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(54) Title: USE OF CATIONIC POLYMER HAVING QUATERNARY AMMONIUM GROUPS FOR THE PROTECTION OF HAIR AGAINST UV DAMAGE

(57) Abstract: The present invention relates to the use of a very specific class of cationic polymers having quaternary ammonium groups for the protection of hair against UV damage.



USE OF CATIONIC POLYMER HAVING QUATERNARY AMMONIUM GROUPS FOR THE PROTECTION OF HAIR AGAINST UV DAMAGE

Technical Field

5 The present invention relates to the UV protection of hair.

Background of the invention

UV radiation is known to have a detrimental effect not only on skin but also on hair. The UV light leads to a damage of the keratin and the structure of
10 cuticle composition. This results particular in dull and lifeless looking hair.

Such UV damage is traditionally reduced by the use of UV filters, which absorb the detrimental UV irradiation.

However, UV filters, are very expensive and their use is often limited by their solubility, respectively compatibility, in a cosmetic preparation. Therefore, it is
15 a desire to have an efficient UV protection at a competitive lower price level without formulation restrictions.

Cationic polymers have been known and used already for several years in the field of cosmetics. Particularly, the polyquaternium compounds are used as film formers, as conditioning agents, as thickening agents and as antistatic agents.
20

Summary of the invention

The inventors of the present invention have surprisingly found that a very specific class of cationic polymers having quaternary ammonium groups can be used for the protection of hair against UV damage.

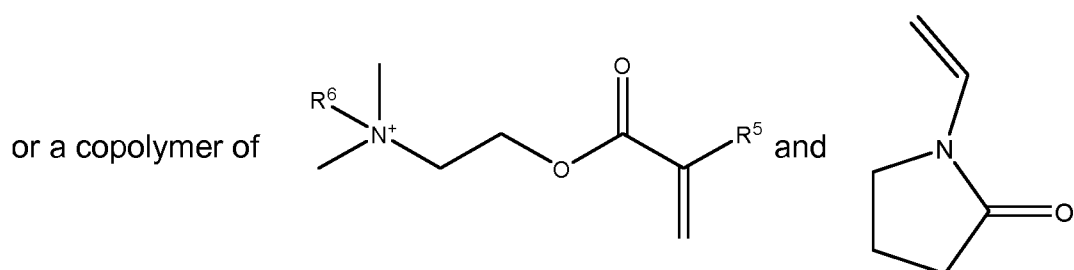
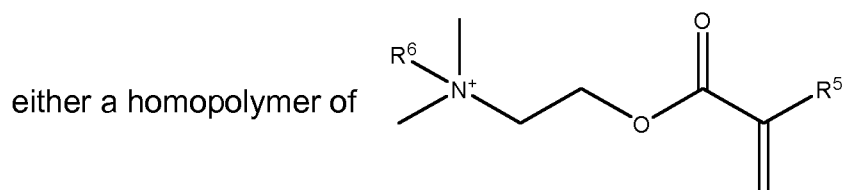
25 Treatment of hair with these homopolymers and copolymers leads to the fact that after UV exposure a higher denaturation temperature of hair as well as a higher denaturation enthalpy can be measured by DSC reflecting better hair integrity. It has been found that these homopolymers and copolymers protect the hair against the UVB radiation (280–315 nm) as well as against UVA radiation
30 (315-400 nm).

This effect of UV protection is particularly surprising as this specific class of cationic polymers having quaternary ammonium groups has no suitable chromophores in its chemical structure which might absorb the UV radiation.

Further aspects of the invention are subject of further independent claims.
Particularly preferred embodiments are subject of dependent claims.

Detailed description of the invention

5 In a first aspect, the present invention relates to a use of a cationic polymer having quaternary ammonium groups which is



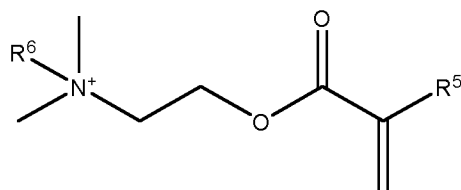
for the protection of hair against UV damage;

wherein

10 R^5 represents independently from each other either H or a methyl group; and

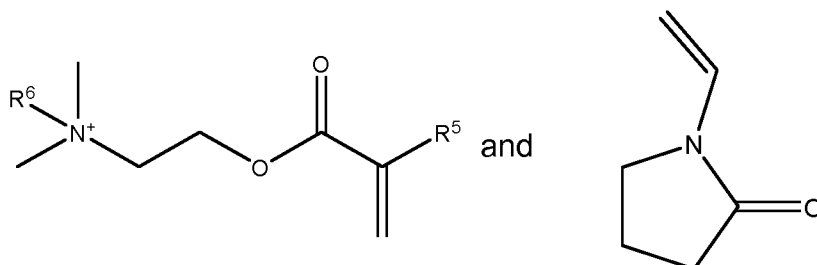
R^6 represents a linear C_{1-3} -alkyl group, particularly a methyl or an ethyl group, preferably an ethyl group.

The term "*Polymer A*" indicates in this document a homopolymer of



15

The term "*Polymer B*" indicates in this document a copolymer of



The term “independently from each other” in this document means, in the context of substituents, moieties, or groups, that identically designated substituents, moieties, or groups can occur simultaneously with a different meaning in the same molecule.

5 A “C_{x-y}-alkyl” group is an alkyl group comprising x to y carbon atoms, i.e., for example, a C₁₋₃-alkyl group is an alkyl group comprising 1 to 3 carbon atoms. The alkyl group can be linear or branched. For example -CH(CH₃)-CH₂-CH₃ is considered as a C₄-alkyl group.

10 In case identical labels for symbols or groups are present in several formulae, in the present document, the definition of said group or symbol made in the context of one specific formula applies also to other formulae which comprises said same label.

The expression “process of preparation” is a synonym for “method of preparation” and can be used interchangeable to each other.

15 Ultraviolet light (=UV light) is understood in the present document of electromagnetic radiation of the wavelength between 280 and 400 nm.

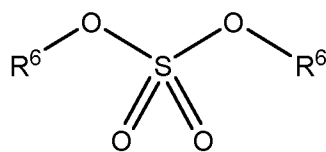
“Leave-on treatment”, sometimes also called “Leave-in treatment” is a term used and known by the person skilled in the art for any hair treatment in which a cosmetic product is applied to the hair and is not washed out or off the
20 hair thereafter.

It is preferred that R⁵ is a methyl group.

It is, furthermore, preferred that R⁶ is an ethyl group.

25

The group R⁶ is typically introduced by the alkylation agent



. Typically, this is dimethylsulfate or diethylsulfate.

Therefore, the anion of the cationic polymer is typically [R⁶OSO₃]⁻.

The homopolymer or copolymer, is obtained from the respective
30 monomers by polymerization. No further polymerizable monomers are present in the polymerization. The process of the polymerization of the monomers and

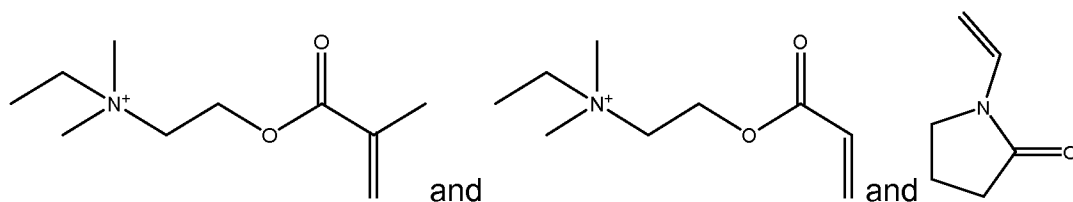
particular the polymerization conditions are known to the person skilled in the art. Particularly the polymerization of the monomers is initiated by free-radical polymerization initiators such as peroxides or azo compounds.

Examples of peroxide are hydrogen peroxide or peroxodisulfates, such as
 5 the mono- or di-alkali metal or ammonium salts of peroxide disulfuric acid, for example, its mono- and di-sodium, -potassium or ammonium salts or organic peroxides, such as alkyl hydroperoxides, for example tert-butyl, p-menthyl or cumyl hydroperoxide, tert-butyl perpivalate, and dialkyl or diaryl peroxides, such as di-tert-butyl or di-cumyl peroxide, 2,5-dimethyl-2,5-di(t)butyl-peroxy(hexane) or
 10 dibenzoyl peroxide.

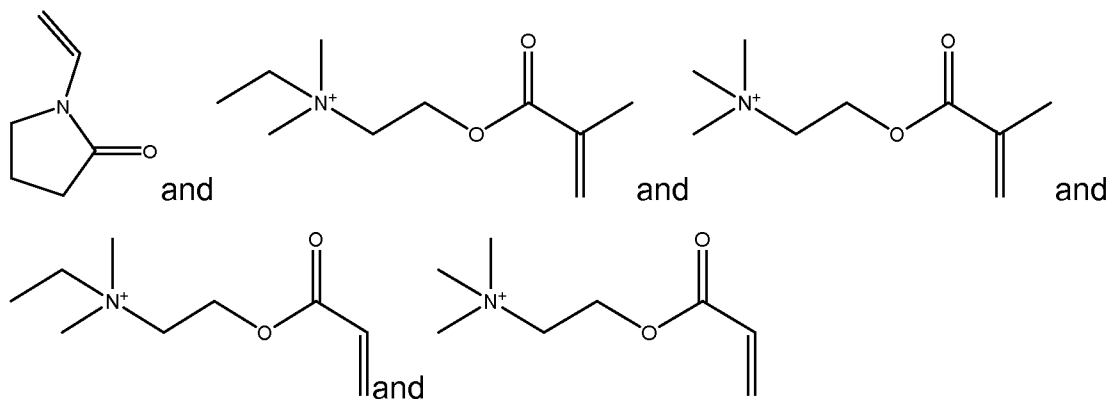
Examples of suitable azo compounds are 2,2'-azobis(isobutyronitrile), 2,2'-azobis(2,4-dimethylvaleronitrile) and 2,2'-azobis(amidinopropyl) dihydrochloride, 1,1'-azobis(1-cyclohexanecarbonitrile), 2,2'-azobis(2-amidinopropane) salts, 4,4'-azobis(4-cyanovaleric acid) or 2-(carbamoilazo)isobutyronitrile.

15 Particularly the polymerization is an emulsion polymerization.

In the case of copolymers, also monomers of different R⁵ and/or R⁶ can be used. For example, a copolymer of

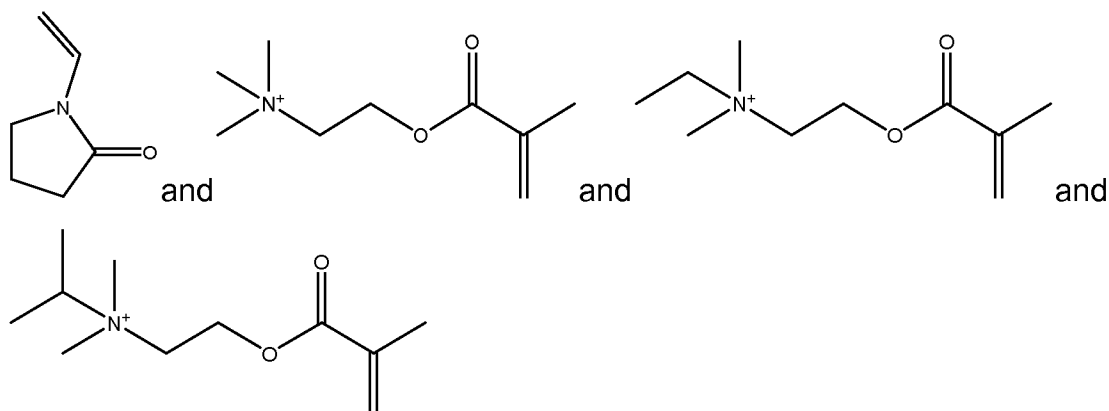


20 or a copolymer of

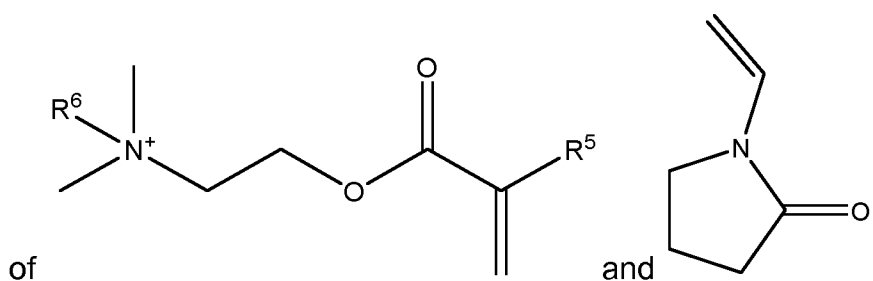


or a copolymer of

- 5 -



are all regarded as being a copolymer



5

In a preferred embodiment, the cationic polymer having quaternary ammonium groups is selected from the group consisting of polyquaternium-11 and polyquaternium-37.

10 In an even more preferred embodiment, the cationic polymer having quaternary ammonium groups is polyquaternium-11.

Polyquaternium-11 and polyquaternium-37 are known substances under the above INCI nomenclature, respectively under their CAS numbers [53633-54-8] and [26161-33-1] and are commercially available from different suppliers.

15

These cationic polymers are found to be very beneficial for the UV protection of the hair.

20 Therefore, in a preferred embodiment the cationic polymer having quaternary ammonium groups is incorporated in a cosmetic composition suitable for topical application on hair, particularly a hair care product, preferably a hair shampoo or a hair conditioner or hair styling product or a hair treatment product.

Hair mask, hair serum, hair balm, hair loss treatments or hair lotions are examples for treatment products.

5 When incorporated in such a cosmetic composition, it is preferred that the amount of the cationic polymer having quaternary ammonium groups in the cosmetic product is between 0.1 and 15 % by weight, particularly between 0.3 and 10 % by weight, preferably between 0.5 and 7 % by weight, relative to the cosmetic composition.

10

Beside the cationic polymer as described above the cosmetic composition can have further constituents.

Particularly, the cosmetic composition comprises a cosmetically suitable carrier.

15

One or more surfactants may be added to the cosmetic composition. When surfactants are present, they are preferably present at a concentration of from 0.1 to 15 weight percent, based on the total weight of the composition. The surfactants which may be used in the cosmetic composition include for example
20 anionic, cationic, nonionic, or amphoteric surfactants. For example, suitable surfactants include sodium laureth sulfate, ammonium laureth sulfate, sodium lauryl sulfate, ammonium lauryl sulfate, cocamidopropyl betaine, disodium coco-amphodiacetate, sodium cocoamphoacetate, disodium laureth sulfosuccinate, sodium cocoyl glutamate, sodium lauroyl methyl isethionate, coco-glucoside, decyl
25 glucoside, coco betaine, PEG-200 hydrogenated glyceryl palmate, PEG-7 glyceryl cocoate, PEG-120 methyl glucose dioloeate, PEG-150 distearate, PEG-80 sorbitan laurate, cocamide MEA, sucrose cocoate isostearamide MIPA, PPG 28 buteth 35, PEG 75 lanolin, perfluoropolymethyl isopropyl ether, octoxynol-9, PEG-
25 hydrogenated castor oil, PEG-40 hydrogenated castor oil, polyethylene
30 terephthalate, polyethylene glycol 25 glyceryl trioleate, oleth-3 phosphate, PPG-5-ceteth-10 phosphate, PEG-20 methyl glucose ether, glycereth-7-triacetate, glycereth-7-benzoate, fatty acid ester of polysorbate (TWEEN), or n-alkyl substituted lactam such as n-octyl pyrrolidone, or combinations thereof.

One or more emulsifiers may be added to the cosmetic composition.

When emulsifiers are present, they are preferably present at a concentration of from 0.1 to 10.0 weight percent, based on the total weight of the composition. The emulsifiers which may be used in the cosmetic composition include for example
5 anionic, cationic, nonionic, or amphoteric emulsifiers, especially useful are cationic emulsifiers. For example, suitable emulsifiers include behentrimonium chloride, distearyldimonium chloride, cetrimonium chloride, steartrimonium chloride, palmitamidopropyltrimonium chloride, palmitamidopropyl dimethylamine, behentrimonium methosulfate, cocotrimonium methosulfate, brassicyl isoleucinate esylate
10 and brassica alcohol, cetareth-20, cetareth-30,

One or more co-emulsifiers may be added to the cosmetic composition.

When emulsifiers are present, they are preferably present at a concentration of from 0.1 to 10.0 weight percent, based on the total weight of the composition. The co-emulsifiers which may be used in the cosmetic composition include for
15 example glyceryl stearate, fatty alcohols such as cetyl alcohol, stearyl alcohol, behenyl alcohol, cetearyl alcohol, fatty esters such as cetyl palmitate.

One or more siloxane derivatives may be present in the cosmetic composition. When they are used, they are preferably present in a concentration from 0.01 to 3.0 weight percent, based on the total weight of the composition. The
20 siloxane derivatives include for example dimethicones, phenyl trimethicones, dimethiconols, amodimethicones, alkoxyated dimethicones e.g. PEG-12 dimethicone or methoxy PEG/PPG-7/3 aminopropyl dimethicone.

One or more solvents may be added to the cosmetic composition. The
25 solvents may or may not be VOC (= Volatile Organic Compounds). When solvents are added to the cosmetic composition they preferably comprise 55 weight percent or less, and more preferably 100 weight percent or less, based on the total weight of the composition. Suitable solvents include for example C1 to C12 straight or branched chain alcohols such as methanol, ethanol, isopropanol, or
30 propanol or combinations thereof.

The cosmetic composition typically comprises water.

Preservatives which may be used in the cosmetic composition include for example isothiazolones, benzyl alcohol, chlorphenesin, sodium benzoate,

potassium sorbate, phenoxyethanol, parabens such as methylparaben, ethylparaben and propylparaben, ethylhexylglycerin, caprylylglycol, methylidibromoglutaronitrile, iodopropinyl butylcarbamate or imidazolidinylurea and diazolidinyl urea. The preservatives are preferably used in an amount of about 0.001 to 2.0 wt.-% based on the total weight of the cosmetic composition.

One or more thickeners may be desirable in the cosmetic composition. Suitable thickeners include for example polycarboxylic acid thickeners such as acrylates/steareth-20 methacrylate copolymer, carbomers, acrylates copolymer, sodium polyacrylates, or acrylates C10-30 acrylate crosspolymer; polyethoxylated urethane thickeners, or polyamide thickeners. Other suitable thickeners are based on natural polymers such as polysaccharides or polyamides and can be chemically modified. Such thickeners include for instance hydroxyethyl celluloses, hydroxypropyl celluloses, microcrystalline cellulose, xanthan gum, gelatine, agar-agar, carragenens, alginates or mixtures thereof. The thickeners are preferably used in an amount of about 0.001 to 5.0 wt.-% based on the total weight of the cosmetic composition.

The cosmetic composition may also comprise further polymers providing beneficial hair attributes or styling attributes such as acrylate copolymers, particularly copolymers of n-butyl methacrylate, methacrylic acids, and ethyl acrylate such as disclosed in detail in WO 2012/072774, particularly as the acrylate copolymer been commercialized as TILAMAR® Fix A140 (CAS:[26715-43-5]) and TILAMAR® Fix A1000 (CAS:[1070166-98-1]) by DSM, Switzerland

Additionally other additives, such as those commonly used by those skilled in the art may be added to the cosmetic composition. The other additives used in the composition will depend upon the type of cosmetic composition desired. Other additives include for example fragrances; moisturizers such as sorbitol, propane diol, butylene glycol, glycerin, hydrolyzed silk protein, or hydrolyzed wheat protein; detangling aids such as panthenol; conditioning agents such as those disclosed in US Patent 5,164,177, emulsifiers; antistatic aids, extracts, proteins, vitamins, dyes, tints, colorants or combinations thereof.

Further examples of such additives are ingredients to enhance the performance and/or consumer acceptability such as antioxidants, fatty

substances/ oils, thickeners, softeners, antifoaming agents, fillers, sequestering agents, cationic-, nonionic- or amphoteric polymers or mixtures thereof, acidifying or basifying agents, pigments or nanopigments, pearlzers or opacifiers such as styrene/acrylates copolymer for example commercialized as TILAMAR® OP 40
5 (CAS:[9010-92-8]), organic or inorganic particles, viscosity modifiers, and natural hair nutrients such as botanicals, fruit extracts, sugar derivatives and/or amino acids or any other ingredients usually formulated into hair care compositions. The necessary amounts of the adjuvants and additives can, based on the desired product, easily be chosen by a person skilled in the art in this field and will be
10 illustrated in the examples, without being limited hereto. The other additives are typically present from 0.005 to 10 wt.-%; more preferably from 0.01 to 5 wt.-% based on total weight of the cosmetic composition.

The cosmetic composition may also comprise at least one substance which
15 has beneficial attributes to the scalp or the hair. Such substances are particularly sericin, leontopodium alpinum extract, commercialized under the tradename ALPAFLOR® Edelweiss B, saccharide isomerate, commercialized under the tradename PENTAVITIN®, phytantriol, argania spinose kernel oil and tocopherol and butyrospermum parkii butter extract and spent grain wax, commercialized
20 under the tradename STIMU®-TEX AS, panthenol ethyl ether, commercialized under the tradename Ethyl Panthenol, niacinamide, commercialized under the tradename Niacinamide PC, tocopherol, commercialized under the tradename dl-alpha-Tocopherol, and ceratonia siliqua gum, commercialized under the tradename PHYTALURONATE® PF.

25

Additional other additives, as well as additional surfactants, solvents, other preservatives, and thickeners, which may be suitable in the cosmetic composition may be found in the International Cosmetic Ingredients Dictionary, 5th Edition, 1993, published by the CTFA in Washington D.C.

30

It may be advantageous to add also at least one or more UV filters to the above cosmetic composition. The UV filter is advantageously selected from UV-A, UV-B, UV-C and/ or broadband filters such as in particular from the commercially available and widely used UV-filter substances octocrylene (PARSOL® 340), 4-

methyl benzylidene camphor (PARSOL® 5000), ethylhexyl methoxycinnamate (PARSOL® MCX), ethylhexyl triazone (Uvinul® T-150), diethylhexyl butamido triazone (Uvasorb® HEB), 2,2'-methylene-bis-(6-(2H-benzotriazole-2-yl)-4-(1,1,3,3,-tetramethylbutyl)-phenol (Tinosorb® M), bis-ethylhexyloxyphenol
5 methoxyphenyl triazine (Tinosorb® S), 2,2-(1,4-phenylene)bis-(1H-benzimidazol-4,6-disulfonic acid (NeoHeliopan® AP), 2-(4-Diethylamino-2-hydroxy-benzoyl)-benzoic acid hexylester (Uvinul® A plus), polysilicone-15 (PARSOL® SLX), 2-phenyl benzimidazole sulfonic acid (PARSOL® HS), ethylhexyl salicylate (PARSOL® EHS), homomenthyl salicylate (PARSOL® HMS), Benzophenone-3
10 (Uvinul® M 40), Benzophenone-4 (Uvinul® MS 40), PEG-25 PABA, butyl methoxydibenzoyl methane (PARSOL® 1789) as well as mixtures thereof.

Preferred UV Filters are polysilicone-15 (PARSOL® SLX) and ethylhexyl methoxycinnamate (PARSOL® MCX).

The effect of the UV protection can be further improved by adding at least
15 one UV-filter.

Such cosmetic compositions have the same level of UV protection at a significantly lower price due to the fact that less amount of expensive UV filters are needed.

20 In a further aspect, the present invention relates to a method of protecting hair from UV damage comprising the steps

- a) applying a cationic polymer having quaternary ammonium groups as described in great detail above to the surface of hair;
- b) exposing the hair to which cationic polymer having quaternary
25 ammonium groups has been applied according to step a) to UV radiation;
- c) observing a lower level of hair damages after UV exposure according to step b) as compared to hair which has been exposed to UV radiation according to step b), however, to which no cationic polymer having
30 quaternary ammonium groups has been applied according to step a);

The lower hair damage after UV exposure can be determined by DSC (Differential Scanning Calorimetry) method in having a higher denaturation temperature and higher denaturation enthalpy as compared to the unprotected hair.

It has been observed that already small amounts of cationic polymer having quaternary ammonium groups in a cosmetic composition lead to a significant UV protection of the hair. It has been found that already as little as 0.6 % by weight of cationic polymer having quaternary ammonium groups relative to the weight of the cosmetic composition applied to the hair lead to an increase in denaturation temperature of more than 2%, sometimes even more than 5.0 %, as compared to the non-UV-protected hair. It has been, furthermore, found that already as little as 1.2 % by weight of cationic polymer having quaternary ammonium groups relative to the weight of the cosmetic composition applied to the hair lead to an significant increase in denaturation enthalpy of more than 20%, sometimes even more than 50 %, as compared to the non-UV-protected hair.

Already as little between 0.1 and 15 % by weight, particularly between 0.3 and 10 % by weight, preferably between 0.5 and 7 % by weight, relative to the cosmetic composition can achieve significant UV protection of hair.

15

Examples

The present invention is further illustrated by the following, non-limiting examples, in which all percentages are by weight based on total weight unless otherwise specified.

20

Leave-on water based protection pump sprays

In a first series of examples, the compositions according to table 1 have been applied with a syringe (0.8 ml) each onto three tresses of hair (826200, Eurohair –over bleached, 1cm width, free hair length 10 cm (Kerling International) color 10/0, mixture 476) which before have been cleaned by washing them twice using standard cleansing shampoo (HC.E. 100147.001) and towel-dried. After massaging the composition during 2 minutes and combing the respective tresses have been dried in a climate chamber (20°C, 60 % relative humidity) during 4 hours and exposed to UV irradiation using an Atlas Suntester with 500 W/m² during 150 hours.

30

After the exposure to UV light, 3 sample of respective hair have been measured by DSC (Differential Scanning Calorimetry)(Discovery DSC, DSC 1-0070 TA instruments) (25mg hair in a high volume pan) between 80°C and 180°C at a heating rate of 10°C/min. The denaturation temperature T_D (DSC peak) and

the denaturation enthalpy ΔH_D are determined using the TA software and listed in table 1. In table 1 also the relative increase of T_D respectively of ΔH_D relative to the composition having no respective cationic polymer having quaternary ammonium groups (i.e. relative to **Ref.1**) is given.

- 5 It is explicitly stated that the Polyquaternium-11 solution used comprises no stabilizers which might result in a UV protection effect.

Ingredients (INCI)	Ref.1	1	2
Polyquaternium-11 (solution 20% by weight in water)		3.0	3.0
Acrylate Copolymer (solution 40% by weight) ¹			1.25
Water	93.48	90.48	89.23
Aminomethyl Propanol	0.27	0.27	0.27
Sodium Cocoyl Glutamate	5.0	5.0	5.0
Panthenyl Ethyl Ether	0.25	0.25	0.25
Ethylhexylglycerin, Phenoxyethanol	1.0	1.0	1.0
T_D [°C]	146.3	149.6	149.6
increase [%]		+2.3%	+2.3%
ΔH_D [J/g]	9.0	12.3	11.8
increase [%]		+36.7%	+31.1%

Table 1. The UV protection effect of cationic polymer having quaternary ammonium groups in water based compositions.

¹ TILAMAR® Fix A140

- The results of table 1 show that the compositions comprising a *Polymer B* (**1,2**) show an increased denaturation temperature and denaturation enthalpy as compared to the respective composition having no respective cationic polymer having quaternary ammonium groups (**Ref.1**)
- 10

Leave-on water based protection pump sprays

- In a second series of examples, no product (**Ref.2**) or the compositions according to table 2 (**3, 4, 5**) have been applied with a syringe (0.8 ml) each onto three tresses of hair (826200, Eurohair –over bleached, 1cm width, free hair length 10 cm (Kerling International) color 10/0, mixture 476) which before have been cleaned by washing them twice using standard cleansing shampoo (HC.E. 100147.001) and towel-dried. After massaging the composition during 2 minutes and combing the respective tresses have been dried in a climate chamber (20°C,
- 15
- 20

60 % relative humidity) during 4 hours and exposed to UV irradiation using an Atlas Suntester with 500 W/m² during 150 hours.

After the exposure to UV light, 3 sample of respective hair have been measured by DSC (Differential Scanning Calorimetry)(Discovery DSC, DSC 1-0070 TA instruments) (25mg hair in a high volume pan) between 80°C and 180°C at a heating rate of 10°C/min. The denaturation temperature T_D (DSC peak) and the denaturation enthalpy ΔH_D are determined using the TA software and listed in table 2. In table 2 also the relative increase of T_D respectively of ΔH_D relative to the hair not been treated with a composition having respective cationic polymer having quaternary ammonium groups (i.e. relative to **Ref.2**) is given.

It is explicitly stated that the Polyquaternium-11 solution and Polyquaternium-37 used comprise no stabilizers which might result in a UV protection effect.

Ingredients (INCI)	Ref.2	3	4	5	6
Polyquaternium-11 (solution 20% by weight in water)		6.0			3.0
Polyquaternium-37			1.2		0.6
Polyquaternium-37 (50% by weight in LP ¹)				2.4	
Ethylhexylglycerin, Phenoxyethanol		0.5	0.5	0.5	0.5
Water		93.5	98.3	97.1	95.9
T_D [°C]	141.1	148.3	151.3	145.8	144.0
increase [%]		+5.1%	+7.2%	+3.3%	+2.1%
ΔH_D [J/g]	7.5	10.1	12.0	9.3	11.6
increase [%]		+34.7%	+60.0%	+24.0%	+54.7%

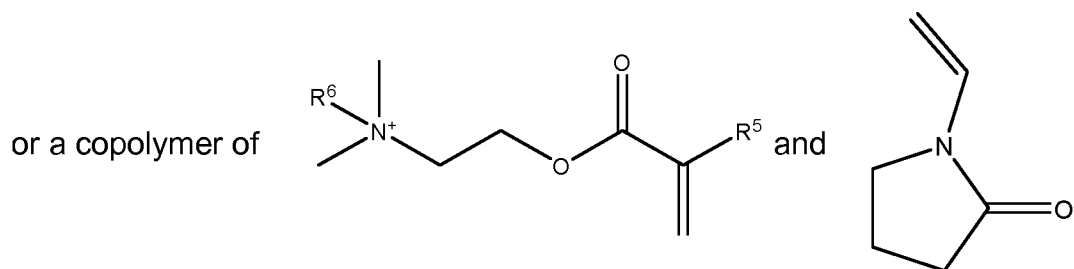
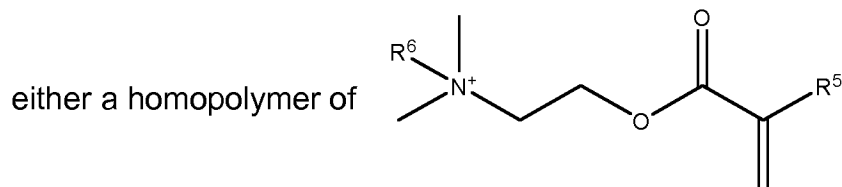
Table 2. The UV protection effect of cationic polymer having quaternary ammonium groups in water based compositions.

¹ LP = 86 % by weight of propylene glycol dicaprylate/dicaprate +14% by weight of trideceth-6

The results of table 2 show that the compositions comprising a *Polymer A* and/or *Polymer B* (**3-6**) show a significantly increased denaturation temperature and denaturation enthalpy as compared to the UV damaged hair not been treated with compositions having respective cationic polymers having quaternary ammonium groups (**Ref.2**).

Claims

1. A use of a cationic polymer having quaternary ammonium groups which is



for the protection of hair against UV damage;

wherein

- 5 R⁵ represents independently from each other either H or a methyl group; and
- R⁶ represents a linear C₁₋₃-alkyl group, particularly a methyl or an ethyl group, preferably an ethyl group.
- 10 2. The use according to claim 1, characterized in that R⁵ is a methyl group.
3. The use according to anyone of the preceding claims, characterized in that R⁶ is an ethyl group.
- 15 4. The use according to anyone of the preceding claims, characterized in that the cationic polymer having quaternary ammonium groups is selected from the group consisting of polyquaternium-11 and polyquaternium-37.
5. The use according to anyone of the preceding claims 1 to 4, characterized in
- 20 that the cationic polymer having quaternary ammonium groups is polyquaternium-11.
6. The use according to anyone of the preceding claims, characterized in that the cationic polymer having quaternary ammonium groups is incorporated in
- 25 a cosmetic composition suitable for topical application on hair, particularly a hair care product, preferably a hair shampoo or a hair conditioner or hair styling product or a hair treatment product.

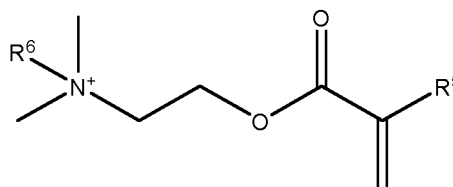
7. The use according to claim 6, characterized in that the amount of the cationic polymer having quaternary ammonium groups in the cosmetic product is between 0.1 and 15 % by weight, particularly between 0.3 and 10 % by weight, preferably between 0.5 and 7 % by weight, relative to the cosmetic composition.

8. A method of protecting hair from UV damage comprising the steps:

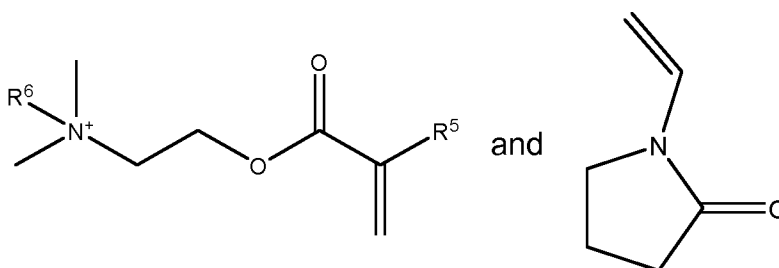
- applying a cationic polymer having quaternary ammonium groups to the surface of hair;
- exposing the hair to which cationic polymer having quaternary ammonium groups has been applied according step a) to UV radiation;
- observing a lower level of hair damages after UV exposure according to step b) as compared to hair which has been exposed to UV radiation according to step b), however, to which no cationic polymer having quaternary ammonium groups has been applied according to step a);

characterized in that the cationic polymer having quaternary ammonium groups is

either a homopolymer
of



or a copolymer
of



wherein

R^5 represents independently from each other either H or a methyl group; and

R^6 represents a linear C_{1-3} -alkyl group, particularly an ethyl group.

9. The method according to claim 8, characterized in that R^5 is a methyl group.

10. The method according to claim 8 or 9, characterized in that R^6 is an ethyl group.

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2017/077289

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61K8/81 A61Q17/00 A61Q17/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61K A61Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, CHEM ABS Data, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	A Sionkowska ET AL: "Copernican Letters Vol 5/2014 ISSN: 2082 968X The influence of Polyquaternium-7 on the hair properties", 5 May 2014 (2014-05-05), XP055321682, Retrieved from the Internet: URL: http://apcz.pl/czasopisma/index.php/CL/article/download/CL.2014.002/5192 [retrieved on 2016-11-22] pages 28,30	1-10
Y	EP 1 437 120 A1 (WELLA AG [DE]) 14 July 2004 (2004-07-14) page 8; claims 1-13	1-10
Y	WO 2004/043412 A1 (NALCO CO [US]) 27 May 2004 (2004-05-27) the whole document	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

6 December 2017

Date of mailing of the international search report

19/12/2017

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/077289

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