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(54) Title: PROCESS FOR SHAPING THE HAIR COMPRISING A STEP OF APPLYING A COMPOSITION COMPRISING AN ORGANIC ACID, A HAIR-SHAPING STEP AND A LONG LEAVE-ON TIME

(57) Abstract: The present invention relates to a process for shaping the hair, in which: -a composition comprising one or more organic acid(s) is applied to the hair, preferably wet hair, -the hair is placed under tension using a tensioning means, -the composition and the tensioning means are left on the hair for at least four hours, then -the tensioning means is removed, the composition comprising one or more organic acids in a total content ranging from 1% to 25% by weight relative to the total weight of the composition.



**PROCESS FOR SHAPING THE HAIR COMPRISING A STEP OF APPLYING A
COMPOSITION COMPRISING AN ORGANIC ACID, A HAIR-SHAPING STEP AND
A LONG LEAVE-ON TIME**

The present invention relates to a process for shaping the hair which comprises a
5 step of applying a composition comprising an organic acid, a step of placing under
mechanical tension and a long leave-on time.

Styling products are normally used to construct and structure the hairstyle and to
give it hold. They are usually in the form of lotions, gels, mousses, creams or sprays.
These compositions generally comprise one or more film-forming polymers, or "fixing
10 polymers", which allow the formation of a coating film on the hair and thus ensure the
form retention of the hairstyle and/or the formation of micro-bonds between the individual
hairs, thus ensuring the fixing of the hairstyle.

These compositions are generally applied to wet hair, which is shaped before
performing blow drying or drying.

15 To obtain satisfactory and long-lasting fixing power, it is known practice to
incorporate into styling products polymers with very high fixing power, and/or to increase
the concentration of fixing polymer. However, the use of such extremely fixing products
causes a certain number of drawbacks.

Although the objective of these products is to fix and hold the hairstyle over time,
20 they generally have a tendency to make the hairstyle rigid, in particular producing a
"helmet effect", often poorly perceived by users.

The head of hair, thus made rigid, has a dry and rough feel which is unliked by
consumers.

In addition, in order to improve the hairstyle and the form retention while at the
25 same time retaining good cosmetic properties, users have a tendency to apply several
products or compositions, which can prove to be lengthy and expensive.

Thus, there is a real need to develop a hair treatment process, and in particular a
styling process, which does not have the drawbacks mentioned above, i.e. which can be
carried out easily without requiring the application of several products, and which makes
30 it possible to obtain shaping of the hairstyle while at the same time preserving a natural
and non-rigid appearance of the hairstyle.

The process sought must also make it possible to care for the hair while at the
same time giving it a pleasant cosmetic feel, in particular a smooth and soft feel.

The applicant has discovered that applying a composition comprising an acid and
35 placing the hair under tension for a long leave-on time, namely for at least four hours,
makes it possible to achieve the objectives set out above; in particular to obtain a styling

process which is easy to carry out and capable of shaping the hairstyle while at the same time preserving a natural and non-rigid appearance, and also a smooth and soft feel.

The subject of the present invention is in particular a process for shaping the hair, in which:

- 5 - a composition comprising one or more organic acid(s) is applied to the hair, preferably wet hair,
- the hair is placed under tension using a tensioning means,
- the composition and the tensioning means are left on the hair for at least four hours, then
- 10 - the tensioning means is removed,
- the composition comprising one or more organic acids in a total content ranging from 1% to 25% by weight relative to the total weight of the composition.

The process for shaping the hair according to the invention is simple to use and it
15 makes it possible to easily shape the hair without any risk of damaging the hair, since it does not require heating means or sulfur-containing reducing agents such as those conventionally used in the field of permanent reshaping.

It also makes it possible to obtain the same styling results as with an iron, without requiring the heat from the iron, with results that last until the next shampooing operation.

20 Finally, it makes it possible to obtain a hairstyle with a natural appearance and in particular a soft feel.

Other features, aspects, objects and advantages of the present invention will emerge even more clearly on reading the description and the examples that follow.

25 In the following text, and unless otherwise indicated, the limits of a range of values are included in that range, especially in the expressions "between" and "ranging from ... to ...".

Moreover, the expression "at least one" used in the present description is equivalent to the expression "one or more".

30 According to the present application, the term "keratin fibers" denotes human keratin fibers and more particularly the hair.

The process according to the invention comprises a step of applying a composition comprising one or more organic acid(s).

For the purposes of the invention, acid is intended to mean an acidifying agent
35 capable, by its presence at 1% by weight, of reducing, at 25°C, the pH of pure water or of an aqueous-ethanolic solution containing 30% by weight of ethanol by at least 0.01 unit.

The organic acid(s) of the invention may be chosen from the following compounds or mixtures thereof:

(1) aromatic or non-aromatic carboxylic acids comprising at least one carboxyl function --C(O)--OH chosen from:

- 5 - C2-C8, preferably C2-C6 monoacids corresponding to the formula Rb--C(O)--OH in which the radical Rb represents a C1-C7 alkyl, (hetero)aryl, preferably (hetero)(C4-C8aryl), or (hetero)arylalkyl group, preferably (hetero)(C4-C8aryl)(C1-C4alkyl) group, the alkyl part being linear or branched, the alkyl and/or (hetero)aryl part being optionally substituted, preferably by one or more hydroxyl groups, one of the hydroxyl groups
10 preferably being separated from the carboxyl --C(O)--OH function by one or two carbon atoms.

Among these carboxylic acids, mention will preferentially be made of glycolic acid, lactic acid, benzoic acid and salicylic acid;

- C2-C10, preferably C2-C6 diacids corresponding to the formula $\text{HO--C(O)--Rc--C(O)--OH}$, in which the radical Rc represents:

- 15 a) a covalent single σ bond;
- b) an acyclic, linear or branched, saturated or unsaturated C1-C8, in particular C1-C4 divalent hydrocarbon-based group, optionally substituted preferably by one or more hydroxyl groups, the divalent hydrocarbon-based group preferably being a C1-C8, better
20 still C1-C4 alkylene group optionally substituted by one or more hydroxyl groups, or a (C2-C6)alkenylene group optionally substituted by one or more hydroxyl groups;
- c) a (hetero)arylene group, preferably a C4-C10, better still C5-C8 heteroarylene group, optionally substituted preferably by one or more hydroxyl groups, and preferably being an arylene group such as phenylene;
- 25 d) a (hetero)cycloalkylene group, preferably a C3-C8 (hetero)cycloalkylene group, optionally substituted preferably by one or more hydroxyl groups, and preferably being a cycloalkylene group, preferably a C3-C6 cycloalkylene group, such as cyclohexylene;
- e) or a divalent group resulting from the combination of radicals derived from the groups defined in b), c) and/or d), preferentially $\text{--aryl(C1-C4)alkyl--}$ such as --phenyl(C1-
30 C4)alkyl--;

The diacids are particularly chosen from those in which Rc represents a), b) or c); mention will be made more particularly of oxalic acid, malonic acid, hydroxymalonic acid, succinic acid, malic acid, tartaric acid, maleic acid, fumaric acid, itaconic acid, glutaric acid, adipic acid, azelaic acid and sebacic acid, phthalic acid, isophthalic acid,
35 terephthalic acid;

 - polyacids corresponding to the formula Rd[C(O)--OH]_x with x representing an integer greater than or equal to 3, preferably x ranging from 3 to 6, more particularly from

3 to 4 and especially such that x is equal to 3; and Rd represents a polyvalent group chosen from:

- a) an acyclic, linear or branched, saturated or unsaturated C1-C8, in particular C2-C3 polyvalent hydrocarbon-based group, optionally substituted by one or more groups, preferably hydroxyl, the hydrocarbon-based group preferably being C1-C8, better still C2-C3 trivalent, optionally substituted by one or more hydroxyl groups;
- b) a polyvalent (hetero)aryl group, optionally substituted preferably by one or more hydroxyl groups, preferably being an at least trivalent aryl group such as phenyl;
- c) a polyvalent (hetero)cycloalkyl group, optionally substituted preferably by one or more hydroxyl groups, preferably being a cycloalkyl group such as cyclohexyl;
- d) or a polyvalent group resulting from the combination of radicals derived from the groups defined in a), b) and/or c), such as: (hetero)aryl(C1-C8)alkyl; (C1-C8)alkyl(hetero)aryl(C1-C8)alkyl; (hetero)aryl(C1-C8)alkyl(hetero)aryl; or (hetero)cycloalkyl(C1-C8)alkyl; and more preferentially aryl(C1-C6)alkyl such as phenyl(C1-C6)alkyl;

More particularly, the polyacids may be chosen from triacids derived from groups defined in a), in particular C2-C6 triacids, among which mention may be made of citric acid;

- (2) aromatic or non-aromatic sulfocarboxylic acids, comprising at least one carboxyl $-C(O)-OH$ function and at least one sulfonic $-S(O)_2-OH$ function such as $[HO-C(O)]_y-Rd-[S(O)_2-OH]_z$ with Rd as defined previously for the polyacids; y and z being integers greater than or equal to 1, the sum $y + z$ preferably being greater than or equal to 2, such as equal to 3.

The sulfocarboxylic acids are preferably C2-C8 sulfocarboxylic acids and the sulfonic acid group is preferably separated from the carboxylic acid group(s) by a polyvalent (C1-C7)alkyl or aryl(C1-C4)alkyl chain, the alkyl part of which is linear or branched, optionally substituted by a hydroxyl group. Mention may in particular be made of sulfosuccinic acid, para-sulfobenzoic acid, 4-sulfosalicylic acid;

- (3) aromatic or non-aromatic phosphocarboxylic acids comprising at least one carboxyl $-C(O)-OH$ function and at least one phosphoric $-O-P(O)(OH)_2$ function such as $[HO-C(O)]_y-Rd-[O-P(O)(OH)_2]_z$ with Rd as defined previously for polyacids; y and z being integers greater than or equal to 1, preferably the sum of $y + z$ being greater than or equal to 2, such as equal to 3; the phosphocarboxylic acids preferably being C2-C8 and the phosphonic acid group being separated from the carboxylic acid group(s) by a polyvalent (C1-C6)alkyl or aryl(C1-C6)alkyl chain, the alkyl part of which is linear or branched and optionally substituted by a hydroxyl group. Mention may be made in particular of phosphoglycolic acid.

Unless otherwise mentioned:

The “(hetero)aryl” radicals or the “(hetero)aryl” part of a radical, when they are optionally substituted, may be substituted on a carbon atom, by an atom or group chosen from: i) C1-C16, preferably C1-C8 alkyl, optionally substituted by one or more radicals chosen from hydroxyl, C1-C2 alkoxy, C2-C4 (poly)hydroxyalkoxy, acylamino, amino substituted by two identical or different C1-C4 alkyl radicals, which optionally bear at least one hydroxyl group or the two radicals possibly forming, with the nitrogen atom to which they are attached, an optionally substituted saturated or unsaturated heterocycle comprising from 5 to 7 members, preferably 5 or 6 members, optionally comprising another heteroatom identical to or different from nitrogen; ii) halogen; iii) hydroxyl; iv) C1-C2 alkoxy; v) C2-C4 (poly)hydroxyalkoxy; vi) amino; vii) 5- or 6-membered heterocycloalkyl; viii) 5- or 6-membered optionally cationic heteroaryl, preferentially imidazolium, and optionally substituted by a (C1-C4) alkyl radical, preferentially methyl; ix) amino substituted by one or two identical or different C1-C6 alkyl radicals optionally bearing at least one hydroxyl group, amino optionally substituted by one or two optionally substituted C1-C3 alkyl radicals, x) acylamino (-NR-C(O)-R') in which the radical R is a hydrogen atom, a C1-C4 alkyl radical optionally bearing at least one hydroxyl group and the radical R' is a C1-C2 alkyl radical; xi) carbamoyl ((R)₂N-C(O)-) in which the radicals R, which are identical or different, represent a hydrogen atom, a C1-C4 alkyl radical optionally bearing at least one hydroxyl group; xii) alkylsulfonylamino (R'-S(O)₂-N(R)-) in which the radical R represents a hydrogen atom, a C1-C4 alkyl radical optionally bearing at least one hydroxyl group and the radical R' represents a C1-C4 alkyl radical, a phenyl radical; xiii) aminosulfonyl ((R)₂N-S(O)₂-) in which the radicals R, which are identical or non-identical, represent a hydrogen atom, a C1-C4 alkyl radical optionally bearing at least one hydroxyl group; xiv) carboxyl in acid or salified form (preferably with an alkali metal or an ammonium, substituted or unsubstituted); xv) cyano; xvi) nitro or nitroso; xvii) polyhaloalkyl, preferentially trifluoromethyl;

The “(hetero)cyclic” or “(hetero)cycloalkyl” radicals, when they are optionally substituted, may be substituted by at least one atom or group chosen from: i) hydroxyl; ii) C1-C4 alkoxy, C2-C4 (poly)hydroxyalkoxy; iii) C1-C4 alkyl; iv) alkylcarbonylamino (R-C(O)-N(R')-) in which the radical R' is a hydrogen atom, a C1-C4 alkyl radical optionally bearing at least one hydroxyl group and the radical R is a C1-C2 alkyl radical, amino optionally substituted by one or two identical or different C1-C4 alkyl groups, themselves optionally bearing at least one hydroxyl group, said alkyl radicals possibly forming, with the nitrogen atom to which they are attached, a saturated or unsaturated optionally substituted heterocycle comprising from 5 to 7 members optionally comprising at least

one other nitrogen or non-nitrogen heteroatom; v) alkylcarbonyloxy (R-C(O)-O-) in which the radical R is a C1-C4 alkyl radical, amino group optionally substituted by one or two identical or different C1-C4 alkyl groups, themselves optionally bearing at least one hydroxyl group, said alkyl radicals possibly forming, with the nitrogen atom to which they are attached, a saturated or unsaturated optionally substituted heterocycle comprising from 5 to 7 members, optionally comprising at least one other nitrogen or non-nitrogen heteroatom; vi) alkoxy carbonyl (R-G-C(O)-) in which the radical R is a C1-C4 alkoxy radical, G is an oxygen atom, or an amino group optionally substituted by a C1-C4 alkyl group itself optionally bearing at least one hydroxyl group, said alkyl radical possibly forming, with the nitrogen atom to which they are attached, a saturated or unsaturated optionally substituted heterocycle comprising from 5 to 7 members, optionally comprising at least one other nitrogen or non-nitrogen heteroatom;

The "(hetero)cyclic" or "(hetero)cycloalkyl" radicals, or a non-aromatic part of a (hetero)aryl radical, when they are optionally substituted, may also be substituted with one or more oxo groups;

A hydrocarbon-based chain is "unsaturated" when it comprises one or more double bonds and/or one or more triple bonds;

An "aryl radical" represents a monocyclic or fused or non-fused polycyclic carbon-based group comprising from 6 to 22 carbon atoms, and in which at least one ring is aromatic; preferentially, the aryl radical is a phenyl, biphenyl, naphthyl, indenyl, anthracenyl or tetrahydronaphthyl;

A "heteroaryl radical" represents an optionally cationic, 5- to 22-membered, monocyclic or fused or non-fused polycyclic group, comprising from 1 to 6 heteroatoms chosen from nitrogen, oxygen, sulfur and selenium, at least one ring of which is aromatic; preferentially, a heteroaryl radical is chosen from acridinyl, benzimidazolyl, benzobistriazolyl, benzopyrazolyl, benzopyridazinyl, benzoquinolyl, benzothiazolyl, benzotriazolyl, benzoxazolyl, pyridinyl, tetrazolyl, dihydrothiazolyl, imidazopyridinyl, imidazolyl, indolyl, isoquinolyl, naphthoimidazolyl, naphthoxazolyl, naphthopyrazolyl, oxadiazolyl, oxazolyl, oxazolopyridyl, phenazinyl, phenoxazolyl, pyrazinyl, pyrazolyl, pyrilyl, pyrazoyltriazyl, pyridyl, pyridinoimidazolyl, pyrrolyl, quinolyl, tetrazolyl, thiadiazolyl, thiazolyl, thiazolopyridinyl, thiazoylimidazolyl, thiopyrylyl, triazolyl, xanthyl and the ammonium salt thereof;

A "heterocyclic" or "heterocycloalkyl" radical is a fused or non-fused, 5- to 22-membered monocyclic or polycyclic radical which may contain one or two unsaturations but is non-aromatic, comprising from 1 to 6 heteroatoms chosen from nitrogen, oxygen, sulfur and selenium, such as morpholino, piperidino, piperazino, tetrahydrofuryl or pyrrolidyl;

A "cycloalkyl" radical is a monocyclic or polycyclic, fused or non-fused, 5- to 22-membered hydrocarbon-based radical which may contain one or two unsaturations but is non-aromatic, such as cyclohexyl or cyclobutyl;

5 An "alkyl radical" is a linear or branched C1-C20, preferably C1-C8 hydrocarbon-based radical, such as methyl or ethyl;

An "alkenylene radical" is an unsaturated hydrocarbon-based divalent radical as defined previously, which may contain from 1 to 4 conjugated or unconjugated double bonds -C=C- or -C(=CH₂)-; the alkenylene group particularly contains 1 or 2 unsaturation(s);

10 The term "optionally substituted" attributed to the "alkyl", "alkylene", "alkenylene" radical or to "a hydrocarbon-based chain" implies that said radical may be substituted by one or more radicals chosen from the following radicals: i) hydroxyl, ii) C1-C4 alkoxy, iii) acylamino, iv) amino optionally substituted with one or two identical or different C1-C4 alkyl radicals, said alkyl radicals possibly forming, with the nitrogen atom that bears them,
15 a 5- to 7-membered heterocycle, optionally comprising another nitrogen or non-nitrogen heteroatom; v) or a quaternary ammonium group -N⁺R'R''R''', M⁻ for which R', R'' and R''', which may be identical or different, represent a hydrogen atom or a C1-C4 alkyl group, or else -N⁺R'R''R'''' forms a heteroaryl such as imidazolium optionally substituted with a C1-C4 alkyl group, and M⁻ represents the counterion of the organic or mineral acid
20 or of the corresponding halide;

An "alkoxy radical" is an alkyl-oxy radical for which the alkyl radical is a linear or branched C1-C16 and preferentially C1-C8 hydrocarbon-based radical;

When the alkoxy group is optionally substituted, this implies that the alkyl group is optionally substituted as defined hereinabove.

25 According to an advantageous embodiment of the invention, the acid(s) of the invention are chosen from aromatic or non-aromatic organic carboxylic acids, comprising at least one carboxyl -C(O)-OH function.

Preferably, the acids are chosen from monocarboxylic acids, dicarboxylic acids and tricarboxylic acids.

30 Preferentially, the acids are chosen from glycolic acid, lactic acid, succinic acid, glutaric acid, itaconic acid, maleic acid, citric acid, preferably from maleic acid and citric acid.

More preferably still, the acid is citric acid.

The composition used in the process according to the invention comprises one or more
35 organic acids in a total content ranging from 1% to 25%, preferably from 1.5% to 20%, more preferably still from 2% to 15%, better still from 3% to 10% by weight, relative to total weight of the composition.

The composition used in the process according to the invention may also comprise at least one conditioning agent.

The term "conditioning agent" is intended to mean any compound that is capable of producing a conditioning effect on keratin fibers when the composition comprising same is applied to the fibers.

The conditioning effect may be constituted of any improvement of a cosmetic nature in the condition and/or appearance of keratin fibers, for instance, in a non-limiting manner, a visual and/or tactile sensory improvement, reinforcement of the keratin fibers, improvement of their ease of disentangling, styling or shaping, provision of sheen or provision of resistance to frizziness.

The conditioning agents may advantageously be chosen, alone or as a mixture, from:

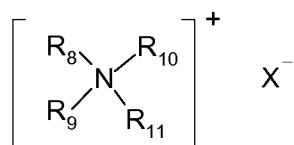
- i) cationic surfactants;
- ii) cationic polymers and/or amphoteric polymers;
- iii) organosilicon compounds, and especially silicones and silanes;
- iv) non-silicone liquid fatty substances, and especially: hydroxylated or non-hydroxylated liquid fatty acids; liquid fatty alcohols; mineral, plant or animal oils; liquid fatty esters; liquid hydrocarbons;
- v) non-silicone solid fatty substances, and especially: solid fatty alcohols; solid fatty esters; ceramides; animal, plant or mineral waxes other than ceramides.

i) cationic surfactants:

The cationic surfactant(s) that may be used as conditioning agents in the composition of the process of the invention especially comprise optionally polyoxyalkylenated primary, secondary or tertiary fatty amine salts, quaternary ammonium salts, and mixtures thereof.

Examples of quaternary ammonium salts that may especially be mentioned include:

- those corresponding to the general formula (A4) below:



(A4)

in which formula (A4):

- R_8 to R_{11} , which may be identical or different, represent a linear or branched aliphatic group comprising from 1 to 30 carbon atoms, or an aromatic group such

as aryl or alkylaryl, it being understood that at least one of the groups R_8 to R_{11} comprises from 8 to 30 carbon atoms and preferably from 12 to 24 carbon atoms; and

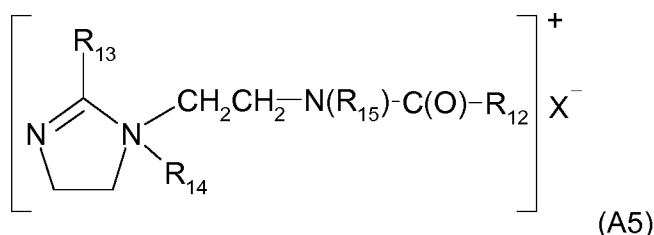
- X^- represents an organic or inorganic anionic counterion, such as that chosen from halides, acetates, phosphates, nitrates, (C_1-C_4) alkyl sulfates, (C_1-C_4) alkyl- and (C_1-C_4) alkylarylsulfonates, in particular methyl sulfate and ethyl sulfate.

The aliphatic groups of R_8 to R_{11} may also comprise heteroatoms in particular such as oxygen, nitrogen, sulfur and halogens.

The aliphatic groups of R_8 to R_{11} are chosen, for example, from C_1-C_{30} alkyl, C_1-C_{30} alkoxy, polyoxy(C_2-C_6)alkylene, C_1-C_{30} alkylamide, $(C_{12}-C_{22})$ alkylamido(C_2-C_6)alkyl, $(C_{12}-C_{22})$ alkyl acetate, and C_1-C_{30} hydroxyalkyl groups; X^- is an anionic counterion chosen from halides, phosphates, acetates, lactates, (C_1-C_4) alkyl sulfates, and (C_1-C_4) alkyl or (C_1-C_4) alkylaryl sulfonates.

Among the quaternary ammonium salts of formula (A4), preference is given firstly to tetraalkylammonium chlorides, for instance dialkyldimethylammonium or alkyltrimethylammonium chlorides in which the alkyl group contains from about 12 to 22 carbon atoms, in particular behenyltrimethylammonium chloride, distearyldimethylammonium chloride, cetyltrimethylammonium chloride, benzyldimethylstearyl ammonium chloride, or else, secondly, distearoylethylhydroxyethylmethylammonium methosulfate, dipalmitoylethylhydroxyethylammonium methosulfate or distearoylethylhydroxyethylammonium methosulfate, or else, lastly, palmitylamidopropyltrimethylammonium chloride or stearamidopropyl dimethyl(myristyl acetate) ammonium chloride, sold under the name Ceraphyl® 70 by the company Van Dyk;

- quaternary ammonium salts of imidazoline, for instance those of formula (A5) below:



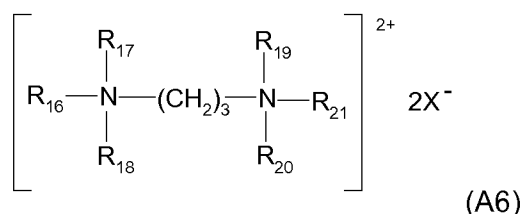
in which formula (A5):

- R_{12} represents an alkenyl or alkyl group comprising from 8 to 30 carbon atoms, for example fatty acid derivatives of tallow;

- R₁₃ represents a hydrogen atom, a C₁-C₄ alkyl group or an alkenyl or alkyl group comprising from 8 to 30 carbon atoms;
- R₁₄ represents a C₁-C₄ alkyl group;
- R₁₅ represents a hydrogen atom or a C₁-C₄ alkyl group;
- 5 ▪ X⁻ represents an organic or inorganic anionic counterion, such as that chosen from halides, phosphates, acetates, lactates, (C₁-C₄)alkyl sulfates, (C₁-C₄)alkyl and (C₁-C₄)alkylaryl sulfonates.

Preferably, R₁₂ and R₁₃ denote a mixture of alkenyl or alkyl groups including from 12 to 21 carbon atoms, for example derived from tallow fatty acids, R₁₄ denotes a methyl group and R₁₅ denotes a hydrogen atom. Such a product is sold, for example, under the name Rewoquat® W 75 by the company Rewo;

- di- or triquaternary ammonium salts, in particular having formula (A6) below:

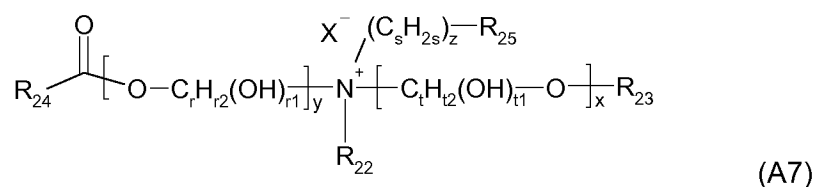


in which formula (A6):

- 15 ▪ R₁₆ denotes an alkyl group comprising approximately from 16 to 30 carbon atoms, which is optionally hydroxylated and/or interrupted with one or more oxygen atoms;
- R₁₇ is chosen from hydrogen, an alkyl group comprising from 1 to 4 carbon atoms and a group -(CH₂)₃-N⁺(R_{16a})(R_{17a})(R_{18a}), X⁻;
- 20 ▪ R_{16a}, R_{17a}, R_{18a}, R₁₈, R₁₉, R₂₀ and R₂₁, which may be identical or different, are chosen from hydrogen and an alkyl group comprising from 1 to 4 carbon atoms; and
- X⁻, which may be identical or different, represents an organic or inorganic anionic counterion, such as that chosen from halides, acetates, phosphates, nitrates, alkyl(C₁-C₄) sulfates, alkyl(C₁-C₄)- and alkyl(C₁-C₄)aryl-sulfonates, in particular methyl sulfate and ethyl sulfate.
- 25

Such compounds are, for example, Finquat CT-P, made available by the company Finetex (Quaternium 89), and Finquat CT, made available by the company Finetex (Quaternium 75);

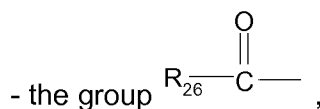
- 30 - quaternary ammonium salts containing one or more ester functions, such as those of formula (A7) below:



in which formula (A7):

- R_{22} is chosen from C_1 - C_6 alkyl groups and C_1 - C_6 hydroxyalkyl or dihydroxyalkyl groups;

- 5 ▪ R_{23} is chosen from:

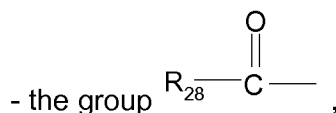


- saturated or unsaturated, linear or branched C_1 - C_{22} hydrocarbon-based groups

R_{27} ,

- a hydrogen atom,

- 10 ▪ R_{25} is chosen from:



- saturated or unsaturated, linear or branched C_1 - C_6 hydrocarbon-based groups

R_{29} ,

- a hydrogen atom,

- 15 ▪ R_{24} , R_{26} and R_{28} , which may be identical or different, are chosen from linear or branched, saturated or unsaturated C_7 - C_{21} hydrocarbon-based groups;
- r , s and t , which may be identical or different, are integers ranging from 2 to 6;
 - r_1 and t_1 , which may be identical or different, are equal to 0 or 1, with $r_2+r_1=2r$ and $t_1+t_2=2t$;

- 20 ▪ y is an integer ranging from 1 to 10;
- x and z , which may be identical or different, are integers ranging from 0 to 10;
 - X^- represents an organic or inorganic anionic counterion;

with the proviso that the sum $x + y + z$ is from 1 to 15, that when x is 0 then R_{23} denotes R_{27} , and that when z is 0 then R_{25} denotes a linear or branched, saturated or unsaturated C_1 - C_6 hydrocarbon-based radical R_{29} .

- 25

The alkyl groups R_{22} may be linear or branched, and more particularly linear.

Preferably, R_{22} denotes a methyl, ethyl, hydroxyethyl or dihydroxypropyl group, and more particularly a methyl or ethyl group.

Advantageously, the sum $x + y + z$ is from 1 to 10.

- 30 When R_{23} is a hydrocarbon-based group R_{27} , it may be long and contain from 12 to 22 carbon atoms, or may be short and contain from 1 to 3 carbon atoms.

When R_{25} is a hydrocarbon-based group R_{29} , it preferably contains 1 to 3 carbon atoms.

Advantageously, R_{24} , R_{26} and R_{28} , which may be identical or different, are chosen from linear or branched, saturated or unsaturated C_{11} - C_{21} hydrocarbon-based groups, and more particularly from linear or branched, saturated or unsaturated C_{11} - C_{21} alkyl and alkenyl groups.

Preferably, x and z , which may be identical or different, are equal to 0 or 1.

Advantageously, y is equal to 1.

Preferably, r , s and t , which may be identical or different, are equal to 2 or 3, and even more particularly are equal to 2.

The anionic counterion X^- is preferably a halide, such as chloride, bromide or iodide; a (C_1-C_4) alkyl sulfate or a (C_1-C_4) alkyl- or (C_1-C_4) alkylarylsulfonate. However, use may be made of methanesulfonate, phosphate, nitrate, tosylate, an anion derived from an organic acid, such as acetate or lactate, or any other anion that is compatible with the ammonium bearing an ester function.

The anionic counterion X^- is even more particularly chloride, methyl sulfate or ethyl sulfate.

Use is made more particularly in the composition of the ammonium salts of formula (A7) in which:

- R_{22} denotes a methyl or ethyl group,
- x and y are equal to 1,
- z is equal to 0 or 1,
- r , s and t are equal to 2,
- R_{23} is chosen from:

- the group $R_{26}-\overset{\text{O}}{\parallel}{\text{C}}-$
- methyl, ethyl or C_{14} - C_{22} hydrocarbon-based groups,
- a hydrogen atom,
- R_{25} is chosen from:

- the group $R_{28}-\overset{\text{O}}{\parallel}{\text{C}}-$
- a hydrogen atom,

- R_{24} , R_{26} and R_{28} , which may be identical or different, are chosen from linear or branched, saturated or unsaturated C_{13} - C_{17} hydrocarbon-based groups, and preferably from linear or branched, saturated or unsaturated C_{13} - C_{17} alkyl and alkenyl groups.

Advantageously, the hydrocarbon-based radicals are linear.

Among the compounds of formula (A7), examples that may be mentioned include salts, especially the chloride or methyl sulfate, of diacyloxyethyltrimethylammonium, diacyloxyethylhydroxyethyltrimethylammonium,

5 monoacyloxyethylhydroxyethyltrimethylammonium, triacyloxyethyltrimethylammonium or monoacyloxyethylhydroxyethyltrimethylammonium, and mixtures thereof. The acyl groups preferably contain from 14 to 18 carbon atoms and are derived more particularly from a plant oil such as palm oil or sunflower oil. When the compound contains several acyl groups, these groups may be identical or different.

10 These products are obtained, for example, by direct esterification of triethanolamine, triisopropanolamine, alkyldiethanolamine or alkyl diisopropanolamine, which are optionally oxyalkylenated, with fatty acids or with fatty acid mixtures of plant or animal origin, or by transesterification of the methyl esters thereof. This esterification is followed by a quaternization using an alkylating agent such as an alkyl halide, preferably methyl or ethyl halide, a dialkyl sulfate, preferably methyl or ethyl sulfate, 15 methyl methanesulfonate, methyl para-toluenesulfonate, glycol chlorohydrin or glycerol chlorohydrin.

Such compounds are sold, for example, under the names Dehyquat® by the company Henkel, Stepanquat® by the company Stepan, Noxanium® by the company 20 Ceca or Rewoquat® WE 18 by the company Rewo-Witco.

The composition may contain, for example, a mixture of quaternary ammonium monoester, diester and triester salts with a weight majority of diester salts.

Use may also be made of the ammonium salts containing at least one ester function that are described in patents US-A-4 874 554 and US-A-4 137 180.

25 Use may be made of behenoylhydroxypropyltrimethylammonium chloride made available by KAO under the name Quatarmin BTC 131.

Preferably, the ammonium salts containing at least one ester function contain two ester functions.

Among the cationic surfactants that may be present in the composition, it is more 30 particularly preferred to choose cetyltrimethylammonium, behenyltrimethylammonium and dipalmitoylethylhydroxyethyltrimethylammonium salts, and mixtures thereof, and more particularly behenyltrimethylammonium chloride, cetyltrimethylammonium chloride, and dipalmitoylethylhydroxyethyltrimethylammonium methosulfate, and mixtures thereof.

The cationic surfactants may be present in a total amount ranging from 0.01% to 35 10% by weight, preferably from 0.1% to 5% by weight and better still from 0.2% to 3% by weight, relative to the total weight of the composition.

ii) Cationic and amphoteric polymers

The composition used in the process according to the invention can comprise, as conditioning agent, one or more polymers chosen from amphoteric polymers, cationic polymers, and also mixtures thereof.

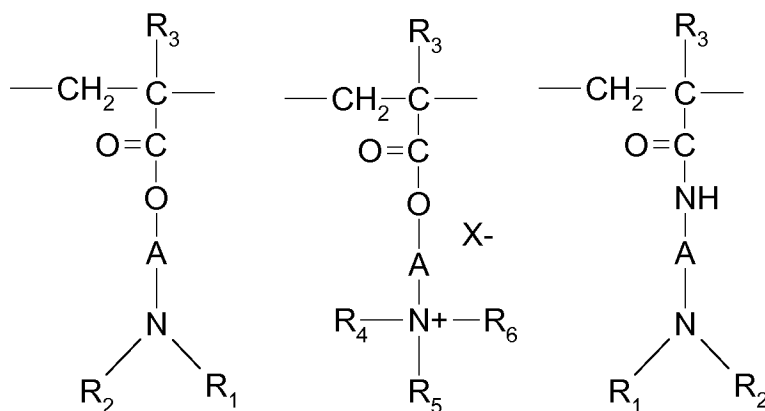
The term "cationic polymer" means any polymer comprising cationic groups and/or groups that can be ionized into cationic groups and not comprising any anionic groups and/or groups that can be ionized into anionic groups.

Preferably, the cationic polymer is hydrophilic or amphiphilic. The preferred cationic polymers are chosen from those that contain units comprising primary, secondary, tertiary and/or quaternary amine groups that may either form part of the main polymer chain or may be borne by a side substituent directly connected thereto.

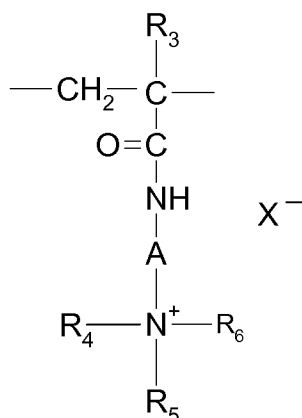
The cationic polymers that may be used preferably have a weight-average molar mass (M_w) of between 500 and 5×10^6 approximately and preferably between 10^3 and 3×10^6 approximately.

Among the cationic polymers, mention may be made more particularly of:

(1) homopolymers or copolymers derived from acrylic or methacrylic esters or amides and comprising at least one of the units of the following formulae:



20



in which:

- R3, which may be identical or different, denote a hydrogen atom or a CH₃ radical;
- A, which may be identical or different, represent a linear or branched divalent alkyl group of 1 to 6 carbon atoms, preferably 2 or 3 carbon atoms, or a hydroxyalkyl group of 1 to 4 carbon atoms;

5 - R4, R5 and R6, which may be identical or different, represent an alkyl group containing from 1 to 18 carbon atoms or a benzyl radical, preferably an alkyl group containing from 1 to 6 carbon atoms;

- R1 and R2, which may be identical or different, represent a hydrogen atom or an alkyl group containing from 1 to 6 carbon atoms, preferably methyl or ethyl;

10 - X denotes an anion derived from a mineral or organic acid, such as a methosulfate anion or a halide such as chloride or bromide.

The copolymers of family (1) may also contain one or more units derived from comonomers that may be chosen from the family of acrylamides, methacrylamides, diacetone acrylamides, acrylamides and methacrylamides substituted on the nitrogen
15 with lower (C1-C4) alkyls, acrylic or methacrylic acids, vinyl lactams such as vinylpyrrolidone or vinylcaprolactam, and vinyl esters.

Among these homopolymers or copolymers of family (1), mention may be made of:

- copolymers of acrylamide and of dimethylaminoethyl methacrylate quaternized
20 with dimethyl sulfate or with a dimethyl halide, such as that sold under the name Hercofloc by the company Hercules,

- copolymers of acrylamide and of methacryloyloxyethyltrimethylammonium chloride, such as those sold under the name Bina Quat P 100 by the company Ciba Geigy,

25 - the copolymer of acrylamide and of methacryloyloxyethyltrimethylammonium methosulfate, such as that sold under the name Reten by the company Hercules,

- quaternized or non-quaternized vinylpyrrolidone/dialkylaminoalkyl acrylate or methacrylate copolymers, such as the products sold under the name Gafquat by the company ISP, for instance Gafquat 734 or Gafquat 755, or alternatively the products
30 known as Copolymer 845, 958 and 937. These polymers are described in detail in French patents 2 077 143 and 2 393 573,

- dimethylaminoethyl methacrylate/vinylcaprolactam/vinylpyrrolidone terpolymers, such as the product sold under the name Gaffix VC 713 by the company ISP,

- vinylpyrrolidone/methacrylamidopropyl dimethylamine copolymers, such as those
35 sold under the name Styleze CC 10 by ISP;

- vinylpyrrolidone/quaternized dimethylaminopropylmethacrylamide copolymers such as the product sold under the name Gafquat HS 100 by the company ISP,

- preferably crosslinked polymers of methacryloyloxy(C1-C4)alkyltri(C1-C4)alkylammonium salts, such as the polymers obtained by homopolymerization of dimethylaminoethyl methacrylate quaternized with methyl chloride, or by copolymerization of acrylamide with dimethylaminoethyl methacrylate quaternized with methyl chloride, the homopolymerization or copolymerization being followed by crosslinking with an olefinically unsaturated compound, in particular methylenebisacrylamide. A crosslinked acrylamide/methacryloyloxyethyltrimethylammonium chloride copolymer (20/80 by weight) in the form of a dispersion comprising 50% by weight of said copolymer in mineral oil may more particularly be used. This dispersion is sold under the name Salcare® SC 92 by the company Ciba. Use may also be made of a crosslinked methacryloyloxyethyltrimethylammonium chloride homopolymer comprising approximately 50% by weight of the homopolymer in mineral oil or in a liquid ester. These dispersions are sold under the names Salcare® SC 95 and Salcare® SC 96 by the company Ciba.

(2) cationic polysaccharides, especially cationic galactomannan gums and celluloses. Among the cationic polysaccharides, mention may be made more particularly of cellulose ether derivatives including quaternary ammonium groups, cationic cellulose copolymers or cellulose derivatives grafted with a water-soluble quaternary ammonium monomer and cationic galactomannan gums.

The cellulose ether derivatives including quaternary ammonium groups are notably described in FR 1 492 597, and mention may be made of the polymers sold under the name Ucare Polymer JR (JR 400 LT, JR 125 and JR 30M) or LR (LR 400 and LR 30M) by the company Amerchol. These polymers are also defined in the CTFA dictionary as quaternary ammoniums of hydroxyethylcellulose that have reacted with an epoxide substituted with a trimethylammonium group.

The cationic cellulose copolymers or cellulose derivatives grafted with a water-soluble quaternary ammonium monomer are described in particular in patent US 4 131 576, and mention may be made of hydroxyalkyl celluloses, for instance hydroxymethyl, hydroxyethyl or hydroxypropyl celluloses grafted, in particular, with a methacryloylethyltrimethylammonium, methacrylamidopropyltrimethylammonium or dimethyldiallylammonium salt. The commercial products corresponding to this definition are more particularly the products sold under the names Celquat L 200 and Celquat H 100 by the company National Starch.

The cationic galactomannan gums are described more particularly in patents US 3 589 578 and US 4 031 307, and mention may be made of guar gums comprising cationic trialkylammonium groups. Use is made, for example, of guar gums modified with

a 2,3-epoxypropyltrimethylammonium salt (for example, a chloride). Such products are in particular sold under the names Jaguar C13 S, Jaguar C 15, Jaguar C 17 and Jaguar C162 by the company Rhodia.

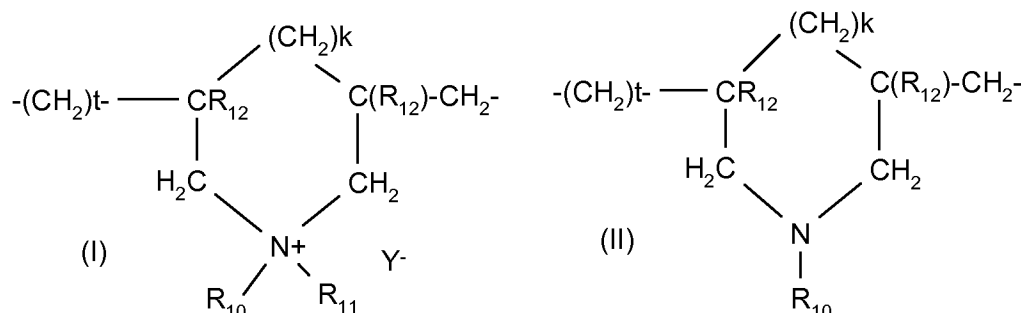
(3) polymers constituted of piperaziny units and of divalent alkylene or hydroxyalkylene radicals bearing linear or branched chains, optionally interrupted with oxygen, sulfur or nitrogen atoms or with aromatic or heterocyclic rings, and also the oxidation and/or quaternization products of these polymers.

(4) water-soluble polyaminoamides prepared in particular by polycondensation of an acidic compound with a polyamine; these polyaminoamides can be crosslinked with an epihalohydrin, a diepoxide, a dianhydride, an unsaturated dianhydride, a bis-unsaturated derivative, a bis-halohydrin, a bis-azetidinium, a bis-haloacyldiamine, a bis-alkyl halide or alternatively with an oligomer resulting from the reaction of a difunctional compound which is reactive with a bis-halohydrin, a bis-azetidinium, a bis-haloacyldiamine, a bis-alkyl halide, an epihalohydrin, a diepoxide or a bis-unsaturated derivative; the crosslinking agent being used in proportions ranging from 0.025 to 0.35 mol per amine group of the polyaminoamide; these polyaminoamides can be alkylated or, if they include one or more tertiary amine functions, they can be quaternized.

(5) polyaminoamide derivatives resulting from the condensation of polyalkylene polyamines with polycarboxylic acids followed by alkylation with difunctional agents. Mention may be made, for example, of adipic acid/dialkylaminohydroxyalkyldialkylenetriamine polymers in which the alkyl radical includes from 1 to 4 carbon atoms and preferably denotes methyl, ethyl or propyl. Among these derivatives, mention may be made more particularly of the adipic acid/dimethylaminohydroxypropyl/diethylenetriamine polymers sold under the name Cartaretine F, F4 or F8 by the company Sandoz.

(6) polymers obtained by reacting a polyalkylene polyamine including two primary amine groups and at least one secondary amine group with a dicarboxylic acid chosen from diglycolic acid and saturated aliphatic dicarboxylic acids containing from 3 to 8 carbon atoms; the mole ratio between the polyalkylene polyamine and the dicarboxylic acid preferably being between 0.8:1 and 1.4:1; the resulting polyaminoamide being reacted with epichlorohydrin in a mole ratio of epichlorohydrin relative to the secondary amine group of the polyaminoamide preferably of between 0.5:1 and 1.8:1. Polymers of this type are sold in particular under the name Hercosett 57 by the company Hercules Inc. or else under the name PD 170 or Delsette 101 by the company Hercules in the case of the adipic acid/epoxypropyl/diethylenetriamine copolymer.

(7) cyclopolymers of alkyldiallylamine or of dialkyldiallylammonium, such as the homopolymers or copolymers containing, as main constituent of the chain, units corresponding to formula (I) or (II) below:



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in which

- k and t are equal to 0 or 1, the sum k + t being equal to 1;

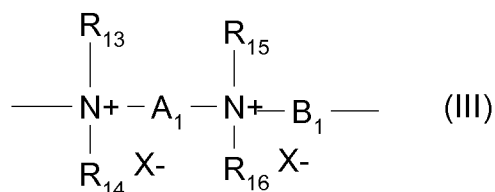
- R₁₂ denotes a hydrogen atom or a methyl radical;

- R₁₀ and R₁₁, independently of each other, denote an alkyl group containing from 1 to 6 carbon atoms, a hydroxyalkyl group in which the alkyl group contains 1 to 5 carbon atoms, a C1-C4 amidoalkyl group; or alternatively R₁₀ and R₁₁ may denote, together with the nitrogen atom to which they are attached, heterocyclic groups such as piperidinyl or morpholinyl; R₁₀ and R₁₁, independently of each other, preferably denote an alkyl group containing from 1 to 4 carbon atoms;

- Y⁻ is an anion such as bromide, chloride, acetate, borate, citrate, tartrate, bisulfate, bisulfite, sulfate or phosphate.

Mention may be made more particularly of the dimethyldiallylammonium salt (for example chloride) homopolymer for example sold under the name Merquat 100 by the company Nalco (and homologs thereof of low weight-average molar masses) and the copolymers of dialkyldimethylammonium and acrylamide salts (for example chloride), sold in particular under the name Merquat 550 or Merquat 7SPR.

(8) quaternary diammonium polymers comprising repeating units of formula:



in which:

- R₁₃, R₁₄, R₁₅ and R₁₆, which may be identical or different, represent aliphatic, alicyclic or arylaliphatic radicals comprising from 1 to 20 carbon atoms, or lower hydroxyalkylaliphatic radicals, or else R₁₃, R₁₄, R₁₅ and R₁₆, together or separately,

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constitute, with the nitrogen atoms to which they are attached, heterocycles optionally comprising a second non-nitrogen heteroatom, or else R13, R14, R15 and R16 represent a linear or branched C1-C6 alkyl radical substituted with a nitrile, ester, acyl, amide or -CO-O-R17-D or -CO-NH-R17-D group in which R17 is an alkylene and D is a quaternary ammonium group;

- A1 and B1 represent divalent polymethylene groups comprising from 2 to 20 carbon atoms, which may be linear or branched, saturated or unsaturated, and which may contain, linked to or intercalated in the main chain, one or more aromatic rings or one or more oxygen or sulfur atoms or sulfoxide, sulfone, disulfide, amino, alkylamino, hydroxyl, quaternary ammonium, ureido, amide or ester groups, and

- X⁻ denotes an anion derived from a mineral or organic acid;

it being understood that A1, R13 and R15 can form, with the two nitrogen atoms to which they are attached, a piperazine ring;

in addition, if A1 denotes a linear or branched, saturated or unsaturated alkylene or hydroxyalkylene radical, B1 may also denote a group (CH₂)_n-CO-D-OC-(CH₂)_n- in which D denotes:

a) a glycol residue of formula -O-Z-O-, in which Z denotes a linear or branched hydrocarbon-based radical, or a group corresponding to one of the following formulae: -(CH₂-CH₂-O)_x-CH₂-CH₂- and -[CH₂-CH(CH₃)-O]_y-CH₂-CH(CH₃)-, in which x and y denote an integer from 1 to 4, representing a defined and unique degree of polymerization or any number from 1 to 4 representing an average degree of polymerization;

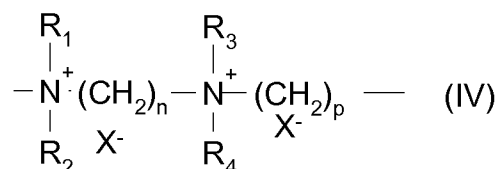
b) a bis-secondary diamine residue, such as a piperazine derivative;

c) a bis-primary diamine residue of formula: -NH-Y-NH-, where Y denotes a linear or branched hydrocarbon-based radical, or else the divalent radical -CH₂-CH₂-S-S-CH₂-CH₂-;

d) a ureylene group of formula: -NH-CO-NH-.

Preferably, X⁻ is an anion, such as chloride or bromide. These polymers have a number-average molar mass (M_n) generally of between 1000 and 100 000.

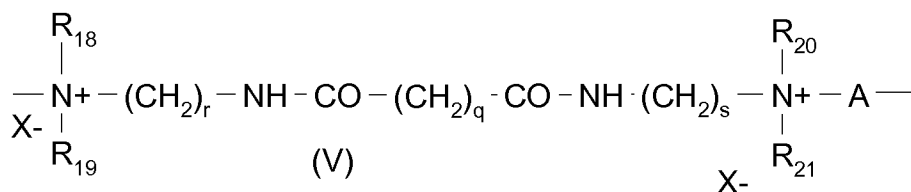
Mention may be made more particularly of polymers that are constituted of repeating units corresponding to the formula:



in which R1, R2, R3 and R4, which may be identical or different, denote an alkyl or hydroxyalkyl radical containing from 1 to 4 carbon atoms approximately, n and p are integers ranging from 2 to 20 approximately, and X⁻ is an anion derived from a mineral or organic acid.

- 5 A particularly preferred compound of formula (IV) is the one for which R1, R2, R3 and R4 represent a methyl radical and n = 3, p = 6 and X = Cl, known as Hexadimethrine chloride according to the INCI (CTFA) nomenclature.

(9) polyquaternary ammonium polymers comprising units of formula (V):



10

in which:

- R18, R19, R20 and R21, which may be identical or different, represent a hydrogen atom or a methyl, ethyl, propyl, β-hydroxyethyl, β-hydroxypropyl or -CH₂CH₂(OCH₂CH₂)_pOH radical, in which p is equal to 0 or to an integer between 1 and 6, with the proviso that R18, R19, R20 and R21 do not simultaneously represent a hydrogen atom,

15

- r and s, which may be identical or different, are integers between 1 and 6,
- q is equal to 0 or to an integer between 1 and 34,
- X⁻ denotes an anion such as a halide,

20

- A denotes a dihalide radical or preferably represents -CH₂-CH₂-O-CH₂-CH₂-.

Examples that may be mentioned include the products Mirapol® A 15, Mirapol® AD1, Mirapol® AZ1 and Mirapol® 175 sold by the company Miranol.

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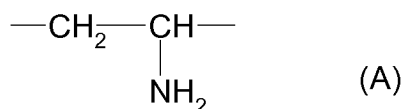
(10) quaternary polymers of vinylpyrrolidone and of vinylimidazole, for instance the products sold under the names Luviquat® FC 905, FC 550 and FC 370 by the company BASF.

(11) polyamines such as Polyquart® H sold by Cognis, referred to under the name of Polyethylene glycol (15) tallow polyamine in the CTFA dictionary.

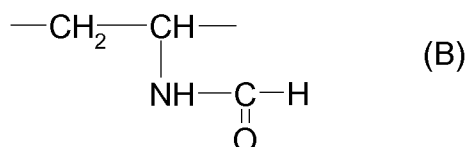
(12) polymers including in their structure:

(a) one or more units corresponding to formula (A) below:

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(b) optionally one or more units corresponding to formula (B) below:



In other words, these polymers may be notably chosen from homopolymers or copolymers including one or more units derived from vinylamine and optionally one or more units derived from vinylformamide.

Preferably, these cationic polymers are chosen from polymers comprising, in their structure, from 5 mol% to 100 mol% of units corresponding to the formula (A) and from 0 mol% to 95 mol% of units corresponding to the formula (B), preferentially from 10 mol% to 100 mol% of units corresponding to the formula (A) and from 0 mol% to 90 mol% of units corresponding to the formula (B).

These polymers may be obtained, for example, by partial hydrolysis of polyvinylformamide. This hydrolysis may take place in acidic or basic medium.

The weight-average molecular weight of said polymer, measured by light scattering, may range from 1000 to 3 000 000 g/mol, preferably from 10 000 to 1 000 000 and more particularly from 100 000 to 500 000 g/mol.

The cationic charge density of these polymers may range from 2 meq/g to 20 meq/g, preferably from 2.5 to 15 and more particularly from 3.5 to 10 meq/g.

The polymers including units of formula (A) and optionally units of formula (B) are notably sold under the name Lupamin by the company BASF, for instance, in a nonlimiting manner, the products provided under the names Lupamin 9095, Lupamin 5095, Lupamin 1095, Lupamin 9030 (or Luviquat 9030) and Lupamin 9010.

Preferably, the cationic polymers are chosen from those of families (1), (2), (7), (10) and (12) mentioned above, and more preferably from those of family (1).

Among the cationic polymers mentioned above, the ones that may preferably be used are cationic polysaccharides, in particular cationic celluloses and cationic galactomannan gums, and in particular quaternary cellulose ether derivatives such as the products sold under the name JR 400 by the company Amerchol, cationic cyclopolymers, in particular dimethyldiallylammonium salt (for example chloride) homopolymers or copolymers, sold under the names Merquat 100, Merquat 550 and Merquat S by the company Nalco, and homologs thereof of low weight-average molecular weights, quaternary polymers of vinylpyrrolidone and of vinylimidazole, optionally crosslinked homopolymers or copolymers of methacryloyloxy(C₁-C₄)alkyltri(C₁-C₄)alkylammonium salts, and mixtures thereof.

According to a preferred embodiment of the invention, the cationic polymer(s) are chosen from:

- alkyldiallylamine or dialkyldiallylammonium cyclopolymers,
- homopolymers or copolymers derived from acrylic or methacrylic esters or amides
- 5 and including units as defined in family (1),
- and mixtures thereof.

More preferentially, according to this embodiment of the invention, the cationic polymer(s) are chosen from 2-methacryloyloxyethyltrimethylammonium chloride homopolymers or copolymers, dimethyldiallylammonium chloride homopolymers, and

10 mixtures thereof.

It is also possible to use amphoteric polymers as conditioning agent.

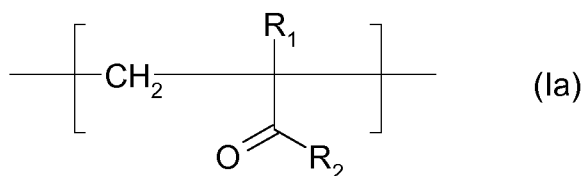
The term “amphoteric polymer” is intended to mean any polymer comprising cationic groups and/or groups that can be ionized into cationic groups and also anionic groups and/or groups that can be ionized into anionic groups.

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The amphoteric polymers may preferably be chosen from amphoteric polymers comprising the repetition of:

- (i) one or more units derived from a monomer of (meth)acrylamide type,
- (ii) one or more units derived from a monomer of
- 20 (meth)acrylamidoalkyltrialkylammonium type, and
- (iii) one or more units derived from an acidic monomer of (meth)acrylic acid type,

Preferably, the units derived from a monomer of (meth)acrylamide type (i) are units of structure (Ia) below:



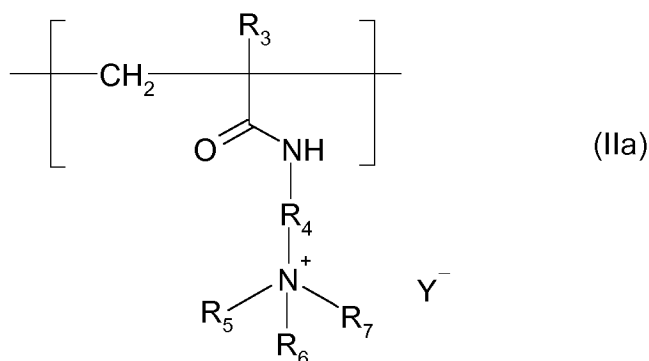
25 in which R₁ denotes H or CH₃ and R₂ is chosen from an amino, dimethylamino, tert-butylamino, dodecylamino and -NH-CH₂OH radical.

Preferably, said amphoteric polymer comprises the repetition of only one unit of formula (Ia).

The unit derived from a monomer of (meth)acrylamide type of formula (Ia) in which R₁ denotes H and R₂ is an amino radical (NH₂) is particularly preferred. It corresponds to the acrylamide monomer per se.

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Preferably, the units resulting from a monomer of (meth)acrylamidoalkyltrialkylammonium type (ii) are units of structure (IIa) below:



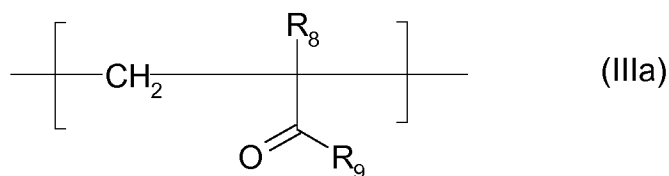
in which:

- 5 - R₄ denotes a group (CH₂)_k with k being an integer ranging from 1 to 6 and preferably from 2 to 4;
- R₅, R₆ and R₇, which may be identical or different, each denote an alkyl group containing from 1 to 4 carbon atoms;
- Y⁻ is an anion such as bromide, chloride, acetate, borate, citrate, tartrate, 10 bisulfate, bisulfite, sulfate or phosphate.

Preferably, said amphoteric polymer comprises the repetition of only one unit of formula (IIa).

Among these units derived from a monomer of (meth)acrylamidoalkyltrialkylammonium type of formula (IIa), the ones that are preferred are those derived from the methacrylamidopropyltrimethylammonium chloride monomer, for which R₃ denotes a methyl radical, k is equal to 3, R₅, R₆ and R₇ denote a methyl radical, and Y⁻ denotes a chloride anion.

Preferably, the units derived from a monomer of (meth)acrylic acid type (iii) are units of formula (IIIa):



in which R₈ denotes H or CH₃ and R₉ denotes a hydroxyl radical or an –NH-C(CH₃)₂-CH₂-SO₃H radical.

The preferred units of formula (IIIa) correspond to the acrylic acid, methacrylic acid and 2-acrylamido-2-methylpropanesulfonic acid monomers.

25 Preferably, the unit derived from a monomer of (meth)acrylic acid type of formula (IIIa) is that derived from acrylic acid, for which R₈ denotes a hydrogen atom and R₉ denotes a hydroxyl radical.

The acidic monomer(s) of (meth)acrylic acid type may be non-neutralized or partially or totally neutralized with an organic or mineral base.

Preferably, said amphoteric polymer comprises the repetition of only one unit of formula (IIIa).

5 According to a preferred embodiment of the invention, the amphoteric polymer(s) of this type comprise at least 30 mol% of units derived from a monomer of (meth)acrylamide type (i). Preferably, they comprise from 30 mol% to 70 mol% and more preferably from 40 mol% to 60 mol% of units derived from a monomer of (meth)acrylamide type.

10 The content of units derived from a monomer of (meth)acrylamidoalkyltrialkylammonium type (ii) may advantageously be from 10 mol% to 60 mol% and preferentially from 20 mol% to 55 mol%.

The content of units derived from an acidic monomer of (meth)acrylic acid type (iii) may advantageously be from 1 mol% to 20 mol% and preferentially from 5 mol% to 15
15 mol%.

According to a particularly preferred embodiment of the invention, the amphoteric polymer of this type comprises:

- from 30 mol% to 70 mol% and more preferably from 40 mol% to 60 mol% of units derived from a monomer of (meth)acrylamide type (i),
- 20 - from 10 mol% to 60 mol% and preferentially from 20 mol% to 55 mol% of units derived from a monomer of (meth)acrylamidoalkyltrialkylammonium type (ii), and
- from 1 mol% to 20 mol% and preferentially from 5 mol% to 15 mol% of units derived from a monomer of (meth)acrylic acid type (iii).

Amphoteric polymers of this type may also comprise additional units, other than
25 the units derived from a monomer of (meth)acrylamide type, of (meth)acrylamidoalkyltrialkylammonium type and of (meth)acrylic acid type as described above.

However, according to a preferred embodiment of the invention, said amphoteric polymers are constituted solely of units derived from monomers of (meth)acrylamide type
30 (i), of (meth)acrylamidoalkyltrialkylammonium type (ii) and of (meth)acrylic acid type (iii).

Examples of particularly preferred amphoteric polymers that may be mentioned include acrylamide/methacrylamidopropyltrimethylammonium chloride/acrylic acid terpolymers. Such polymers are listed in the CTFA dictionary, 10th edition 2004, under the name Polyquaternium 53. Corresponding products are in particular sold under the
35 names Merquat 2003 and Merquat 2003 PR by the company Nalco.

As another type of amphoteric polymer that may be used, mention may also be made of copolymers based on (meth)acrylic acid and on a dialkyldiallylammonium salt,

and optionally on acrylamide or a derivative thereof, such as copolymers of (meth)acrylic acid and of dimethyldiallylammonium chloride. An example that may be mentioned is Merquat 280 sold by the company Nalco.

Preferably, when the composition comprises one or more cationic and/or amphoteric polymers, it comprises them in a total amount ranging from 0.01% to 5% by weight, especially from 0.05% to 3% by weight and preferentially from 0.1% to 2.5% by weight, relative to the total weight of composition.

iii) Organosilicon compounds

The composition used in the process according to the invention may comprise, as conditioning agent, one or more organosilicon compounds, chosen especially from silicones and silanes, and also mixtures thereof.

For the purposes of the present invention, the term "organosilicon compound" is intended to mean any organic compound comprising in its structure at least one silicon atom.

The silicones that may be used according to the invention may be soluble or insoluble in the composition; they may be in the form of oils, waxes, resins or gums; they may be volatile or non-volatile.

In particular, the silicones may be organopolysiloxanes, which are especially insoluble in the composition of the invention. Organopolysiloxanes are especially described in Walter Noll's *Chemistry and Technology of Silicones* (1968), Academic Press.

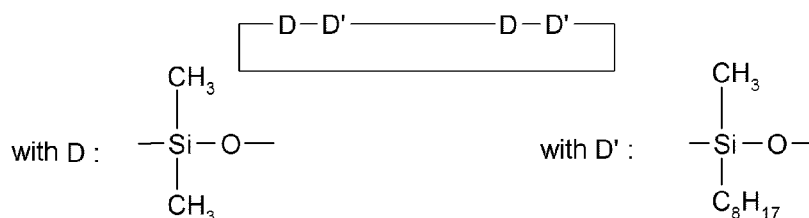
The volatile silicones are more particularly chosen from those with a boiling point of between 60°C and 260°C. Mention may be made of:

i) cyclic volatile silicones comprising from 3 to 7 and preferably 4 to 5 silicon atoms, such as:

- octamethylcyclotetrasiloxane and decamethylcyclopentasiloxane.

Mention may be made of the products sold under the name Volatile Silicone 7207 by Union Carbide or Silbione 70045 V 2 by Rhodia, Volatile Silicone 7158 by Union Carbide or Silbione 70045 V 5 by Rhodia;

- cyclocopolymers of the dimethylsiloxane/methylalkylsiloxane type having the chemical structure:



Mention may be made of Volatile Silicone FZ 3109 sold by the company Union Carbide;

5 - mixtures of cyclic silicones with silicon-derived organic compounds, such as the mixture of octamethylcyclotetrasiloxane and of tetratrimethylsilylpentaerythritol (50/50) and the mixture of octamethylcyclotetrasiloxane and of 1,1'-oxy(2,2,2',2',3,3'-hexatrimethylsilyloxy)bisneopentane;

ii) linear volatile silicones containing 2 to 9 silicon atoms, which generally have a viscosity of less than or equal to $5 \times 10^{-6} \text{ m}^2/\text{s}$ at 25°C, such as:

10 - decamethyltetrasiloxane; other silicones belonging to this category are described in the article published in *Cosmetics and Toiletries*, Vol. 91, Jan. 76, pages 27-32, Todd & Byers *Volatile Silicone Fluids for Cosmetics*; mention may be made of the product sold under the name SH 200 by the company Toray Silicone.

15 Among the non-volatile silicones, mention may be made of, alone or as a mixture, polydialkylsiloxanes, polydiarylsiloxanes, polyalkylarylsiloxanes, silicone gums and resins, and also organopolysiloxanes which are silicones as defined above, comprising in their structure one or more organofunctional groups attached by means of a hydrocarbon-based group (also called organomodified silicones).

20 Among the organomodified silicones, mention may be made of polyorganosiloxanes comprising:

- polyethyleneoxy and/or polypropyleneoxy groups optionally comprising C₆-C₂₄ alkyl groups, such as dimethicone copolyols and especially those sold by the company Dow Corning under the name DC 1248 or the oils Silwet® L 722, L 7500, L 77 and L 711 by the company Union Carbide; or else (C₁₂)alkylmethicone copolyols and especially
25 those sold by the company Dow Corning under the name Q2-5200;

- thiol groups, such as the products sold under the names GP 72 A and GP 71 from Genesee;

- alkoxyated groups, such as the product sold under the name Silicone Copolymer F-755 by SWS Silicones and Abil Wax® 2428, 2434 and 2440 by the company
30 Goldschmidt;

- hydroxylated groups, for instance polyorganosiloxanes containing a hydroxyalkyl function;

- acyloxyalkyl groups, such as the polyorganosiloxanes described in patent US-A-4 957 732;

35 - anionic groups of the carboxylic acid type, as described, for example, in EP 186 507, or of the alkylcarboxylic type, such as the product X-22-3701E from the company Shin-Etsu; or else of the 2-hydroxyalkylsulfonate or 2-hydroxyalkylthiosulfate type, such

as the products sold by the company Goldschmidt under the names Abil® S201 and Abil® S255;

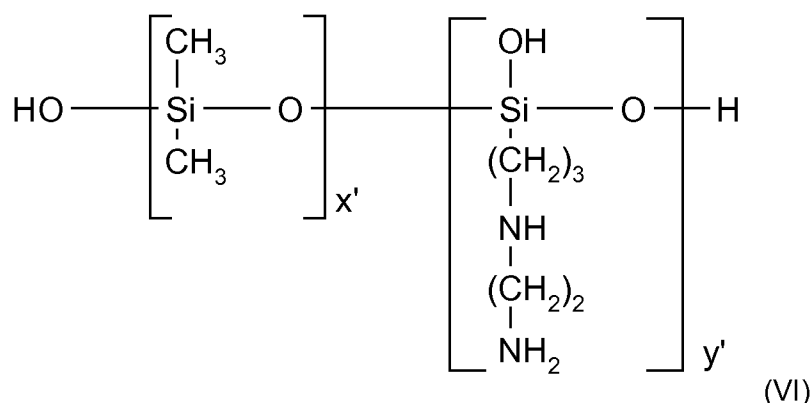
- amino groups (amino silicones).

The term “amino silicone” denotes any silicone including at least one primary, secondary or tertiary amine or a quaternary ammonium group.

The weight-average molecular masses of these amino silicones may be measured by gel permeation chromatography (GPC) at ambient temperature (25°C), as polystyrene equivalent. The columns used are μ styragel columns. The eluent is THF and the flow rate is 1 ml/min. 200 μ l of a 0.5% by weight solution of silicone in THF are injected. Detection is performed by refractometry and UV-metry.

Preferably, the amino silicone(s) that may be used in the context of the invention are chosen from:

a) the polysiloxanes corresponding to formula (VI):



in which x' and y' are integers such that the weight-average molecular mass (M_w) is between 5000 and 500 000 g/mol approximately;

b) the amino silicones corresponding to formula (VII):



in which:

- G, which may be identical or different, denotes a hydrogen atom or a phenyl, OH, C_1 - C_8 alkyl, for example methyl, or C_1 - C_8 alkoxy, for example methoxy, group,

- a, which may be identical or different, denotes 0 or an integer from 1 to 3, in particular 0,

- b denotes 0 or 1, in particular 1,

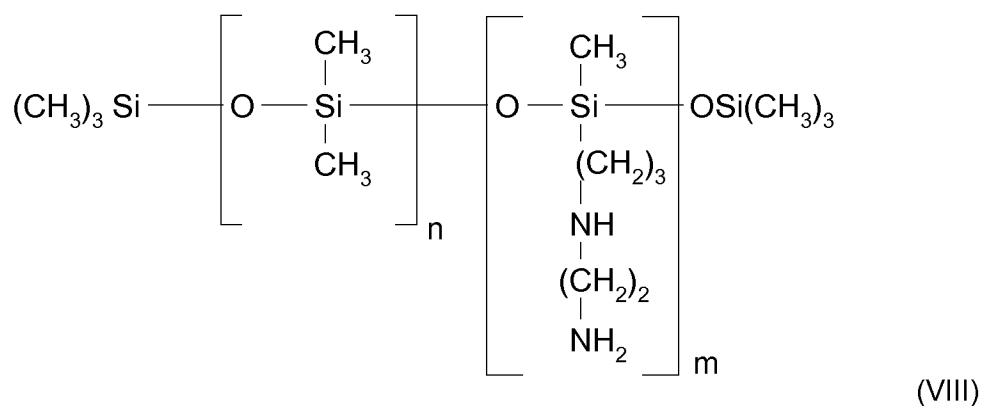
- m and n are numbers such that the sum (n + m) ranges from 1 to 2000 and in particular from 50 to 150, n possibly denoting a number from 0 to 1999 and in particular from 49 to 149, and m possibly denoting a number from 1 to 2000 and in particular from 1 to 10;

5 - R', which may be identical or different, denotes a monovalent radical of formula -C_qH_{2q}L in which q is a number ranging from 2 to 8 and L is an optionally quaternized amino group chosen from the following groups: -NR"-Q-N(R'')₂, -N(R'')₂, -N⁺(R'')₃ A⁻, N⁺H(R'')₂ A⁻, N⁺H₂(R'') A⁻, -NR"-Q-N⁺(R'')H₂ A⁻, -NR"-Q-N⁺(R'')₂H A⁻ and NR"-Q-N⁺(R'')₃ A⁻,

10 in which R'', which may be identical or different, denotes hydrogen, phenyl, benzyl, or a saturated monovalent hydrocarbon-based radical, for example a C₁-C₂₀ alkyl radical; Q denotes a linear or branched group of formula C_rH_{2r}, r being an integer ranging from 2 to 6, preferably from 2 to 4; and A⁻ represents a cosmetically acceptable anion, in particular a halide such as fluoride, chloride, bromide or iodide.

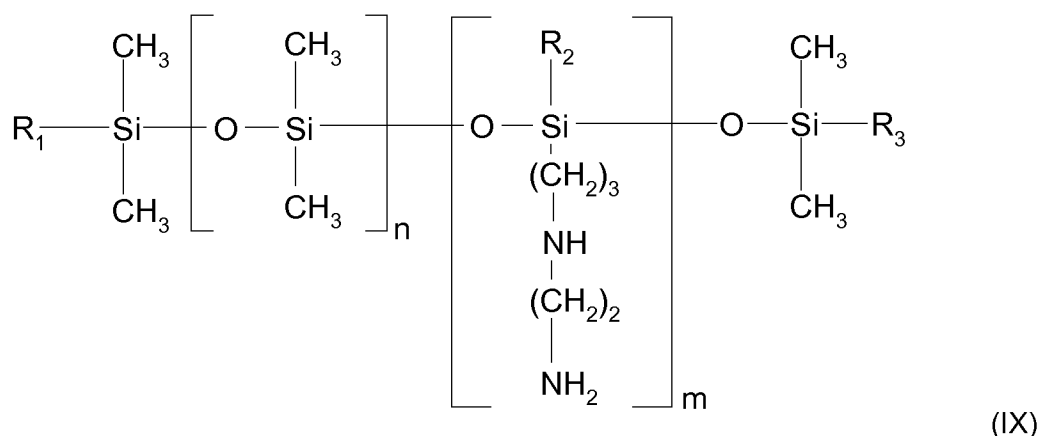
15 Preferably, the amino silicones that may be used according to the invention are chosen from the amino silicones of formula (VII). Even more preferably, the amino silicones of formula (VII) are chosen from the amino silicones corresponding to formulae (VIII), (IX), (X), (XI) and/or (XII) below.

20 According to a first embodiment, the amino silicones corresponding to formula (VII) are chosen from the silicones known as "trimethylsilyl amodimethicone", corresponding to formula (VIII):



25 in which m and n are numbers such that the sum (n + m) ranges from 1 to 2000 and in particular from 50 to 150, it being possible for n to denote a number from 0 to 1999 and notably from 49 to 149, and for m to denote a number from 1 to 2000 and notably from 1 to 10.

According to a second embodiment, the amino silicones corresponding to formula (VII) are chosen from the silicones of formula (IX) below:



in which:

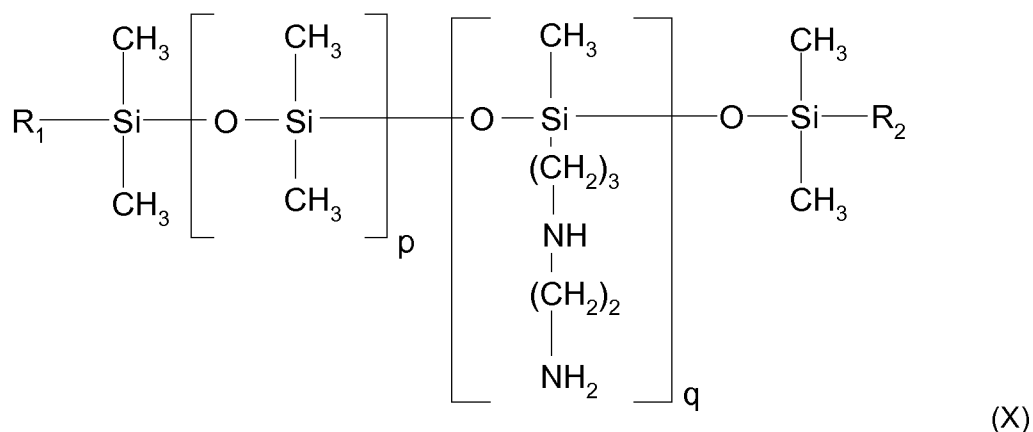
- m and n are numbers such that the sum (n + m) ranges from 1 to 1000 and in particular from 50 to 250 and more particularly from 100 to 200; it being possible for n to denote a number from 0 to 999 and in particular from 49 to 249 and more particularly from 125 to 175, and for m to denote a number from 1 to 1000 and in particular from 1 to 10, and more particularly from 1 to 5;

- R₁, R₂ and R₃, which may be identical or different, represent a hydroxyl or C₁-C₄ alkoxy radical, at least one of the radicals R₁ to R₃ denoting an alkoxy radical.
- 10 Preferably, the alkoxy radical is a methoxy radical.

The hydroxy/alkoxy mole ratio preferably ranges from 0.2:1 to 0.4:1 and preferably from 0.25:1 to 0.35:1 and more particularly equals 0.3:1.

The weight-average molecular mass (M_w) of these silicones preferably ranges from 2000 to 1 000 000 g/mol and more particularly from 3500 to 200 000 g/mol.

- 15 According to a third embodiment, the amino silicones corresponding to formula (VII) are chosen from the silicones of formula (X) below:



in which:

- p and q are numbers such that the sum (p + q) ranges from 1 to 1000, in particular from 50 to 350 and more particularly from 150 to 250; it being possible for p to denote a number from 0 to 999 and in particular from 49 to 349 and more particularly from 159 to 239, and for q to denote a number from 1 to 1000, in particular from 1 to 10 and more particularly from 1 to 5;

- R₁ and R₂, which may be different, represent a hydroxyl or C₁-C₄ alkoxy radical, at least one of the radicals R₁ or R₂ denoting an alkoxy radical.

Preferably, the alkoxy radical is a methoxy radical.

The hydroxy/alkoxy mole ratio generally ranges from 1:0.8 to 1:1.1 and preferably from 1:0.9 to 1:1 and more particularly equals 1:0.95.

The weight-average molecular mass (M_w) of the silicone preferably ranges from 2000 to 200 000 g/mol, more preferentially from 5000 to 100 000 g/mol and in particular from 10 000 to 50 000 g/mol.

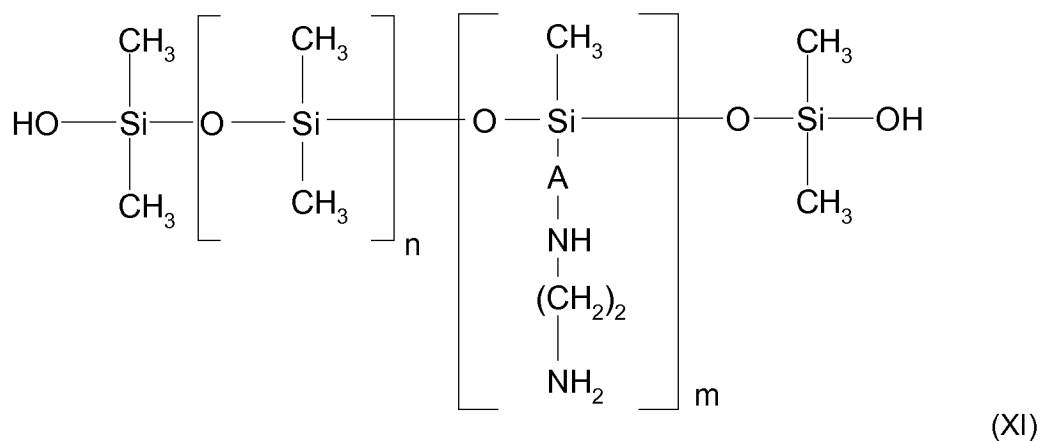
The commercial products comprising silicones of structure (IX) or (X) may include in their composition one or more other amino silicones of which the structure is different from formula (IX) or (X).

A product containing amino silicones of structure (IX) is sold by the company Wacker under the name Belsil® ADM 652.

A product containing amino silicones of structure (X) is sold by the company Wacker under the name Fluid WR 1300®. Another product containing amino silicones of structure (X) is sold by Wacker under the name Belsil ADM LOG 1®.

When these amino silicones are used, one particularly advantageous embodiment consists in using them in the form of an oil-in-water emulsion. The oil-in-water emulsion may comprise one or more surfactants. The surfactants may be of any nature but are preferably cationic and/or non-ionic. The number-average size of the silicone particles in the emulsion generally ranges from 3 nm to 500 nanometers. Preferably, in particular as amino silicones of formula (X), use is made of microemulsions of which the mean particle size ranges from 5 nm to 60 nm (limits included) and more particularly from 10 nm to 50 nm (limits included). Thus, use may be made according to the invention of the amino silicone microemulsions of formula (X) sold under the names Finish CT 96 E® or SLM 28020® by the company Wacker.

According to a fourth embodiment, the amino silicones corresponding to formula (VII) are chosen from the silicones of formula (XI) below:



in which:

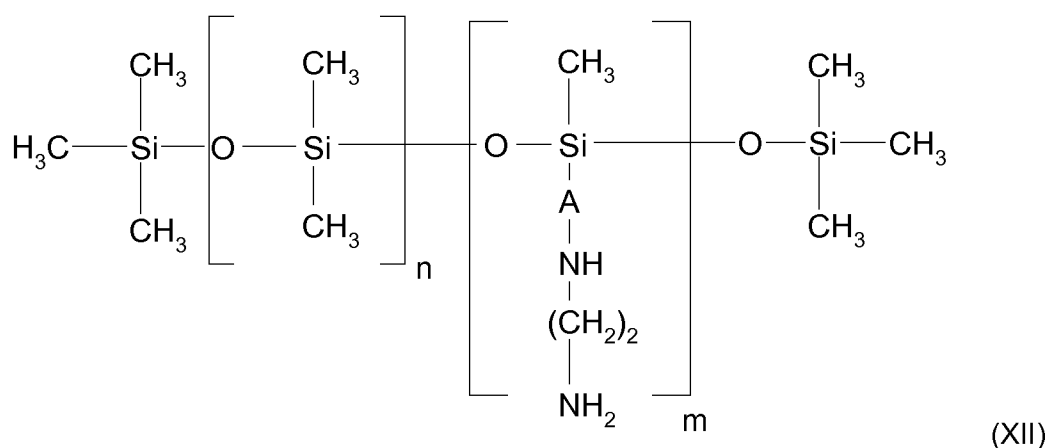
5 - m and n are numbers such that the sum $(n + m)$ ranges from 1 to 2000 and in particular from 50 to 150, it being possible for n to denote a number from 0 to 1999 and notably from 49 to 149, and for m to denote a number from 1 to 2000 and notably from 1 to 10;

- A denotes a linear or branched alkylene radical containing from 4 to 8 carbon atoms and preferably 4 carbon atoms. This radical is preferably linear.

The weight-average molecular mass (M_w) of these amino silicones preferably ranges from 2000 to 1 000 000 g/mol and more particularly from 3500 to 200 000 g/mol.

A silicone corresponding to this formula is sold, for example, under the name Xiameter MEM 8299 Emulsion by the company Dow Corning.

According to a fifth embodiment, the amino silicones corresponding to formula (VII) are chosen from the silicones of formula (XII) below:



in which:

- m and n are numbers such that the sum $(n + m)$ ranges from 1 to 2000 and in particular from 50 to 150, it being possible for n to denote a number from 0 to 1999 and

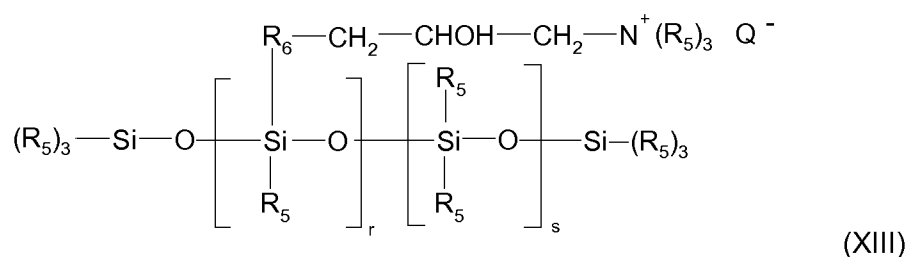
notably from 49 to 149, and for m to denote a number from 1 to 2000 and notably from 1 to 10;

- A denotes a linear or branched alkylene radical containing from 4 to 8 carbon atoms and preferably 4 carbon atoms. This radical is preferably branched.

5 The weight-average molecular mass (Mw) of these amino silicones preferably ranges from 500 to 1 000 000 g/mol and more particularly from 1000 to 200 000 g/mol.

A silicone corresponding to this formula is sold, for example, under the name DC2-8566 Amino Fluid by Dow Corning.

10 c) the amino silicones corresponding to formula (XIII):



in which:

15 - R₅ represents a monovalent hydrocarbon-based radical containing from 1 to 18 carbon atoms, and in particular a C₁-C₁₈ alkyl or C₂-C₁₈ alkenyl, for example methyl, radical;

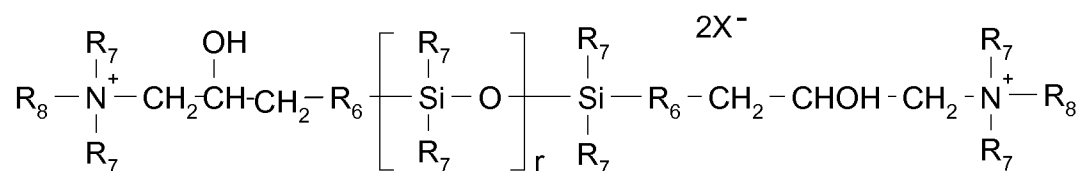
- R₆ represents a divalent hydrocarbon-based radical, in particular a C₁-C₁₈ alkylene radical or a divalent C₁-C₁₈, for example C₁-C₈, alkyleneoxy radical linked to the Si via an SiC bond;

20 - Q⁻ is an anion such as a halide, especially chloride, ion or an organic acid salt, especially acetate;

- r represents a mean statistical value ranging from 2 to 20 and in particular from 2 to 8;

- s represents a mean statistical value ranging from 20 to 200 and in particular from 25 to 50.

d) the silicones containing quaternary ammonium groups of formula (XIV):

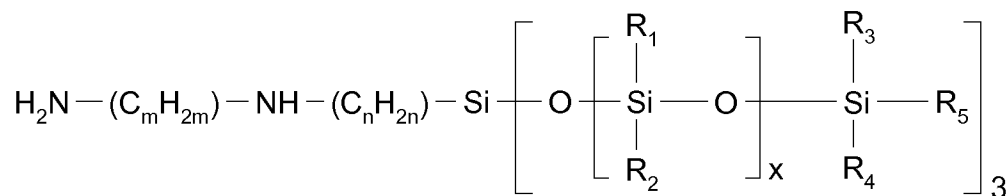


(XIV)

in which:

- R_7 , which may be identical or different, represent a monovalent hydrocarbon-based radical containing from 1 to 18 carbon atoms, and in particular a C_1 - C_{18} alkyl radical, a C_2 - C_{18} alkenyl radical or a ring comprising 5 or 6 carbon atoms, for example methyl;
- R_6 represents a divalent hydrocarbon-based radical, notably a C_1 - C_{18} alkylene radical or a divalent C_1 - C_{18} , for example C_1 - C_8 , alkyleneoxy radical linked to the Si via an SiC bond;
- R_8 , which may be identical or different, represent a hydrogen atom, a monovalent hydrocarbon-based radical having from 1 to 18 carbon atoms, and in particular a C_1 - C_{18} alkyl radical, a C_2 - C_{18} alkenyl radical or a radical $-R_6-NHCO R_7$;
- X^- is an anion such as a halide, especially chloride, ion or an organic acid salt, especially acetate;
- r represents a mean statistical value ranging from 2 to 200 and in particular from 5 to 100;

e) the amino silicones of formula (XV):

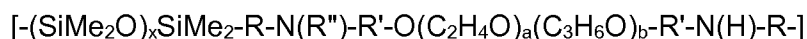


(XV)

in which:

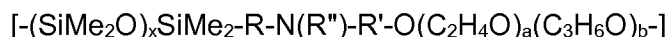
- R_1 , R_2 , R_3 and R_4 , which may be identical or different, denote a C_1 - C_4 alkyl radical or a phenyl group,
- R_5 denotes a C_1 - C_4 alkyl radical or a hydroxyl group,
- n is an integer ranging from 1 to 5,
- m is an integer ranging from 1 to 5, and
- x is chosen such that the amine number ranges from 0.01 to 1 meq/g;

- f) multiblock polyoxyalkylenated amino silicones, of the type $(AB)_n$, A being a polysiloxane block and B being a polyoxyalkylenated block comprising at least one amine group. Said silicones are preferably constituted of repeating units of the following general formulae:



or alternatively

5



in which:

10 - a is an integer greater than or equal to 1, preferably ranging from 5 to 200 and more particularly ranging from 10 to 100;

- b is an integer between 0 and 200, preferably ranging from 4 to 100 and more particularly between 5 and 30;

- x is an integer ranging from 1 to 10 000 and more particularly from 10 to 5000;

- R'' is a hydrogen atom or a methyl;

15 - R, which may be identical or different, represent a linear or branched divalent C₂-C₁₂ hydrocarbon-based radical, optionally comprising one or more heteroatoms such as oxygen; preferably, R denotes an ethylene radical, a linear or branched propylene radical, a linear or branched butylene radical or a radical CH₂CH₂CH₂OCH₂CH(OH)CH₂-; preferentially, R denotes a radical CH₂CH₂CH₂OCH₂CH(OH)CH₂-;

20 - R', which may be identical or different, represent a linear or branched divalent C₂-C₁₂ hydrocarbon-based radical, optionally comprising one or more heteroatoms such as oxygen; preferably, R' denotes an ethylene radical, a linear or branched propylene radical, a linear or branched butylene radical or a radical -CH₂CH₂CH₂OCH₂CH(OH)CH₂-; preferentially, R' denotes -CH(CH₃)-CH₂-.

25 The siloxane blocks preferably represent 50 mol% and 95 mol% of the total weight of the silicone, more particularly from 70 mol% to 85 mol%.

The amine content is preferably between 0.02 and 0.5 meq/g of copolymer in a 30% solution in dipropylene glycol, more particularly between 0.05 and 0.2.

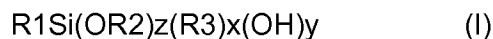
30 The weight-average molecular mass (Mw) of the silicone is preferably between 5000 and 1 000 000 g/mol and more particularly between 10 000 and 200 000 g/mol.

Mention may be made notably of the silicones sold under the names Silsoft A-843 or Silsoft A+ by Momentive;

g) and mixtures thereof.

35 Preferably, the amino silicone(s) are chosen from the amino silicones of formulae (VIII), (IX), (X), (XI) and (XII) above, and better still from the amino silicones of formulae (IX), (X) or (XI).

The silanes are preferably chosen from the compounds of formula (I) and/or oligomers thereof:



in which

- 5 - R1 is a linear or branched, saturated or unsaturated C1-C22 and especially C2-C20 hydrocarbon-based chain, which may be substituted with an amine group NH_2 or NHR ($\text{R} = \text{C1-C20}$ and especially C1-C6 alkyl, C3-C40 cycloalkyl or C6-C30 aromatic); or with a hydroxyl group, a thiol group, an aryl group (more particularly benzyl), which is substituted or unsubstituted; R1 possibly being interrupted with a heteroatom (O, S or
- 10 NH) or a carbonyl group (CO);
- R2 and R3, which may be identical or different, represent a linear or branched alkyl group comprising from 1 to 6 carbon atoms,
- y denotes an integer ranging from 0 to 3,
- z denotes an integer ranging from 0 to 3, and
- 15 - x denotes an integer ranging from 0 to 2,
- with $z + x + y = 3$.

The term "oligomer" means the polymerization products of the compounds of formula (I) comprising from 2 to 10 silicon atoms.

20 Preferably, R1 is a linear or branched, preferably linear, saturated C1-C22, especially C2-C20 or even C6-C20 hydrocarbon-based chain, which may be substituted with an amine group NH_2 or NHR ($\text{R} = \text{C1-C20}$, especially C1-C6, alkyl).

 Preferably, R2 represents an alkyl group comprising from 1 to 4 carbon atoms, better still a linear alkyl group comprising from 1 to 4 carbon atoms, and preferably the ethyl group.

25 Preferably, z ranges from 1 to 3. Preferentially, $z=3$, and therefore $x=y=0$.
 Preferably, $y = 0$.

 In one variant, R1 represents an alkyl group, and even more preferentially a linear alkyl group, comprising from 7 to 18 carbon atoms and more particularly from 7 to 12 carbon atoms or a C1-C6 and preferably C2-C4 aminoalkyl group. More particularly, R1

30 represents an octyl group. Preferentially, in this variant, the composition comprises octyltriethoxysilane (OTES).

 In another variant, R1 is a linear or branched, saturated or unsaturated C1-C22 hydrocarbon-based chain, substituted with an amine group NH_2 or NHR ($\text{R} = \text{C1-C20}$, in particular C1-C6, alkyl, C3-C40 cycloalkyl or C6-C30 aromatic). In this variant, R1

35 preferably represents a C1-C6, preferably C2-C4, aminoalkyl group. Preferentially, in this variant, the composition comprises γ -aminopropyltriethoxysilane (APTES).

Preferably, the composition may comprise, as silane, at least one compound chosen from octyltriethoxysilane, dodecyltriethoxysilane, octadecyltriethoxysilane, hexadecyltriethoxysilane and γ -aminopropyltriethoxysilane; more particularly chosen from octyltriethoxysilane (OTES) and γ -aminopropyltriethoxysilane (APTES).

- 5 According to another preferred embodiment, the silanes may also be chosen from the compounds of formula (III) below, and/or hydrolysis products thereof and/or oligomers thereof:



in which:

- 10 R_4 and R_5 each represent, independently of each other, a C_{1-6} , better still C_{1-4} , alkyl group such as methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl and tert-butyl, preferably methyl, ethyl or n-propyl,

n ranges from 1 to 3,

m ranges from 1 to 3,

- 15 on condition that $m+n=4$.

Preferably, R_5 represents a methyl, ethyl or n-propyl group, $n=3$ and $m=1$.

Preferably, the oligomers of the compounds of formula (III) are water-soluble.

- As examples of alkylalkoxysilanes that are particularly preferred, mention may be made especially of methyltriethoxysilane (MTES), methyltripropoxysilane, oligomers thereof and hydrolysis products thereof.
- 20

The silanes used in the composition of the invention, especially those comprising a basic function, may be partially or totally neutralized in order to improve their water solubility. In particular, the neutralizer may be chosen from organic or mineral acids, such as citric acid, tartaric acid, lactic acid or hydrochloric acid.

- 25 Preferably, the optionally neutralized silanes according to the invention are water-soluble and especially soluble at a concentration of 2%, better still at a concentration of 5% and even better still at a concentration of 10% by weight in water at a temperature of $25^\circ\text{C} \pm 5^\circ\text{C}$ and at atmospheric pressure (1 atm). The term "soluble" implies the formation of a single macroscopic phase.

- 30 Preferably, the siliceous compounds are chosen from amino silicones.

Preferably, when the composition used in the process according to the invention comprises one or more organosilicon compounds, it comprises them in a total amount ranging from 0.1% to 15% by weight, preferentially from 0.5% to 10% by weight and better still from 1% to 5% by weight, relative to the total weight of the composition.

- 35 Preferably, when the composition used in the process according to the invention comprises one or more amino silicones, it comprises them in a total amount ranging from

0.1% to 15% by weight, preferentially from 0.5% to 10% by weight and better still from 1% to 5% by weight, relative to the total weight of the composition.

Non-silicone fatty substances

The term "fatty substance" means an organic compound that is insoluble in water at ordinary temperature (25°C) and at atmospheric pressure (760 mmHg or 1.013×10^5 Pa) (solubility of less than 5%, preferably of less than 1% and even more preferentially of less than 0.1% by weight). The non-silicone fatty substances (i.e. the fatty substances not comprising any silicon atoms in their structure) have in their structure at least one hydrocarbon-based chain comprising at least 6 carbon atoms. In addition, the non-silicone fatty substances are generally soluble in organic solvents under the same temperature and pressure conditions, for instance chloroform, dichloromethane, carbon tetrachloride, ethanol, benzene, toluene, tetrahydrofuran (THF), liquid petroleum jelly or decamethylcyclopentasiloxane.

The non-silicone fatty substances of the invention do not contain any salified carboxylic acid groups.

In addition, the non-silicone fatty substances of the invention are not (poly)oxyalkylenated or (poly)glycerolated ethers.

The term "liquid fatty substance" or "oil" is intended to mean a "fatty substance" that is liquid at ambient temperature (25°C) and at atmospheric pressure (760 mmHg or 1.013×10^5 Pa).

The term "solid fatty substance" is intended to mean a "fatty substance" that is solid at ambient temperature (25°C) and at atmospheric pressure (760 mmHg or 1.013×10^5 Pa).

iv) Non-silicone liquid fatty substances

The composition used in the process according to the invention may comprise, as conditioning agent, one or more non-silicone liquid fatty substances. These substances may be chosen notably from liquid fatty alcohols; mineral, plant or animal oils; liquid fatty esters; liquid hydrocarbons, and mixtures thereof.

The liquid fatty alcohols may be linear or branched; they preferably comprise 8 to 30 carbon atoms; they may be saturated or unsaturated.

The saturated liquid fatty alcohols are preferably branched. They may optionally comprise in their structure at least one aromatic or non-aromatic ring. Preferably, they are acyclic. More particularly, the saturated liquid fatty alcohols are chosen from octyldodecanol, isostearyl alcohol, 2-hexyldecanol, and also palmityl, myristyl, stearyl and lauryl alcohols, and mixtures thereof.

The unsaturated liquid fatty alcohols contain in their structure at least one double or triple bond, and preferably one or more double bonds. When several double bonds are present, there are preferably 2 or 3 of them, and they may be conjugated or unconjugated. They may optionally comprise in their structure at least one aromatic or non-aromatic ring. Preferably, they are acyclic. More particularly, the unsaturated liquid fatty alcohols are chosen from oleyl alcohol, linoleyl alcohol, linolenyl alcohol and undecylenyl alcohol, and mixtures thereof.

Among the mineral, plant or animal oils that may be used, mention may be made notably: as oils of plant origin, of sweet almond oil, avocado oil, castor oil, olive oil, jojoba oil, sunflower oil, wheatgerm oil, sesame oil, groundnut oil, grapeseed oil, soybean oil, rapeseed oil, safflower oil, coconut oil, corn oil, hazelnut oil, shea butter, palm oil, apricot kernel oil, beauty-leaf oil, evening primrose oil or camelina oil; as oil of animal origin, perhydosqualene; as oils of mineral origin, liquid paraffin and liquid petroleum jelly; and mixtures thereof.

The liquid fatty esters may be esters of monoalcohols or of polyols with monoacids or polyacids, at least one of the alcohols and/or acids including at least one chain of more than 7 carbon atoms. Preferably, the liquid fatty ester according to the invention is chosen from esters of a fatty acid and of a monoalcohol. Preferably, at least one of the alcohols and/or acids is branched. Mention may be made of isopropyl myristate, isopropyl palmitate, isononyl or isostearyl isononanoate, 2-ethylhexyl palmitate, 2-hexyldecyl laurate, 2-octyldecyl palmitate and 2-octyldodecyl myristate, Purcellin oil (stearyl octanoate), isopropyl lanolate, and mixtures thereof.

The term "liquid hydrocarbon" means a hydrocarbon composed solely of carbon and hydrogen atoms, which is liquid at 25°C and 1 atm, which is notably of mineral or plant origin, preferably of plant origin.

As liquid hydrocarbon that may be used in the composition according to the invention, mention may be made of:

- linear or branched, optionally cyclic, C6-C16 alkanes; mention may be made of hexane, undecane, dodecane, tridecane, and isoparaffins, for instance isohexadecane, isododecane and isodecane;

- linear or branched hydrocarbons notably of mineral, animal or synthetic origin with more than 16 carbon atoms, such as volatile or non-volatile liquid paraffins, petroleum jelly, liquid petroleum jelly, polydecenes, hydrogenated polyisobutene such as the product sold under the brand name Parleam® by the company NOF Corporation, and squalane.

Preferably, when the composition comprises one or more non-silicone liquid fatty substances, it comprises them in a total amount ranging from 0.1% to 15% by weight,

preferably from 0.5% to 10% by weight and even better still from 1% to 5% by weight, relative to the total weight of the composition.

v) Non-silicone solid fatty substances

5 The composition used in the process according to the invention may comprise, as conditioning agent, one or more non-silicone solid fatty substances. These substances may be chosen notably from solid fatty alcohols; solid fatty esters, ceramides; animal, plant or mineral waxes other than ceramides; and mixtures thereof.

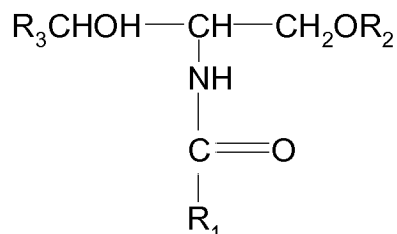
10 The solid fatty alcohols that may be used are preferably chosen from saturated or unsaturated, linear or branched, preferably linear and saturated, (mono)alcohols including from 8 to 30 carbon atoms and notably 10 to 24 carbon atoms. Mention may be made, for example, of cetyl alcohol, stearyl alcohol and the mixture thereof (cetylstearyl alcohol).

15 The solid fatty esters that may be used are preferably chosen from esters derived from C₉-C₂₆ monocarboxylic acids and from C₉-C₂₆ alcohols. Mention may be made of octyldodecyl behenate, isocetyl behenate, cetyl lactate, stearyl octanoate, octyl octanoate, cetyl octanoate, decyl oleate, myristyl stearate, octyl palmitate, octyl pelargonate, octyl stearate, alkyl myristates such as cetyl myristate, myristyl myristate or stearyl myristate, and hexyl stearate.

20 Esters of C₄-C₂₂ dicarboxylic or tricarboxylic acids and of C₁-C₂₂ alcohols and esters of mono-, di- or tricarboxylic acids and of C₂-C₂₆ di-, tri-, tetra- or pentahydroxy alcohols may also be used. Mention may be made notably of diethyl sebacate, diisopropyl sebacate, diisopropyl adipate, di-n-propyl adipate, dioctyl adipate and dioctyl maleate.

25 Preferentially, it is preferred to use C₉-C₂₆ alkyl palmitates, notably myristyl, cetyl or stearyl palmitates, and C₉-C₂₆ alkyl myristates such as cetyl myristate, stearyl myristate and myristyl myristate or mixtures of myristyl palmitate and myristyl stearate.

30 The ceramides, or ceramide analogues such as glycoceramides, that may be used in the composition according to the invention, are known per se; mention may in particular be made of ceramides of classes I, II, III and V according to the Dawning classification; they are molecules which may correspond to the formula below:



in which:

- R₁ denotes a linear or branched, saturated or unsaturated alkyl group, derived from C₁₄-C₃₀ fatty acids, it being possible for this group to be substituted with a hydroxyl group in the alpha position, or a hydroxyl group in the omega position esterified with a saturated or unsaturated C₁₆-C₃₀ fatty acid;

- R₂ denotes a hydrogen atom, a (glycosyl)_n group, a (galactosyl)_m group or a sulfogalactosyl group, in which n is an integer ranging from 1 to 4 and m is an integer ranging from 1 to 8;

- R₃ denotes a C₁₅-C₂₆ hydrocarbon-based group, which is saturated or unsaturated in the alpha position, this group possibly being substituted with one or more C₁-C₁₄ alkyl groups;

it being understood that, in the case of natural ceramides or glycosceramides, R₃ may also denote a C₁₅-C₂₆ alpha-hydroxyalkyl group, the hydroxyl group optionally being esterified with a C₁₆-C₃₀ alpha-hydroxy acid.

The ceramides more particularly preferred are the compounds for which R₁ denotes a saturated or unsaturated alkyl derived from C₁₆-C₂₂ fatty acids; R₂ denotes a hydrogen atom and R₃ denotes a saturated linear C₁₅ group.

Preferentially, use is made of ceramides for which R₁ denotes a saturated or unsaturated alkyl group derived from C₁₄-C₃₀ fatty acids; R₂ denotes a galactosyl or sulfogalactosyl group; and R₃ denotes a -CH=CH-(CH₂)₁₂-CH₃ group.

Use may also be made of the compounds for which R₁ denotes a saturated or unsaturated alkyl radical derived from C₁₂-C₂₂ fatty acids; R₂ denotes a galactosyl or sulfogalactosyl radical and R₃ denotes a saturated or unsaturated C₁₂-C₂₂ hydrocarbon-based radical and preferably a -CH=CH-(CH₂)₁₂-CH₃ group.

As compounds that are particularly preferred, mention may also be made of 2-N-linoleoylamino-octadecane-1,3-diol; 2-N-oleoylamino-octadecane-1,3-diol; 2-N-palmitoylamino-octadecane-1,3-diol; 2-N-stearoylamino-octadecane-1,3-diol; 2-N-behenoylamino-octadecane-1,3-diol; 2-N-[2-hydroxypalmitoyl]amino-octadecane-1,3-diol; 2-N-stearoylamino-octadecane-1,3,4-triol and in particular N-stearoylphyto-sphingosine; 2-N-palmitoylamino-hexadecane-1,3-diol, N-linoleoyldihydro-sphingosine, N-oleoyldihydro-sphingosine, N-

palmitoyldihydrosphingosine, N-stearoyldihydrosphingosine, and N-behenoyldihydrosphingosine, N-docosanoyl-N-methyl-D-glucamine, cetylic acid N-(2-hydroxyethyl)-N-(3-cetyloxy-2-hydroxypropyl)amide and bis(N-hydroxyethyl-N-cetyl)malonamide; and mixtures thereof.

5 For the purposes of the present invention, a wax is a lipophilic compound, which is solid at ambient temperature (25°C), with a reversible solid/liquid change of state, having a melting point greater than about 40°C, which may be up to 200°C, and having in the solid state anisotropic crystal organization. In general, the size of the wax crystals is such that the crystals diffract and/or scatter light, giving the composition that comprises them
10 a more or less opaque cloudy appearance. By bringing the wax to its melting point, it is possible to make it miscible with oils and to form a microscopically homogeneous mixture, but, on returning the temperature of the mixture to ambient temperature, recrystallization of the wax, which is microscopically and macroscopically detectable (opalescence), is obtained in the oils of the mixture.

15 As waxes, other than the ceramides above, that can be used in the present invention, mention may be made of waxes of animal origin, such as beeswaxes or modified beeswaxes (cera bellina), spermaceti, lanolin wax and lanolin derivatives; plant waxes such as carnauba wax, candelilla wax, esparto wax, ouricury wax, Japan wax, cocoa butter, cork-fiber wax, sugarcane wax, olive-tree wax, rice wax, hydrogenated
20 jojoba wax or absolute waxes of flowers; mineral waxes, for example paraffin wax, petroleum jelly wax, lignite wax, microcrystalline waxes, ozokerites, and mixtures thereof.

Preferably, the non-silicone solid fatty substances may be chosen from solid fatty alcohols and solid fatty esters.

Preferably, when the composition comprises one or more solid fatty substances, it
25 comprises them in a total amount ranging from 0.1% to 15% by weight, preferably from 0.5% to 10% by weight and even better still from 1% to 5% by weight, relative to the total weight of the composition.

Preferably, the conditioning agent(s) are chosen from:

- i) cationic surfactants;
- 30 ii) cationic polymers,
- iii) organosilicon compounds, and especially silicones and silanes and preferably amino silicones;
- iv) non-silicone liquid fatty substances, and especially liquid fatty alcohols; mineral or plant oils; liquid fatty esters; liquid hydrocarbons;
- 35 v) non-silicone solid fatty substances, and especially solid fatty alcohols; solid fatty esters; ceramides; animal, plant or mineral waxes other than ceramides; and mixtures of these compounds.

Even more preferentially, the conditioning agent(s) are chosen from cationic surfactants, cationic polymers, amino silicones, liquid fatty alcohols, solid fatty alcohols, liquid fatty esters and solid fatty esters, and mixtures thereof.

5 Preferably, the composition does not comprise any fixing polymer.

For the purposes of the invention, the term "fixing polymer" is intended to mean any polymer that is capable, by application to the hair, of giving a shape to the head of hair or of holding an already acquired shape, it being possible for the fixing polymers to be anionic, cationic, amphoteric or non-ionic fixing polymers.

10 If the composition comprises one or more fixing polymers, then it preferably comprises less than 3% by weight thereof relative to the total weight of the composition, preferably less than 2% by weight relative to the total weight of the composition.

The composition applied in the process according to the present invention is
15 preferably aqueous.

The water content is preferably greater than or equal to 10% by weight, more preferentially greater than or equal to 20% by weight, and even better still greater than or equal to 30% by weight relative to the total weight of the composition.

Preferably, the water content present in the composition of the invention ranges
20 from 30% to 98% by weight, preferably from 50% to 95% by weight and more preferentially from 65% to 95% by weight, relative to the total weight of the composition.

Besides water, the composition according to the present invention may optionally comprise one or more organic solvents, or mixtures thereof.

Examples of organic solvents that may be mentioned include linear or branched
25 C₂ to C₄ alkanols, such as ethanol and isopropanol; glycerol; polyols and polyol ethers, for instance 2-butoxyethanol, propylene glycol, hexylene glycol, dipropylene glycol, propylene glycol monomethyl ether, diethylene glycol monomethyl ether and monoethyl ether, and also aromatic alcohols or ethers, such as benzyl alcohol or phenoxyethanol, and mixtures thereof.

30

The pH of the composition is preferably greater than or equal to 2, preferably greater than or equal to 3 and preferably ranges from 2 to 8, better still from 3 to 5.

It may be adjusted to the desired value by means of acidifying and/or basifying agents usually used for treating keratin fibers, other than the acids of the invention.

35 The basifying agent may be chosen from mineral or organic or hybrid alkaline agents, or mixtures thereof.

The mineral alkaline agent(s) are preferably chosen from aqueous ammonia, alkali metal carbonates or bicarbonates such as sodium or potassium carbonates and sodium or potassium bicarbonates, sodium hydroxide or potassium hydroxide, or mixtures thereof.

- 5 The organic alkaline agent(s) are preferably chosen from organic amines with a pK_b at 25°C of less than 12, preferably less than 10 and even more advantageously less than 6. It should be noted that this is the pK_b corresponding to the function of highest basicity.

- 10 Hybrid compounds that may be mentioned include the salts of the amines mentioned previously with acids such as carbonic acid or hydrochloric acid.

The organic alkaline agent(s) are chosen, for example, from amine derivatives such as alkanolamines, oxyethylenated and/or oxypropylenated ethylenediamines, and amines such as 1,3-diaminopropane, 1,3-diamino-2-propanol, spermine or spermidine.

- 15 The term "alkanolamine" is intended to mean an organic amine comprising a primary, secondary or tertiary amine function, and one or more linear or branched C1-C8 alkyl groups bearing one or more hydroxyl radicals.

Sodium hydroxide is in particular suitable for use in the invention.

The acidifying agent may be chosen from mineral acids, for instance hydrochloric acid or phosphoric acid.

20

Preferably, the composition according to the invention comprises neither hair-dyeing agent, nor sulfur-containing or phosphorus-containing reducing agent for permanent reshaping.

- 25 According to the present invention, the term "reducing agent" is intended to mean an agent that is capable of reducing the disulfide bonds of the hair, such as compounds chosen from thiols, alkaline sulfites, hydrides and phosphines.

- 30 For the purposes of the present invention, the term "hair-dyeing agent" is intended to mean a direct dye, an oxidation dye precursor (oxidation base and coupler) or any other compound which gives color to the keratin fibers, usually used for coloring human keratin fibers, or alternatively, if it does comprise any, the total amount thereof does not exceed 0.005% by weight relative to the weight of the composition. Specifically, at such a content, only the composition would be dyed, i.e. no coloring effect would be observed on the keratin fibers.

- 35 It is recalled that oxidation dye precursors, oxidation bases and couplers are colorless or sparingly colored compounds, which, via a condensation reaction in the presence of an oxidizing agent, give a colored species. With regard to direct dyes, these compounds are colored and have a certain affinity for keratin fibers.

The composition may also comprise at least one usual cosmetic ingredient, in particular chosen from surfactants other than the cationic surfactants described above and in particular from non-ionic surfactants; polymeric or non-polymeric thickeners, and
5 most particularly polysaccharide thickeners and/or associative polymers, sunscreens; antidandruff agents; antioxidants; chelating agents; nacreous agents and opacifiers; plasticizers or coalescence agents; fillers; emulsifiers; fragrances; crosslinking agents. The composition can, of course, comprise several cosmetic ingredients appearing in the above list.

10 Depending on their nature and the purpose of the composition, the usual cosmetic ingredients may be present in usual amounts, which can be readily determined by those skilled in the art and which may be, for each ingredient, between 0.01% and 80% by weight. Those skilled in the art will take care to select the ingredients included in the composition, and also the amounts thereof, so that they do not harm the properties of
15 the composition of the present invention.

The composition that is of use in the process of the invention may be in any of the conventionally used galenical forms, in particular in the form of a gel or a cream.

20 The application of the composition as described above can be carried out on dry hair or on wet hair. Preferably, the composition is applied to wet hair. More preferably, the wet hair has been predried before the application of the composition, that is to say it has been wiped with a towel for example, or optionally partially dried using a hairdryer.

The process according to the invention also comprises a step of placing the hair
25 under mechanical tension using a tensioning means.

The step of placing the hair under mechanical tension can be carried out before or after the application of the composition to the hair. Preferably, the step of placing the hair under mechanical tension is carried out after the application of the composition to the hair.

30 The step of placing under mechanical tension can be carried out with a mechanical tensioning means chosen from rollers, head bands, elastic hair ties, bun rings, strips for braiding with or around the hair of the braid, headscarves.

The mechanical tensioning means can be made of flexible or rigid material, for example of woven or nonwoven textile material, of plastic, or foam.

35 The tensioning means may be variable in shape, for example spherical, toric, tubular, elongated, flat.

Depending on the hairstyle result that it is desired to obtain, for example straightening or curling the hair, size and definition of the curls, the mechanical tensioning means most suitable for the desired effect will be chosen.

The composition is left on the hair subjected to a mechanical stress for at least four hours, preferably at least six hours, more preferentially for at least eight hours, better still between eight hours and ten hours. It is for example possible to apply the composition and to place the hair under mechanical tension before going to bed and to leave this on overnight, in particular while sleeping.

Preferably, the step of placing the hair under tension using a tensioning means is carried out without applying heat using a heating means.

After the leave-on-time defined above, the one or more mechanical tensioning means are removed.

Preferably, the process according to the invention does not comprise a step of rinsing the hair after the step of removing the tensioning means.

It is also possible to adjust the hairstyle with the fingers. Preferably, the process for shaping the hair according to the invention does not comprise any step in which a composition comprising a reducing agent and/or a coloring agent as defined above are applied.

The invention is illustrated in greater detail in the examples that follow, which are given as non-limiting illustrations of the invention.

EXAMPLES

Exemple 1

The following compositions were prepared. The concentrations are expressed as weight percentages of active material in the final composition.

	Composition T1	Composition C	Composition T2
Citric acid	-	10	-
VP/VA copolymer	-	-	2
NaOH		qs pH 3	
Deionized water	qs 100	qs 100	qs 100
Relaxation at T4h (cm)	13	9	9
Length of the lock at 4 h (cm)	21	17	18

Each of the compositions T1, C and T2 were applied, in a proportion of 0.4 g of composition per lock, to locks of straight natural caucasian hair of 2.7 g, 27 cm long,

prewashed with a shampoo, rinsed and predried using a towel. The locks thus treated were rolled around a spiral roller and left to dry for 8 hours in a chamber at 37°C.

The rollers were then removed.

For each lock, the appearance and the fixing were evaluated, that is to say whether the hair is set (a great deal of fixing) or whether it retains a natural feel (no fixing).

Each lock was then suspended vertically in front of graph paper and they were then placed in a chamber at controlled humidity (65% RH).

The locks obtained were then photographed at T0 and after 4 hours (T4h) and the length of each lock was measured. The relaxation after 4 h corresponds to the difference in length between the lock at T0 and the lock after 4 h.

It is observed that the process according to the invention using the composition C makes it possible to improve the feel of the hair, which is more natural, after 4 hours, and to obtain curls which remain tighter (shorter length of the lock at 4 h with the invention) compared to an identical process in which a conventional fixing polymer is used, while having equal hold of the hairstyle (identical relaxation).

Example 2

The following compositions were prepared. The concentrations are expressed as weight percentages of active material in the final composition.

	C1 invention	C2 comparative
Succinic acid	2%	0.65% *
Deionized water	Qs 100	Qs 100

Each of the compositions C1 and C2 were applied, in a proportion of 0.4 g of composition per lock, to locks of straight natural caucasian hair of 2.7 g, 27 cm long, prewashed with a shampoo, rinsed and predried using a towel. The locks thus treated were rolled around a spiral roller (16 mm) and left to dry for 7 hours in a chamber at 37°C (for simulating scalp temperature).

The rollers were then removed.

Each lock was then suspended vertically in front of graph paper and they were then placed in a chamber at controlled humidity (65% RH).

The locks obtained were then photographed at T0 and after 4 hours (T4h) and the length of each lock was measured. The relaxation after 4 h corresponds to the difference in length between the lock at T0 and the lock after 4 h.

	C1 invention	C2 comparative
Length of the lock at T0 h (cm)	12	11
Length of the lock at 4 h (cm)	18	20
Relaxation (cm)	6	9
Relaxation %	50%	81%

- It is observed that the process according to the invention using the composition C1
- 5 makes it possible to obtain curls which remain tighter (shorter length of the lock at 4 h with the invention) compared to an identical process in which a concentration less than 1% is used.

CLAIMS

1. A process for shaping the hair, wherein:
 - a composition comprising one or more organic acid(s) is applied to the hair, preferably
 - 5 wet hair,
 - the hair is placed under tension using a tensioning means,
 - the composition and the tensioning means are left on the hair for at least four hours,
 - then
 - the tensioning means is removed,
 - 10 the composition comprising one or more organic acids in a total content ranging from 1% to 25% by weight relative to the total weight of the composition.

2. The process as claimed in the preceding claim, wherein the composition and the tensioning means are left on the hair for at least six hours, preferably for at least eight
- 15 hours, better still between eight hours and ten hours.

3. A process for shaping the hair, wherein the tensioning means is chosen from rollers, head bands, elastic hair ties, bun rings, strips for braiding with or around the hair, headscarves.
- 20
4. The process as claimed in any one of the preceding claims, in which the organic acid(s) are chosen from the following compounds or mixtures thereof:
 - (1) aromatic or non-aromatic carboxylic acids comprising at least one carboxyl function -C(O)-OH chosen from:
 - 25 - $\text{C}_2\text{-C}_8$, preferably $\text{C}_2\text{-C}_6$ monoacids corresponding to the formula $\text{R}_b\text{-C(O)-OH}$ in which the radical R_b represents a $\text{C}_1\text{-C}_7$ alkyl, (hetero)aryl, preferably (hetero)($\text{C}_4\text{-C}_8$ aryl), or (hetero)arylalkyl group, preferably (hetero)($\text{C}_4\text{-C}_8$ aryl)($\text{C}_1\text{-C}_4$ alkyl) group, the alkyl part being linear or branched, the alkyl and/or (hetero)aryl part being optionally substituted, preferably by one or more hydroxyl groups, one of the hydroxyl groups preferably being
 - 30 separated from the carboxyl -C(O)-OH function by one or two carbon atoms;
 - $\text{C}_2\text{-C}_{10}$, preferably $\text{C}_2\text{-C}_6$ diacids corresponding to the formula $\text{HO-C(O)-R}_c\text{-C(O)-OH}$, in which the radical R_c represents:
 - a) a covalent single σ bond;
 - b) an acyclic, linear or branched, saturated or unsaturated $\text{C}_1\text{-C}_8$, in particular $\text{C}_1\text{-C}_4$
 - 35 divalent hydrocarbon-based group, optionally substituted preferably by one or more hydroxyl groups, more particularly the divalent hydrocarbon-based group preferably

being a C₁-C₈, better still C₁-C₄ alkylene group optionally substituted by one or more hydroxyl groups, or a (C₂-C₆)alkenylene group optionally substituted by one or more hydroxyl groups;

5 c) a (hetero)arylene group, preferably a C₄-C₁₀, better still C₅-C₈ (hetero)arylene group, optionally substituted preferably by one or more hydroxyl groups, and preferably being an arylene group such as phenylene;

d) a (hetero)cycloalkylene group, preferably a C₃-C₈ (hetero)cycloalkylene group, optionally substituted preferably by one or more hydroxyl groups, and preferably being a cycloalkylene group, preferably a C₃-C₆ cycloalkylene group, such as cyclohexylene;

10 e) or a divalent group resulting from the combination of radicals derived from the groups defined in b), c) and/or d) as defined above, preferentially -aryl(C₁-C₄)alkyl- such as -phenyl(C₁-C₄)alkyl-;

the diacids are particularly chosen from those in which **R_c** represents a), b) or c)

- polyacids corresponding to the formula **R_d[C(O)-OH]_x** with **x** representing an integer greater than or equal to 3, preferably **x** ranging from 3 to 6, more particularly from 3 to 4 and especially such that **x** is equal to 3; and **R_d** represents a polyvalent group chosen from:

a) an acyclic, linear or branched, saturated or unsaturated C₁-C₈, in particular C₂-C₃ polyvalent hydrocarbon-based group, optionally substituted by one or more groups, preferably hydroxyl, the hydrocarbon-based group preferably being C₁-C₈, better still C₂-C₃ trivalent, optionally substituted by one or more hydroxyl groups;

b) a polyvalent (hetero)aryl group, optionally substituted preferably by one or more hydroxyl groups, preferably being an at least trivalent aryl group such as phenyl;

25 c) a polyvalent (hetero)cycloalkyl group, optionally substituted preferably by one or more hydroxyl groups, preferably being a cycloalkyl group such as cyclohexyl;

d) or a polyvalent group resulting from the combination of radicals derived from the groups defined in a), b) and/or c), such as: (hetero)aryl(C₁-C₈)alkyl; (C₁-C₈)alkyl(hetero)aryl(C₁-C₈)alkyl; (hetero)aryl(C₁-C₈)alkyl(hetero)aryl; or (hetero)cycloalkyl(C₁-C₈)alkyl; and more preferentially aryl(C₁-C₆)alkyl such as phenyl(C₁-C₆)alkyl;

more particularly, the polyacids are chosen from the triacids derived from the groups defined in a), in particular C₂-C₆;

(2) aromatic or non-aromatic sulfocarboxylic acids comprising at least one carboxyl -C(O)-OH function and at least one sulfonic -S(O)₂-OH function such as **[HO-C(O)]_y-R_d-[S(O)₂-OH]_z** with **R_d** as defined previously for the polyacids; **y** and **z** being integers greater than or equal to 1, the sum **y + z** preferably being greater than or equal to 2 such as equal to 3; sulfocarboxylic acids, preferably being C₂-C₈, the sulfonic group being

separated from the carboxylic acid groups(s) by a polyvalent (C₁-C₇)alkyl or aryl(C₁-C₄)alkyl chain, the alkyl part of which is linear or branched, optionally substituted by a hydroxyl group;

(3) aromatic or non-aromatic phosphocarboxylic acids comprising at least one carboxyl
 5 -C(O)-OH function and at least one phosphoric -O-P(O)(OH)₂ function such as **[HO-C(O)]_y-R_d-[O-P(O)(OH)₂]_z** with **R_d** as defined previously for polyacids; **y** and **z** being integers greater than or equal to 1, preferably the sum of y + z being greater than or equal to 2, such as equal to 3; in particular, the phosphocarboxylic acids being C₂-C₈, the phosphonic acid group being separated from the carboxylic acid group(s) by a
 10 polyvalent (C₁-C₆)alkyl or aryl(C₁-C₆)alkyl chain, the alkyl part of which is linear or branched and optionally substituted by a hydroxyl group.

5. The process as claimed in any one of the preceding claims, wherein the acid(s) are chosen from polyacids corresponding to the formula Rd[C(O)-OH]_x with x representing
 15 an integer greater than or equal to 3, preferably x ranging from 3 to 6, more particularly from 3 to 4 and especially such that x is equal to 3; and Rd represents a polyvalent group chosen from an acyclic, linear or branched, saturated or unsaturated C₁-C₈, in particular C₂-C₃ polyvalent hydrocarbon-based group, optionally substituted by one or more groups, preferably hydroxyl, the hydrocarbon-based group preferably being trivalent C₁-
 20 C₈, better still C₂-C₃, optionally substituted by one or more hydroxyl groups.

6. The process as claimed in any one of claims 1 to 4, wherein the organic acid(s) are chosen from monocarboxylic acids, dicarboxylic acids and tricarboxylic acids, in particular from glycolic acid, lactic acid, succinic acid, glutaric acid, itaconic acid, maleic
 25 acid and citric acid, preferably from maleic acid and citric acid, and preferably is citric acid.

7. The process as claimed in any one of the preceding claims, wherein the composition comprises one or more organic acids in a total content ranging from 1.5% to 20%, more
 30 preferably still from 2% to 15%, better still from 3% to 10% by weight, relative to total weight of the composition.

8. The process as claimed in any one of the preceding claims, characterized in that the composition comprises one or more conditioning agents, preferably chosen from, alone
 35 or as a mixture:

i) cationic surfactants;

ii) cationic polymers and/or amphoteric polymers;

iii) organosilicon compounds, and especially silicones and silanes;

iv) non-silicone liquid fatty substances, and especially: hydroxylated or non-hydroxylated liquid fatty acids; liquid fatty alcohols; mineral, plant or animal oils; liquid fatty esters; liquid hydrocarbons;

- 5 v) non-silicone solid fatty substances, and especially: solid fatty alcohols; solid fatty esters; ceramides; animal, plant or mineral waxes other than ceramides.

9. The process as claimed in any one of the preceding claims, characterized in that the composition comprises the conditioning agent(s) in a total amount ranging from 1% to
10 20% by weight and preferably from 4% to 15% by weight relative to the total weight of the composition.

10. The process as claimed in the preceding claim, which does not comprise a step of rinsing the hair after the step of removing the tensioning means.

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11. The process as claimed in any one of the preceding claims, characterized in that the step of placing the hair under tension using a tensioning means is carried out without applying heat using a heating means.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/067407

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K8/365 A61Q5/06
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 A45D

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 606 934 A2 (BEIERSDORF AG [DE]) 26 June 2013 (2013-06-26) paragraph [0007] table; page 8 - page 9 paragraph [0094] -----	1-11
X	WO 89/04180 A1 (GILLETTE CO [US]) 18 May 1989 (1989-05-18) page 2, line 23 - page 3, line 10 example 1 -----	1-11
X	EP 2 067 467 A2 (OREAL [FR]) 10 June 2009 (2009-06-10) paragraph [0001] paragraph [0310] - paragraph [0333] ----- -/-	1-11



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

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"&" document member of the same patent family

Date of the actual completion of the international search

26 July 2019

Date of mailing of the international search report

07/08/2019

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2019/067407

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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International application No

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