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(54) **FABRIC TREATMENT COMPOSITION**

GEWEBEHANDLUNG SZUBEREITUNG

COMPOSITION POUR TRAITEMENT DE TEXTILES

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(73) Proprietors:
• **UNILEVER PLC**
London EC4P 4BQ (GB)
Designated Contracting States:
CY GB IE
• **UNILEVER N.V.**
3013 AL Rotterdam (NL)
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(72) Inventors:
• **BATCHELOR, S. N., Unilever Research**
PortSunlight
Wirral, Merseyside CH63 3JW (GB)
• **WILLIAMS, J., Unilever Research Port Sunlight**
Wirral, Merseyside CH63 3JW (GB)

(74) Representative: **Elliott, Peter William**
Unilever PLC
Unilever Intellectual Property Group
Colworth House
Sharnbrook Bedford, MK44 1LQ (GB)

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GB-A- 2 179 053

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Description**Technical Field**

[0001] The present invention relates to bleaching compositions comprising radical initiators. More particularly the invention relates to laundry treatment compositions for the spot or other direct treatment of soiled articles and to a process using the said compositions.

Background of the Invention

[0002] Typical laundry stains contain chromophores based on carotenoids, phenolics and phytoestrogens. Radical photoinitiators are known as stain bleaches for laundry application. These are materials, which on exposure to light generate reactive radicals. In turn, these radicals cause chemical changes in the stain, which decolourise it.

[0003] Radical photo-initiators are well known in the unrelated fields of polymerisation and curing reactions.

[0004] Other types of radical initiators are known (such as thermal or chemical initiators) and use of these in bleaching and sewage or other effluent treatment has also been envisaged.

[0005] It is a well established problem in the field of laundry bleaching that compounds which can bleach stains will also have the capacity to bleach dyes present in the cloth.

[0006] Consequently, much effort has been spent in finding bleaches, which are effective against stains but are ineffective against dyes. This problem is especially difficult to solve in the context of porous fibres such as dyed cotton and other dyed cellulosics, particularly where these have been dyed with common dyestuffs based on strongly coloured azo-, anthroquinone or phthalocyanine compounds.

[0007] UK Patent application no: 9917451.8, teaches that photoinitiators with high logarithm of octanol-water partition coefficient (logP) give good stain bleaching with little dye damage on the fabric. This is highly desirable as consumers wish to remove stains without damaging their coloured fabric. The most preferred photoinitiators are those with logP values in excess of 4.0.

[0008] Many effective photoinitiators have logP values much lower than 4.0 and are known to give some fabric dye damage particularly when used at high levels.

[0009] For example 1-hydroxy-cyclohexyl-phenyl-ketone has logP = 2.81, 2-hydroxy-4'-hydroxyethoxy-2-methyl-propiophenone has logP = 0.84.

[0010] It would be advantageous if low logP initiators could be used without causing damage.

[0011] A prior approach to this problem is disclosed in co-pending UK patent application UK 9929693.1. This teaches the use of radical terminators in conjunction with radical initiators to reduce dye damage. These systems are effective under both wet and dry conditions. However the use of two active ingredients may not always be desirable, particularly for reasons of cost.

Brief Description of the Invention

[0012] We have found that application of initiators from surfactants in a liquid-crystalline phase reduces dye damage without a corresponding reduction of stain bleaching.

[0013] The swelling behaviour of cotton is discussed in 'Cellulose - Structure Accessibility and Reactivity', Gordon and Breach Science Publishers and references therein. Commonplace solvents such as water and ethanol are effective at swelling the amorphous regions of cotton and other cellulosics. It is believed that swelling is avoided by use of neat surfactant.

[0014] Accordingly, the present invention provides a fabric treatment composition which comprises:

- a) a radical initiator, and
- b) surfactant in a liquid-crystalline phase

[0015] Typical surfactant phases in the present specification comprise more than about 10% water.

[0016] In the context of this invention the term 'liquid crystalline phase' is meant to include both lamellar phase and other forms of liquid crystalline phases including hexagonal and cubic phases. The common property of these phases is that while a significant quantity of water may be present the water is structured by the presence of surfactant and its activity is greatly reduced. Liquid crystalline phases are well understood in the detergent art and most surfactants can be induced to form liquid crystalline phases over some region of their water/surfactant phase diagram.

[0017] The lamellar phase is a particularly preferred liquid crystalline phase.

[0018] It is believed that such formulations prevent the passage of the initiator into the regions of the fibres where

the dye resides while allowing the initiator to come into contact with the stain, which is essentially superficial.

[0019] The present invention further provides a method for the treatment of fabrics, which comprises applying to the fabric a composition according to the invention.

Detailed Description of the Invention

[0020] The preferred radical initiators are photo and thermal initiators. The use of photo initiator systems is preferred as sunlight and other suitable sources of illumination are generally freely available. It is commonplace, for example, to dry laundered articles in sunlight.

Mode of application:

[0021] The surfactant may be contained in a wipe or swab and the wipe used to physically remove stain and apply photo-initiator to it. Alternatively, the composition may be applied directly to the substrate being treated.

[0022] Surfactants may be employed in solid or liquid form. In some markets, liquid surfactants are preferred for ease of application. In other markets soft-solid forms will be preferred. Preferably, these can take the form of soap or other non-soap detergent bars, although embodiments of the invention may take the form of other applicator sticks.

[0023] A range of suitable application forms can be found in the art of deodorant sticks and other applicators.

[0024] The initiator may be a perfume material or the carrier of a perfume material. Inclusion of the initiator in a final composition together with the perfume is advantageous as both classes of materials may require careful dosing and the composition is generally not subjected to heating once the perfume has been added.

[0025] The photo-initiator system must generally be stored in the absence of light of wavelength below 500nm, to avoid photoreaction. An opaque packaging is sufficient for this purpose.

Surfactant:

[0026] The surfactant may be chosen from soap and non-soap anionic, cationic, nonionic, amphoteric and zwitterionic detergent active compounds, and mixtures thereof. It is necessary that the combination of surfactant and water present forms a liquid crystal phase. The size of the phase region over which such a phase forms can be modified by the presence of salts.

[0027] Many suitable detergent active compounds are available and are fully described in the literature, for example, in "Surface-Active Agents and Detergents", Volumes I and II, by Schwartz, Perry and Berch.

[0028] The preferred textile-compatible carriers that can be used are soaps and synthetic non-soap anionic and nonionic compounds.

[0029] Preferred soaps are those having a C₈-C₁₈ alkyl chain.

[0030] Nonionic surfactants that may be used include the primary and secondary alcohol ethoxylates, especially the C₈-C₂₀ aliphatic alcohols ethoxylated with an average of from 1 to 20 moles of ethylene oxide per mole of alcohol, and more especially the C₁₀-C₁₅ primary and secondary aliphatic alcohols ethoxylated with an average of from 1 to 10 moles of ethylene oxide per mole of alcohol.

[0031] Non-ethoxylated nonionic surfactants include alkylpolyglycosides, glycerol monoethers, and polyhydroxyamides (glucamide).

[0032] Anionic surfactants are well-known to those skilled in the art. Examples include alkylbenzene sulphonates, particularly linear alkylbenzene sulphonates having an alkyl chain length of C₈-C₁₅; primary and secondary alkylsulphates, particularly C₈-C₁₅ primary alkyl sulphates; alkyl ether sulphates; olefin sulphonates; alkyl xylene sulphonates; dialkyl sulphosuccinates; and fatty acid ester sulphonates. Sodium salts are generally preferred.

[0033] Cationic surfactants that may be used include quaternary ammonium salts of the general formula R₁R₂R₃R₄N⁺X⁻ wherein the R groups are independently hydrocarbyl chains of C₁-C₂₂ length, typically alkyl, hydroxyalkyl or ethoxylated alkyl groups, and X is a solubilising anion (for example, compounds in which R₁ is a C₈-C₂₂ alkyl group, preferably a C₈-C₁₀ or C₁₂-C₁₄ alkyl group, R₂ is a methyl group, and R₃ and R₄, which may be the same or different, are methyl or hydroxyethyl groups); and cationic esters (for example, choline esters) and pyridinium salts.

[0034] Amphoteric surfactants may also be used, for example amine oxides or betaines.

Radical Initiators:

[0035] The photo-initiators can be hydrogen abstraction radical photoinitiators. These include benzophenones, acetophenones, pyrazines, quinones and benzils.

[0036] Bond cleavage photoinitiators are preferred. Suitable bond cleavage radical initiators may be selected from the following groups:

(a) alpha amino ketones, particularly those containing a benzoyl moiety, otherwise called alpha-amino acetophenones, for example 2-methyl 1-[4-phenyl]-2-morpholinopropan-1-one (Irgacure 907, trade mark, ex CIBA), (2-benzyl-2-dimethyl amino-1-(4-morpholinophenyl)-butan-1-one (Irgacure 369, trade mark, ex CIBA);

(b) alphahydroxy ketones, particularly alpha-hydroxy acetophenones, eg (1-[4-(2-hydroxyethoxy)-phenyl]-2-hydroxy-2-methyl-1-propan-1-one) (Irgacure 2959, trade mark, ex CIBA), 1-hydroxy-cyclohexyl-phenyl-ketone (Irgacure 184, trade mark, ex CIBA); 2-hydroxy-2-methyl-1-phenylpropan-1-one (Esacure™ KL200 ex Lamberti SPA); and, oligomeric polyfunctional alpha-hydroxyketones (such as Esacure KIP150 ex Lamberti SPA);

(c) phosphorus-containing photoinitiators, including monoacyl and bisacyl phosphine oxide and sulphides, for example 2-4-6-(trimethylbenzoyl)diphenyl-phosphine oxide, bis(2,4,6-trimethylbenzoyl)-phenyl-phosphine oxide (Irgacure 819, trade mark ex CIBA), (2,4,6-trimethylbenzoyl)phenyl phosphinic acid ethyl ester (Lucirin TPO-L (trade mark) ex BASF);

(d) dialkoxy acetophenones; particularly Benzilidimethylketal (Esacure™ KB1 ex Lamberti SPA);

(e) alpha-haloacetophenones;

(f) trisacyl phosphine oxides; and,

(g) benzoin and benzoin-based photoinitiators.

[0037] Further suitable radical photoinitiators are disclosed in WO 96 07662 (trisacyl phosphine oxides), US 5399782 (phosphine sulphides), US 5410060, EP-A-57474, EP-A-73413 (phosphine oxides), EP-A-088050, EP-A-0117233, EP-A-0138754, EP-A-0446175 and US 4559371.

[0038] Other suitable radical photoinitiators are disclosed in EP-A-0003002 in the name of Ciba Geigy, EP-A-0446175 in the name of Ciba Geigy, GB 2259704 in the name of Ciba Geigy (alkyl bisacyl phosphine oxides), US 4792632 (bisacyl phosphine oxides), US 5554663 in the name of Ciba Geigy (alpha amino acetophenones), US 5767169 (alkoxy phenyl substituted bisacyl phosphine oxides) and US 4719297 (acylphosphine compounds).

[0039] Radical photoinitiators are discussed in general in A.F.. Cunningham, V. Desorby, K. Dietliker, R. Husler and D.G. Leppard, *Chemia* 48 (1994) 423-426 and H.F.Gruber, *Prog. Polym. Sci.*, 17, (1992), 953-1044.

[0040] The preferred radical photoinitiators become active when excited by radiation falling generally in the range 290-800 nm. For example, natural sunlight, which comprises light in this region, will be suitable for causing the radical photoinitiator to undergo one of the reactions described above.

[0041] Preferably, the radical photoinitiator has a maximum extinction coefficient in the ultraviolet range (290-400 nm) which is greater than $100 \text{ mol}^{-1} \text{ l cm}^{-1}$. Suitably, the radical photoinitiator is a solid or a liquid at room temperature.

[0042] Particularly preferred photo-initiators include alpha hydroxy ketones, particularly those containing a benzoyl moiety.

[0043] Suitably, the radical photoinitiator is substantially colourless and gives non-coloured photo products upon undergoing one of the reactions set out above.

[0044] Optionally, the compositions comprise sensitisers such as thioxanthenes, for example as described in EP-A-0088050, EP-A-0138754, as well as one or more perfume components or a radical terminator.

[0045] The radical photoinitiators are preferably activated by ambient light eg, domestic lighting or sunlight. However, a separate light source (for example a tungsten filament or gas discharge tube) may be employed for activation of the photoinitiator.

[0046] In the alternative, the initiator may be a thermal initiator, which decomposes to form radicals on heating. As will be apparent, there will be some degree of overlap between the classes of initiator, which may be used in these two aspects of the invention. Some radical photoinitiators also decompose by heating (particularly at higher temperatures) and some thermal initiators decompose on exposure to light (particularly at shorter wavelengths).

[0047] Suitable thermal initiators include compounds comprising an azo group or a peroxygen group. Preferred materials exclude those containing a peroxygen group and include those forming a carbon-centred radical rather than an oxygen-centred radical.

[0048] The thermal initiators are preferably stable at ambient temperature. Temperatures to which the thermal initiators should be heated to cause them to decompose are preferably in the range of up to 100°C , more preferably from 35°C to 90°C , most preferably 35°C to 40°C . Heat may conveniently be applied by means available in the laundering environment such as by use of an iron or tumble drier.

[0049] The invention will be further described with reference to the following non-limiting examples.

Examples

[0050] For all the examples, values given are the average of 4 experiments.

Example 1:

[0051] Cotton cloth samples were reactively dyed with Remazol Black B TM so that the cloth contained 1.5×10^{-4} mol kg^{-1} of dye. This cloth is a sensitive monitor of dye damage.

[0052] Separate samples of white cloth were heavily stained with β -carotene (ex. Equest, Newcastle GB). These cloths served as monitors of bleaching activity.

[0053] 50g l^{-1} of a C-12 soap in water (a waxy liquid-crystalline solid at room temperature) was melted by heating.

[0054] 1% of Lucirin TPO-L or Irgacure 184 was dissolved in the hot liquid and then the solution poured into a plastic mould and allowed to solidify by cooling. The so-formed solid was wiped across the surface of β -carotene stained cotton and cotton dyed with Remazol Black B then irradiated in a WeatherometerTM for 6 minutes. Control experiments were also carried out using C-12 soap only.

[0055] After irradiation the stained cloth treated with initiator was clearly bleached and no dye damage on the dyed cloth above control could be observed. The control stained cloth showed no bleaching.

Table 1

| | ΔE of stained cloth compared to white original | ΔE of black cloth compared to original |
|-------------------------------|--|--|
| Control (irradiation + rinse) | 53.6 | 0.2 |
| Soap only | 52.7 | 0.4 |
| Soap with 1% Irgacure 184 | 28.6 | 0.4 |
| 1% Irgacure 184 from ethanol | - | 3.5 |
| Soap with 1% Lucirin TPO-L | 17.5 | 0.4 |
| 1% Lucirin TPO-L from ethanol | - | 2.3 |

[0056] **Table 1** Stain bleaching and Dye damage from Lucirin TPO-L applied from 50g/l C-12 soap.

Example 2:

[0057] Cotton cloth samples were reactively dyed with Remazol Black B TM so that the cloth contained 1.5×10^{-4} mol kg^{-1} of dye. This cloth is a sensitive monitor of dye damage.

[0058] Separate samples of white cloth were heavily stained with β -carotene (ex. Equest, Newcastle, G.B.). These cloths served as monitors of bleaching activity.

[0059] A C-14 soap was dissolved in hot water such that its concentration was 50g l^{-1} .

[0060] 1% IrgacureTM 184 (ex. Ciba Speciality Chemicals, also sold under the EsacureTM KS 300 name by Lamberti Spa) was dissolved in the hot liquid and the solution then poured into a plastic mould and allowed to solidify by cooling. The so-formed solid was wiped across the surface of the β -carotene stained cotton and then irradiated in a WeatherometerTM for 6 minutes. The procedure was repeated for the dyed cotton except the clothes were irradiated for 18 minutes. Control experiments were performed using C-14 soap only.

[0061] All clothes were then washed in water, dried and the CIELAB ΔE values of the stained clothes relative to a clean white original measured using a reflectance spectrometer. The CIELAB ΔE values of the dyed cotton clothes were also measured relative to an untreated piece.

[0062] The experiment was repeated using 25, 75, 100 and 150 g l^{-1} soap and the results shown in table 2. For comparison 1% of Irgacure 184 was applied from an ethanol solution, the ethanol dried and the cloth then irradiated wet with water or dry.

[0063] The results show that use of the soap solution reduces the damage to the coloured cloth whilst bleaching the stained cloth.

Table 2

| | ΔE if stained cloth compared to white original | ΔE of black cloth compared to original |
|---|--|--|
| Control (irradiation + rinse) | 56.3 | 0.3 |
| 25gl ⁻¹ soap only | 50.4 | 0.5 |
| 25gl ⁻¹ soap + Irgacure 184 | 34.0 | 3.5 |
| 50gl ⁻¹ soap only | 49.6 | 0.3 |
| 50gl ⁻¹ soap + Irgacure 184 | 37.0 | 2.9 |
| 75gl ⁻¹ soap only | 56.0 | 0.4 |
| 75gl ⁻¹ soap + Irgacure 184 | 38.6 | 2.2 |
| 100gl ⁻¹ soap only | 52.9 | 0.5 |
| 100gl ⁻¹ soap + Irgacure 184 | 40.2 | 2.1 |
| 150gl ⁻¹ soap only | 44.1 | 0.5 |
| 150gl ⁻¹ soap + Irgacure 184 | 41.0 | 1.3 |
| 1% Irgacure 184 from Ethanol -wet cloth | - | 11.3 |
| 1% Irgacure 184 from Ethanol -dry cloth | - | 4.0 |

[0064] Table 2 Stain bleaching and Dye damage from Irgacure 184 applied from C-14 soap solutions.

Example 3 (comparative) :

[0065] The experiment of example 2 were repeated except using 2gl⁻¹ of the C-14 soap. The initiator did not dissolve in the solution and the solution was liquid.

Example 4 (comparative):

[0066] 0.2% initiator was dissolved in Genapol C-050 at room temperature. Water was added to this solution until the initiator precipitated. For both Irgacure 184 and Lucirin TPO-L precipitation occurred with less than 10% added water.

Example 5 (comparative):

[0067] 0.2% initiator was dissolved in Synperonic™ A20 at its melting point. Water was added to this solution until the initiator precipitated. For both Irgacure 184 and Lucirin TPO-L precipitation occurred with less than 10% added water.

Claims

1. A fabric treatment composition, which comprises:

- a) a radical initiator, and
- b) a surfactant in a liquid-crystalline phase.

2. A composition according to claim 1 wherein the composition is a liquid or soft-solid.

3. A composition according to any preceding claim, wherein the surfactant is a soap.

4. A composition according to any preceding claim, wherein the radical initiator is a photo or thermal initiator.
5. A composition according to any preceding claim, wherein the initiator is a bond cleavage photoinitiator.

6. A composition according to claim 5, wherein the initiator is selected from:

- (a) alpha amino ketones,
- (b) alphahydroxy ketones,
- (c) phosphorus-containing photoinitiators,
- (d) dialkoxo acetophenones;
- (e) alpha-haloacetophenones;
- (f) trisacyl phosphine oxides;
- (g) benzoin and benzoin-based photoinitiators, and,
- (h) mixtures thereof.

7. A composition according to claim 6, wherein the radical photo-initiator becomes active when excited by radiation falling generally in the range 290-800 nm.

8. A composition according to claim 6, wherein the radical photo-initiator has a maximum extinction coefficient in the ultraviolet range (290-400 nm) which is greater than $100 \text{ mol}^{-1} \text{ l cm}^{-1}$.

9. A composition according to any preceding claim, in combination with a wipe or swab.

10. A composition according to any preceding claim, further comprising one or more perfume components.

11. A composition according to any preceding claim, further comprising a radical terminator.

12. A method for the treatment of fabrics which comprises applying to the fabric a composition according to any of claims 1-11.

Patentansprüche

1. Gewebebehandlungszusammensetzung enthaltend:

- a) einen radikalischen Initiator und
- b) ein Tensid in einer flüssigkristallinen Phase.

2. Zusammensetzung nach Anspruch 1, wobei die Zusammensetzung eine Flüssigkeit oder ein weicher Feststoff ist.

3. Zusammensetzung nach einem der vorhergehenden Ansprüche, wobei das Tensid eine Seife ist.

4. Zusammensetzung nach einem der vorhergehenden Ansprüche, wobei der radikalische Initiator ein Fotoinitiator oder thermischer Initiator ist.

5. Zusammensetzung nach einem der vorhergehenden Ansprüche, wobei der Initiator ein Bindungsspaltungsfotoinitiator ist.

6. Zusammensetzung nach Anspruch 5, wobei der Initiator ausgewählt ist aus:

- a) α -Aminoketonen;

- b) α -Hydroxyketonen;
- c) phosphorhaltigen Fotoinitiatoren;
- d) Dialkoxyacetophenonen;
- e) α -Halogenacetophenonen;
- f) Trisacylphosphinoxiden;
- g) Benzoinfotoinitiatoren und auf Benzoin basierenden Fotoinitiatoren und
- h) Mischungen davon.

7. Zusammensetzung nach Anspruch 6, wobei der radikalische Fotoinitiator aktiv wird, wenn er durch Strahlung angeregt wird, die in einen Bereich von 290 bis 800 nm fällt.
8. Zusammensetzung nach Anspruch 6, wobei der radikalische Fotoinitiator einen maximalen Extinktionskoeffizienten im Ultraviolettbereich (290-400 nm) hat, der größer als $100 \text{ Mol}^{-1} \text{ l cm}^{-1}$ ist.
9. Zusammensetzung nach einem der vorhergehenden Ansprüche in Kombination mit einem Tuch oder Tupfer.
10. Zusammensetzung nach einem der vorhergehenden Ansprüche weiter enthaltend eine oder mehrere Parfumkomponenten.
11. Zusammensetzung nach einem der vorhergehenden Ansprüche, weiter enthaltend einen radikalischen Terminator.
12. Verfahren zur Behandlung von Gewebe, das beinhaltet, dass auf das Gewebe eine Zusammensetzung nach einem der Ansprüche 1 bis 11 aufgebracht wird.

Revendications

1. Composition pour le traitement de textiles qui comprend :

- a) un initiateur radicalaire, et
- b) un tensio-actif dans une phase liquide-cristalline.

2. Composition selon la revendication 1, dans laquelle la composition est un liquide ou un solide mou.

3. Composition selon l'une quelconque des revendications précédentes, dans laquelle le tensio-actif est un savon.

4. Composition selon l'une quelconque des revendications précédentes, dans laquelle l'initiateur radicalaire est un photo-initiateur ou un initiateur thermique.

5. Composition selon l'une quelconque des revendications précédentes, dans laquelle l'initiateur est un photo-initiateur de clivage de liaison.

6. Composition selon la revendication 5, dans laquelle l'initiateur est choisi parmi :

- (a) les cétones α -aminées,
- (b) les cétones α -hydroxy,
- (c) les photo-initiateurs contenant du phosphore,
- (d) les acétophénonnes dialcoxy,
- (e) les haloacétophénonnes α ,
- (f) les oxydes de phosphine trisacycle,
- (g) la benzoine et des photo-initiateurs à base de benzoine, et,
- (h) des mélanges de ceux-ci.

7. Composition selon la revendication 6, dans laquelle le photo-initiateur radicalaire devient actif lorsqu'il est excité par une radiation se trouvant généralement dans la gamme de 290 à 800 nm.

8. Composition selon la revendication 6, dans laquelle le photo-initiateur radicalaire présente un coefficient d'extinction maximum dans la gamme du rayonnement ultraviolet (290-400 nm) qui est supérieur à $100 \text{ mol}^{-1} \text{ l cm}^{-1}$.

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9. Composition selon l'une quelconque des revendications précédentes, en combinaison avec une lingette ou un tampon.

5 10. Composition selon l'une quelconque des revendications précédentes comprenant en outre un ou plusieurs composants de parfum.

11. Composition selon l'une quelconque des revendications précédentes, comprenant en outre un terminateur radicalaire.

10 12. Procédé pour le traitement de textiles qui comprend l'application sur le textile d'une composition selon l'une quelconque des revendications 1 à 11.

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