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(54) **Title:** PROCESS FOR SHAPING THE HAIR COMPRISING A STEP OF APPLYING A COMPOSITION COMPRISING A SUGAR OR SUGAR DERIVATIVE, 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 sugar(s) or sugar derivatives 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.

PROCESS FOR SHAPING THE HAIR COMPRISING A STEP OF APPLYING A COMPOSITION COMPRISING A SUGAR OR SUGAR DERIVATIVE, A HAIR-SHAPING STEP AND A LONG LEAVE-ON TIME

The present invention relates to a process for shaping the hair which comprises a step of applying a composition comprising a sugar or sugar derivative, 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 polymers”, which allow the formation of a coating film on the hair and thus ensure the hold 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.

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, 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 hold while at the 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 treatment process for the hair, 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 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 a sugar or sugar derivative and 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.

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

- a composition comprising one or more sugar(s) or sugar derivative(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 process for shaping the hair according to the invention is simple to use and it makes it possible to easily shape their 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 long-lasting results until the next shampooing operation.

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.

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".

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

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

The sugar(s) may be chosen from carbohydrates of the family of monosaccharides, oligosaccharides and homopolysaccharides.

The term "carbohydrate" is intended to mean any organic molecule containing a carbonyl group (aldehyde or ketone) and several hydroxyl groups (-OH), in their acyclic form.

Carbohydrates comprise:

(1) monosaccharides, which are simple, non-hydrolysable crystal-forming molecules. They are of two types: (a) aldoses comprising an aldehyde function on the first carbon and ketoses comprising a ketone function on the second carbon, in their acyclic form. They are also distinguished according to the number of carbon atoms they contain;

(2) oligosaccharides, which are saccharide polymers bearing a sequence of monosaccharides comprising from 2 to 10 monosaccharide units linked via glycoside bonds;

(3) polysaccharides, which are saccharide polymers bearing a sequence of more than 10 monosaccharide units (for example: amylose, amylopectin, cellulose, glycogen).

Among the oligosaccharides and polysaccharides, the following are distinguished:

- homopolysaccharides are carbohydrates of which the hydrolysis gives only one type of saccharide;
- heteropolysaccharides are carbohydrates of which the hydrolysis does not give just one type of saccharide;
- glycosides are polymers of monosaccharides and of non-carbohydrate molecule(s). By way of example of a glycoside, mention may be made of salicin.

(1) Monosaccharides

Among the monosaccharides that may be used according to the invention, mention may be made of:

- trioses containing 3 carbons: dihydroxyacetone, glyceraldehyde;
- tetroses containing 4 carbons: erythrose, threose, erythrulose;
- pentoses containing 5 carbons: ribose, arabinose, xylose, lyxose, ribulose, xylulose, deoxyribose;
- hexoses containing 6 carbons: allose, altrose, glucose, mannose, fucose, gulose, idose, galactose, talose, fuculose, psicose, fructose, sorbose, tagatose, quinovose, pneumose, rhamnose;
- heptoses containing 7 carbons: sedoheptulose, glucoheptose, idoheptulose, mannoheptulose, taloheptulose;
- octoses containing 8 carbons;
- monosaccharides having more than 8 carbons, for instance maltitol;

in their D or L form.

Among these monosaccharides, use may more preferentially be made of fructose, glucose, erythrose, xylose, lyxose, ribose, arabinose, galactose and mannose, more

particularly from erythrose, ribose, arabinose and mixtures thereof, preferably from erythrose.

Mention may also be made of derivatives thereof, in particular alkylated derivatives thereof, such as methylated derivatives, for instance methyl glucose, and also compounds containing one or more sugars, and mixtures thereof. As compound containing a sugar or a mixture of sugars, mention may be made of natural compounds such as honey, and polymers, for instance the product sold under the name Fucogel 1000 by the company Solabia (CTFA name Biosaccharide gum-1), which is a polymer containing fucose, galactose and galacturonic acid.

(2) Oligosaccharides

Among the oligosaccharides that may be used according to the invention, mention may be made of:

(i) disaccharides composed of two monosaccharide molecules and which may be reducing or non-reducing. The term “non-reducing disaccharide” is intended to mean any disaccharide of which the carbon 1 bearing the hemiacetal OH is involved in a bond, namely the hemiacetal function is therefore not free. The term “reducing disaccharide” is intended to mean any disaccharide of which the hemiacetal function is free.

Among the non-reducing disaccharides, mention may be made of sucrose and trehalose.

Among the reducing disaccharides, mention may be made of lactose, lactulose, maltose, cellobiose, isomaltose and melibiose;

(ii) trisaccharides composed of three monosaccharide molecules, such as, for example, raffinose, gentianose or melezitose;

(iii) dextrins and cyclodextrins which are mixtures of linear gluco-oligosaccharides (oligosaccharides of glucose) of which the glucose units are bonded by saccharide bonds of the α-(1,4) type, but of which the group is bonded by an α-(1,6) saccharide bond.

Among these oligosaccharides, use will more preferentially be made of trehalose, lactulose, maltose, in particular in their D form, and more particularly trehalose, in particular in its D form.

(3) Polysaccharides

The polysaccharides may in particular be chosen from polysaccharides derived from microorganisms, polysaccharides isolated from algae and polysaccharides of higher plants.

The polysaccharides are chosen from fructans, gellans, glucans, in particular pullulans and scleroglucans, modified or unmodified starches (such as those derived, for

example, from cereals, for instance wheat, corn or rice, from vegetables, for instance yellow pea, and tubers, for instance potato or cassava), amylose, amylopectin, glycogen, dextrans, celluloses and derivatives thereof (methylcelluloses, hydroxyalkylcelluloses, ethylhydroxyethylcelluloses, carboxymethylcelluloses), mannans, xylans, lignins, arabans, galactans, galacturonans, chitin, chitosans, glucuronoxylans, arabinoxylans, xyloglucans, glucomannans, pectic acids and pectins, arabinogalactans, carrageenans, agars, glycosaminoglycans, gum arabics, gum tragacanths, ghatti gums, karaya gums, carob gums, galactomannans such as guar gums and non-ionic derivatives thereof (hydroxypropyl guar) and ionic derivatives thereof, gums of biopolysaccharides of microbial origin, such as scleroglucan gum or xanthan gum, mucopolysaccharides and in particular chondroitin sulfates, and mixtures thereof.

These polysaccharides may be chemically modified, especially with urea or urethane groups or by hydrolysis, oxidation, esterification, etherification, sulfation, phosphatation, amination, amidation or alkylation reaction, or by several of these modifications.

The derivatives obtained may be anionic, cationic, amphoteric or non-ionic.

In general, the compounds of this type that may be used in the present invention are chosen from those described especially in Kirk-Othmer's Encyclopedia of Chemical Technology, Third Edition, 1982, volume 3, pp. 896-900, and volume 15, pp. 439-458, in Polymers in Nature by E.A. McGregor and C.T. Greenwood, published by John Wiley & Sons, Chapter 6, pp. 240-328, 1980, in the book by Robert L. Davidson entitled Handbook of Water-Soluble Gums and Resins published by McGraw Hill Book Company (1980) and in Industrial Gums – Polysaccharides and their Derivatives, edited by Roy L. Whistler, Second Edition, published by Academic Press Inc., the content of these three books being totally included the present application by way of reference.

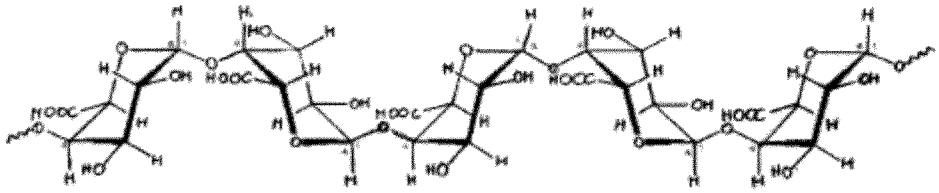
According to one preferred embodiment, the polysaccharide(s) may be chosen from pectins, alginates, carrageenans, xanthans, cationic chitosans and neutral guars.

Pectins, or more broadly pectic substances, are polysaccharides, linked to carbohydrates. They are substances that are exclusively of plant origin. Pectin is present in large amount in certain algae, and in currant, apple, quince and lemon seeds and zests. Pectins are extracted from the raw material by solubilization in acidic medium under hot conditions, and by precipitation from alcohol. The precipitate is then washed with a sodium hydroxide solution in order to obtain the desired pH.

Pectins are polymers of acid polysaccharides. Pectins are linear polymers of α-D-galacturonic acid (at least 65%) linked in positions 1 and 4 with a certain proportion of carboxylic groups esterified with a methanol group. About 20% of the sugars constituting the pectin molecule are neutral sugars (L-rhamnose, D-glucose, D-galactose, L-

arabinose, D-xylose). L-Rhamnose residues are found in all pectins, incorporated into the main chain in positions 1,2. They are responsible for the non-linear nature of the main chain (cf. chemical structure). Their molecular weight is about 10^5 g/mol.

Chemical structure (polygalacturonic acid):



Uronic acid molecules bear carboxyl functions. This function gives pectins the capacity for exchanging ions, when they are in COO- form. Divalent ions (in particular calcium) have the capacity of forming ionic bridges between two carboxyl groups of two different pectin molecules.

In the natural state, a certain proportion of the carboxylic groups are esterified with a methanol group. The natural degree of esterification of a pectin may range between 70% (apple, lemon) and 10% (strawberry) depending on the source used. Using pectins with a high degree of esterification, it is possible to hydrolyse the $-COOCH_3$ groups so as to obtain weakly esterified pectins. Depending on the proportion of methylated or non-methylated monomers, the chain is thus more or less acidic. HM (high-methoxy) pectins are thus defined as having a degree of esterification of greater than 50%, and LM (low-methoxy) pectins are defined as having a degree of esterification of less than 50%.

In the case of amidated pectins, the $-OCH_3$ group is substituted with an $-NH_2$ group.

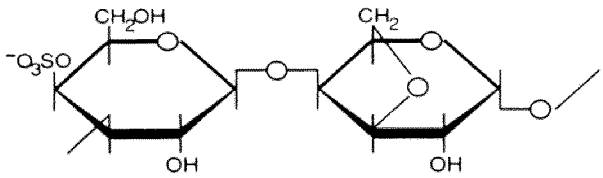
The degree of esterification influences the gelling properties of HM pectins. The ester group is less hydrophilic than the acid group and, consequently, an HM pectin (with a high degree of esterification) gels at a higher temperature than an LM pectin (with a low degree of esterification). The difference is reflected in terms of rapid, medium and slow gelling.

Pectins are especially sold by the company Cargill under the name Unipectine™, by the company CP-Kelco under the name Genu, and by Danisco under the name Grinsted Pectin.

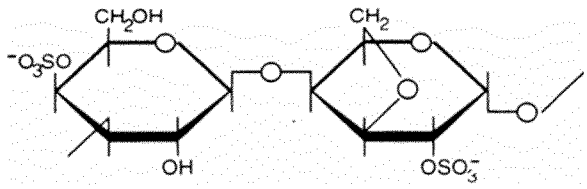
Carrageenans are anionic polysaccharides constituting the cell walls of various red algae (Rhodophyceae) belonging to the Gigartinacae, Hypneaceae, Furcellariaceae and Polyideaceae families. They are generally obtained by hot aqueous extraction from natural strains of said algae. These linear polymers, formed by disaccharide units, are composed of two D-galactopyranose units linked alternately by α(1,3) and β(1,4) bonds. They are highly sulfated polysaccharides (20-50%) and the α-D-galactopyranosyl residues may be in 3,6-anhydro form. Depending on the number and position of sulfate-ester groups on the repeating disaccharide of the molecule, several types of carrageenans are distinguished, namely: kappa-carrageenans, which bear one sulfate-ester group, iota-carrageenans, which bear two sulfate-ester groups, and lambda-carrageenans, which bear three sulfate-ester groups.

The carrageenans have in particular the following chemical structures:

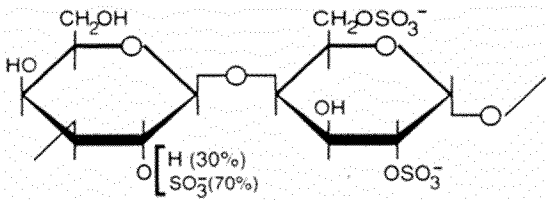
Kappa



Iota



Lambda



Carrageenans are composed essentially of potassium, sodium, magnesium, triethanolamine and/or calcium salts and of polysaccharide sulfate esters.

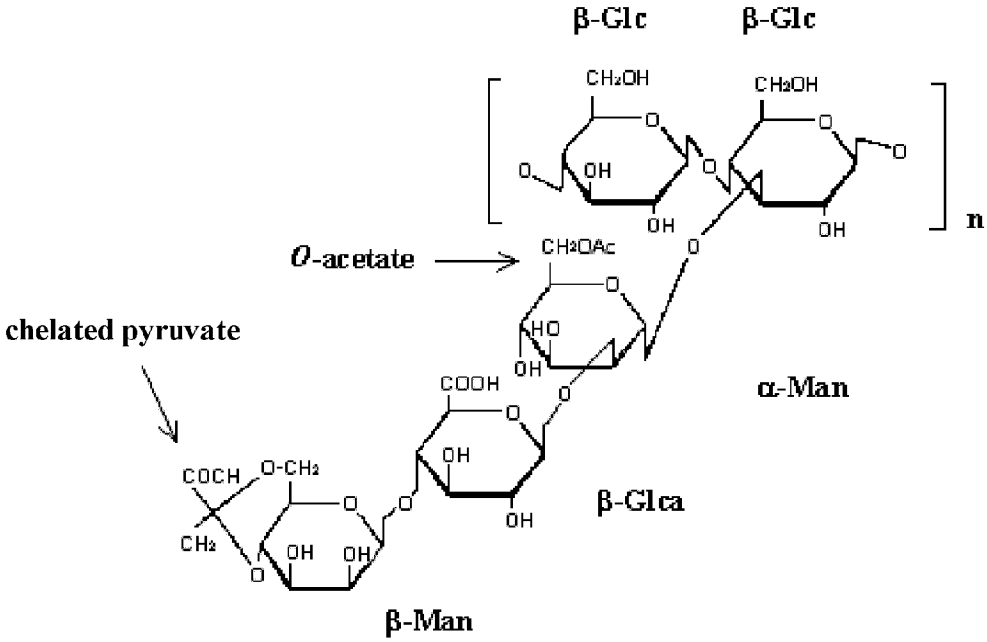
The physicochemical properties and the uses of these polysaccharides as gelling agents are based on their capacity to establish ball-helix conformational transitions as a function of the thermal and ionic environment [Kloareg et al. Oceanography and Marine Biology - An annual review 26: 259-315 (1988)].

Carrageenans are sold especially by the company SEPPIC under the name Solagum®, by the company Gelymar under the names Carragel®, Carralact® and

Carrasol®, by the company Cargill under the names Satiagel™ and Satiagum™, and by the company CP-Kelco under the names Genulacta®, Genugel® and Genuvisco®.

Xanthan is a heteropolysaccharide produced on the industrial scale by the aerobic fermentation of the bacterium Xanthomonas campestris. Its structure is constituted of a main chain of β(1,4)-linked β-D-glucoses, similar to cellulose. One glucose molecule in two carries a trisaccharide side chain composed of an α-D-mannose, of a β-D-glucuronic acid and of a terminal β-D-mannose. The internal mannose residue is generally acetylated on the 6 carbon. About 30% of the terminal mannose residues carry a pyruvate group linked in chelated form between the 4 and 6 carbons. The charged pyruvic acids and glucuronic acids are ionizable, and are thus responsible for the anionic nature of xanthan (negative charge down to pH 1). The content of the pyruvate and acetate residues varies according to the bacterial strain, the fermentation process, the conditions after fermentation and the purification stages. These groups can be neutralized in commercial products with Na^+, K^+ or Ca^{2+} ions (Satia, 1986). The neutralized form can be converted into the acid form by ion exchange or by dialysis of an acidic solution.

Chemical structure of the base unit of xanthan:



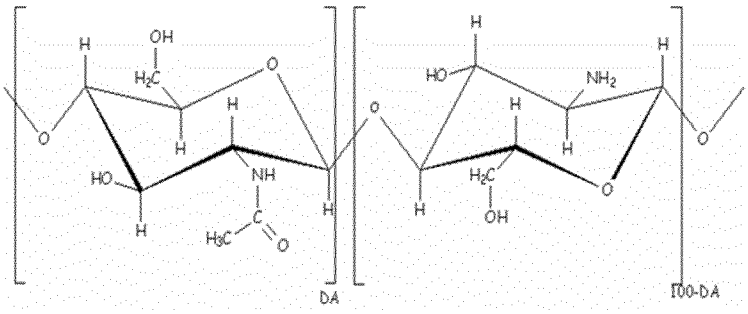
Source: Christensen et al. (1993).

Xanthan gums have a molecular weight of between 1 000 000 and 50 000 000 and a viscosity of between 0.6 and 1.65 Pa.s for an aqueous composition containing 1% of xanthan gum (measured at 25°C on a Brookfield viscometer of LVT type at 60 rpm).

Xanthan gums are represented, for example, by the products sold under the names Rhodicare by the company Rhodia Chimie, under the name Satiaxane™ by the company Cargill Texturizing Solutions (for the food, cosmetic and pharmaceutical industries), under the name Novaxan™ by the company ADM, and under the names Kelzan® and Keltrol® by the company CP-Kelco.

Chitosan is a polysaccharide composed of the random distribution of ß(1,4)-linked D-glucosamine (deacetylated unit) and of N-acetyl-D-glucosamine (acetylated unit). It is produced by chemical deacetylation (in an alkaline medium) or enzymatic deacetylation of chitin, the component of the arthropod (crustacean) exoskeleton or of the cephalopod (squid, etc.) endoskeleton or else of the fungal wall. This raw material is demineralized by treatment with hydrochloric acid, then deproteinated in the presence of sodium hydroxide or potassium hydroxide and, finally, discoloured using an oxidizing agent.

Chemical structure of chitosan:



The degree of acetylation (DA) is the percentage of acetylated units relative to the number of total units; it can be determined by Fourier transform infrared (FTIR) spectrometry or by titration with a strong base. The border between chitosan and chitin corresponds to a DA of 50%: below this the compound is called chitosan, above it, it is called chitin. Chitosan is soluble in an acidic medium, unlike chitin which is insoluble. It is important to distinguish between the degree of acetylation (DA) and the degree of deacetylation (DD). One is the inverse of the other, that is to say that chitosan having a DD of 85% has 15% of acetylated groups and 85% of amine groups on its chains.

The unmodified non-ionic guar gums are, for example, the products sold under the names Vidogum GH, Vidogum G and Vidocrem by the company Unipektin and under the name Jaguar by the company Rhodia, under the name Meypro® Guar by the company Danisco, under the name Viscogum™ by the company Cargill, and under the name Supercol® guar gum by the company Aqualon.

The hydrolysed non-ionic guar gums that may be used according to the invention are represented, for example, by the products sold under the name Meyprodor® by the company Danisco.

The modified non-ionic guar gums that may be used according to the invention are preferably modified with C_1 to C_6 hydroxyalkyl groups.

Among the hydroxyalkyl groups, mention may be made, by way of example, of hydroxymethyl, hydroxyethyl, hydroxypropyl and hydroxybutyl groups.

These guar gums are well known from the prior art and may be prepared, for example, by reacting corresponding alkene oxides, for instance, propylene oxides, with the guar gum so as to obtain a guar gum modified with hydroxypropyl groups.

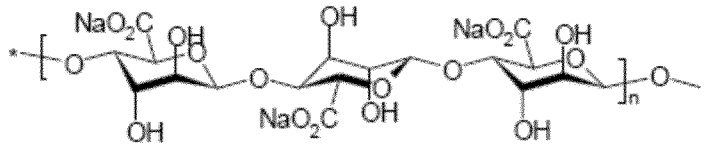
The degree of hydroxyalkylation, which corresponds to the number of alkylene oxide molecules consumed by the number of free hydroxyl functions present on the guar gum, preferably ranges from 0.4 to 1.2.

Such non-ionic guar gums optionally modified with hydroxyalkyl groups are sold, for example, under the trade names Jaguar HP 60, Jaguar HP 105 and Jaguar HP 120 (hydroxypropyl guar) by the company Rhodia or under the name N-Hance® HP (hydroxypropyl guar) by the company Aqualon.

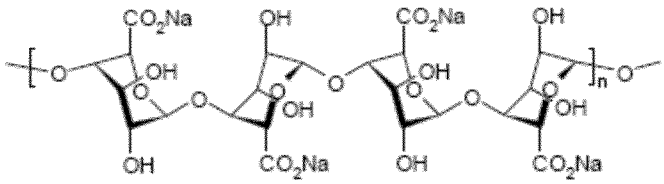
Alginates are water-soluble salts formed from alginic acid and from an alkali metal such as sodium, potassium or lithium, substituted cations of lower amine and of ammonium such as methylamine, ethanolamine, diethanolamine or triethanolamine. These alginates are water-soluble in aqueous medium at pH 4 but dissociate into alginic acid at a pH below 4.

Alginic acid, a natural substance resulting from brown algae or certain bacteria, is a polyuronic acid composed of 2 uronic acids linked by 1,4-glycosidic bonds: β-D-mannuronic acid (M) and α-L-glucuronic acid (G), having the following chemical structures:

β-D-mannuronate



α-L-glucuronate



These alginates are capable of crosslinking together in the presence of complexing agents, by forming ionic bonds between said complexing agents and the negatively charged group of the residue G. The formation of multiple crosslinks between several alginate molecules leads to the formation of a matrix that forms a gel which is insoluble in water.

Use is preferably made of alginic acid-based compounds that have a weight-average molecular mass ranging from 10 000 to 1 000 000, preferably from 15 000 to 500 000 and better still from 20 000 to 250 000.

According to one preferred embodiment of the invention, the alginate is a sodium or potassium alginate.

The alginates and derivatives are represented, for example, by the products sold under the names, Satialgine™, Cecalgum™ or Algogel™ by the company Cargill Products, under the name Protanal™ by the company FMC Biopolymer, under the name Grindsted® Alginate by the company Danisco, under the name Kimica Algin by the company Kimica, and under the names Manucol® and Manugel® by the company ISP.

According to one preferred embodiment, the polysaccharide(s) may be chosen from pectins.

The sugar derivatives may be chosen from alkyl glycosides of formula (II) below. For the purposes of the present invention, the term “alkylglycoside” is intended to mean an alkylmonosaccharide (degree of polymerization 1) or alkylpolysaccharide (degree of polymerization greater than 1).

The sugar derivatives that can be used in the invention are represented by general formula (I) below:

R1O-(R2O)t (G)v (I)

in which:

R1 represents a linear or branched alkyl and/or alkenyl group, comprising from about 8 to 24 carbon atoms, or an alkylphenyl group of which the linear or branched alkyl group comprises from 8 to 24 carbon atoms,

R2 represents an alkylene group containing from about 2 to 4 carbon atoms,

G represents a sugar unit chosen from dextrose, sucrose, maltose, maltotriose, lactose, cellobiose, mannose, ribose, dextran, talose, allose, xylose,

t denotes a value ranging from 0 to 10 and preferably 0 to 4 and

v denotes a value ranging from 1 to 15.

Alkylpolyglycosides that are preferred in the present invention are compounds of formula (II) in which:

R1denotes more particularly a saturated or unsaturated, linear or branched alkyl group comprising from 8 to 22 carbon atoms, R1 is preferably a branched alkyl comprising from 12 to 22 carbon atoms,

t denotes a value ranging from 0 to 3 and even more particularly is equal to 0,

G denotes dextrose, sucrose, maltose, maltotriose, lactose, cellobiose, mannose, ribose, dextran, talose, allose, xylose and preferably xylose.

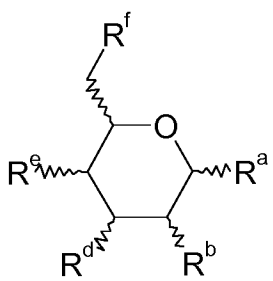
The degree of polymerization, i.e. the value of v in formula (II), may range from 1 to 15 and preferably from 1 to 4. The average degree of polymerization is more particularly between 1 and 2 and even more preferentially from 1.1 to 1.5.

The glycoside bonds between the sugar units are of 1-6 or 1-4 type and preferably of 1-4 type.

Examples of compounds of formula (I) are in particular octyldodecylxyloside such as for example Fluidanov 20X from SEPPIC.

The sugar(s) can also be chosen from amino sugars. The term “amino sugar” is intended to mean a sugar bearing at least amino group(s) NR1R2 with R1 and R2, which may be identical or different, representing i) a hydrogen atom, ii) a (C_1-C_6)alkyl group which is optionally substituted, preferably with one or more hydroxyl or NH_2 or aryl groups such as phenyl, vii) a (C_1-C_6)alkylcarbonyl radical such as an acetyl radical. Preferably, R1 and R2 independently represent a hydrogen atom or an acyl or alkenyl radical or a benzyl radical. According to one particular form of the invention, R1 and R2 are identical and denote a hydrogen.

More preferentially, the amino sugar(s) may be glucosamines of formula (A) and the organic or inorganic acid salts or base salts thereof, and the solvates thereof such as the hydrates:



(A)

in which formula (A):

- R^a, R^b, R^d, R^e and R^f, which are identical or different, represent a hydroxyl or (C_1-C_4)alkoxy group, the alkyl group of which may be optionally substituted, especially with one or more hydroxyl or carboxyl groups, and an NR1R2 group, with R1 and R2 as defined above, in particular R1 and R2 are chosen from a hydrogen atom and -C(O)-R'1 with R'1 denoting a (C1-C4)alkyl radical, in particular a methyl radical; preferably, R1 and R2 represent i) a hydrogen atom or ii) an (acetyl) group;

it being understood that at least one of the radicals R^a, R^b, R^d, R^e and R^f represents an NR1R2 group, preferably R^b represents an NR1R2 group such as NH_2, and R^a, R^d, R^e and R^f represent a hydroxyl group.

These compounds may be in free form, but are usually in salified form, in particular in the form of addition salts with organic or mineral acids as defined above, in particular hydrochloric acid, hydrobromic acid, sulfuric acid, pyruvic acid, phosphoric acid, and in particular hydrochloric acid.

Among the amino sugars, mention may in particular be made of D-glucosamine hydrochloride.

Preferably, the sugar(s) and/or sugar derivative(s) are chosen from erythrose, trehalose, lactulose and maltose, preferably in their D form, pectin, D-glucosamine hydrochloride, preferably from trehalose and pectin.

The sugar(s) and/or derivatives thereof can be present in the composition that can be used in the process of the invention in a content ranging from 0.1% to 30% by weight, preferably from 0.5% to 20% by weight, better still from 1% to 10% by weight, relative to the 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 fibres when the composition comprising same is applied to the fibres.

The conditioning effect may be constituted of any improvement of a cosmetic nature in the condition and/or appearance of keratin fibres, for instance, in a non-limiting manner, a visual and/or tactile sensory improvement, reinforcement of the keratin fibres, 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; and

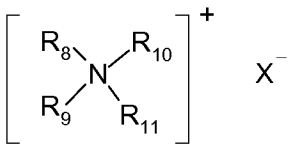
v) non-silicone solid fatty substances, and especially solid fatty alcohols; solid fatty esters; ceramides; animal, plant or mineral waxes other than ceramides.

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 mineral 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.

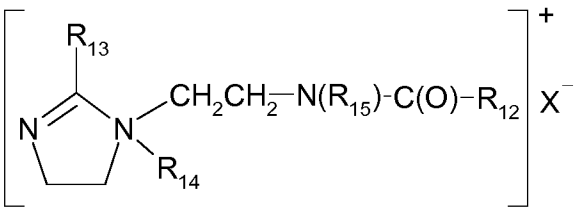
The aliphatic groups of R_8 to R_{11} may also comprise heteroatoms in particular such as oxygen, nitrogen, sulfur and halogens.

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 approximately from 12 to 22 carbon atoms, in particular behenyltrimethylammonium chloride, distearyldimethylammonium chloride, cetyltrimethylammonium chloride, benzyldimethylstearylammonium chloride, or else, secondly, distearoylethylhydroxyethylmethylammonium methosulfate, dipalmitoylethylhydroxyethylammonium methosulfate or distearoylethylhydroxyethylammonium methosulfate, or else, lastly, palmitylamidopropyltrimethylammonium chloride or stearamidopropyldimethyl(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:



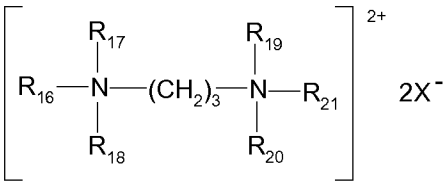
(A5)

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;
- R_{13} represents a hydrogen atom, a C_1-C_4 alkyl group or an alkenyl or alkyl group comprising from 8 to 30 carbon atoms;
- R_{14} represents a C_1-C_4 alkyl group;
- R_{15} represents a hydrogen atom or a C_1-C_4 alkyl group;
- X^- represents an organic or mineral anionic counterion, such as that chosen from halides, phosphates, acetates, lactates, (C_1-C_4)alkyl sulfates, (C_1-C_4)alkyl and (C_1-C_4)alkylaryl sulfonates.

Preferably, R_{12} and R_{13} denote a mixture of alkenyl or alkyl groups including from 12 to 21 carbon atoms, for example derived from tallow fatty acids, R_{14} denotes a methyl group and R_{15} 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:



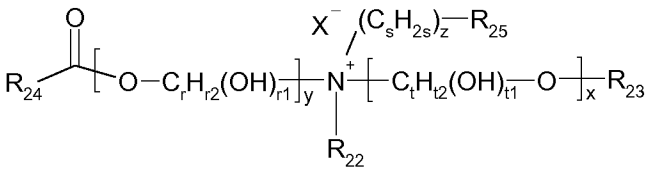
(A6)

in which formula (A6):

- R_{16} 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;
- R_{17} is chosen from hydrogen, an alkyl group comprising from 1 to 4 carbon atoms or a group $-(CH_2)_3-N^+(R_{16a})(R_{17a})(R_{18a})$, X^-;
- R_{16a}, R_{17a}, R_{18a}, R_{18}, R_{19}, R_{20} and R_{21}, 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 mineral anionic counterion, such as that chosen from halides, acetates, phosphates, nitrates, alkyl(C_1-C_4) sulfates, alkyl(C_1-C_4)- and alkyl(C_1-C_4)aryl-sulfonates, in particular methyl sulfate and ethyl sulfate.

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);

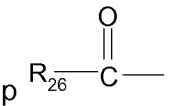
- quaternary ammonium salts containing one or more ester functions, such as those of formula (A7) below:



(A7)

in which formula (A7):

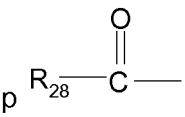
- R_{22} is chosen from C_1-C_6 alkyl groups and C_1-C_6 hydroxyalkyl or dihydroxyalkyl groups;
- R_{23} is chosen from:

- the group  ,

- saturated or unsaturated, linear or branched C_1-C_{22} hydrocarbon-based groups R_{27},

- a hydrogen atom,

- R_{25} is chosen from:



- the group ,

- saturated or unsaturated, linear or branched C_1-C_6 hydrocarbon-based groups R_{29},

- 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_7-C_{21} hydrocarbon-based groups;
- r, s and t, which may be identical or different, are integers ranging from 2 to 6,
- r1 and t1, which may be identical or different, are equal to 0 or 1, with r2+r1=2r and t1+t2=2t,
- 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 mineral 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}.

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.

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.

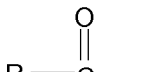
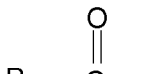
Preferably, r, s and t, which may be identical or different, are equal to 2 or 3, and even more particularly are equal to 2.

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 
  - methyl, ethyl or C_{14}-C_{22} hydrocarbon-based groups,
  - a hydrogen atom,
- R_{25} is chosen from:
  - the group 
  - 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 diacyloxyethyldimethylammonium, diacyloxyethylhydroxyethylmethylammonium, monoacyloxyethyldihydroxyethylmethylammonium, triacyloxyethylmethylammonium or monoacyloxyethylhydroxyethyldimethylammonium, 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.

These products are obtained, for example, by direct esterification of triethanolamine, triisopropanolamine, an alkyldiethanolamine or an alkyldiisopropanolamine, 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 by means of an alkylating agent such as an alkyl halide, preferably methyl or ethyl halide, a dialkyl sulfate, preferably methyl or ethyl sulfate, methyl methanesulfonate, methyl para-toluenesulfonate, glycol chlorohydrin or glycerol chlorohydrin.

Such compounds are sold, for example, under the names Dehyquart® by the company Henkel, Stepanquat® by the company Stepan, Noxamium® by the company 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.

Use may be made of behenoylhydroxypropyltrimethylammonium chloride sold 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 particularly preferred to choose cetyltrimethylammonium, behenyltrimethylammonium and dipalmitoylethylhydroxyethylmethylammonium salts, and mixtures thereof, and more particularly behenyltrimethylammonium chloride, cetyltrimethylammonium chloride, and dipalmitoylethylhydroxyethylammonium methosulfate, and mixtures thereof.

The cationic surfactants may be present in a total amount ranging from 0.01% to 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.

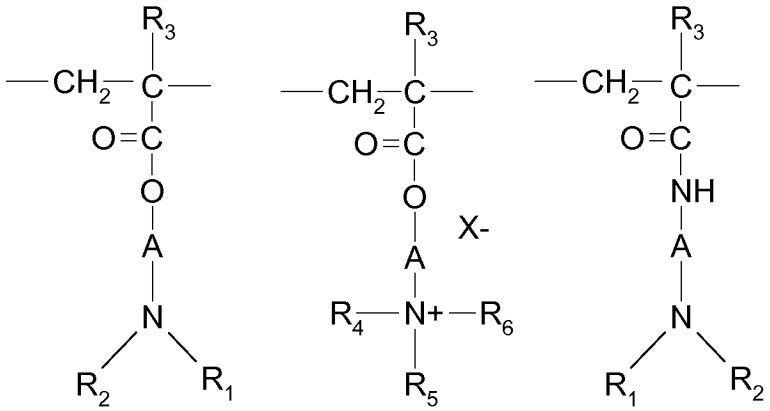
The term “cationic polymer” means any polymer comprising cationic groups and/or groups that can be ionized into cationic groups and not comprising any anionic groups and/or groups that can be ionized into anionic groups.

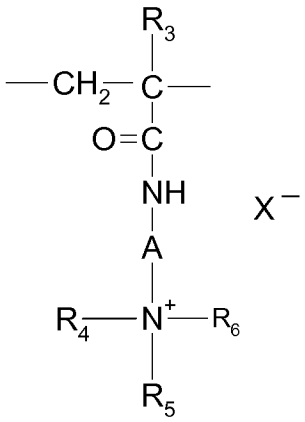
Preferably, the cationic polymer is hydrophilic or amphiphilic. The preferred cationic polymers are chosen from those that contain units comprising primary, secondary, tertiary and/or quaternary amine groups that may either form part of the main polymer chain or may be borne by a side substituent directly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

The cationic polymers that may be used preferably have a weight-average molar mass (Mw) 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 following formulae:





in which:

- R3, which may be identical or different, denote a hydrogen atom or a CH_3 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;
- 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;
- 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 with lower (C_1-C_4) alkyls, acrylic or methacrylic acids, vinyllactams 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 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 the products sold under the name Bina Quat P 100 by the company Ciba Geigy,

- 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 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/methacrylamidopropyldimethylamine copolymers, such as the copolymers 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. Use may be made more particularly of 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. 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 comprising 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 comprising quaternary ammonium groups are in particular 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.

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 piperazinyl units and of divalent alkylene or hydroxyalkylene radicals containing 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.

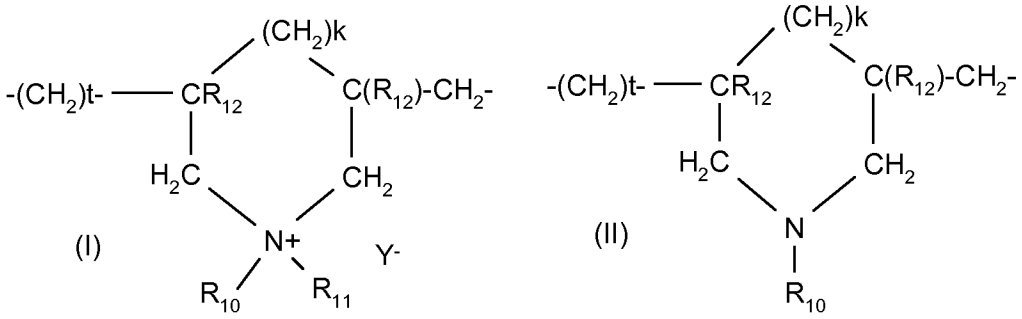
(4) water-soluble polyaminoamides prepared in particular by polycondensation of an acidic compound with a polyamine; these polyaminoamides can be crosslinked with an epihalohydrin, a diepoxide, a dianhydride, an unsaturated dianhydride, a bis-unsaturated derivative, a bis-halohydrin, a bis-azetidinium, 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 comprise 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 comprises 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 comprising 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:



in which

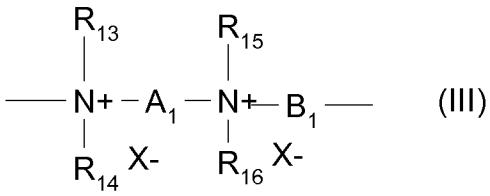
- k and t are equal to 0 or 1, the sum k + t being equal to 1;
- R12 denotes a hydrogen atom or a methyl radical;

- 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 piperidyl 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 diallyldimethylammonium 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:



(III)

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, 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;

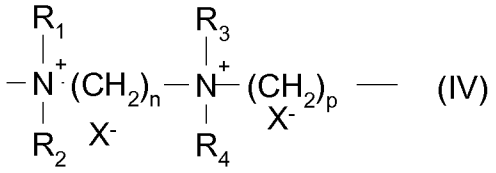
b) a bis-secondary diamine residue, such as a piperazine derivative;

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 (Mn) 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:

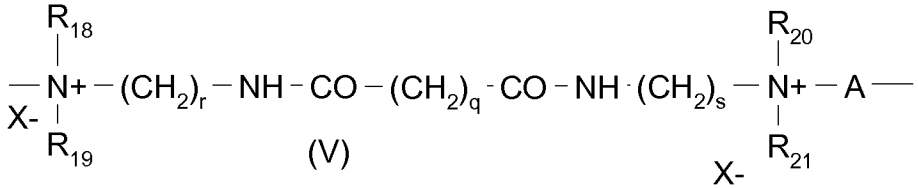


(IV)

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.

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):



(V)

in which:

- R_{18}, R_{19}, R_{20} and R_{21}, which may be identical or different, represent a hydrogen atom or a methyl, ethyl, propyl, β-hydroxyethyl, β-hydroxypropyl or -$CH_2CH_2(OCH_2CH_2)_pOH$ radical, in which p is equal to 0 or to an integer between 1 and 6, with the proviso that R_{18}, R_{19}, R_{20} and R_{21} do not simultaneously represent a hydrogen atom,

- 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,

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

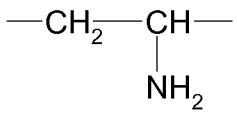
Examples that may be mentioned include the products Mirapol® A 15, Mirapol® AD1, Mirapol® AZ1 and Mirapol® 175 sold by the company Miranol.

(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 Polyethylene glycol (15) tallow polyamine in the CTFA dictionary.

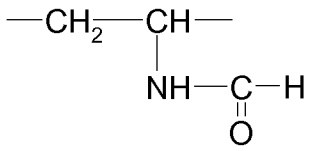
(12) polymers comprising in their structure:

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



(A)

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



(B)

In other words, these polymers may especially be chosen from homopolymers or copolymers comprising 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 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% 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 comprising units of formula (A) and optionally units of formula (B) are sold in particular under the name Lupamin by the company BASF, for instance, in a non-limiting way, 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 one 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 and comprising units as defined in the 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 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.

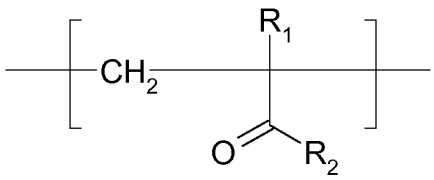
The amphoteric polymers may preferably be chosen from amphoteric polymers comprising the repetition of:

(i) one or more units derived from a (meth)acrylamide-type monomer,

(ii) one or more units derived from a (meth)acrylamidoalkyltrialkylammonium-type monomer, and

(iii) one or more units derived from a (meth)acrylic acid-type acid monomer.

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



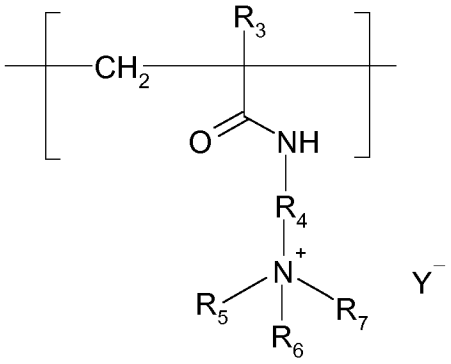
(Ia)

in which R_1 denotes H or CH_3 and R_2 is chosen from an amino, dimethylamino, tert-butylamino, dodecylamino and -NH-CH_2OH 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 R_1 denotes H and R_2 is an amino radical (NH_2) is particularly preferred. It corresponds to the acrylamide monomer per se.

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



(IIa)

in which:

- R_3 denotes H or CH_3,
- R_4 denotes a group $(CH_2)k$ with k being an integer ranging from 1 to 6 and preferably from 2 to 4;

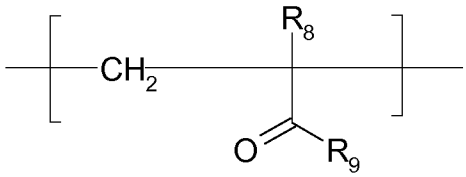
- R_5, R_6 and R_7, which may be identical or different, each denote an alkyl group containing from 1 to 4 carbon atoms;

- Y^- is an anion such as bromide, chloride, acetate, borate, citrate, tartrate, 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 (meth)acrylamidoalkyltrialkylammonium-type monomer of formula (IIa), the ones that are preferred are those derived from the methacrylamidopropyltrimethylammonium chloride monomer, for which R_3 denotes a methyl radical, k is equal to 3, R_5, R_6 and R_7 denote a methyl radical, and Y^- denotes a chloride anion.

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



(IIIa)

in which R_8 denotes H or CH_3 and R_9 denotes a hydroxyl radical or an –NH-$C(CH_3)_2$-CH_2-SO_3H radical.

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

Preferably, the unit derived from a monomer of (meth)acrylic acid type of formula (IIIa) is that derived from acrylic acid, for which R_8 denotes a hydrogen atom and R_9 denotes a hydroxyl radical.

The (meth)acrylic acid-type acidic monomer(s) 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).

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 (meth)acrylamide-type monomer.

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 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),
- 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 the units derived from a (meth)acrylamide-type monomer, a (meth)acrylamidoalkyltrialkylammonium-type monomer and a (meth)acrylic acid-type monomer such 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 (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 names Merquat 2003 and Merquat 2003 PR by 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 one of its derivatives, such as copolymers of (meth)acrylic acid and of dimethyldiallylammonium chloride. An example that may be mentioned is Merquat 280 sold by 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.

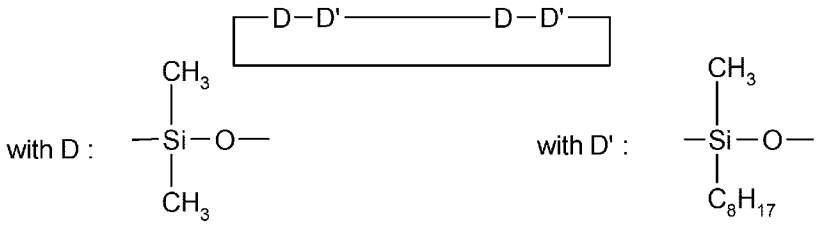
The volatile silicones are more particularly chosen from those with a boiling point of between 60°C and 260°C. Mention may be made of:

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;

- 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 5×10^{-6} m^2/s at 25°C, such as:

- 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.

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).

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

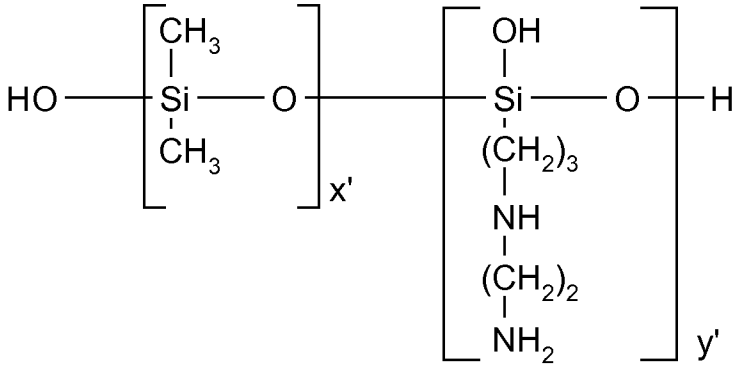
- polyethyleneoxy and/or polypropyleneoxy groups optionally comprising C_6-C_{24} alkyl groups, such as dimethicone copolyols and especially those sold by the company Dow Corning under the name DC 1248 or the oils Silwet® L 722, L 7500, L 77 and L 711 by the company Union Carbide; or (C_{12})alkylmethicone copolyols and especially 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;
- alkoxylated 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 Goldschmidt;
- hydroxylated groups, for instance polyorganosiloxanes containing a hydroxyalkyl function;
- acyloxyalkyl groups, such as the polyorganosiloxanes described in patent US-A-4 957 732;
- 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 μl 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):



(VI)

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

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

$$R'_aG_{3-a}\text{-}Si(OSiG_2)_n\text{-}(OSiG_bR'_{2-b})_m\text{-}O\text{-}SiG_{3-a}\text{-}R'_a \quad (VII)$$

in which:

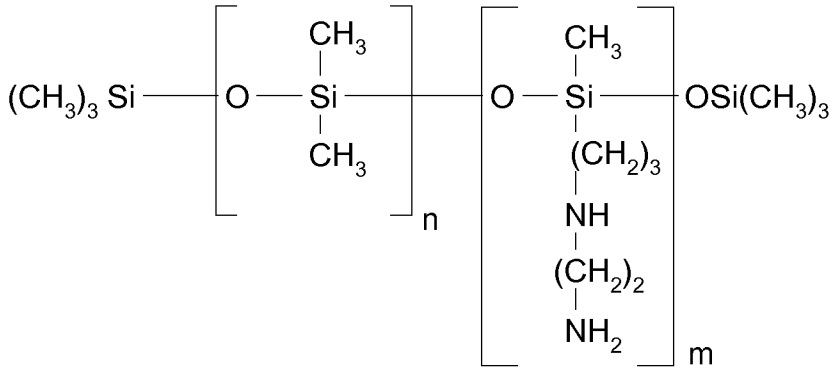
- G, which may be identical or different, denotes a hydrogen atom or a phenyl, OH, C_1-C_8 alkyl, for example methyl, or C_1-C_8 alkoxy, for example methoxy, group,
- a, which may be identical or different, denotes 0 or an integer from 1 to 3, in particular 0,
- b denotes 0 or 1, in particular 1,
- m 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;
- 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: $-NR''\text{-}Q\text{-}N(R'')_2$, $-N(R'')_2$, $-N^+(R'')_3\ A^-$, $N^+H(R'')_2\ A^-$, $N^+H_2(R'')\ A^-$, $-NR''\text{-}Q\text{-}N^+(R'')H_2\ A^-$, $-NR''\text{-}Q\text{-}N^+(R'')_2H\ A^-$ and $NR''\text{-}Q\text{-}N^+(R'')_3\ A^-$,

in which R", which may be identical or different, denotes hydrogen, phenyl, benzyl, or a saturated monovalent hydrocarbon-based radical, for example a C_1-C_{20} 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 anion.

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.

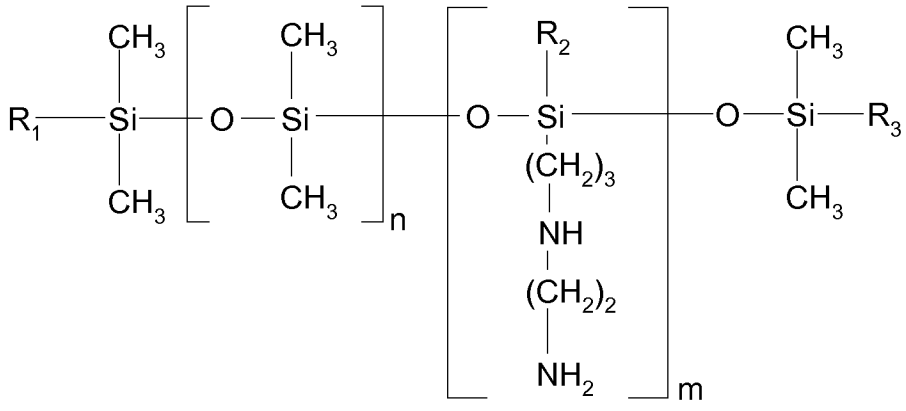
According to a first embodiment, the amino silicones corresponding to formula (VII) are chosen from the silicones known as "trimethylsilyl amodimethicone", corresponding to formula (VIII):



(VIII)

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:



(IX)

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;

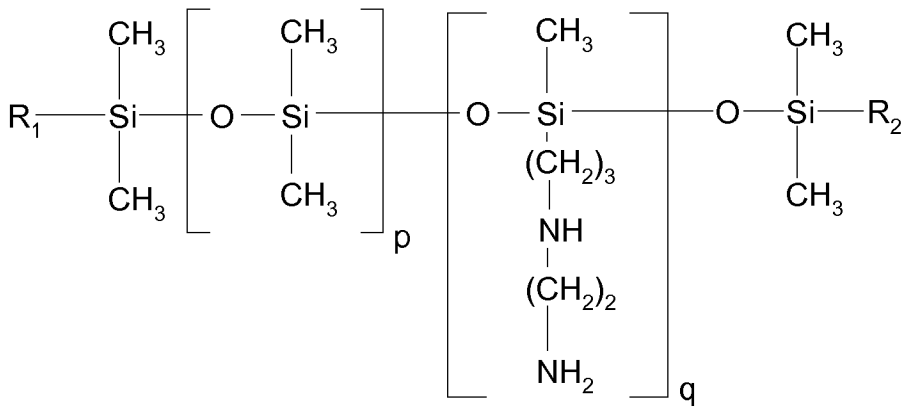
- R_1, R_2 and R_3, which may be identical or different, represent a hydroxyl or C_1-C_4 alkoxy radical, at least one of the radicals R_1 to R_3 denoting an alkoxy radical.

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 (Mw) of these silicones preferably ranges from 2000 to 1 000 000 g/mol and more particularly from 3500 to 200 000 g/mol.

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



(X)

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;

- R_1 and R_2, which are different, represent a hydroxyl or C_1-C_4 alkoxy radical, at least one of the radicals R_1 or R_2 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 (Mw) 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.

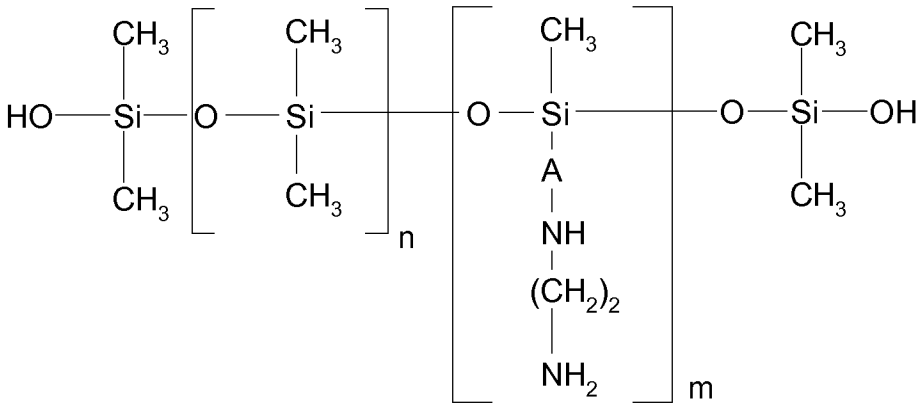
The commercial products comprising silicones of structure (IX) or (X) may include in their composition one or more other amino silicones of which the structure is different from formula (IX) or (X).

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 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 nanometres. 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:



(XI)

in which:

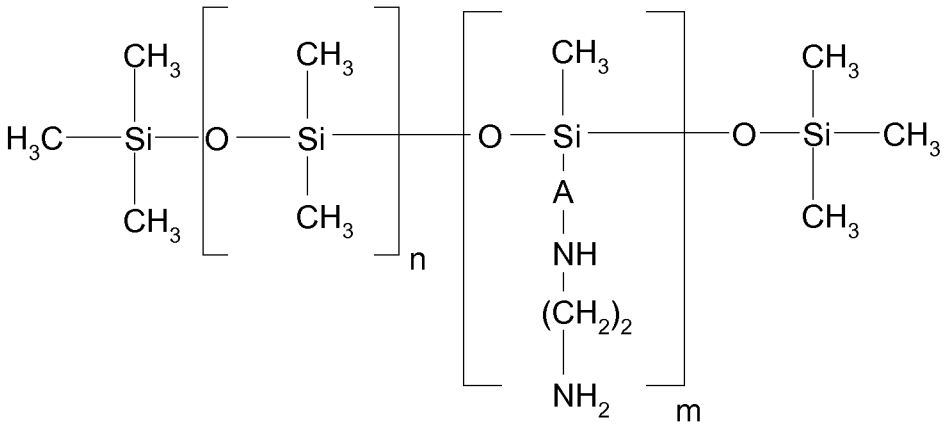
- m and n are numbers such that the sum (n + m) ranges from 1 to 2000 and in particular from 50 to 150, it being possible for n to denote a number from 0 to 1999 and notably from 49 to 149, and for m to denote a number from 1 to 2000 and notably from 1 to 10;

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

The weight-average molecular mass (Mw) 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:



(XII)

in which:

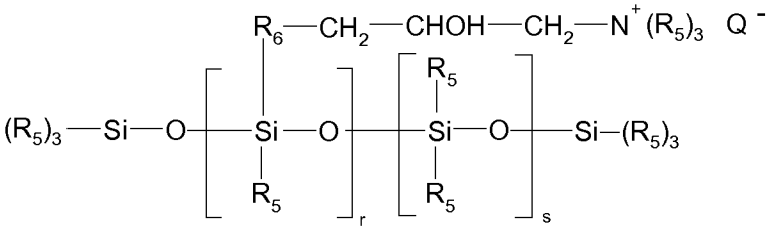
- m and n are numbers such that the sum (n + m) ranges from 1 to 2000 and in particular from 50 to 150, it being possible for n to denote a number from 0 to 1999 and notably from 49 to 149, and for m to denote a number from 1 to 2000 and notably from 1 to 10;

- 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.

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.

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



(XIII)

in which:

- R_5 represents a monovalent hydrocarbon-based radical containing from 1 to 18 carbon atoms, and in particular a C_1-C_{18} alkyl or C_2-C_{18} alkenyl, for example methyl, radical;

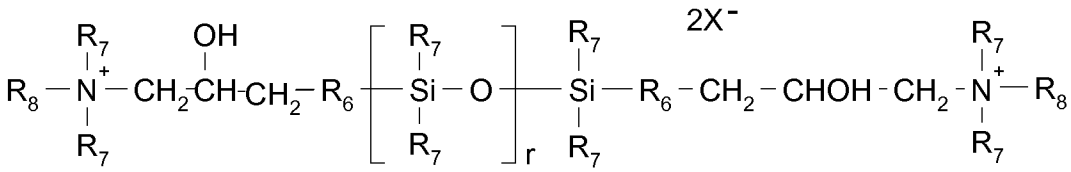
- R_6 represents a divalent hydrocarbon-based radical, in particular a C_1-C_{18} alkylene radical or a divalent C_1-C_{18}, for example C_1-C_8, alkyleneoxy radical linked to the Si via an SiC bond;

- 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 20 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;

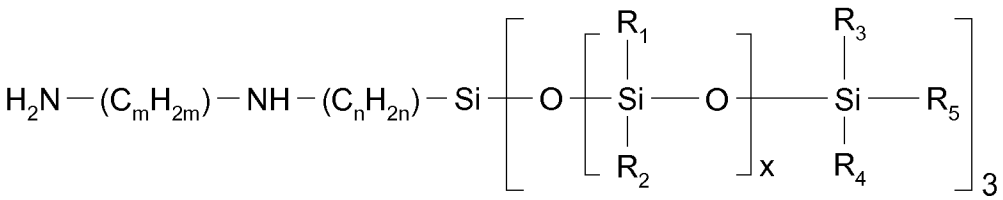
- R_6 represents a divalent hydrocarbon-based radical, notably a C_1-C_{18} alkylene radical or a divalent C_1-C_{18}, for example C_1-C_8, alkyleneoxy radical linked to the Si via an SiC bond;

- 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-NHCOR_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 polyoxyalkylene block comprising at least one amine group. Said silicones are preferably constituted of repeating units of the following general formulae:

$[-(SiMe_2O)_xSiMe_2\text{-}R\text{-}N(R'')\text{-}R'\text{-}O(C_2H_4O)_a(C_3H_6O)_b\text{-}R'\text{-}N(H)\text{-}R\text{-}]$

or alternatively

$[-(SiMe_2O)_xSiMe_2\text{-}R\text{-}N(R'')\text{-}R'\text{-}O(C_2H_4O)_a(C_3H_6O)_b\text{-}]$

in which:

- 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;
- R, which may be identical or different, represent a linear or branched divalent C_2-C_{12} 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 $CH_2CH_2CH_2OCH_2CH(OH)CH_2$-; preferentially, R denotes a radical $CH_2CH_2CH_2OCH_2CH(OH)CH_2$-;

- R', which may be identical or different, represent a linear or branched divalent C_2-C_{12} 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 -$CH_2CH_2CH_2OCH_2CH(OH)CH_2$-; preferentially, R' denotes -$CH(CH_3)$-CH_2-.

The siloxane blocks preferably represent from 50 mol% to 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.

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.

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

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

R1Si(OR2)z(R3)x(OH)y (I)

in which

- 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 (R = 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 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
- 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.

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 (R = 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.

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 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 NH2 or NHR (R = C1-C20, in particular C1-C6, alkyl, C3-C40 cycloalkyl or C6-C30 aromatic). In this variant, R1 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).

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:

$$(R_4)_mSi(OR_5)_n \qquad (III)$$

in which:

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,

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.

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.

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°C ± 5°C and at atmospheric pressure (1 atm). The term “soluble” is intended to mean the formation of a single macroscopic phase.

Preferably, the siliceous compound(s) 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.

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 agents 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, perhydrosqualene; 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, C_6-C_{16} alkanes; mention may be made of hexane, undecane, dodecane, tridecane, and isoparaffins, for instance isohexadecane, isododecane and isodecane;

- linear or branched hydrocarbons especially 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

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.

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).

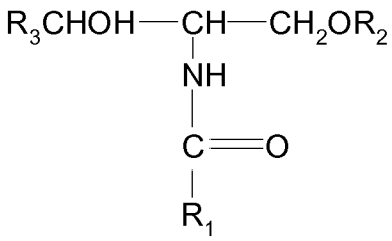
The solid fatty esters that may be used are preferably chosen from esters derived from C_9-C_{26} monocarboxylic acids and from C_9-C_{26} alcohols. Mention may be made of octyldodecyl behenate, isocetyl behenate, cetyl lactate, stearyl octanoate, octyl octanoate, cetyl octanoate, decyl oleate, myristyl stearate, octyl palmitate, octyl

pelargonate, octyl stearate, alkyl myristates such as cetyl myristate, myristyl myristate or stearyl myristate, and hexyl stearate.

Esters of C_4-C_{22} dicarboxylic or tricarboxylic acids and of C_1-C_{22} alcohols and esters of mono-, di- or tricarboxylic acids and of C_2-C_{26} 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.

Preferentially, it is preferred to use C_9-C_{26} alkyl palmitates, notably myristyl, cetyl or stearyl palmitates, and C_9-C_{26} alkyl myristates such as cetyl myristate, stearyl myristate and myristyl myristate or mixtures of myristyl palmitate and myristyl stearate.

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:

- R_1 denotes a linear or branched, saturated or unsaturated alkyl group, derived from C_{14}-C_{30} 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 C_{16}-C_{30} fatty acid;

- R_2 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;

- R_3 denotes a C_{15}-C_{26} hydrocarbon-based group, which is saturated or unsaturated in the alpha position, this group possibly being substituted with one or more C_1-C_{14} alkyl groups;

it being understood that, in the case of natural ceramides or glycoceramides, R_3 may also denote a C_{15}-C_{26} alpha-hydroxyalkyl group, the hydroxyl group optionally being esterified with a C_{16}-C_{30} alpha-hydroxy acid.

The ceramides more particularly preferred are the compounds for which R_1 denotes a saturated or unsaturated alkyl derived from C_{16}-C_{22} fatty acids; R_2 denotes a hydrogen atom and R_3 denotes a saturated linear C_{15} group.

Preferentially, use is made of ceramides for which R_1 denotes a saturated or unsaturated alkyl group derived from C14-C30 fatty acids; R_2 denotes a galactosyl or sulfogalactosyl group; and R_3 denotes a -CH=CH-$(CH_2)_{12}$-CH_3 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-linoleoylaminooctadecane-1,3-diol; 2-N-oleoylaminooctadecane-1,3-diol; 2-N-palmitoylaminooctadecane-1,3-diol; 2-N-stearoylaminooctadecane-1,3-diol; 2-N-behenoylaminooctadecane-1,3-diol; 2-N-[2-hydroxypalmitoyl]aminooctadecane-1,3-diol; 2-N-stearoylaminooctadecane-1,3,4-triol and in particular N-stearoylphytosphingosine; 2-N-palmitoylaminohexadecane-1,3-diol, N-linoleoyldihydrosphingosine, N-oleoyldihydrosphingosine, 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.

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 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.

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-fibre wax, sugarcane wax, olive-tree wax, rice wax, hydrogenated

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 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.

In general, the composition used in the process according to the invention may comprise the conditioning agent(s) in a total amount ranging from 1% to 20% by weight and preferably from 4% to 15% by weight relative to the total weight of composition.

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

i) cationic surfactants;

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; hydroxylated or non-hydroxylated liquid fatty acids, 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;

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.

The composition used in the process according to the invention may also comprise an organic acid and/or a lactone.

In particular, the organic acid(s) may be chosen from monocarboxylic acids, dicarboxylic acids and tricarboxylic acids, in particular from glycolic acid, lactic acid, succinic acid, glutaric acid, itaconic acid, maleic acid and citric acid, preferably from maleic acid and citric acid, and preferably is citric acid.

The lactone(s) may be chosen from sugar-derived polyhydroxylated lactones, preferably from gluconolactone, ribonolactone, galactonolactone, glucoheptonolactone, glucuronolactone, galacturonolactone, glucarolactone and galactarolactone, preferably gluconolactone.

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.

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 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 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 C_2 to C_4 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.

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 fibres, other than the acids of the invention.

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, alkaline carbonates or bicarbonates such as sodium or potassium carbonates and sodium or potassium bicarbonates, sodium hydroxide or potassium hydroxide, or mixtures thereof.

The organic alkaline agent(s) are preferably chosen from organic amines with a pKb 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 pKb corresponding to the function of highest basicity.

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.

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 C_1-C_8 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.

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

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.

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 colour to the keratin fibres, usually used for colouring human keratin fibres, 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 dyeing effect would be observed on the keratin fibres.

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

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

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.

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 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.

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 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.

The step of placing under mechanical tension can be carried out with a mechanical tensioning means chosen from rollers, head bands, elastics, buns, strips for braiding with or around the hair braiding, 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.

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 mechanical tensioning means are removed.

It is also possible to adjust the hairstyle with the fingers.

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

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 colouring 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

Example 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
pectin	-	1.0	-
VP/VA copolymer	-	-	2.0
Deionized water	qs 100	qs 100	qs 100
Fixing score*	1	2	3
Relaxation at T1h (cm)	9.5	6.5	8.5
Relaxation at T4h (cm)	11	7.5	11.5

*fixing: 1: none; 2: a little; 3: quite a lot; 4: a great deal

Each of the compositions C and T1 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 ((in order to simulate scalp temperature).

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 are then photographed at T0, after 1 hour (T1h) and after 4 hours (T4h) and the length of each lock was measured. The relaxation after 1 h and then 4 h corresponds to the difference in length between the lock at T0 and the lock after 1 h and 4 h, respectively.

It is noted that the process according to the invention using composition C makes it possible to improve the hold of the hairstyle compared with an identical process in which a conventional fixing polymer is used, this being even after 4 hours, and also makes it possible to improve the feel of the hair, which is more natural.

	T1	C1	T4
TREHALOSE	-	10.00	-
PROPYLENE GLYCOL	-	1.84	1.84
PHENOXYETHANOL	-	0.50	0.50
CAPRYLYL GLYCOL	-	0.20	0.20
PEG-150/DECYL ALCOHOL/SMDI COPOLYMER	-	0.72	0.72
CYCLOPENTASILOXANE (and) DIMETHICONOL	-	5.00	5.00
POLYQUATERNIUM-37 (and) PROPYLENE GLYCOL DICAPRYLATE/DICAPRATE (and) PPG-1 TRIDECETH-6	-	0.95	0.95
Fragrance	-	qs	qs
water	qs 100	qs 100	qs 100
Relaxation at T1h (cm)	9.5	6	10
Relaxation at T4h (cm)	11	9	12

Locks of straight natural caucasian hair of 2.7 g, 27 cm long, were treated according to the same protocol as that described above, by this time applying compositions C1, T1 and T4.

It is noted that the process according to the invention using composition C1 makes it possible to improve the hold of the hairstyle compared with an identical process in which an identical composition without trehalose is used, this being even after 4 hours.

Example 2

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

	Composition A1	Composition A2
Lactose	5	-
Trehalose	-	5
Guar gum	1	1
Citric acid qs	pH5	pH5
Deionized water	qs 100	qs 100
Comparative : Tensioning means during T3h (cm)	14,5	13
Invention : Tensioning means during T7h (cm)	10	10,5
Improvement (%)	45%	23.8%

Each of the compositions A1 and A2 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 (diameter 16 mm) and left to dry for 3 hours or 7 hours in a chamber at 37°C (in order to simulate scalp temperature).

The rollers were then removed.

Each lock was then suspended vertically in front of graph paper and they were photographed at T0. The length of each lock was measured.

More the length is short better is the fixing power.

It is noted that the process according to the invention using composition A1 or A2 with a tensioning means during more than 4 hours makes it possible to improve the fixing of the hairstyle compared with an identical composition but with tensioning means during lesser the 4 hours.

CLAIMS

1. Process for shaping the hair, in which:
- a composition comprising one or more sugar(s) or sugar derivatives 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.

2. Process according to the preceding claim, in which the composition and the tensioning means are left on the hair for at least six hours, preferably for at least eight hours, better still between eight hours and ten hours.

3. Process for shaping the hair, in which the tensioning means is chosen from rollers, head bands, elastics, buns, strips for braiding with or around the hair, headscarves.

4. Process according to any one of the preceding claims, in which the sugar(s) or sugar derivative(s) are chosen from carbohydrates of the family of monosaccharides, oligosaccharides or polysaccharides.

5. Process according to the preceding claim, in which the monosaccharide(s) are chosen from trioses having 3 carbons: dihydroxyacetone, glyceraldehyde; tetroses having 4 carbons: erythrose, threose, erythrulose; pentoses having 5 carbons: ribose, arabinose, xylose, lyxose, ribulose, xylulose, desoxyribose; hexoses having 6 carbons: allose, altrose, glucose, mannose, fucose, gulose, idose, galactose, talose, fuculose, psicose, fructose, sorbose, tagatose, quinovose, pneumose, rhamnose; heptoses having 7 carbons: sedoheptulose, glucoheptose, idoheptulose, mannoheptulose, taloheptulose; octoses having 8 carbons; monosaccharides having more than 8 carbons, such as for example maltitol; in their D or L form, preferably from fructose, glucose, erythrose, xylose, lyxose, ribose, arabinose, galactose, mannose, more particularly from erythrose, ribose, arabinose and mixtures thereof, more preferably erythrose, preferably in its D form.

6. Process according to Claim 4, in which the oligosaccharide(s) are chosen from:

(i) disaccharides composed of two monosaccharide molecules and which may be non-reducing, such as sucrose or trehalose, or reducing, such as lactose, lactulose, maltose, cellobiose, isomaltose or melibiose;

(ii) trisaccharides composed of three monosaccharide molecules, such as, for example, raffinose, gentianose or melezitose;

(iii) dextrins and cyclodextrins which are mixtures of linear gluco-oligosaccharides (oligosaccharides of glucose) of which the glucose units are bonded by saccharide bonds of the α-(1,4) type, but of which the group is bonded by an α-(1,6) saccharide bond, preferably chosen from trehalose, lactulose and maltose, preferably in their D form.

7. Process according to Claim 4, in which the polysaccharide(s) are chosen from polysaccharides derived from microorganisms, polysaccharides isolated from algae, polysaccharides of higher plants, and a mixture thereof.

8. Process according to the preceding claim, characterized in that the polysaccharide(s) are chosen from:

- polysaccharides derived from microorganisms, chosen from xanthan, pullulan, dextran and dextran sulfate, succinoglycan, scleroglucan and a mixture thereof,
- polysaccharides isolated from algae, chosen from galactans, furcellaran and a mixture thereof;
- polysaccharides of higher plants, chosen from
  - o a) homogeneous polysaccharides constituted of a single species of monosaccharides, such as glucosans, in particular native starches, modified starches, cellulose and its derivatives; fructosans, in particular inulin and its derivatives, such as in particular dicarboxy and carboxymethyl inulin, and a mixture thereof; and
  - o b) heterogeneous polysaccharides composed of several types of monosaccharides, such as gums, in particular cassia gums, acacia gum or gum arabic, karaya gum, konjac gum, tragacanth gum, and a mixture thereof; galactomannans and derivatives thereof, in particular guar, locust bean, fenugreek, tara gum and derivatives thereof among guar phosphate, hydroxypropyl guar, and a mixture thereof; LM and HM pectins and derivatives thereof; chitin and chitosan and derivatives thereof; glycosaminoglycans, in particular hyaluronic acid, chondroitin sulfate, dermatan sulfate, keratan sulfate or heparin and heparan sulfate; (poly C-5) xylans and derivatives thereof, preferably chosen from heterogeneous polysaccharides composed of several types of monosaccharides, and more preferably from alginates, carrageenans, xanthans, pectins, cationic chitosans and non-ionic guars, preferably from pectins.

9. Process according to any one of the preceding claims, in which the sugar derivative(s) are of general formula (II) below:

R1O-(R2O)t (G)v (II)

in which:

R1 represents a linear or branched alkyl and/or alkenyl group, comprising from about 8 to 24 carbon atoms, or an alkylphenyl group whose linear or branched alkyl group comprises from 8 to 24 carbon atoms,

R2 represents an alkylene group containing from about 2 to 4 carbon atoms,

G represents a sugar unit chosen from dextrose, sucrose, maltose, maltotriose, lactose, cellobiose, mannose, ribose, dextran, talose, allose, xylose, and preferably xylose,

t denotes a value ranging from 0 to 10 and preferably 0 to 4, and

v denotes a value ranging from 1 to 15.

10. Process according to any one of the preceding claims, in which the sugar(s) and/or sugar derivative(s) are chosen from amino sugars, preferably from glucosamines and salts thereof, preferably from D-glucosamine hydrochloride.

11. Process according to any one of the preceding claims, in which the sugar(s) and/or sugar derivative(s) are chosen from erythrose, trehalose, lactulose and maltose, preferably in their D form, D-glucosamine hydrochloride, pectin, preferably from trehalose and pectin.

12. Process according to any one of the preceding claims, in which the composition comprises one or more sugars or sugar derivatives in a total content ranging from 0.1% to 25%, preferably from 0.5% to 20%, more preferably from 1% to 15%, better still from 1% to 12% by weight, relative to total weight of the composition.

13. Process according to any one of the preceding claims, characterized in that the composition comprises one or more conditioning agents, preferably chosen from, alone 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: liquid fatty alcohols; mineral, plant or animal oils; hydroxylated or non-hydroxylated liquid fatty acids; liquid fatty esters; liquid hydrocarbons; and

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

14. Process according to any one of the preceding claims, characterized in that the composition comprises the conditioning agent(s) in a total amount ranging from 1% to 20% by weight and preferably from 4% to 15% by weight relative to the total weight of composition.

15. Process according to the preceding claim, which does not comprise a step of rinsing the hair after the step of removing the tensioning means.

16. Process according to 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/EP2019/067203

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61Q5/06 A61K8/73 A61K8/60
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)
A61Q A61K

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

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 September 2019	13/09/2019

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INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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