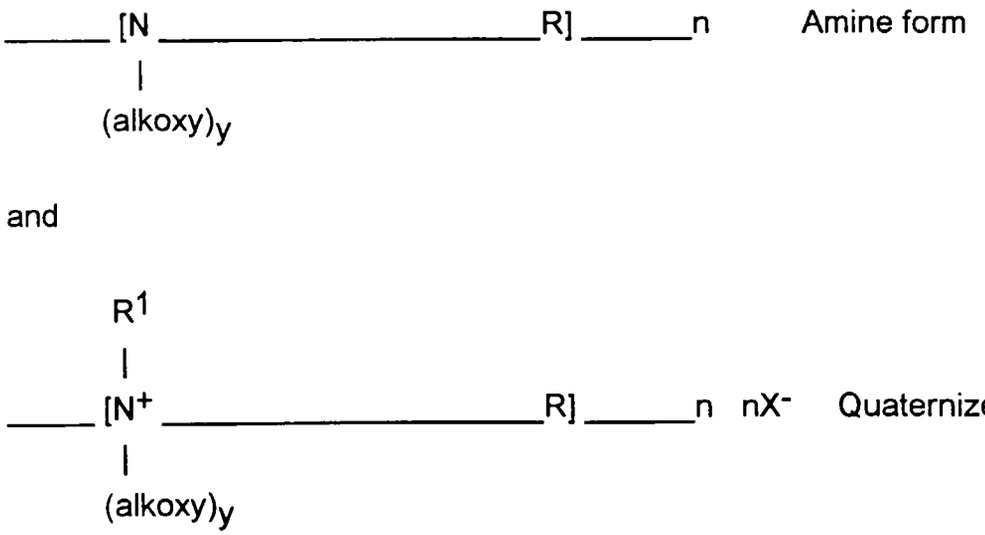
wherein each R_1 is a hydrocarbon, e.g. an alkyl group containing from 8 up to 20, preferably up to 18, more preferably up to 16 carbon atoms, each R_2 is either a hydrogen (when attached to the amido nitrogen), short chain alkyl or substituted alkyl containing from one to 4 carbon atoms, preferably groups selected from the group consisting of methyl, ethyl, propyl, hydroxy substituted ethyl or propyl and mixtures thereof, preferably methyl, each R_3 is selected from the group consisting of hydrogen and hydroxy groups and each n is a number from 1 to 4, preferably from 2 to 3, more preferably 3, with no more than one hydroxy group in any $(C(R_3)_2)$ moiety. The R_1 groups can be branched and/or unsaturated. The R_2 groups can also be connected to form ring structures. A surfactant of this type is a C_{10}-C_{14} fatty acylamidopropylene(hydroxypropylene)sulfobetaine that is available from the Sherex Company under the trade name "Varion CAS sulfobetaine"®.

Any soil suspending polycarboxylate polymer known to those skilled in the art can be use in the compositions according to the present invention such as homo- or co-polymeric polycarboxylic acids or their salts including polyacrylates and copolymers of maleic anhydride or/and acrylic acid and the like. Indeed, such soil suspending polycarboxylate polymers can be prepared by polymerizing or copolymerizing suitable unsaturated monomers, preferably in their acid form. Unsaturated monomeric acids which can be polymerized to form suitable polymeric polycarboxylates include acrylic acid, maleic acid (or maleic anhydride), fumaric acid, itaconic acid, aconitic acid, mesaconic acid, citraconic acid and methylenemalonic acid. The presence in the polymeric polycarboxylates herein of monomeric segments, containing no carboxylate radicals such as vinylmethyl ether, styrene, ethylene, etc. is suitable provided that such segments do not constitute more than about 40% by weight.

Particularly suitable polymeric polycarboxylates to be used herein can be derived from acrylic acid. Such acrylic acid-based polymers which are useful herein are the water-soluble salts of polymerized acrylic acid. The average molecular weight of such polymers in the acid form preferably ranges from about 2,000 to 10,000, more preferably from about 4,000 to 7,000 and most preferably from about 4,000 to 5,000. Water-soluble salts of such acrylic acid polymers can include, for example, the alkali metal, ammonium and substituted ammonium salts. Soluble polymers of this type are known materials. Use of polyacrylates of this type in detergent compositions has been disclosed, for example, in Diehl, U.S. Patent 3,308,067, issued March 7, 1967.

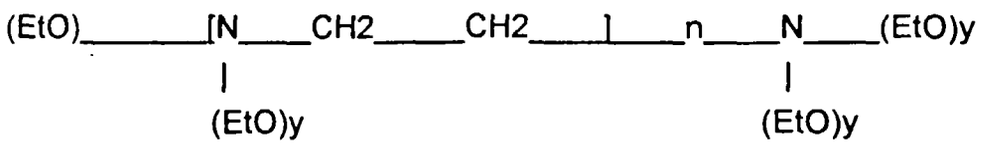
Acrylic/maleic-based copolymers may also be used as a preferred soil suspending polycarboxylic polymer. Such materials include the water-soluble salts of copolymers of acrylic acid and maleic acid. The average molecular weight of such copolymers in the acid form preferably ranges from about 2,000 to 100,000, more preferably from about 5,000 to 75,000, most preferably from about 7,000 to 65,000. The ratio of acrylate to maleate segments in such copolymers will generally range from about 30:1 to about 1:1, more preferably from about 10:1 to 2:1. Water-soluble salts of such acrylic acid/maleic acid copolymers can include, for example, the alkali metal, ammonium and substituted ammonium salts. Soluble acrylate/maleate copolymers of this type are known materials which are described in European Patent Application No. 66915, published December 15, 1982. Particularly preferred is a copolymer of maleic / acrylic acid with an average molecular weight of about 70,000. Such copolymers are commercially available from BASF under the trade name SOKALAN CP5.

Any soil suspending polyamine polymer known to those skilled in the art may also be used herein. Particularly suitable polyamine polymers for use herein are polyalkoxylated polyamines. Such materials can conveniently be represented as molecules of the empirical structures with repeating units :



wherein R is a hydrocarbyl group, usually of 2-6 carbon atoms; R^1 may be a C_1-C_{20} hydrocarbon; the alkoxy groups are ethoxy, propoxy, and the like, and y is 2-30, most preferably from 10-20; n is an integer of at least 2, preferably from 2-20, most preferably 3-5; and X^- is an anion such as halide or methylsulfate, resulting from the quaternization reaction.

The most highly preferred polyamines for use herein are the so-called ethoxylated polyethylene amines, i.e., the polymerized reaction product of ethylene oxide with ethyleneimine, having the general formula :



when y = 2-30. Particularly preferred for use herein is an ethoxylated polyethylene amine, in particular ethoxylated tetraethylenepentamine, and quaternized ethoxylated hexamethylene diamine.

The compositions according to the present invention may comprise up to 5% by weight of the total composition of a soil suspending polycarboxylate polymer and/or polyamine polymer, preferably from 0.01% to 2% and more preferably from 0.1% to 1%.

Suitable chelating agents to be used in the compositions according to the present invention include any chelating agent known to those skilled in the art. Suitable chelating agents include for example phosphonate chelating agents, polyfunctionally-substituted aromatic chelating agents, amino carboxylate chelating agents, other chelating agents like ethylene diamine N,N'- disuccinic acid and mixtures thereof.

Suitable phosphonate chelating agents to be used herein may include ethydronic acid, alkali metal ethane 1-hydroxy diphosphonates as well as amino phosphonate compounds, including amino alkylene poly (alkylene phosphonate), alkali metal ethane 1-hydroxy diphosphonates, nitrilo trimethylene phosphonates, ethylene diamine tetra methylene phosphonates, and diethylene triamine penta methylene phosphonates. The phosphonate compounds may be present either in their acid form or as salts of different cations on some or all of their acid functionalities. Preferred phosphonate chelating agents to be used herein are diethylene triamine penta methylene phosphonates (DETPMP). Such phosphonate chelating agents are commercially available from Monsanto under the trade name DEQUEST®.

Polyfunctionally-substituted aromatic chelating agents may also be useful in the compositions herein. See U.S. patent 3,812,044, issued May 21, 1974, to Connor et al. Preferred compounds of this type in acid form are dihydroxydisulfobenzenes such as 1,2-dihydroxy -3,5-disulfobenzene.

A preferred biodegradable chelating agent for use herein is ethylene diamine N,N'- disuccinic acid, or alkali metal, or alkaline earth, ammonium or substitutes ammonium salts thereof or mixtures thereof. Ethylenediamine N,N'- disuccinic acids, especially the (S,S) isomer have been extensively described in US patent 4, 704, 233, November 3, 1987. to Hartman and Perkins. Ethylenediamine N,N'- disuccinic acids is, for instance, commercially available under the trade-

name ssEDDS® from Palmer Research Laboratories.

Suitable amino carboxylate chelants to be used herein include ethylene diamine tetra acetates, diethylene triamine pentaacetates, diethylene triamine pentaacetate (DTPA), N-hydroxyethylethylenediamine triacetates, nitrilotriacetates, ethylenediamine tetrapropionates, triethylenetetraaminehexaacetates, ethanoldiglycines, propylene diamine tetracetic acid (PDTA) and methyl glycine di-acetic acid (MGDA), both in their acid form, or in their alkali metal, ammonium, and substituted ammonium salt forms. Particularly suitable amino carboxylates to be used herein is diethylene triamine penta acetic acid (DTPA).

The compositions according to the present invention may comprise up to 5% by weight of the total composition of a chelating agent or mixtures thereof, preferably from 0.01% to 3% and more preferably from 0.05% to 1.5%.

The compositions of the present invention may further comprise a solvent or mixtures thereof. Solvents suitable for use herein may be octyl alcohol, isopropyl alcohol, propyl alcohol, ethoxypropoxy alcohol, buthoxypropoxy alcohol and/or furfuryl alcohol.

The compositions according to the present invention may further comprise a bleach activator or mixtures thereof, as another optional ingredient. By "bleach activator", it is meant herein a compound other than the carboxylic acids according to the present invention which may react with hydrogen peroxide present to form a peracid. The peracid thus formed constitutes the activated bleach. Suitable bleach activators to be used herein include those belonging to the class of esters, amides, imides, or anhydrides. Examples of suitable compounds of this type are disclosed in British Patent GB 1 586 769 and GB 2 143 231 and a method for their formation into a prilled form is described in European Published Patent Application EP-A-62 523. Suitable examples of such compounds to be used herein are tetracetyl ethylene diamine (TAED), sodium 3,5,5 trimethyl hexanoyloxybenzene sulphonate, diperoxy dodecanoic acid as described for instance in US 4 818 425 and nonylamide of peroxyadipic acid as described for instance in US 4 259 201 and n-nonanoyloxybenzenesulphonate (NOBS). Also suitable are N-acyl caprolactam selected from the group consisting of substituted or unsubstituted benzoyl caprolactam, octanoyl caprolactam, nonanoyl caprolactam, hexanoyl caprolactam, decanoyl caprolactam, undecenoyl caprolactam, formyl caprolactam, acetyl caprolactam, propanoyl caprolactam, butanoyl caprolactam pentanoyl caprolactam or mixtures thereof. A particular family of bleach activators of interest was disclosed in EP 624 154, and particularly preferred in that family is acetyl triethyl citrate (ATC). Acetyl triethyl citrate has the advantage that it is environmentally friendly as it eventually degrades into citric acid and alcohol. Furthermore, acetyl triethyl citrate has a good hydrolytical stability in the composition upon storage and it is an efficient bleach activator.

The compositions according to the present invention may comprise up to 30% by weight of the total composition of said bleach activator, or mixtures thereof, preferably from 1% to 20%, and more preferably from 2% to 10%.

The compositions according to the present invention may further comprise a builder system. Any conventional builder system is suitable for use herein. Suitable builders for use herein include citric acid, preferably in the form of a water-soluble salt, derivatives of succinic acid of the formula R_CH(COOH)CH_2(COOH) wherein R is C_{10-20} alkyl or alkenyl, preferably C_{12-16}, or wherein R can be substituted with hydroxyl, sulpho sulphoxyl or sulphone substituents. Specific examples include lauryl succinate, myristyl succinate, palmityl succinate, 2-dodecenylsuccinate, 2-tetradecenyl succinate. Succinate builders are preferably used in the form of their water-soluble salts, including sodium, potassium, ammonium and alkanolammonium salts.

Other suitable builders are oxodisuccinates and mixtures of tartrate monosuccinic and tartrate disuccinic acid such as described in US 4,663,071.

Further suitable builders for use herein are fatty acid builders including saturated or unsaturated C_{10-18} fatty acids, as well as the corresponding soaps. Preferred saturated species have from 12 to 16 carbon atoms in the alkyl chain. The preferred unsaturated fatty acid is oleic acid.

The compositions according to the present invention may comprise up to 5% by weight of the total composition of a builder or mixtures thereof, preferably from 0.1% to 3% and more preferably from 0.1% to 2%.

The present invention will be further illustrated by the following examples.

Examples

The compositions hereinafter are obtained according to the process of the present invention and contain the following ingredients in the following proportions:

Compositions (% by weight)	I	II	III	IV	V	VI
Dobanol 91-10	1.2	--	--	--	--	7
Dobanol 91-2.5	4.8	--	--	--	--	--
Hydrogen peroxide	7.0	45	10	7	35	6
2methylperglutaric acid	1.8	--	--	--	--	--
2methylglutaric acid	--	30	5	5	20	3
Citric acid	6	--	--	1	--	1
Sulfuric acid	1.9	20	1	--	15	--
Perfume	0.5	--	0.2	0.2	--	0.2
LAS	--	--	2	2	--	2
Water	----------balance----------					
Compositions (% by weight)	VII	VIII	IX	X	XI	XII
Dobanol 91-10	1.2	--	--	--	--	7
Dobanol 91-2.5	4.8	--	--	--	--	--
Hydrogen peroxide	7.0	45	10	7	35	6
2methylpersuccinic acid	1.8	--	--	--	--	--
2methyl succinic acid	--	30	--	--	--	3
2,4-dimethyl glutaric acid	--	--	5	--	20	--
2-methyl pimelic acid	--	--	--	5	--	--
Citric acid	6	--	--	1	--	1
Sulfuric acid	1.9	20	1	--	15	--
Perfume	0.5	--	0.2	0.2	--	0.2
LAS	--	--	2	2	--	2
Water	----------balance----------					
LAS is linear C12 alkyl benzene sulphonate						

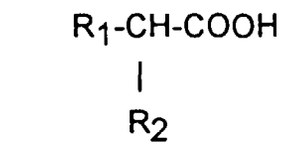
Preparation of the peracid according to the process of the present invention

Peracids such as 2-methyl persuccinic acid, 2,4-dimethyl diperglutaric acid or 2-methyl perpimelic acid were obtained by carrying out the following process. 0.02 moles of 2-methyl succinic acid, 2,4-dimethyl glutaric acid or 2-methyl pimelic acid were solubilized in 18 grs of a concentrated aqueous solution of sulfuric acid (95% by weight). Then each solution was contacted under stirring with a concentrated solution of hydrogen peroxide (36% by weight) that was added drop by drop up to 100% excess with respect to the peracid precursor. After the addition of said solution of hydrogen peroxide, the reaction mixture was stirred at room temperature (about 30°C) for 50 minutes. The yield of 2-methyl persuccinic acid was 26%. The yield of 2,4 dimethyl diperglutaric acid was 20%. The yield of 2-methyl perpimelic acid was 65%.

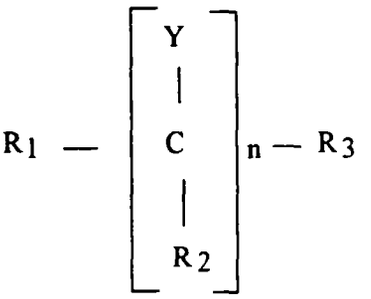
Claims

1. A process for forming a peracid, said process comprising the step of reacting in an aqueous medium a carboxylic acid with hydrogen peroxide or a water-soluble source thereof, characterized in that said carboxylic acid is an alpha motto alkylated carboxylic acid and/or an alpha mono alkoxylated carboxylic acid.

2. A process according to claim 1 wherein said carboxylic acid is an alpha mono alkylated or alpha mono alkoxylated monocarboxylic acid of the following formula, or mixtures thereof:



wherein R1 is an alkyl group of from 1 to 26 carbon atoms, preferably from 2 to 18 and more preferably from 2 to 14 and wherein R2 is an alkyl or alkoxy group of from 1 to 14 carbon atoms, preferably from 1 to 8, and/or an alpha mono alkylated or alpha mono alkoxylated polycarboxylic acid of the following formula, or mixtures thereof:



wherein R1 and R3 are H or an alkyl group of from 1 to 26 carbon atoms, preferably from 2 to 18 and more preferably from 2 to 14; R2 is H or an alkyl or alkoxy group of from 1 to 14 carbon atoms, preferably from 1 to 8; wherein n is an integer of from 2 to 20, preferably from 2 to 12; Y is H or a carboxylic group, wherein Y and R2 each have the same or different representations when repeated in a given molecular formula, and wherein at least two Y in a molecule are a carboxylic group and at least one R2 in alpha position with respect to at least one of said carboxylic group is an alkyl or alkoxy group of from 1 to 14 carbon atoms.

3. A process according to claim 2 wherein said carboxylic acid is 2-methyl propionic acid, 2-ethyl propionic acid, 2-methyl hexanoic acid, 2-methyl octanoic acid, 2-methoxy octanoic acid, 2-methyl lauric acid, 2-ethyl lauric acid, 2-ethoxy lauric acid, 2-propyl lauric acid, 2-methyl adipic acid, 2-methyl succinic acid, 2-methoxy succinic acid, 2,3-dimethyl succinic acid, 2-methyl pimelic acid, 2-ethoxy pimelic acid, 2,6-dimethyl pimelic acid, 2-ethyl glutaric acid, 2-methyl glutaric acid, 2,4-dimethyl glutaric acid, or mixtures thereof.

4. A process according to any of the preceding claims wherein said carboxylic acid is reacted with said hydrogen peroxide or water-soluble source thereof in a molar ratio of said carboxylic acid to said hydrogen peroxide or a source thereof of from 0.5 to 20, preferably of from 1 to 10, and more preferably of from 1 to 5.

5. A process according to any of the preceding claims which is conducted at a temperature of from 0°C to 40°C and at a pH up to 8, preferably from 0 to 6, and more preferably from 0 to 4.

6. A process according to any of the preceding claims which further comprises a step where at least one additional ingredient, other than water, said hydrogen peroxide or a water-soluble source thereof and said carboxylic acid is provided.

7. A process according to claim 6 wherein said additional ingredient is selected from the group consisting of surfactants, soil suspending agents, builders, chelants, bleach activators, radical scavengers, pigments, enzymes, dye transfer inhibitors, solvents, buffering agents, suds suppressing agents, photobleaching agents, brighteners, dyes, perfumes and mixtures thereof.

8. A process according to any of the preceding claims 1 to 7 for manufacturing an aqueous peracid-containing composition, wherein said peracid is emulsified in a surfactant system comprising at least a hydrophilic surfactant hav-

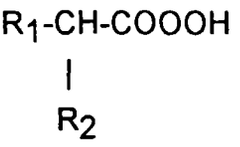
ing an HLB above 11, preferably a nonionic surfactant having an HLB above 12 and at least a hydrophobic surfactant having an HLB below 11, preferably a nonionic surfactant having an HLB below 10, said process comprising the steps of :

1 - forming a peracid according to any of the claims 1 to 7;
2 - preparing a hydrophobic mixture which comprises at least said hydrophobic surfactant;
3 - preparing a hydrophilic mixture which comprises at least water and said hydrophilic surfactant;
4 - mixing the composition obtained in step 1 in said hydrophilic mixture if said peracid is hydrophilic or in said hydrophobic mixture if said peracid is hydrophobic;
5 - then mixing together said hydrophobic mixture and said hydrophilic mixture,

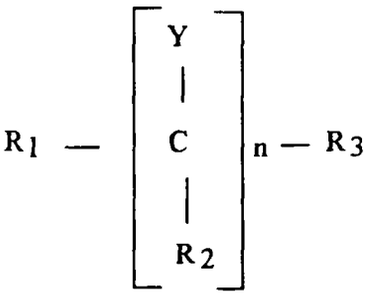
and wherein steps 1, 2 and 3 may be performed in any order.

9. A composition comprising an alpha mono alkylated or alpha mono alkoxylated percarboxylic acid or mixtures thereof.

10. A composition according to claim 9 wherein said percarboxylic acid is an alpha mono alkylated or alpha mono alkoxylated monopercarboxylic acid of the following formula, or mixtures thereof:



wherein R1 is an alkyl group of from 1 to 26 carbon atoms, preferably from 2 to 18 and more preferably from 2 to 14 and wherein R2 is an alkyl or alkoxy group of from 1 to 14 carbon atoms, preferably from 1 to 8, and/or an alpha mono alkylated or alpha mono alkoxylated polypercarboxylic acid of the following formula, or mixtures thereof:



wherein R1 and R3 are H or an alkyl group of from 1 to 26 carbon atoms, preferably from 2 to 18 and more preferably from 2 to 14; R2 is H or an alkyl or alkoxy group of from 1 to 14 carbon atoms, preferably from 1 to 8; wherein n is an integer of from 2 to 20, preferably from 2 to 12; Y is H or a percarboxylic group, wherein Y and R2 each have the same or different representations when repeated in a given molecular formula, and wherein at least two Y in a molecule are a percarboxylic group and at least one R2 in alpha position with respect to at least one of said percarboxylic group is an alkyl or alkoxy group of from 1 to 14 carbon atoms.

11. A composition according to any of the preceding claims 9 to 10 which comprises from 0.005% to 50% by weight of the total composition of said alpha mono alkylated or alpha mono alkoxylated percarboxylic acid or mixtures thereof, preferably from 0.01% to 30% and more preferably from 0.01% to 20%.

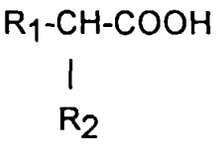
12. A composition according to any of the preceding claims 9 to 11, which is in the form of an emulsion wherein said alpha mono alkylated or alpha mono alkoxylated percarboxylic acid or mixtures thereof is preferably emulsified by a surfactant system comprising at least a hydrophilic surfactant having an HLB above 11, preferably a nonionic sur-

factant having an HLB above 12 and at least a hydrophobic surfactant having an HLB below 11, preferably a nonionic surfactant having an HLB below 10.

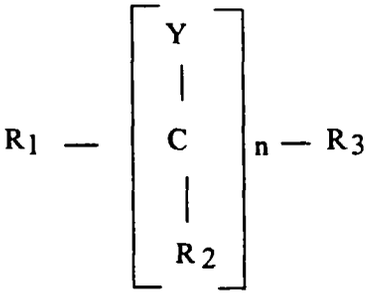
13. A composition comprising an alpha mono alkylated or alpha mono alkoxylated carboxylic acid or mixtures thereof, and hydrogen peroxide or a water-soluble source thereof.

14. A composition according to claim 13 which comprises from 0.01% to 60% by weight of the total composition of said alpha mono alkylated or alpha mono alkoxylated carboxylic acid or mixtures thereof, preferably from 0.1% to 40% and more preferably from 0.5% to 30% and from 0.5% to 90% by weight of the total composition of hydrogen peroxide or a water-soluble source thereof or mixtures thereof, preferably from 1% to 70% and more preferably from 2% to 40.

15. A composition according to any of the claims 13 to 14 wherein said carboxylic acid is an alpha mono alkylated or alpha mono alkoxylated monocarboxylic acid of the following formula, or mixtures thereof:



wherein R1 is an alkyl group of from 1 to 26 carbon atoms, preferably from 2 to 18 and more preferably from 2 to 14 and wherein R2 is an alkyl or alkoxy group of from 1 to 14 carbon atoms, preferably from 1 to 8, and/or an alpha mono alkylated or alpha mono alkoxylated polycarboxylic acid of the following formula, or mixtures thereof:



wherein R1 and R3 are H or an alkyl group of from 1 to 26 carbon atoms, preferably from 2 to 18 and more preferably from 2 to 14; R2 is H or an alkyl or alkoxy group of from 1 to 14 carbon atoms, preferably from 1 to 8; wherein n is an integer of from 2 to 20, preferably from 2 to 12; Y is H or a carboxylic group, wherein Y and R2 each have the same or different representations when repeated in a given molecular formula, and wherein at least two Y in a molecule are a carboxylic group and at least one R2 in alpha position with respect to at least one of said carboxylic group is an alkyl or alkoxy group of from 1 to 14 carbon atoms.

16. A composition according to any of the preceding claims 9 to 15 wherein said composition further comprises an additional ingredient preferably selected from the group consisting of surfactants, soil suspending agents, builders, chelants, bleach activators, radical scavengers, pigments, enzymes, dye transfer inhibitors, solvents, buffering agents, suds suppressing agents, photobleaching agents, brighteners, dyes, perfumes and mixtures thereof.