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(54) **Bleaching composition**

(57) The present invention concerns the bleaching of substrates with periodate.

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DescriptionFIELD OF INVENTION

[0001] The present invention relates to a bleaching composition and use thereof.

BACKGROUND OF THE INVENTION

[0002] The use of peroxides, in particular sodium percarbonate, has been known for many years for removing stains from textiles.

SUMMARY OF THE INVENTION

[0003] The present invention concerns the use of periodate in bleaching textile stains.

[0004] In one aspect the present invention provides a bleaching composition comprising from 2 and 60 wt % of a surfactant and from 0.01 to 40 wt % of a periodate salt.

[0005] In another aspect the present invention provides a method of treating a textile comprising the following steps:

(i) treating a textile with the bleaching composition in an aqueous medium, wherein the aqueous medium comprises from 0.2 g/L to 5 g/L of a surfactant and from 0.2 mmolar to 25 mmolar of periodate ions, the aqueous medium having a pH in the range 4 to 13, preferably 8 to 11; and,

(ii) rinsing the textile with water; and,

(iii) drying the textile. Preferably the periodate is provided by sodium periodate which is present in the aqueous medium from 0.05 to 5 g/l, preferably between 0.1 to 1.5 g/l, most preferably 0.5 to 2.5 g/l.

DETAILED DESCRIPTION OF THE INVENTION

[0006] The composition may be provided in the form of a granular powder or a pre-treatment form. An example of a pre-treatment form may be a stick or pen for direct application to a textile stain. It is preferred that pre-treatment forms have higher levels of actives, e.g., periodate and transition metal catalyst, than that in a bleaching composition designed for direct dosage to a wash medium. Commercially, the composition may be provided in a liquid format, in particular when the periodate is provided in the absence of a transition metal catalyst.

[0007] The bleaching compositions according to the present invention may be used for laundry cleaning, hard surface cleaning (including cleaning of lavatories, kitchen work surfaces, floors, mechanical ware washing etc.). As is generally known in the art, bleaching compositions are also employed in waste-water treatment, pulp bleaching during the manufacture of paper, leather manufacture, dye transfer inhibition, food processing, starch bleaching, sterilisation, whitening in oral hygiene preparations and/or contact lens disinfection.

PERIODATE

[0008] The cation to the periodate (IO_4^-) may be many things for example transition metals, alkaline earth metals, alkali metals and quaternary ammonium compounds such as $\text{Me}_3(\text{C}_{16})\text{N}^+$, $\text{Me}(\text{C}_8)_3\text{N}^+$, Me_4N^+ , $\text{Bu}_3(\text{C}_{16})\text{N}^+$, Bu_4N^+ , $(\text{C}_{16})_4\text{N}^+$, $(\text{C}_{18})_2(\text{CH}_3)_2\text{N}^+$, $(\text{C}_8-\text{C}_{18})(\text{PhCH}_2)(\text{CH}_3)_2\text{N}^+$, cationic nitriles, surfactant cations. Preferred cations are alkali metals and in particular sodium [CAS 7790-28-5] and potassium.

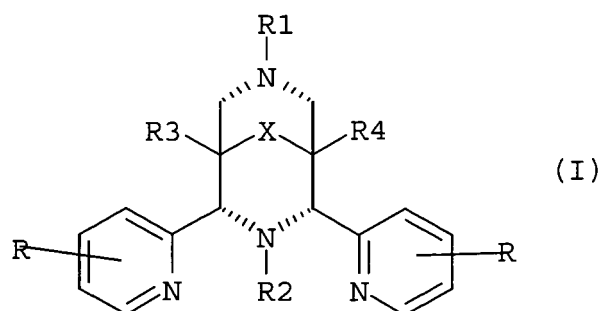
Transition Metal Catalyst

[0009] The composition preferably comprises a transition metal catalyst. There are many transition metal catalysts that may be used including those known to be active in the presence of a peroxide source and those known to be active in the absence of an added peroxide.

[0010] Particular reference is made to transition metal catalysts as described in EP 458397, WO00/12808, WO02/48301, WO 03/104234, and WO04/039934. The transition metal of the transition metal catalyst is preferably Mn (II)-(III)-(IV)-(V) or Fe (II) - (III) - (IV) - (V).

[0011] In typical washing compositions the level of the transition metal catalyst is such that the in-use level is from 0.05 μM to 50 mM, with preferred in-use levels for domestic laundry operations falling in the range 1 to 100 μM . Higher levels may be desired and applied in industrial textile bleaching processes.

[0012] The following is a preferred class transition metal catalyst ligand:



15 wherein each R is independently selected from: hydrogen, F, Cl, Br, hydroxyl, C1-C4-alkylo-, -NH-CO-H, -NH-CO-C1-C4-alkyl, -NH2, -NH-C1-C4-alkyl, and C1-C4-alkyl;

R1 and R2 are independently selected from:

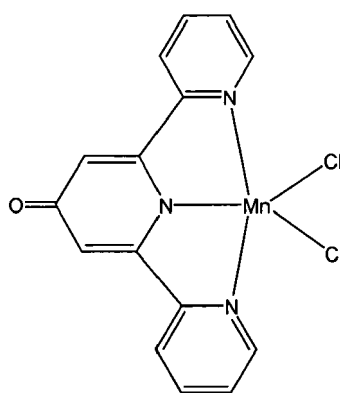
C1-C4-alkyl, C6-C10-aryl, and, a group containing a heteroatom capable of coordinating to a transition metal;

20 R3 and R4 are independently selected from hydrogen, C1-C8 alkyl, C1-C8-alkyl-O-C1-C8-alkyl, C1-C8-alkyl-O-C6-C10-aryl, C6-C10-aryl, C1-C8-hydroxyalkyl, and $-(CH_2)_n C(O)OR_5$

wherein R5 is independently selected from: hydrogen, C1-C4-alkyl, n is from 0 to 4, and mixtures thereof; and,

X is selected from $C=O$, $-[C(R_6)_2]_Y-$ wherein Y is from 0 to 3 each R6 is independently selected from hydrogen, hydroxyl, C1-C4-alkoxy and Cl-C4-alkyl.

25 **[0013]** Another preferred class of transition metal catalyst is that of a manganese complex which incorporates ligands having structures similar to that of 2,2':6',2''-Teryridine. A preferred example of which is the manganese 2,6-bis(2-pyridyl)-4(lh)-pyridone (terpyridone) complex as show below:



45 Mn (terpyridone) .

[0014] The transition metal complex preferably is of the general formula (AI):



in which:

M represents a metal selected from Mn(II)-(III)-(IV)-(V), Cu(I)-(II)-(III), Fe (II)-(III)-(IV)-(V), Ru(II)-(III), Co(I)-(II)-(III), Ti(II)-(III)-(IV), V(II)-(III)-(IV)-(V), Mo(II)-(III)-(IV)-(V)-(VI) and W(IV)-(V)-(VI),

55 L represents the ligand;

X represents a coordinating species selected from any mono, bi or tri charged anions and any neutral molecules able to coordinate the metal in a mono, bi or tridentate manner;

Y represents any non-coordinated counter ion;

a represents an integer from 1 to 10;
 k represents an integer from 1 to 10;
 n represents zero or an integer from 1 to 10;
 m represents zero or an integer from 1 to 20.

[0015] Further to the above we have found that metal halides, preferably chlorides, also provide synergy with the periodate. Preferred metal chlorides are transition metal chlorides, in particular MnCl_2 , FeCl_3 , CuCl_2 and RuCl_3 . The transition metal chlorides are preferably used in the same concentration range as the transition metal catalysts described above. The metal halides are preferably used instead of a used transition metal catalyst rather than with a transition metal catalyst.

Surfactant

[0016] The composition comprises between 2 to 60 wt % of a surfactant, most preferably 10 to 30 wt %. In general, the nonionic and anionic surfactants of the surfactant system may be chosen from the surfactants described "Surface Active Agents" Vol. 1, by Schwartz & Perry, Interscience 1949, Vol. 2 by Schwartz, Perry & Berch, Interscience 1958, in the current edition of "McCutcheon's Emulsifiers and Detergents" published by Manufacturing Confectioners Company or in "Tenside-Taschenbuch", H. Stache, 2nd Edn., Carl Hauser Verlag, 1981. Preferably the surfactants used are saturated.

[0017] Suitable nonionic detergent compounds which may be used include, in particular, the reaction products of compounds having a hydrophobic group and a reactive hydrogen atom, for example, aliphatic alcohols, acids, amides or alkyl phenols with alkylene oxides, especially ethylene oxide either alone or with propylene oxide. Specific nonionic detergent compounds are C_6 to C_{22} alkyl phenol-ethylene oxide condensates, generally 5 to 25 EO, i.e. 5 to 25 units of ethylene oxide per molecule, and the condensation products of aliphatic C_8 to C_{18} primary or secondary linear or branched alcohols with ethylene oxide, generally 5 to 40 EO.

[0018] Suitable anionic detergent compounds which may be used are usually water-soluble alkali metal salts of organic sulphates and sulphonates having alkyl radicals containing from about 8 to about 22 carbon atoms, the term alkyl being used to include the alkyl portion of higher acyl radicals. Examples of suitable synthetic anionic detergent compounds are sodium and potassium alkyl sulphates, especially those obtained by sulphating higher C_8 to C_{18} alcohols, produced for example from tallow or coconut oil, sodium and potassium alkyl C_9 to C_{20} benzene sulphonates, particularly sodium linear secondary alkyl C_{10} to C_{15} benzene sulphonates; and sodium alkyl glyceryl ether sulphates, especially those ethers of the higher alcohols derived from tallow or coconut oil and synthetic alcohols derived from petroleum. The preferred anionic detergent compounds are sodium C_{11} to C_{15} alkyl benzene sulphonates and sodium C_{12} to C_{18} alkyl sulphates. Also applicable are surfactants such as those described in EP-A-328 177 (Unilever), which show resistance to salting-out, the alkyl polyglycoside surfactants described in EP-A-070 074, and alkyl monoglycosides.

[0019] Preferred surfactant systems are mixtures of anionic with nonionic detergent active materials, in particular the groups and examples of anionic and nonionic surfactants pointed out in EP-A-346 995 (Unilever). Especially preferred is surfactant system that is a mixture of an alkali metal salt of a C_{16} to C_{18} primary alcohol sulphate together with a C_{12} to C_{15} primary alcohol 3 to 7 EO ethoxylate.

[0020] The nonionic detergent is preferably present in amounts greater than 10%, e.g. 25 to 90 wt % of the surfactant system. Anionic surfactants can be present for example in amounts in the range from about 5% to about 40 wt % of the surfactant system.

BALANCE CARRIERS AND ADJUNCT INGREDIENTS

[0021] The bleaching composition in addition to the periodate comprises the balance carriers and adjunct ingredients to 100 wt % of the composition.

[0022] These may be, for example, other surfactants, builders, foam agents, anti-foam agents, solvents, fluorescers, other bleaching agents e.g., peroxides, and enzymes. The use and amounts of these components are such that the composition performs depending upon economics, environmental factors and use of the composition. Preferably the composition comprises a builder, in particular sodium carbonate.

BUILDER

[0023] The bleaching composition of the present invention preferably comprises one or more detergency builders. The total amount of detergency builder in the compositions will preferably range from 5 to 80 wt%, more preferably from 10 to 60 wt%.

[0024] Inorganic builders that may be present include sodium carbonate, if desired in combination with a crystallisation

seed for calcium carbonate, as disclosed in GB 1 437 950 (Unilever); crystalline and amorphous aluminosilicates, for example, zeolites as disclosed in GB 1 473 201 (Henkel), amorphous aluminosilicates as disclosed in GB 1 473 202 (Henkel) and mixed crystalline/amorphous aluminosilicates as disclosed in GB 1 470 250 (Procter & Gamble); and layered silicates as disclosed in EP 164 514B (Hoechst). Inorganic phosphate builders, for example, sodium orthophosphate, pyrophosphate and tripolyphosphate are also suitable for use with this invention.

[0025] The compositions of the invention preferably contain an alkali metal, preferably sodium, aluminosilicate builder. Sodium aluminosilicates may generally be incorporated in amounts of from 10 to 70% by weight (anhydrous basis), preferably from 25 to 50 wt%.

[0026] The alkali metal aluminosilicate may be either crystalline or amorphous or mixtures thereof, having the general formula: $0.8-1.5 \text{ Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 0.8-6 \text{ SiO}_2$.

[0027] These materials contain some bound water and are required to have a calcium ion exchange capacity of at least 50 mg CaO/g. The preferred sodium aluminosilicates contain 1.5-3.5 SiO_2 units (in the formula above). Both the amorphous and the crystalline materials can be prepared readily by reaction between sodium silicate and sodium aluminate, as amply described in the literature. Suitable crystalline sodium aluminosilicate ion-exchange detergency builders are described, for example, in GB 1 429 143 (Procter & Gamble). The preferred sodium aluminosilicates of this type are the well-known commercially available zeolites A and X, and mixtures thereof.

[0028] The zeolite may be the commercially available zeolite 4A now widely used in laundry detergent powders. However, according to a preferred embodiment of the invention, the zeolite builder incorporated in the compositions of the invention is maximum aluminium zeolite P (zeolite MAP) as described and claimed in EP 384 070A (Unilever). Zeolite MAP is defined as an alkali metal aluminosilicate of the zeolite P type having a silicon to aluminium ratio not exceeding 1.33, preferably within the range of from 0.90 to 1.33, and more preferably within the range of from 0.90 to 1.20.

[0029] Especially preferred is zeolite MAP having a silicon to aluminium ratio not exceeding 1.07, more preferably about 1.00. The calcium binding capacity of zeolite MAP is generally at least 150 mg CaO per g of anhydrous material.

[0030] Organic builders that may be present include polycarboxylate polymers such as polyacrylates, acrylic/maleic copolymers, and acrylic phosphinates; monomeric polycarboxylates such as citrates, gluconates, oxydisuccinates, glycerol mono-, di and trisuccinates, carboxymethyloxy succinates, carboxymethyloxymalonates, dipicolinates, hydroxyethyl-iminodiacetates, alkyl- and alkenylmalonates and succinates; and sulphonated fatty acid salts. This list is not intended to be exhaustive.

[0031] Especially preferred organic builders are citrates, suitably used in amounts of from 5 to 30 wt%, preferably from 10 to 25 wt%; and acrylic polymers, more especially acrylic/maleic copolymers, suitably used in amounts of from 0.5 to 15 wt%, preferably from 1 to 10 wt%.

[0032] Builders, both inorganic and organic, are preferably present in alkali metal salt, especially sodium salt, form.

FLUORESCENT AGENT

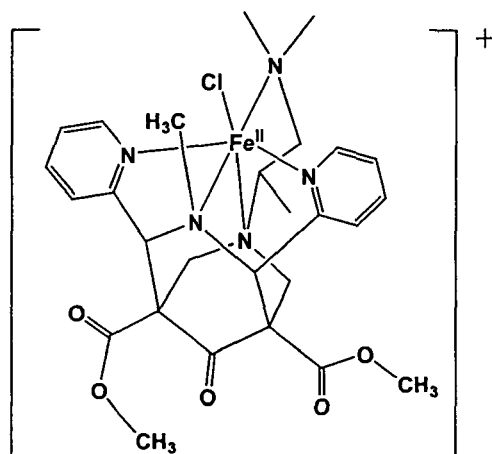
[0033] The bleaching composition composition most preferably comprises a fluorescent agent (optical brightener). Fluorescent agents are well known and many such fluorescent agents are available commercially. Usually, these fluorescent agents are supplied and used in the form of their alkali metal salts, for example, the sodium salts. The total amount of the fluorescent agent or agents used in bleaching composition composition is generally from 0.005 to 2 wt %, more preferably 0.01 to 0.1 wt %. Preferred classes of fluorescer are: Di-styryl biphenyl compounds, e.g. Tinopal (Trade Mark) CBS-X, Di-amine stilbene di-sulphonic acid compounds, e.g. Tinopal DMS pure Xtra and Blankophor (Trade Mark) HRH, and Pyrazoline compounds, e.g. Blankophor SN. Preferred fluorescers are: sodium 2 (4-styryl-3-sulfophenyl)-2H-naphthol[1,2-d]triazole, disodium 4,4'-bis{[(4-anilino-6-(N methyl-N-2 hydroxyethyl) amino 1,3,5-triazin-2-yl)]amino}stilbene-2-2' disulfonate, disodium 4,4'-bis{[(4-anilino-6-morpholino-1,3,5-triazin-2-yl)]amino} stilbene-2-2' disulfonate, and disodium 4,4'-bis(2-sulfoslyryl)biphenyl.

PERFUME

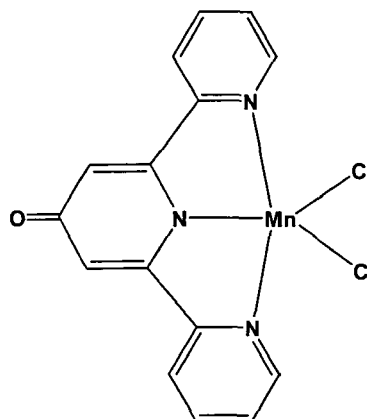
[0034] Preferably the bleaching composition composition comprises a perfume. The perfume is preferably in the range from 0.001 to 3 wt %, most preferably 0.1 to 1 wt %. Many suitable examples of perfumes are provided in the CTFA (Cosmetic, Toiletry and Fragrance Association) 1992 International Buyers Guide, published by CFTA Publications and OPD 1993 Chemicals Buyers Directory 80th Annual Edition, published by Schnell Publishing Co.

EXPERIMENTAL

[0035] The following compounds were used as an example of a transition metal catalyst in the experiments to show bleaching efficacy:



Compound (I)



Compound (II)

BLEACHING EXPERIMENTS

[0036] Bleaching experiments were carried out on stained pieces of cotton cloth in a wash solution that contained a mixture of buffer, periodate, and (where indicated) a transition metal complex. The stains used were BC-1 (tea stain) and a curry. The buffers used were:

pH 6: Potassium phosphate, monobasic/sodium phosphate, dibasic

pH 8: Sodium phosphate, dibasic/potassium phosphate, monobasic

pH 10: Sodium carbonate/sodium bicarbonate.

[0037] Sodium periodate was used at a concentration of 4 millimolar in the wash, and the transition metal complexes were used at a concentration of 10 micromolar in the wash. Wash solutions containing hydrogen peroxide (instead of sodium periodate) were made in a similar manner to that of sodium periodate, and were used at a concentration of 4 millimolar in the wash.

[0038] Bleaching results were obtained for the respective stains by agitation for 30 min at 30 °C. Control experiments were carried out as indicated in the tables below. Bleaching efficacy has also been shown in fully built laundry detergent formulations (both powder and liquid) using a normal 30 minute wash program in a washing machine (data not shown).

[0039] After the washes, the cloths were rinsed with water and subsequently dried for at least 3 h at 50°C. The bleaching efficacy was measured as a change in colour of the stained cloth, before and after the wash. The change in colour is typically expressed as the ΔE value. The value of ΔE can be expressed in two different ways, one which is called ΔE_{AW-B} which is the difference between a washed, stained cloth and a white, unstained cloth. For these measurements, the smaller the ΔE_{AW-B} value, the cleaner the cloth. Alternatively, ΔE can be expressed as the difference between a stained cloth, before being washed, and after being washed (ΔE_{AW-BW}). In this case, the larger the colour difference, the cleaner the cloth (a higher ΔE_{AW-BW} means a cleaner cloth). The measured colour difference (ΔE_{AW-BW}) between the washed cloth and the unwashed cloth is defined as follows:

$$\Delta E_{AW-BW} = [(\Delta L_{AW-BW})^2 + (\Delta a_{AW-BW})^2 + (\Delta b_{AW-BW})^2]^{1/2}$$

wherein ΔL_{AW-BW} is a measure for the difference in darkness between the washed and unwashed test cloth; Δa_{AW-BW} and Δb_{AW-BW} are measures for the difference in redness and yellowness respectively between both cloths. With regard to this colour measurement technique, reference is made to Commission International de l'Eclairage (CIE); Recommendation on Uniform Colour Spaces, colour difference equations, psychometric colour terms, supplement no 2 to CIE Publication, no 15, Colorimetry, Bureau Central de la CIE, Paris 1978. The bleaching results are shown below in the tables. The bleaching effect is expressed in the form of a stain removal index (SRI): $SRI = 100 - \Delta E_{AW-B}$. A higher SRI

translates to a cleaner cloth.

Bleaching Results

BC-1 (Tea) Bleaching

[0040]

	pH 6 (SRI)	pH 8 (SRI)	pH 10 (SRI)
buffer + IO_4^-	82.10	82.37	81.82
buffer + Complex 1 + IO_4^-	86.27	87.39	82.67
buffer + Complex 2 + IO_4^-	86.67	87.99	85.79
buffer + H_2O_2	79.88	79.73	80.34
buffer + Complex 1 + H_2O_2	81.29	82.25	85.98
buffer + Complex 2 + H_2O_2	80.30	81.07	81.08
Buffer Only	79.99	79.43	79.38
buffer + Complex 1	79.98	80.19	79.17
buffer + Complex 2	80.37	80.02	78.78

(Curry) Bleaching

[0041]

	pH 6 (SRI)	pH 8 (SRI)	pH 10 (SRI)
buffer + IO_4^-	80.63	85.74	93.26
buffer + Complex 1 + IO_4^-	87.43	92.61	93.35
buffer + Complex 2 + IO_4^-	91.90	94.48	95.58
buffer + H_2O_2	72.14	72.04	80.81
buffer + Complex 1 + H_2O_2	78.39	82.13	92.69
buffer + Complex 2 + H_2O_2	72.36	79.56	89.82
Buffer Only	71.46	71.72	80.51
buffer + Complex 1	72.81	73.71	86.72
buffer + Complex 2	71.94	73.89	84.10

Claims

1. A bleaching composition comprising from 2 and 60 wt % of a surfactant and from 0.01 to 40 wt % of a periodate salt.
2. A bleaching composition composition according to claim 1, wherein the periodate salt is present in the bleaching composition composition in the range from 2 to 20 wt %.
3. A bleaching composition composition according to claim 1 or 2, wherein the periodate is present as sodium periodate.
4. A bleaching composition composition according to any preceding claim, wherein the composition comprises a transition metal complex, for catalytically bleaching a stain with the periodate, in the range from 0.0001 to 0.1 wt%, the transition metal selected from Mn(II)-(III)-(IV)-(V) and Fe(II)-(III)-(IV)-(V).

5. A method of treating a textile comprising the following steps:

- (i) treating a textile with the bleaching composition in an aqueous medium, wherein the aqueous medium comprises from 0.2 g/L to 5 g/L of a surfactant and from 0.2 mmolar to 25 mmolar of periodate ions, the aqueous medium having a pH in the range 4 to 13; and,
(ii) rinsing the textile with water; and,
(iii) drying the textile.

6. A method of treating a textile according to claim 5, wherein aqueous medium comprises from 0.05 micromolar to 50 mmolar of a transition metal catalyst.



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