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(54) Title: COMPOSITION FOR TREATING KERATIN FIBERS COMPRISING HYDROPHOBIC SILICA AEROGEL PARTICLES, CROSSLINKED COPOLYMER, CLAY, AND SURFACTANT

(57) Abstract: A composition for treating keratin fibers comprises hydrophobic silica aerogel particles, at least one crosslinked copolymer of methacrylic acid and of a C₁-C₄ alkyl acrylate, at least one clay, and at least one surfactant chosen from anionic surfactants, nonionic surfactants, amphoteric or zwitterionic surfactants, or a mixture thereof.



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COMPOSITION FOR TREATING KERATIN FIBERS COMPRISING HYDROPHOBIC SILICA
AEROGEL PARTICLES, CROSSLINKED COPOLYMER, CLAY, AND SURFACTANT

5 The present invention relates to a composition for treating
keratin fibers, comprising hydrophobic silica aerogel particles, one or
more specific crosslinked copolymer(s) of acrylic acid, one or more
clay, and one or more surfactant(s).

10 The invention also relates to a cosmetic process for treating
keratin fibres using this composition.

 The invention further concerns the use of this composition in
the cosmetic treatment of keratin fibres and in particular the hair.

15 Clays are commonly used in cosmetics for their properties of
purifying, cleaning and absorbing excess grease or impurities
deposited on the skin.

 Clays are used in particular in products such as purifying
masks, cleansing products or in products for caring for the skin, in
particular for greasy skin.

20 FR2986425 disclosed a combination of a silica aerogel with
clays which makes it possible to overcome the disadvantages related to
the use of clays and to obtain products exhibiting a uniform
application and the absence of a "pilling" effect.

25 The composition of the prior art makes it possible to obtain a
uniform and pleasant application of the product without the appearance
of little balls at the various stages of use of the product, whether
during application, during drying or during removal, when a cleansing
product is concerned (such as a wash-off mask).

However, the combination as disclosed in the above mentioned patent application is not always satisfying. The inventors found it difficult to obtain a composition with sufficient stability for storage, for example, storage over 2 months.

5 Besides, the above mentioned prior art failed to disclose a composition with an excellent anti-greasiness effect on keratin fibers, in particular hair, and with sufficient stability for storage.

Accordingly, there is a real need to make available hair care compositions comprising silica aerogel particles and clay, and is stable
10 for storage.

Besides, there is a need for formulating the composition as mentioned above, with an excellent anti-greasy effect.

Lastly, the anti-greasy effect is long lasting.

The Applicant has discovered that it is possible to formulate
15 compositions for treating keratin fibres, which have the desired properties as listed above, by combining in these compositions hydrophobic silica aerogel particles, one or more specific crosslinked copolymer(s) of acrylic acid, one or more clay, and one or more surfactant(s).

20 The composition according to the invention is stable over time.

According to the present application, "stable over time" means that the composition after two months of storage at 25 to 45°C, shows no change in appearance, colour, odour, or viscosity.

Fibres treated using this composition are light, i.e., there is no
25 greasy or sticky feeling. There is no "build-up" conditioning effect on the hair after application of the composition of the invention. The "build-up effect" is a common drawback existing in hair care compositions, and which makes hair very lank and heavy.

Besides, the anti-greasy effect is long lasting.

By “anti-greasy effect” we intend to mean the keratin fibers are fresh and light after using the composition of the present invention, it is not greasy or sticky.

5 The anti-greasy effect is measured by the sebum migration on keratin fibers, in particular the hair.

The protocol of the measurement is as follow:

apply the composition of the present invention on dry swatch as a rinse-off shampoo;

10 heat oleic acid, which can be used as an artificial sebum (colored with red 27, 0.1% by weight, relative to the total weight of the oleic acid) and apply the heated and colored oleic acid on the root of the swatch treated by the composition of the present invention;

15 observe the distance of sebum migration using ruler at 20 minutes, 40 minutes, 60 minutes, 120 minutes and 24 hours. It is observed that the composition of the present invention has significantly slowed down the sebum migration, and thus slowed down the hair re-greasing.

Besides, this slow-down of sebum migration is long lasting.

20 Lastly, the effects mentioned above does not impact on the conditioning effect of the composition of the present invention. Fibers treated using the composition of the present invention are soft, smooth and detangle very easily.

25 The subject of the invention is thus a composition for treating keratin fibers, comprising:

- hydrophobic silica aerogel particles;
- at least one crosslinked copolymer of methacrylic acid and of a C₁-C₄ alkyl acrylate;
- at least one clay; and

- at least one surfactant chosen from anionic surfactants, nonionic surfactants, amphoteric or zwitterionic surfactants, or a mixture thereof.

5 The composition according to the invention is useful for treating keratin fibres, in particular human keratin fibres such as the hair.

The present invention also relates to a non-therapeutic process for treating keratin fibres, comprising the application to the said fibres the composition according to the invention.

10 The invention also relates to the use of the composition according to the invention as an anti-greasy shampoo.

Other subjects and characteristics, aspects and advantages of the invention will emerge even more clearly on reading the description and the examples that follows.

15 In that which follows and unless otherwise indicated, the limits of a range of values are included within this range, in particular in the expressions "of between" and "ranging from ... to ...".

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

20 The composition according to the present invention comprises hydrophobic silica aerogel particles.

Silica aerogels are porous materials obtained by replacing (by drying) the liquid component of a silica gel with air.

25 They are generally synthesized via a sol-gel process in a liquid medium and then dried, usually by extraction with a supercritical fluid, the one most commonly used being supercritical CO₂. This type of drying makes it possible to avoid shrinkage of the pores and of the material. The sol-gel process and the various drying operations are

described in detail in Brinker C.J. and Scherer G.W., Sol-Gel Science, New York, Academic Press, 1990.

The hydrophobic silica aerogel particles used in the present invention exhibit a specific surface per unit of weight (S_w) ranging from 500 to 1500 m^2/g , preferably from 600 to 1200 m^2/g and better still from 600 to 800 m^2/g , and a size, expressed as the volume-average diameter ($D[0.5]$), ranging from 1 to 1500 μm , better still from 1 to 1000 μm , preferably from 1 to 100 μm , in particular from 1 to 30 μm , more preferably from 5 to 25 μm , better still from 5 to 20 μm and even better still from 5 to 15 μm .

According to one embodiment, the hydrophobic silica aerogel particles used in the present invention have a size, expressed as volume-average diameter ($D[0.5]$), ranging from 1 to 30 μm , preferably from 5 to 25 μm , better still from 5 to 20 μm and even better still from 5 to 15 μm .

The specific surface per unit of weight can be determined by the nitrogen absorption method, known as the BET (Brunauer-Emmett-Teller) method, described in The Journal of the American Chemical Society, Vol. 60, page 309, February 1938, which corresponds to international standard ISO 5794/1 (appendix D). The BET specific surface corresponds to the total specific surface of the particles under consideration.

The sizes of the silica aerogel particles can be measured by static light scattering using a commercial particle size analyzer of MasterSizer 2000 type from Malvern. The data are processed on the basis of the Mie scattering theory. This theory, which is exact for isotropic particles, makes it possible to determine, in the case of nonspherical particles, an "effective" particle diameter. This theory is described in particular in the publication by Van de Hulst, H.C.,

"Light Scattering by Small Particles", Chapters 9 and 10, Wiley, New York, 1957.

According to an advantageous embodiment, the hydrophobic silica aerogel particles used in the present invention exhibit a specific surface per unit of weight (S_w) ranging from 600 to 800 m^2/g and a size, expressed as the volume-average diameter ($D[0.5]$), ranging from 5 to 20 μm and even better still from 5 to 15 μm .

The silica aerogel particles used in the present invention can advantageously exhibit a packed density (ρ) ranging from 0.04 g/cm^3 to 0.10 g/cm^3 and preferably from 0.05 g/cm^3 to 0.08 g/cm^3 .

In the context of the present invention, this density, known as the packed density, can be assessed according to the following protocol:

40 g of powder are poured into a graduated measuring cylinder; the measuring cylinder is then placed on the Stav 2003 device from Stampf Volumeter; the measuring cylinder is subsequently subjected to a series of 2500 packing actions (this operation is repeated until the difference in volume between 2 consecutive tests is less than 2%); and then the final volume V_f of packed powder is measured directly on the measuring cylinder. The packed density is determined by the ratio w/V_f , in this instance $40/V_f$ (V_f being expressed in cm^3 and w in g).

According to one embodiment, the hydrophobic silica aerogel particles used in the present invention exhibit a specific surface per unit of volume S_v ranging from 5 to 60 m^2/cm^3 , preferably from 10 to 50 m^2/cm^3 and better still from 15 to 40 m^2/cm^3 .

The specific surface per unit of volume is given by the relationship: $S_v = S_w \times \rho$; where ρ is the packed density, expressed in g/cm^3 , and S_w is the specific surface per unit of weight, expressed in m^2/g , as defined above.

Preferably, the hydrophobic silica aerogel particles according to the invention have an oil absorption capacity, measured at the wet point, ranging from 5 to 18 ml/g, preferably from 6 to 15 ml/g and better still from 8 to 12 ml/g.

5 The absorption capacity measured at the wet point, denoted W_p , corresponds to the amount of oil which it is necessary to add to 100 g of particles in order to obtain a homogeneous paste.

 It is measured according to the "wet point" method or method of determination of oil uptake of a powder described in the standard
10 NF T 30-022. It corresponds to the amount of oil adsorbed onto the available surface of the powder and/or absorbed by the powder by measurement of the wet point, described below:

 An amount $w = 2$ g of powder is placed on a glass plate and then the oil (isononyl isononanoate) is added dropwise. After addition
15 of 4 to 5 drops of oil to the powder, mixing is carried out using a spatula, and addition of oil is continued until conglomerates of oil and powder have formed. From this point, the oil is added at the rate of one drop at a time and the mixture is subsequently triturated with the spatula. The addition of oil is stopped when a firm and smooth paste is
20 obtained. This paste must be able to be spread over the glass plate without cracks or the formation of lumps. The volume V_s (expressed in ml) of oil used is then noted.

 The oil uptake corresponds to the ratio V_s/w .

 The aerogels used according to the present invention are
25 hydrophobic silica aerogels, preferably silylated silica (INCI name: silica silylate) aerogels.

 The term "hydrophobic silica" is understood to mean any silica, the surface of which is treated with silylating agents, for example with halogenated silanes, such as alkylchlorosilanes, siloxanes, in
30 particular dimethylsiloxanes, such as hexamethyldisiloxane, or

silazanes, so as to functionalize the OH groups with silyl groups Si-Rn, for example trimethylsilyl groups.

As regards the preparation of hydrophobic silica aerogel particles modified at the surface by silylation, reference may be made
5 to the document US 7 470 725.

Use will in particular be made of hydrophobic silica aerogel particles modified at the surface with trimethylsilyl groups (trimethylsiloxylated silica).

Mention may be made, as hydrophobic silica aerogels which
10 can be used in the invention, for example, of the aerogel sold under the name VM-2260 (INCI name: Silica silylate) by Dow Corning, the particles of which exhibit an average size of approximately 1000 microns and a specific surface per unit of weight ranging from 600 to 800 m²/g.

Mention may also be made of the aerogels sold by Cabot under
15 the references Aerogel TLD 201, Aerogel OGD 201, Aerogel TLD 203, Enova[®] Aerogel MT 1100 and Enova Aerogel MT 1200.

Use will more particularly be made of the aerogel sold under
the name VM-2270 (INCI name: Silica silylate) by Dow Corning, the
20 particles of which exhibit an average size ranging from 5 to 15 microns and a specific surface per unit of weight ranging from 600 to 800 m²/g.

The hydrophobic silica aerogel particles can be present in the composition according to the invention in a content as active material ranging from 0.05% to 3% by weight, preferably from 0.1% to 1% by
25 weight, with respect to the total weight of the composition.

The composition of the present invention comprises at least one polymer, which is a crosslinked copolymer of methacrylic acid and of a C₁-C₄ alkyl acrylate.

The methacrylic acid is preferably present in amounts ranging
30 from 20% to 80% by weight, more particularly from 25% to 70% by

weight and even more particularly from 35% to 60% by weight relative to the total weight of the copolymer.

The alkyl acrylate is preferably present in amounts ranging from 15% to 80% by weight, more particularly from 25% to 75% by weight and even more particularly from 40% to 65% by weight relative to the total weight of the copolymer. It is chosen especially from methyl acrylate, ethyl acrylate and butyl acrylate, but more particularly ethyl acrylate.

This copolymer is partially or totally crosslinked with at least one standard crosslinking agent. The crosslinking agents are especially polyunsaturated compounds, in particular polyethylenically unsaturated compounds. These compounds are especially polyalkenyl ethers of sucrose or of polyols, diallyl phthalates, divinylbenzene, allyl (meth)acrylate, ethylene glycol di(meth)acrylate, methylenebisacrylamide, trimethylolpropane tri(meth)acrylate, diallyl itaconate, diallyl fumarate, diallyl maleate, zinc (meth)acrylate, castor oil derivatives or polyol derivatives manufactured from unsaturated carboxylic acids.

Crosslinking agents that may also be used include unsaturated monomers comprising a reactive group capable of reacting with an unsaturation to form a crosslinked copolymer.

The content of crosslinking agent generally ranges from 0.01% to 5% by weight, preferably from 0.03% to 3% by weight and even more particularly from 0.05% to 1% by weight relative to the total weight of the copolymer.

According to one particularly preferred form, the copolymer of the invention may especially be in the form of dispersion in water. The number-average size of the copolymer particles in the dispersion is generally from 10 to 500 nm, preferably from 20 to 200 nm and more preferably from 50 to 150 nm.

These copolymers are described especially in patent application WO 01/76552.

5 Use will be made more particularly of the crosslinked methacrylic acid/ethyl acrylate copolymer in the form of an aqueous dispersion of 30% active material manufactured and sold under the name Carbopol Aqua SF-1 by the company Lubrizol, with a viscosity of about 700 mPa·s, measured by Brookfield RVF or RVT viscosity at 25°C with a speed of 20 rpm in 0.2% w/w neutralized aqueous solution.

10 The copolymer can be present in the composition according to the invention in a content as active material ranging from 0.01% to 5% by weight, preferably from 0.1% to 2% by weight, with respect to the total weight of the composition.

The composition according to the invention comprises at least one clay.

15 Clays are products which are already well known per se and which are described, for example, in the publication *Minéralogie des argiles* [Mineralogy of Clays], S. Caillère, S. Hénin and M. Rautureau, 2nd Edition 1982, Masson, the teaching of which is included herein by way of reference.

20 Mention may be made, among clays, as examples, of clays of the family of the smectites, such as laponite and montmorillonite, of the family of the kaolinites, such as kaolinite, dickite or nacrite, optionally modified clays of the family of halloysite, donbassite, antigorite, berthierine or pyrophyllite, montmorillonites, beidellite, 25 vermiculites, talc, stevensite, hectorites, bentonites, saponites, chlorites, sepiolite and illite.

The clay or clays present in the composition of the invention can be natural or synthetic. Natural clay is a sedimentary rock in large part composed of specific minerals, silicates, generally, of aluminum. 30 Kaolin is thus natural clay.

Clays can also be chemically modified by various compounds, such as acrylic acids, polysaccharides (for example carboxymethylcellulose) or organic cations.

5 Use is preferably made, in the context of the present invention, of clays which are cosmetically compatible with and acceptable to the hair, skin and/or scalp.

According to a specific embodiment of the present invention, the clay employed is chosen from kaolinite, montmorillonites, saponites, laponites, bentonites, and in particular hectorites, and illites.
10 Use will more particularly be made of mixtures of clays, and natural clays.

Mention may be made, as natural clay, of green clays, in particular rich in illite; clays rich in montmorillonite, known under the name of fuller's earth, or such as bentonites, or also white clays rich in
15 kaolinite. Mention may in particular be made, as bentonites, of those sold under the names "Bentone 38 VCG", "Bentone Gel CAO V", "Bentone 27 V" and "Bentone Gel MIO V" by Elementis.

Montmorillonites and smectites are hydrated aluminum and/or magnesium silicates. Mention may be made, as example, of the
20 montmorillonite sold under the name Gel White H by Rockwood Additives and of the purified smectite sold under the name Veegum Granules by Vanderbilt. Mention may also be made of the montmorillonite sold under the name Kunipia G4 by Kunimine and the sepiolite Pangel S9 sold by Tolsa.

25 Mention may be made, as examples of kaolinites, of the kaolins sold under the names Coslin C 100 by BASF Personal Care Ingredients or Kaolin Supreme by Imerys.

Talcs are hydrated magnesium silicates usually comprising aluminum silicate. The crystal structure of talc consists of repeated
30 layers of a sandwich of brucite between layers of silica. Mention may

be made, as examples, of micronized magnesium silicate with a particle size of 5 microns, sold under the name Micro Ace P3 by Nippon Talc, or the talcs sold under the names Rose Talc and Talc SG-2000 by Nippon Talc, J 68 BC by US Cosmetics (Miyoshi), Luzenac 00 and Luzenac Pharma M by Luzenac and Talc JA-46R by Asada Milling.

Mention may be made, as saponite, which belongs to the family of the montmorillonites, of synthetic saponite, in particular that sold by Kunimine under the Sumecton[®] name.

Mention may be made, as synthetic laponite, of Laponite XLG, sold by Rockwood.

Preferably, the clay of the composition of the present invention is kaolinites.

The clay or clays are present in the composition in accordance with the invention in an amount ranging from 0.01% to 20% by weight, in particular from 0.05% to 5% by weight, and more preferably from 0.1% to 3% by weight, with respect to the total weight of the composition.

The composition of the present invention comprises at least one surfactant, chosen from anionic surfactants, nonionic surfactants, amphoteric or zwitterionic surfactants, or a mixture thereof.

Anionic surfactant agent is understood to mean an amphiphilic compound in which the hydrophobic part carries an anionic hydrophilic group with a cationic counterion which is generally metallic (alkali metal, such as Na or K) or ammonium; the hydrophilic group is thus polar and capable of dissociating to give anions in aqueous solution.

More particularly the anionic part of the anionic surfactant is belonging to the group chosen from : C(O)OH, -C(O)O⁻, -SO₃H, -S(O)₂O⁻, -OS(O)₂OH, -OS(O)2O⁻, -P(O)OH₂, -P(O)₂O⁻, -P(O)O₂⁻, -P(OH)₂, =P(O)OH, -P(OH)O⁻, =P(O)O⁻, =POH, =PO⁻, the anionic part

comprising a cationic counter anion such as alkali or alkaline earth metal or organic cationic counter anion such as ammonium.

Mention may be made, as anionic surfactants, of surfactants comprising carboxylate, sulfate, sulfonate, sulfoacetate, sulfosuccinate, phosphate, isethionate, sarcosinate, glutamate, lactylate or taurate anionic groups, salts of fatty acids, salts of galactosiduronic acids, salts of ether carboxylic acids and their mixtures.

More particularly, the anionic surfactants according to the invention are chosen from:

• (C₆-C₃₀)alkyl sulfates, (C₆-C₃₀)alkyl ether sulfates, (C₆-C₃₀)alkylamido ether sulfates, alkylaryl polyether sulfates or monoglyceride sulfates; preferably for this type of anionic surfactants, (C₆-C₃₀)alkyl sulfates, (C₆-C₃₀)alkyl ether sulfates, alkylaryl polyether sulfates, or a mixture is used. Mentions may be made of sulfate of lauryl alcohol, ether of lauryl alcohol and alkylene oxide, containing from 1 to 50 alkylene oxide groups, or mixtures thereof.

More preferably, the anionic surfactants is chosen from sulfate of lauryl alcohol, sulfate of ether of lauryl alcohol and alkylene oxide containing from 1 to 4 alkylene oxide groups, especially ethylene oxide groups. For example, ammonium lauryl sulfate sold under the name Empicol[®] AL 30/FL3 by the company Huntsman, sodium lauryl sulfate sold under the name Texapon[®] LS 30 by the company BASF, sodium laureth sulfate containing in average 2.2 ethylene oxide groups that are sold by the company Cognis (BASF) under the name Texapon[®] AOS 225 UP, Rhodia under the name Rhodapex[®] esb-70/fla3, and Clariant under the name Genapol[®] LRO L'O, and sodium laureth sulfate containing in average 1 ethylene oxide group that is sold by the company Zhejiang Zanyu Technology under the name SLES (N1EO).

• (C₆-C₃₀)alkyl sulfonates, (C₆-C₃₀)alkylamidesulfonates, (C₆-C₃₀)alkylaryl sulfonates, α -olefin sulfonates, paraffin sulfonates;

- (C₆-C₃₀)alkyl phosphates;
- (C₆-C₃₀)alkyl sulfosuccinates, (C₆-C₃₀)alkyl ether sulfosuccinates or (C₆-C₃₀)alkylamido sulfosuccinates;
- (C₆-C₃₀)alkyl sulfoacetates;
- 5 • (C₆-C₂₄)acylsarcosinates;
- (C₆-C₂₄)acylglutamates;
- (C₆-C₃₀)alkylpolyglycoside carboxylic ethers; (C₆-C₃₀)alkylpolyglycoside sulfosuccinates;
- (C₆-C₃₀)alkyl sulfosuccinamates;
- 10 • (C₆-C₂₄)acyl isethionates;
- N-[(C₆-C₂₄)acyl] taurates;
- salts of fatty acids;
- (C₈-C₂₀)acyl lactylates;
- salts of (C₆-C₃₀)alkyl-D-galactosiduronic acids;
- 15 • salts of (C₆-C₃₀)alkyl polyoxyalkylenated ether carboxylic acids, of (C₆-C₃₀)alkylaryl polyoxyalkylenated ether carboxylic acids or of (C₆-C₃₀)alkylamido polyoxyalkylenated ether carboxylic acids;
- and their mixtures.

20 These anionic surfactants are advantageously found in the form of salts in the composition according to the invention, in particular of salts of alkali metals, such as sodium; of alkaline earth metals, such as, for example, magnesium; of ammonium salts; of amine salts; or of aminoalcohol salts. They might also, according to the conditions, occur in their acid form.

25 It should be noted that the alkyl or acyl radicals of these various compounds preferably comprise from 12 to 20 carbon atoms. Preferably, the aryl radical denotes a phenyl or benzyl group.

Furthermore, the polyoxyalkylenated anionic surfactants preferably comprise from 2 to 50 alkylene oxide groups, in particular ethylene oxide groups.

In accordance with a preferred embodiment of the invention, the anionic surfactant is chosen from sulfate of lauryl alcohol, sulfate of ether of lauryl alcohol and alkylene oxide containing from 1 to 4 alkylene oxide groups, or a mixture thereof.

More preferably, the anionic surfactant is chosen from ammonium lauryl sulfate, sodium lauryl sulfate, sodium laureth sulfate containing in average 2.2 ethylene oxide groups, or a mixture thereof.

Among the nonionic surfactants according to the invention, mention may be made, alone or as mixtures, of fatty alcohols, α -diols and alkylphenols, these three types of compound being polyethoxylated, polypropoxylated and/or polyglycerolated and containing a fatty chain comprising, for example, 8 to 40 carbon atoms, the number of ethylene oxide or propylene oxide groups possibly ranging especially from 2 to 50 and the number of glycerol groups possibly ranging especially from 2 to 30. Mention may also be made of copolymers of ethylene oxide and propylene oxide, condensates of ethylene oxide and of propylene oxide with fatty alcohols; polyethoxylated fatty amides preferably having from 2 to 30 mol of ethylene oxide, polyglycerolated fatty amides containing on average 1 to 5, and in particular 1.5 to 4 glycerol groups, ethoxylated fatty acid esters of sorbitan containing from 2 to 30 mol of ethylene oxide, fatty acid esters of sucrose, fatty acid esters of polyethylene glycol, alkylpolyglycosides, N-alkylglucamine derivatives, amine oxides such as (C₁₀-C₁₄)alkylamine oxides or N-acylaminopropylmorpholine oxides.

Preferably the nonionic surfactant is chosen from:

- (poly)ethoxylated fatty alcohols;
- glycerolated fatty alcohols;

- alkylpolyglycosides.

The term "fatty chain" means a linear or branched, saturated or unsaturated hydrocarbon-based chain comprising from 6 to 30 carbon atoms and preferably from 8 to 30 carbon atoms.

5 As regards the alkyl polyglycosides or APGs, these compounds are represented more particularly by the following general formula:



in which formula (A):

10 R_1 represents a linear or branched alkyl and/or alkenyl radical comprising approximately from 8 to 24 carbon atoms or an alkylphenyl radical, the linear or branched alkyl radical of which comprises from 8 to 24 carbon atoms;

R_2 represents an alkylene radical comprising approximately from 2 to 4 carbon atoms;

15 G represents a sugar unit comprising from 5 to 6 carbon atoms;

t denotes a value ranging from 0 to 10 and preferably from 0 to 4, and v denotes a value ranging from 1 to 15.

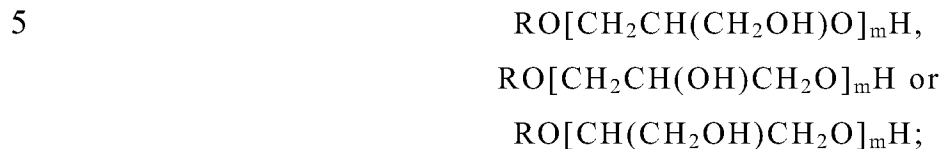
20 Compounds of formula (A) are represented in particular by the products sold by Cognis under the names Plantaren[®] (600 CS/U, 1200 and 2000) or Plantacare[®] (818, 1200 and 2000). Use may also be made of the products sold by Seppic under the names Triton CG 110 (or Oramix CG 110) and Triton CG 312 (or Oramix[®] NS 10), the products sold by BASF under the name Lutensol GD 70 or the products sold by Chem Y under the name AG10 LK.

25 Use may also be made, for example, of C₈-C₁₆ alkyl 1,4-polyglucoside as a 53% aqueous solution, sold by Cognis under the reference Plantacare[®] 818 UP.

As regards the mono- or polyglycerolated surfactants, they preferably comprise on average from 1 to 30 glycerol groups, more

particularly from 1 to 10 glycerol groups and in particular from 1.5 to 5.

The monoglycerolated or polyglycerolated surfactants are preferably chosen from the compounds of the following formulae:



in which formulae:

R represents a saturated or unsaturated, linear or branched
10 hydrocarbon-based radical comprising from 8 to 40 carbon atoms and preferably from 10 to 30 carbon atoms; m is an integer between 1 and 30, preferably between 1 to 10 and more particularly from 1.5 to 6; R may optionally comprise heteroatoms, for instance oxygen and nitrogen. In particular, R may optionally comprise one or more
15 hydroxyl and/or ether and/or amide groups. R preferably denotes optionally mono- or polyhydroxylated C₁₀-C₂₀ alkyl and/or alkenyl radicals.

Use may be made, for example, of the polyglycerolated (3.5 mol) hydroxylauryl ether sold under the name Chimexane[®] NF from
20 Chimex.

The (poly)ethoxylated fatty alcohols that are suitable for performing the invention are chosen more particularly from alcohols containing from 8 to 30 carbon atoms, and preferably from 12 to 22 carbon atoms.

25 The (poly)ethoxylated fatty alcohols more particularly contain one or more linear or branched, saturated or unsaturated hydrocarbon-based groups, comprising 8 to 30 carbon atoms, which are optionally substituted, in particular with one or more (in particular 1 to 4) hydroxyl groups. If they are unsaturated, these compounds may

comprise one to three conjugated or non-conjugated carbon-carbon double bonds.

The (poly)ethoxylated fatty alcohol(s) preferably have the following formula:



with

Ra representing a linear or branched C₈-C₄₀ alkyl or linear or branched C₈-C₄₀ and preferably C₈-C₃₀ alkenyl group, optionally substituted with one or more hydroxyl groups, and

10 n is an integer between 1 and 200 inclusive, preferentially between 2 and 50 and more particularly between 8 and 30, such as 20.

The (poly)ethoxylated fatty alcohols are more particularly fatty alcohols comprising from 8 to 22 carbon atoms, oxyethylenated with 1 to 30 mol of ethylene oxide (1 to 30 OE). Among these, mention may be made more particularly of lauryl alcohol 2 OE, lauryl alcohol 3 OE, 15 decyl alcohol 3 OE, decyl alcohol 5 OE and oleyl alcohol 20 OE.

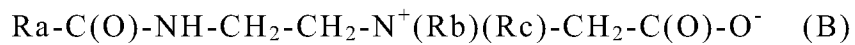
Mixtures of these (poly)oxyethylenated fatty alcohols may also be used.

The amphoteric or zwitterionic surfactant(s) that may be used 20 in the present invention may especially be optionally quaternized secondary or tertiary aliphatic amine derivatives containing at least one anionic group, for instance a carboxylate, sulfonate, sulfate, phosphate or phosphonate group, and in which the aliphatic group or at least one of the aliphatic groups is a linear or branched chain 25 comprising from 8 to 22 carbon atoms.

Mention may be made in particular of (C₈-C₂₀)alkylbetaines, sulfobetaines, (C₈-C₂₀ alkyl)amido(C₂-C₈ alkyl)betaines and (C₈-C₂₀ alkyl)amido(C₂-C₈ alkyl)sulfobetaines.

Among the optionally quaternized secondary or tertiary 30 aliphatic amine derivatives that may be used, as defined above,

mention may also be made of the compounds of respective structures (B) and (C) below:



in which formula (B):

5 Ra represents a C₁₀-C₃₀ alkyl or alkenyl group derived from an acid Ra-C(O)-OH preferably present in hydrolysed coconut oil, or a heptyl, nonyl or undecyl group;

Rb represents a β-hydroxyethyl group; and

Rc represents a carboxymethyl group;

10 and



in which formula (C):

B represents -CH₂CH₂OX';

B' represents -(CH₂)_z-Y', with z = 1 or 2;

15 X' represents the group -CH₂-C(O)-OH, -CH₂-C(O)-OZ', -CH₂CH₂-C(O)-OH, -CH₂-CH₂-C(O)-OZ', or a hydrogen atom;

Y' represents -C(O)-OH, -C(O)-OZ' or the group -CH₂-CH(OH)-SO₃H or -CH₂-CH(OH)-SO₃Z';

20 Z' represents an ion derived from an alkali or alkaline-earth metal, such as sodium, potassium or magnesium; an ammonium ion; or an ion derived from an organic amine and in particular from an aminoalcohol, such as mono-, di- and triethanolamine, mono-, di- or triisopropanolamine, 2-amino-2-methyl-1-propanol, 2-amino-2-methyl-1,3-propanediol and tris(hydroxymethyl)aminomethane.

25 Ra' represents a C₁₀-C₃₀ alkyl or alkenyl group of an acid Ra'C(O)-OH preferably present in coconut oil or in hydrolysed linseed oil, an alkyl group, especially of C₁₇ and its iso form, or an unsaturated C₁₇ group.

30 The compounds corresponding to formula (C) are preferred. These compounds are also classified in the CTFA dictionary, 5th edition, 1993, under the names disodium cocoamphodiacetate,

disodium lauroamphodiacetate, disodium caprylamphodiacetate,
disodium caprylamphodiacetate, disodium cocoamphodipropionate,
disodium lauroamphodipropionate, disodium caprylamphodipropionate,
disodium caprylamphodipropionate, lauroamphodipropionic acid,
5 cocoamphodipropionic acid.

By way of example, mention may be made of the N-cocoylamidocarboxymethyl glycinate of an alkali metal such as sodium, or cocoamphodiacetate sold by the company Rhodia under the trade name Miranol[®] C2M concentrate.

10 Among all the amphoteric or zwitterionic surfactants mentioned above, use is preferably made of cocoylamidopropylbetaine, cocoylbetaine and the N-cocoylamidocarboxymethyl glycinate of an alkali metal such as sodium.

According to a preferred embodiment, the composition of the
15 present invention comprises at least one surfactant chosen from anionic surfactants.

More preferably the composition of the present invention
comprises at least one surfactant chosen from (C₆-C₃₀)alkyl sulfates,
(C₆-C₃₀)alkyl ether sulfates, alkylaryl polyether sulfates, or a mixture
20 thereof.

According to a preferred embodiment, the surfactant of the
composition of the present invention is chosen from sulfate of lauryl
alcohol, sulfate of ether of lauryl alcohol and alkylene oxide
containing from 1 to 4 alkylene oxide groups, or a mixture thereof.

25 More preferably, the surfactant of the composition of the present invention is chosen from ammonium lauryl sulfate, sodium lauryl sulfate, sodium laureth sulfate containing in average 2.2 ethylene oxide groups, or a mixture thereof.

The composition according to the invention preferably comprises from 1% to 30% by weight, in particular from 5% to 20% by weight of the surfactant, relative to the total weight of the composition.

5 Preferably, the composition according to the present invention preferably comprises from 1% to 30% by weight, in particular from 5% to 20% by weight of at least one anionic surfactant, relative to the total weight of the composition.

According to a preferred embodiment, the composition of the present invention comprises:

- 10 - from 0.05% to 3% by weight of hydrophobic silica aerogel particles;
- from 0.01% to 5% by weight of at least one crosslinked copolymer of methacrylic acid and of a C₁-C₄ alkyl acrylate;
 - from 0.05% to 5% by weight of at least one clay; and
- 15 - from 5% to 20% by weight of at least one surfactant chosen from anionic surfactants, nonionic surfactants, amphoteric or zwitterionic surfactants, or a mixture thereof.

According to a preferred embodiment, in the crosslinked copolymer of methacrylic acid and of a C₁-C₄ alkyl acrylate, relative to the total weight of the compolymer:

- 20 - methacrylic acid is present in an amount ranging from 20% to 80% by weight, more particularly from 25% to 70% by weight and even more particularly from 35% to 60% by weight;
- C₁-C₄ alkyl acrylate is present in an amount ranging from
- 25 15% to 80% by weight, more particularly from 25% to 75% by weight and even more particularly from 40% to 65% by weight.

The composition according to the present invention may further comprise one or more oil(s).

30 The oils that are suitable for the present invention may be hydrocarbon-based, silicone-based or fluorine-based.

According to the invention, the term "silicone oil" refers to an oil including at least one silicon atom, and in particular at least on Si-O group.

The term "fluorine oil" refers to an oil including at least one fluorine atom.

5 The term "hydrocarbon oil" refers to an oil containing primarily hydrogen and carbon atoms.

The oils may optionally include oxygen, nitrogen, sulfur and/or phosphorus atoms, for example, in the form of hydroxyl or acid radicals.

10 Preferably, the composition of the present invention may further comprise one or more hydrocarbon oil(s).

Mentions of the hydrocarbon oils can be made of synthetic esters, in particular with the formula R_1COOR_2 , in which R_1 represents a linear or branched fatty acid residue containing from 1 to 40 carbon atoms, and R_2 represents a hydrocarbon-based chain, in particular a
15 branched chain, containing from 1 to 40 carbon atoms provided that R_1 and R_2 is greater than or equal to 10.

The esters may in particular be selected from fatty acid and alcohol esters, for instance: cetostearyl octanoate, isopropyl alcohol esters, such as isopropyl myristate, isopropyl palmitate, ethyl
20 palmitate, 2-ethylhexyl palmitate, isopropyl stearate or isostearate, isostearyl isostearate, octyl stearate, hydroxylated esters, for instance isostearyl lactate, octyl hydroxystearate, diisopropyl adipate, heptanoates, and especially isostearyl heptanoate, alcohol or polyalcohol octanoates, decanoates or ricinoleates, for instance
25 propylene glycol dioctanoate, cetyl octanoate, tridecyl octanoate, 2-ethylhexyl 4-diheptanoate and palmitate, alkyl benzoate, polyethylene glycol diheptanoate, propylene glycol 2-diethylhexanoate, and mixtures thereof, C_{12} - C_{15} alkyl benzoates, hexyl laurate, neopentanoic acid esters, for instance isodecyl neopentanoate, isotridecyl
30 neopentanoate, isostearyl neopentanoate, or octyldodecyl neopentanoate, isononanoic acid esters, for instance isononyl

isononanoate, isotridecyl isononanoate and octyl isononanoate, hydroxylated esters such as isostearyl lactate and diisostearyl malate.

Advantageously, when exists, the oil is present in an amount ranging from 0.01% to 10% by weight, preferably from 0.05% to 5%
5 by weight, relative to the total weight of the composition.

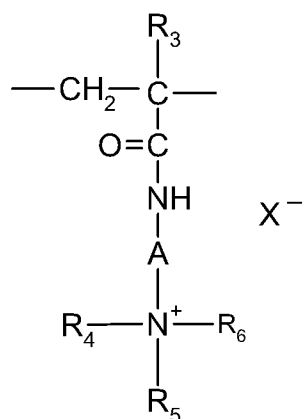
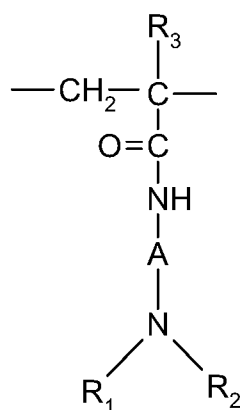
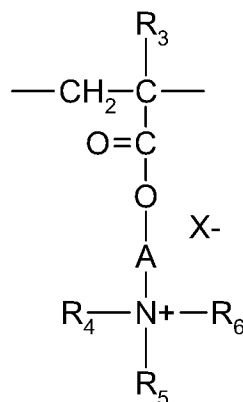
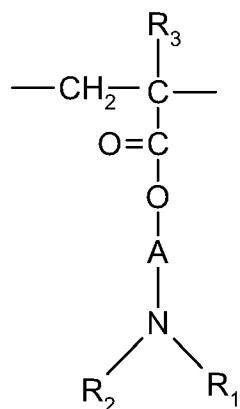
The composition of the invention may further comprise one or more polymer(s), chosen from cationic polymers and amphoteric polymers.

The term "cationic polymer" is intended to mean any polymer
10 comprising cationic groups and/or groups that can be ionized to cationic 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
15 chain or may be borne by a side substituent directly connected thereto.

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

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

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



in which:

- 5 - R₃, which may be identical or different, denote a hydrogen atom or a CH₃ group;
- 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;
- 10 - R₄, R₅ and R₆, which may be identical or different, represent an alkyl group containing from 1 to 18 carbon atoms or a benzyl group, and 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, and
- 15 - X denotes an anion derived from an inorganic 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 which may be chosen from the family of acrylamides, methacrylamides, diacetone acrylamides, acrylamides and methacrylamides substituted on the nitrogen with C₁-C₄ alkyls, acrylic or methacrylic acids or esters thereof, vinyl lactams such as vinylpyrrolidone or vinylcaprolactam, and vinyl esters.

(2) Cationic polysaccharides, in particular cationic celluloses and cationic galactomannan gums. 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.

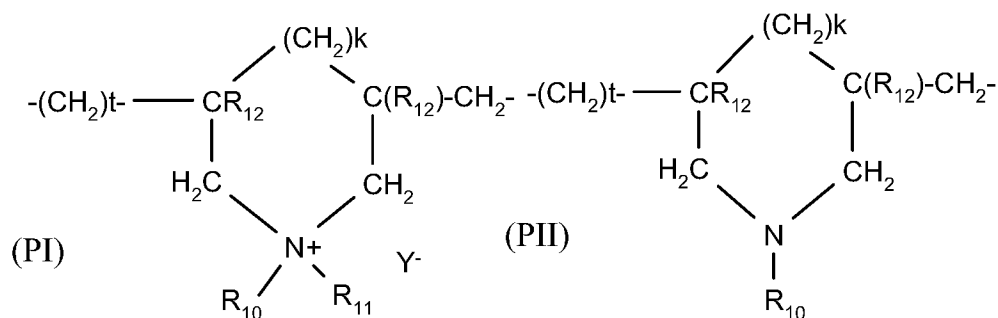
The cellulose ether derivatives comprising quaternary ammonium groups are in particular described in FR patent 1 492 597, and mention may be made of the polymers sold under the name Ucare Polymer JR (JR 400 LT, JR 125 and JR 30M) or LR (LR 400 or LR 30M) by the company Amerchol. These polymers are also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

(3) Polymers composed of piperazinyl units and of divalent alkylene or hydroxyalkylene groups containing linear or branched chains, optionally interrupted by oxygen, sulfur or nitrogen atoms or by 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 by an epihalohydrin, a diepoxide, a dianhydride, an unsaturated dianhydride, a bisunsaturated derivative, a bishalohydrin, a bisazetidinium, a bishaloacyldiamine or an alkyl

bishalide or alternatively by an oligomer resulting from the reaction of a bifunctional compound reactive with respect to a bishalohydrin, a bisazetidinium, a bishaloacyldiamine, an alkyl bishalide, an epihalohydrin, a diepoxide or a bisunsaturated 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, quaternized.

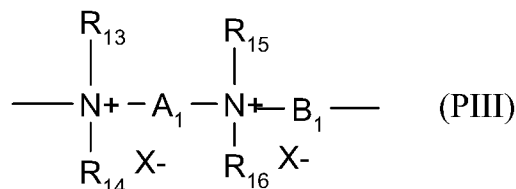
(5) Polyaminoamide derivatives resulting from the condensation of polyalkylene polyamines with polycarboxylic acids followed by alkylation with difunctional agents. (6) Polymers obtained by reaction of a polyalkylenepolyamine comprising two primary amine groups and at least one secondary amine group with a dicarboxylic acid chosen from diglycolic acid and saturated aliphatic dicarboxylic acids having from 3 to 8 carbon atoms; the molar ratio of polyalkylenepolyamine to dicarboxylic acid preferably being of between 0.8:1 and 1.4:1; the polyaminoamide resulting therefrom being reacted with epichlorohydrin in a molar ratio of epichlorohydrin in relation to the secondary amine group of the polyaminoamide preferably of between 0.5:1 and 1.8:1. (7) Cyclopolymers of alkyldiallylamine or of dialkyldiallylammonium, such as the homopolymers or copolymers comprising, as main constituent of the chain, units corresponding to formula (PI) or (PII):



25 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 group;
- 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.

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



- in which:
- R₁₃, R₁₄, R₁₅ and R₁₆, which may be identical or different, represent aliphatic, alicyclic or arylaliphatic groups comprising from 1 to 20 carbon atoms or C₁₋₄ hydroxyalkylaliphatic groups, or else R₁₃, R₁₄, R₁₅ and R₁₆, together or separately, form, with the nitrogen atoms to which they are attached, heterocycles optionally comprising a second heteroatom other than nitrogen, or else R₁₃, R₁₄, R₁₅ and R₁₆ represent a linear or branched C₁-C₆ alkyl group substituted by a nitrile, ester, acyl, amide or -CO-O-R₁₇-D or -CO-NH-R₁₇-D group, where R₁₇ is an alkylene and D a quaternary ammonium group;
 - A₁ and B₁ represent divalent polymethylene groups comprising from 2 to 20 carbon atoms which may be linear or branched, and saturated or unsaturated, and which may contain, linked to or inserted in the main

in which:

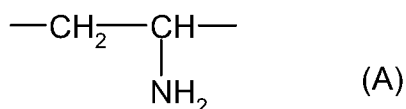
- R₁₈, R₁₉, R₂₀ and R₂₁, which may be identical or different, represent a hydrogen atom or a methyl, ethyl, propyl, β-hydroxyethyl, β-hydroxypropyl or -CH₂CH₂(OCH₂CH₂)_pOH group, where p is equal to 0 or to an integer of between 1 and 6, with the proviso that R₁₈, R₁₉, R₂₀ and R₂₁ do not simultaneously 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 radical of a dihalide or preferably represents -CH₂-CH₂-O-CH₂-CH₂-.

(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.

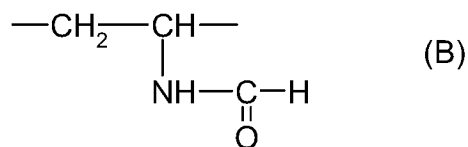
(11) Polyamines such as Polyquart[®] H sold by Cognis, referred to under the name Polyethylene glycol (15) tallow polyamine in the CTFA dictionary.

(12) Polymers comprising in their structure:

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



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



25

In other words, these polymers may be chosen in particular from

homopolymers or copolymers comprising one or more units derived from vinylamine and optionally one or more units derived from vinylformamide.

5 The amphoteric polymers that may be used in accordance with the present invention may be chosen from polymers comprising units K and M randomly distributed in the polymer chain, in which K denotes a unit derived from a monomer comprising at least one basic nitrogen atom and M denotes a unit derived from an acidic monomer comprising one or more carboxylic or sulphonic groups, or alternatively K and M
10 may denote groups derived from zwitterionic carboxybetaine or sulphobetaine monomers;

K and M may also denote a cationic polymer chain comprising primary, secondary, tertiary or quaternary amine groups, in which at least one of the amine groups bears a carboxylic or sulphonic group
15 linked via a hydrocarbon-based radical, or alternatively K and M form part of a chain of a polymer containing a α,β -dicarboxylic ethylene unit in which one of the carboxylic groups has been made to react with a polyamine comprising one or more primary or secondary amine groups.

The amphoteric polymers corresponding to the above definition
20 that are more particularly preferred are chosen from the following polymers:

(1) polymers resulting from the copolymerization of a monomer derived from a vinyl compound bearing a carboxylic group such as, more particularly, acrylic acid, methacrylic acid, maleic acid, α -
25 chloroacrylic acid, and a basic monomer derived from a substituted vinyl compound containing at least one basic atom, such as, more particularly, dialkylaminoalkyl methacrylate and acrylate, dialkylaminoalkylmethacrylamide and -acrylamide. Such compounds are described in US patent No. 3 836 537.

30 Mention may also be made of the sodium acrylate/

acrylamidopropyltrimethylammonium chloride copolymer sold under the name Polyquart KE 3033 by the company Cognis.

The vinyl compound may also be a dialkyldiallylammonium salt such as dimethyldiallylammonium chloride. The copolymers of acrylic acid and of the latter monomer are sold under the names Merquat 280, Merquat 295 and Merquat Plus 3330 by the company Nalco.

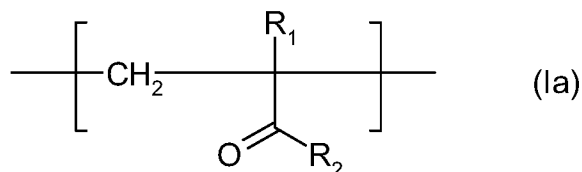
(2) Polymers containing units derived from:

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

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

(iii) one or more units derived from an acidic monomer of (meth)acrylic acid type.

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

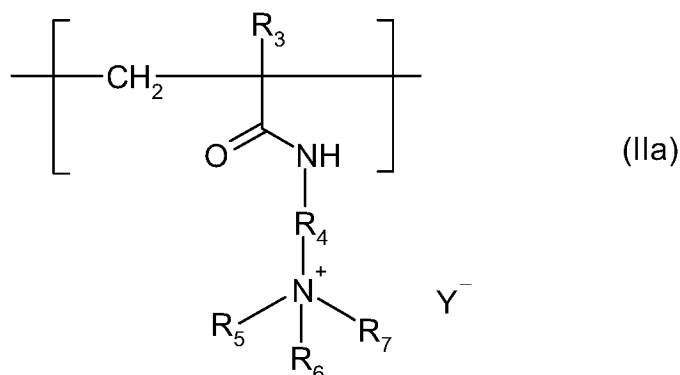


in which R_1 denotes H or CH_3 and R_2 is chosen from a $-\text{O}-(\text{CH}_2)_p-\text{CH}_3$ radical with p being an integer preferably from 0 to 3, and more preferably 0 or 1, amino, dimethylamino, tert-butylamino, dodecylamino or $-\text{NH}-\text{CH}_2\text{OH}$ radical.

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

The unit derived from a monomer of (meth)acrylate or (meth)acrylamide type of formula (Ia) in which R_1 denotes H and R_2 is $-\text{O}-\text{CH}_3$ is particularly preferred. It corresponds to the monomer methylacrylate.

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



5 in which:

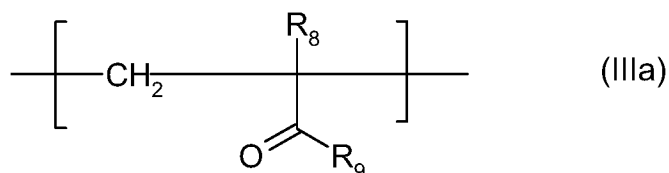
- R_3 denotes H or CH_3 ,
 - R_4 denotes a group $(\text{CH}_2)_k$ with k being an integer ranging from 1 to 6 and preferably from 2 to 4, even more preferably 3;
 - R_5 , R_6 and R_7 , which may be identical or different, denote an
- 10 alkyl group containing from 1 to 4 carbon atoms;
- Y^- is an anion such as bromide, chloride, acetate, borate, citrate, tartrate, bisulfate, bisulfite, sulfate or phosphate.

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

15 Among these units derived from a monomer of (meth)acrylamidoalkyltrialkylammonium type of formula (IIa), the ones that are preferred are those derived from the methacrylamidopropyltrimethylammonium chloride monomer, for which R_3 denotes a methyl radical, k is equal to 3, R_5 , R_6 and R_7

20 denote a methyl radical, and Y^- denotes a chloride anion.

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



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

The preferred units of formula (IIIa) correspond to the acrylic acid, methacrylic acid and 2-acrylamino-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 R₈ denotes a hydrogen atom and R₉ denotes a hydroxyl radical.

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

Preferably, the said amphoteric polymer comprises a 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 5 mol% of units derived from a monomer of (meth)acrylate or (meth)acrylamide type (i). Preferably, they comprise from 5 mol% to 30 mol% and more preferably from 10 mol% to 20 mol% of units derived from a monomer of (meth)acrylamide type.

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 20 mol% to 70 mol% and preferentially from 30 mol% to 60 mol%.

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

5 - from 5 mol% to 30 mol% and more preferably from 10 mol% to 20 mol% of units derived from a monomer of (meth)acrylate or (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

10 - from 20 mol% to 70 mol% and preferentially from 30 mol% to 60 mol% of units derived from a monomer of (meth)acrylic acid type (iii).

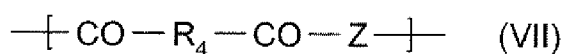
Amphoteric polymers of this type may also comprise additional units, other than the units derived from a monomer of (meth)acrylamide type, of (meth)acrylamidoalkyltrialkylammonium type and of (meth)acrylic acid type as described above.

15 As examples of amphoteric polymers that are particularly preferred, mention may be made of acrylamide/methacrylamidopropyltrimethylammonium chloride (MAPTAC)/acrylic acid terpolymers. Such polymers are listed in the CTFA Dictionary (International Cosmetic Ingredient Dictionary, 10th edition 2004) under the name Polyquaternium 53. Corresponding products are especially sold under the names Merquat[®] 2003 or Merquat[®] 2003PR by the company Nalco.

25 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, such as copolymers of (meth)acrylic acid and of dimethyldiallylammonium chloride. An example that may be mentioned is Merquat[®] 280 sold by the company Nalco.

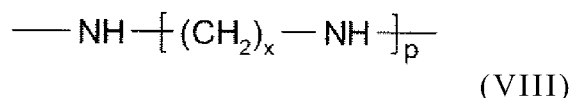
30 (3) Polyamino amides that are crosslinked and alkylated partially

or totally derived from polyamino amides of general formula:



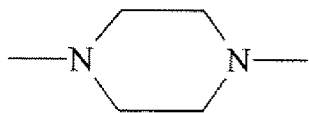
in which R₄ represents a divalent radical derived from a saturated dicarboxylic acid, a mono- or dicarboxylic aliphatic acid containing an ethylenic double bond, an ester of a lower alkanol, having 1 to 6 carbon atoms of these acids or a radical derived from the addition of any one of said acids to a bis(primary) or bis(secondary) amine, and Z denotes a bis(primary), mono- or bis(secondary) polyalkylene-polyamine radical and preferably represents:

a) in proportions of from 60 to 100 mol%, the radical of formula (VIII)



where x = 2 and p = 2 or 3, or alternatively x = 3 and p = 2, this radical being derived from diethylenetriamine, from triethylenetetraamine or from dipropylenetriamine;

b) in proportions of from 0 to 40 mol%, the radical (VIII) above in which x = 2 and p = 1 and which is derived from ethylenediamine, or the radical derived from piperazine:



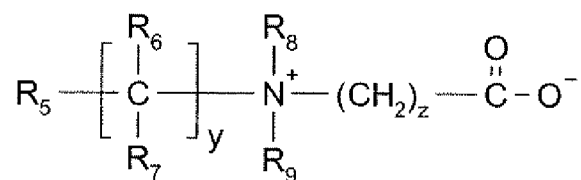
c) in proportions of from 0 to 20 mol%, the -NH-(CH₂)₆-NH- radical derived from hexamethylenediamine, these polyamino amines being crosslinked by addition of a difunctional crosslinking agent chosen from epihalohydrins, diepoxides, dianhydrides and bis-unsaturated derivatives, using from 0.025 to 0.35 mol of crosslinking agent per amine group of the polyamino amide and

alkylated by the action of acrylic acid, chloroacetic acid or an alkane sultone, or salts thereof.

The saturated carboxylic acids are preferably chosen from acids having 6 to 10 carbon atoms, such as adipic acid, 2,2,4-trimethyladipic acid and 2,4,4-trimethyladipic acid, terephthalic acid and acids containing an ethylenic double bond such as, for example, acrylic acid, methacrylic acid and itaconic acid.

The alkane sultones used in the alkylation are preferably propane sultone or butane sultone, and the salts of the alkylating agents are preferably the sodium or potassium salts.

(4) Polymers containing zwitterionic units of formula (IX):



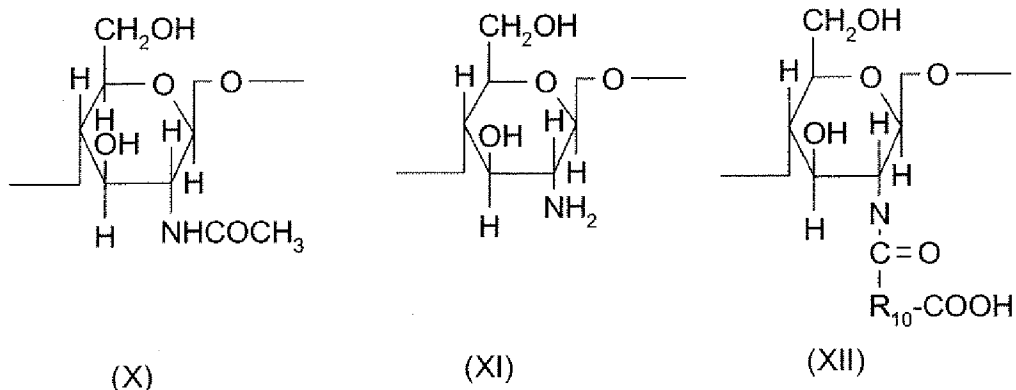
(IX)

in which R_5 denotes a polymerizable unsaturated group such as an acrylate, methacrylate, acrylamide or methacrylamide group, y and z represent an integer from 1 to 3, R_6 and R_7 represent a hydrogen atom, methyl, ethyl or propyl, R_8 and R_9 represent a hydrogen atom or an alkyl radical such that the sum of the carbon atoms in R_8 and R_9 does not exceed 10.

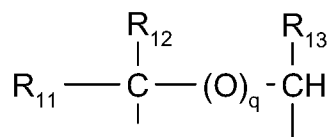
The polymers comprising such units may also comprise units derived from non-zwitterionic monomers such as dimethyl or diethylaminoethyl acrylate or methacrylate, or alkyl acrylates or methacrylates, acrylamides or methacrylamides, or vinyl acetate.

By way of example, mention may be made of the copolymer of butyl methacrylate/dimethyl carboxymethylammonio ethyl methacrylate such as the product sold under the name Diaformer Z301 by the company Sandoz.

(5) Polymers derived from chitosan comprising monomer units corresponding to formulae (X), (XI) and (XII) below:



the unit (X) being present in proportions of from 0 to 30%, the unit (XI) in proportions of from 5 to 50% and the unit (XII) in proportions of from 30 to 90%, it being understood that, in this unit (XII), R₁₀ represents a radical of formula:

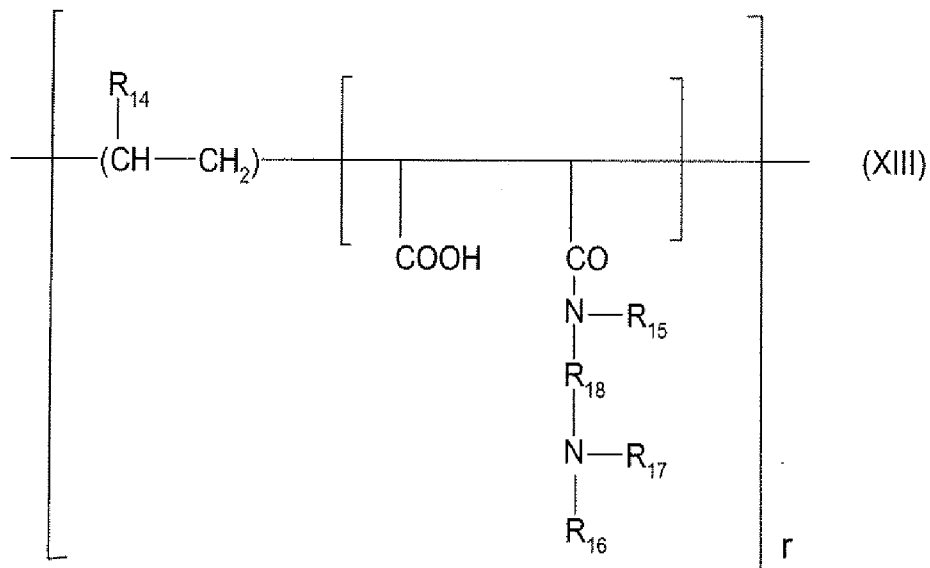


in which
 if $q = 0$, R₁₁, R₁₂ and R₁₃, which may be identical or different, each represent a hydrogen atom, a methyl, hydroxyl, acetoxy or amino residue, a monoalkylamine residue or a dialkylamine residue which are optionally interrupted by one or more nitrogen atoms and/or optionally substituted with one or more amine, hydroxyl, carboxyl, alkylthio or sulphonic groups, an alkylthio residue in which the alkyl group bears an amino residue, at least one of the radicals R₁₁, R₁₂ and R₁₃ being, in this case, a hydrogen atom;
 or, if $q = 1$, R₁₁, R₁₂ and R₁₃ each represent a hydrogen atom, as well as the salts formed by these compounds with bases or acids.

(6) Polymers derived from the N-carboxyalkylation of chitosan,

such as N-carboxymethylchitosan or N-carboxybutylchitosan sold under the name "Evalsan" by the company Jan Dekker.

(7) Polymers corresponding to the general formula (XIII) as described, for example, in French patent 1 400 366:



5

in which R₁₄ represents a hydrogen atom, a CH₃O, CH₃CH₂O or phenyl radical, R₁₅ denotes hydrogen or a lower alkyl radical such as methyl or ethyl, R₁₆ denotes hydrogen or a lower alkyl radical such as methyl or ethyl, R₁₇ denotes a lower alkyl radical such as methyl or ethyl or a radical corresponding to the formula: -R₁₈-N(R₁₆)₂, R₁₈ representing a -CH₂-CH₂-, -CH₂-CH₂-CH₂- or -CH₂-CH(CH₃)- group, R₁₆ having the meanings mentioned above,

10

as well as the higher homologs of these radicals and containing up to 6 carbon atoms.

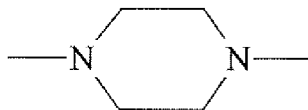
15

(8) Amphoteric polymers of the type -D-X-D-X- chosen from:

a) polymers obtained by the action of chloroacetic acid or sodium chloroacetate on compounds containing at least one unit of formula:



where D denotes a radical

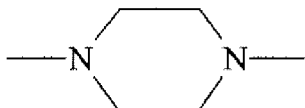


and X denotes the symbol E or E', E or E', which may be identical or
 5 different, denoting a divalent radical which is an alkylene radical with a
 straight or branched chain containing up to 7 carbon atoms in the main
 chain, which is unsubstituted or substituted with hydroxyl groups and
 which can contain, in addition to the oxygen, nitrogen and sulphur atoms,
 1 to 3 aromatic and/or heterocyclic rings; the oxygen, nitrogen and
 10 sulphur atoms being present in the form of ether, thioether, sulphoxide,
 sulphone, sulphonium, alkylamine or alkenylamine groups, hydroxyl,
 benzylamine, amine oxide, quaternary ammonium, amide, imide, alcohol,
 ester and/or urethane groups;

b) polymers of formula (XV):

15 -D-X-D-X- (XV)

where D denotes a radical



and X denotes the symbol E or E' and at least once E'; E having the
 meaning given above and E' being a divalent radical which is an
 20 alkylene radical with a straight or branched chain having up to 7 carbon
 atoms in the main chain, which is unsubstituted or substituted with one
 or more hydroxyl radicals and containing one or more nitrogen atoms,
 the nitrogen atom being substituted with an alkyl chain which is
 optionally interrupted by an oxygen atom and necessarily containing one
 25 or more carboxyl functions or one or more hydroxyl functions and
 betainized by reaction with chloroacetic acid or sodium chloroacetate.

(9) (C₁-C₅)alkyl vinyl ether/maleic anhydride copolymers partially modified by semiamidation with an N,N-dialkylaminoalkylamine such as N,N-dimethylaminopropylamine or by semiesterification with an N,N-dialkanolamine. These copolymers can also contain other vinyl comonomers such as vinylcaprolactam.

Preferably, the composition of the present invention further comprises at least one amphoteric polymer, in particular chosen from amphoteric polymer of family (2).

When exists, the composition of the invention preferably contains said polymer(s) in a total amount ranging from 0.01 to 5% by weight, preferably from 0.05 to 2.5% by weight, with regard to the total weight of the composition.

The composition according to the invention advantageously comprises water, in a content of greater than or equal to 40% by weight relative to the total weight of composition.

The water content in the composition of the invention preferably ranges from 50% to 99% by weight, more preferentially from 80% to 99% by weight, relative to the total weight of the composition.

The composition according to the invention may further comprise one or more water-soluble organic solvents (solubility of greater than or equal to 5% in water at 25°C and at atmospheric pressure).

Examples of water-soluble organic solvents that may be mentioned include linear or branched and preferably saturated monoalcohols or diols, comprising 2 to 10 carbon atoms, such as ethyl alcohol, isopropyl alcohol, hexylene glycol (2-methyl-2,4-pentanediol), neopentyl glycol and 3-methyl-1,5-pentanediol, butylene glycol, dipropylene glycol and propylene glycol; aromatic alcohols such as phenylethyl alcohol; polyols containing more than two hydroxyl

functions, such as glycerol; polyol ethers, for instance ethylene glycol monomethyl, monoethyl and monobutyl ether, propylene glycol or ethers thereof, for instance propylene glycol monomethyl ether; and also diethylene glycol alkyl ethers, especially C₁-C₄ alkyl ethers, for instance diethylene glycol monoethyl ether or monobutyl ether, alone or as a mixture.

The composition according to the invention may further comprise one or more additives.

As additives that may be used in accordance with the invention, mention may be made of polymers other than the cationic and amphoteric polymers described above such as anionic and nonionic polymers, surfactants other than the anionic, non-ionic, and amphoteric or zwitterionic surfactants described above, antidandruff agents, anti-seborrhoea agents, agents for preventing hair loss and/or for promoting hair regrowth, fatty substances, vitamins and provitamins including panthenol, sunscreens, mineral or organic pigments, sequestrants, plasticizers, solubilizers, acidifying agents, mineral or organic thickeners, especially polymeric thickeners, opacifiers or pearlizing agents, antioxidants, hydroxy acids, fragrances, preservatives, pigments and ceramides.

Needless to say, a person skilled in the art will take care to select this or these optional additional compound(s) such that the advantageous properties intrinsically associated with the composition according to the invention are not, or are not substantially, adversely affected by the envisaged addition(s).

The above additives may generally be present in an amount, for each of them, of between 0 and 20% by weight relative to the total weight of the composition.

Preferably, the compositions of the invention are rinse-off hair shampoo.

The compositions according to the invention may be packaged in any suitable dispenser such as for example a jar, a tube, a pump-dispenser bottle or in an aerosol device, in particular a pump-dispenser.

5 The compositions according to the invention may, when they are packaged in an aerosol device, contain at least one propellant. The propellant can then be selected for example from dimethyl ether, C₃ to C₅ alkanes, halogenated hydrocarbons, and mixtures thereof.

10 The present invention also relates to a non-therapeutical process for treating keratin fibres, which consists in applying to the said fibres an effective amount of a composition as described above.

 After an optional leave-in time, the composition may be removed it by rinsing.

 The composition may be applied to dry or damp keratin fibres.

15 The compositions described above may be used on any type of hair: light or dark hair, natural hair or hair that has undergone a cosmetic treatment such as permanent waving, dyeing, bleaching or relaxing.

20 The present invention finally relates to the use of a composition as described hereinbefore for washing keratin fibres and in particular hair.

 According to the present application, "keratin fibres" means human keratin fibres and more specifically hair.

25 The following examples serve to illustrate the invention without, however, being limiting in nature.

 Fig. 1 shows the measurement of average and maximal distance of sebum migration on the hair swatch.

Fig. 2 shows maximal distance of sebum migration over time, on the hair swatch untreated, treated with invention formula 1 and comparative formula 2, respectively.

5 Fig. 3 shows average distance of sebum migration over time, on the hair swatch untreated, treated with invention formula 1 and comparative formula 2, respectively.

EXAMPLE:

10 In the example that follows, all the amounts are given, unless otherwise indicated, as mass percentages of active material relative to the total weight of the composition (AI: active ingredient).

The invention and comparative formulas as follow were prepared:

INCI name	% by weight, by active ingredient		
	Invention formula 1	Comparative formula	
		1 (with different polymer)	2 (without clay)
SODIUM CHLORIDE	2.5	2.5	2.5
ISOPROPYL MYRISTATE (Isopropyl myristate from BASF)	0.25	0.25	0.25
KAOLIN (Kaolin Supreme by Imerys)	3	3	0
SILICA SILYLATE (VM-2270 from Dow Corning)	0.2	0.2	0.2
FRAGRANCE	0.5	0.5	0.5

ACRYLATES COPOLYMER (Carbopol [®] Auqa SF-1 polymer from Lubrizol, with a viscosity of about 700 mPa·s, measured by Brookfield RVF or RVT viscosity at 25°C with a speed of 20 rpm in 0.2% w/w neutralized aqueous solution)	0.8	0	0.8
CARBOMER (Carbopol [®] 980 polymer from Lubrizol)	0	0.8	0
POLYQUATERNIUM-53 (Merquat [™] 2003PR from Nalco(Lubrizol))	0.6	0.6	0.6
SALICYLIC ACID	0.2	0.2	0.2
SODIUM BENZOATE	0.5	0.5	0.5
HEXYLENE GLYCOL	0.3	0.3	0.3
WATER	QS 100	QS 100	QS 100
GLYCERIN	2	2	2
SODIUM LAURETH SULFATE (Texapon [®] AOS 225 UP from Cognis (BASF))	5.5	5.5	5.5
AMMONIUM LAURYL SULFATE (Empicol [®] AL 30/FL3 from Huntsman)	6.0	6.0	6.0

Comparative formula 1 contains Carbomer, which is a crosslinked acrylic acid homopolymer crosslinked with an allyl ether of pentaerythritol, an allyl ether of sucrose, or an allyl ether of propylene, with a viscosity of 13000 to 30000mPa·s, measured by

Brookfield RVF or RVT viscosity at 25°C with a speed of 20 rpm in 0.2% w/w neutralized aqueous solution;

Comparative formula 2 does not contain clays as claimed according to the invention.

5 The formulas were prepared by mixing the ingredients listed above at room temperature (20-25°C), whereas SILICA SILYLATE was pre-mixed with ISOPROPYL MYRISTATE to obtain a homogeneous paste, at room temperature (20-25°C).

10 The cosmetic property of the invention and comparative formulas were tested as rinse-off shampoos on 6 consumers, and evaluation scores were given by a hair dresser, on the cosmetic properties such as: softness of the hair, smoothness to the touch, and easy detangling; light and natural feeling of the hair, in other words, hair without lank, heavy, sticky or greasy feeling, with the following
15 scores:

1: very poor property;

2: poor, not acceptable property;

3: acceptable property;

4: good property;

20 5: excellent property.

The anti-greasy effects of the formulas were tested by the sebum migration protocol.

The protocol of the measurement was as follow:

25 apply 15 g of the invention and comparative formulas, respectively, on dry swatch as a rinse-off shampoo;

30 heat 100 µl of oleic acid, which is used as an artificial sebum (colored with red 27, 0.1% by weight, relative to the total weight of the oleic acid) to 40°C and apply the heated and colored oleic acid on the root of the swatch treated by the invention and comparative formulas;

observe the distance of sebum migration using ruler to measure the distance of the sebum migration, both average and maximal.

The invention and comparative formulas were then stored under temperatures between 25 to 45°C for 2 months, in order to evaluate the stability.

The results obtained are detailed in the table hereunder:

Properties	Invention formula 1	Comparative formula 1	Comparative formula 2
Cosmetic properties	3	N/A, unstable immediately after formulation	3
Stability	Stable	Unstable, phase separation immediately	Unstable at 45°C, phase separation
Anti-greasiness, as shown in Fig. 1 to 3	Significant	N/A	Not significant
Long lasting anti-greasiness, as shown in Fig. 1 to 3	Long lasting	N/A	N/A

It is observed that the invention formula 1 has a good cosmetic property, which is same as the comparative formula 2. The comparative formula 1 is not stable immediately after formulation.

It is shown from the result above that the invention formula 1 is stable over 2 months under different temperatures. However the comparative formula 1 is not stable immediately after formulation; Comparative formula 2 is not stable at 45°C in 2 months.

Comparing to the comparative formula 2, invention formula 1 has a significant anti-greasy effect on the hair, and moreover, this effect is long lasting, whereas the comparative formula 2 did not present such a long lasting anti-greasiness.

CLAIMS

1. Composition for treating keratin fibers, comprising:
 - hydrophobic silica aerogel particles;
 - at least one crosslinked copolymer of methacrylic acid and of a C₁-C₄ alkyl acrylate;
 - 5 - at least one clay; and
 - at least one surfactant chosen from anionic surfactants, nonionic surfactants, amphoteric or zwitterionic surfactants, or a mixture thereof.
2. Composition of claim 1, wherein the hydrophobic silica aerogel particle has a surface per unit of weight S_w ranging from 600 to 1200 m²/g, preferably from 600 to 800 m²/g.
3. Composition of claim 1 or 2, wherein the hydrophobic silica aerogel particle has a volume-average diameter D[0.5] ranging from 1 to 1500 μm, preferably from 1 to 1000 μm, more preferably from 1 to 100 μm, in particular from 1 to 30 μm, more preferably from 5 to 25 μm, better still from 5 to 20 μm and even better still from 5 to 15 μm.
4. Composition of any one of the preceding claims 1 to 3, wherein the hydrophobic silica aerogel particle has a packed density ρ ranging from 0.04 g/cm³ to 0.10 g/cm³ and preferably from 0.05 g/cm³ to 0.08 g/cm³.
5. Composition of any one of the preceding claims 1 to 4, wherein the hydrophobic silica aerogel particle is silylated silica aerogel, preferably trimethylsilylated silica, more preferably silica silylate.
6. Composition of any one of the preceding claims 1 to 5, wherein the hydrophobic silica aerogel particle is present in an amount

ranging from 0.05% to 3% by weight, preferably from 0.1% to 1% by weight, with respect to the total weight of the composition.

7. Composition of any one of the preceding claims 1 to 6, wherein in the crosslinked copolymer of methacrylic acid and of a
5 C₁-C₄ alkyl acrylate, relative to the total weight of the compolymer:

- methacrylic acid is present in an amount ranging from 20% to 80% by weight, more particularly from 25% to 70% by weight and even more particularly from 35% to 60% by weight;

10 - C₁-C₄ alkyl acrylate is present in an amount ranging from 15% to 80% by weight, more particularly from 25% to 75% by weight and even more particularly from 40% to 65% by weight.

8. Composition of claim 7, wherein the alkyl acrylate is selected from the group consisting of methyl acrylate, ethyl acrylate, and butyl acrylate, preferably ethyl acrylate.

15 9. Composition of any one of the preceding claims 1 to 8, wherein the crosslinked copolymer is present in an amount ranging from 0.01% to 5% by weight, preferably from 0.1% to 2% by weight, with respect to the total weight of the composition.

20 10. Composition of any one of the preceding claims 1 to 9, wherein the clay is selected from the group consisting of family of the smectites, family of the kaolinites, optionally modified clays of the family of halloysite, donbassite, antigorite, berthierine or pyrophyllite, montmorillonites, beidellite, vermiculites, talc, stevensite, hectorites, bentonites, saponites, chlorites, sepiolite, and illite; preferably
25 selected from family of kaolinites; more preferably selected from the group consisting of kaolinite, dickite and nacrite, even more preferably, the clay is kaolinite.

30 11. Composition of any one of the preceding claims 1 to 10, wherein the clay is present in an amount ranging from 0.01% to 20% by weight, in particular from 0.05% to 5% by weight, and more

preferably from 0.1% to 3% by weight, with respect to the total weight of the composition.

12. Composition of any one of the preceding claims 1 to 11 further comprises at least one surfactant, chosen from anionic surfactants, nonionic surfactants, amphoteric or zwitterionic surfactants, or a mixture thereof; preferably anionic surfactants; more preferably (C₆-C₃₀)alkyl sulfates, (C₆-C₃₀)alkyl ether sulfates, alkylaryl polyether sulfates, or a mixture thereof.

13. Composition of any one of the preceding claims 1 to 12, wherein the surfactant, in particular the anionic surfactant is present in an amount ranging from 1% to 30% by weight, in particular from 5% to 20% by weight of the surfactant, relative to the total weight of the composition.

14. Composition of anyone of the preceding claims 1 to 13 further comprises at least one oil, preferably hydrocarbon oil, more preferably selected from esters of formula R₁COOR₂, in which R₁ represents a linear or branched fatty acid residue containing from 1 to 40 carbon atoms, and R₂ represents a hydrocarbon-based chain, in particular a branched chain, containing from 1 to 40 carbon atoms provided that R₁ and R₂ is greater than or equal to 10.

15. Composition of anyone of the preceding claims 1 to 14 further comprises at least one polymer chosen from cationic polymers, amphoteric polymers, or a mixture thereof; preferably chosen from amphoteric polymers, more preferably chosen from amphoteric polymers containing units derived from:

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

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

(iii) one or more units derived from an acidic monomer of

(meth)acrylic acid type.

16. Non-therapeutical process for treating keratin fibres such as the hair, comprising the step of applying to the said fibres a composition as defined in any one of the preceding claims 1 to 15, and
5 then, after an optional leave-in time, removing it by rinsing.

17. Use of a composition as defined in any one of claims 1 to 15 for washing keratin fibres and in particular the hair.

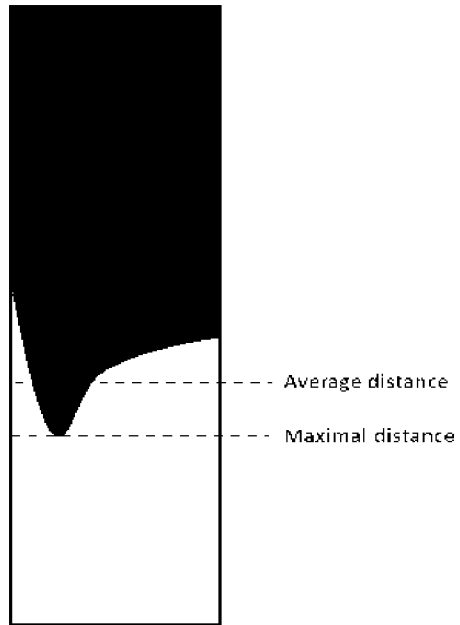


Fig. 1

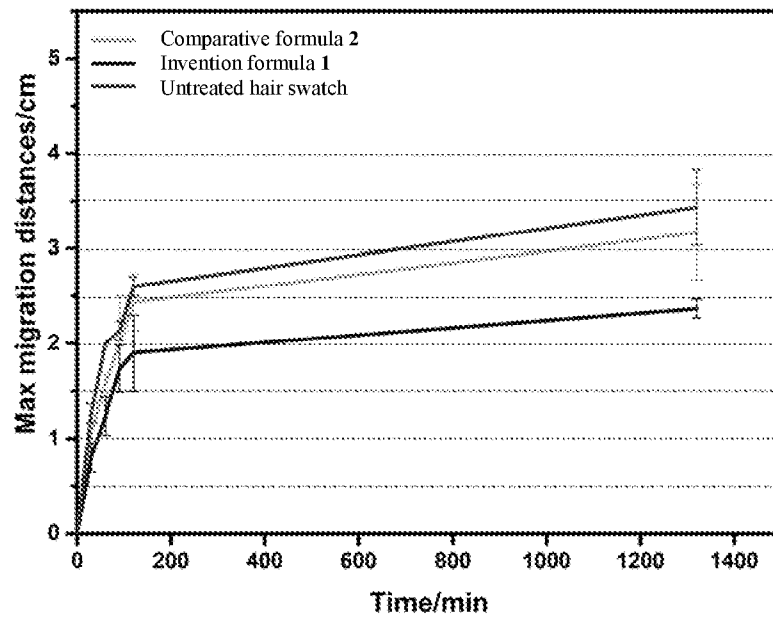


Fig. 2

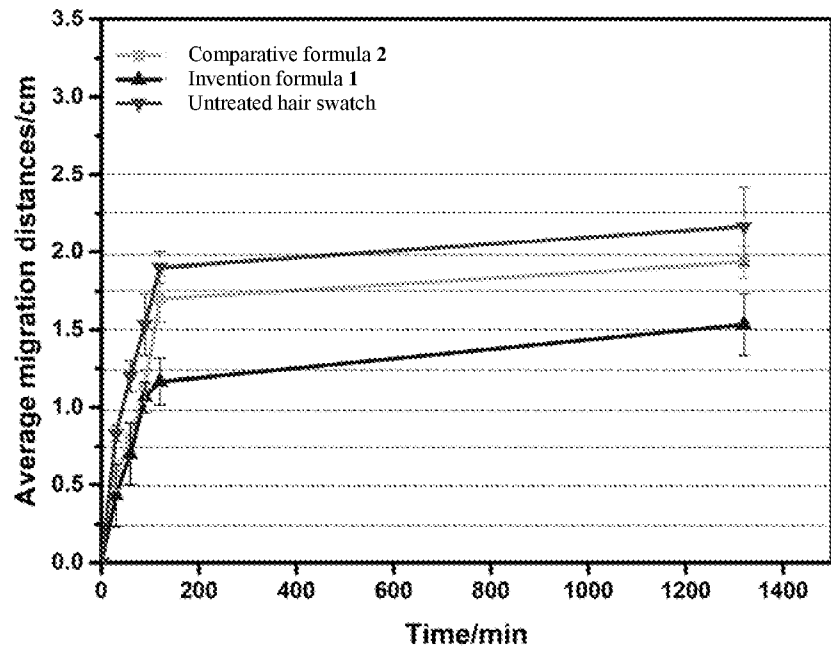


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2015/097278

A. CLASSIFICATION OF SUBJECT MATTER

A61K 8/25(2006.01)i; A61K 8/81(2006.01)i; A61K 8/31(2006.01)i; A61K 8/92(2006.01)i; A61K 8/73(2006.01)i; A61K 8/02(2006.01)i; A61K 8/19(2006.01)i; A61K 8/49(2006.01)i; A61K 8/60(2006.01)i; A61K 8/41(2006.01)i; A61Q 5/06(2006.01)i; A61Q 5/04(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61K; A61Q

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

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

WPLEPODOC,CNKI.CNPAT,keratin,fiber,hair,silica,clay,crosslink+,copolymer,surfactant,aerogel,VM-2270,acrylate,SF-1

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2015150331 A1 (L'OREAL) 08 October 2015 (2015-10-08) description, paragraphs [0041], [0044], [0047], [00153], [00163], [00260], [00268] and [00314]-[00316]	1-17
Y	US 20150342857 A1 (L'OREAL) 03 December 2015 (2015-12-03) description, paragraphs [0006], [0009], [0072]-[0073], and claims 22-23	1-17
A	CN 1683484 A (SHANGHAI HONGLUE IND. CO. LTD.) 19 October 2005 (2005-10-19) claims 1-8	1-17
A	JP 60-184599 A (LION CORP.) 20 September 1985 (1985-09-20) the whole document	1-17

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance
 “E” earlier application or patent but published on or after the international filing date
 “L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
 “O” document referring to an oral disclosure, use, exhibition or other means
 “P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
 “X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
 “Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
 “&” document member of the same patent family

Date of the actual completion of the international search

24 August 2016

Date of mailing of the international search report

21 September 2016

Name and mailing address of the ISA/CN

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2015/097278

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
WO	2015150331	A1	08 October 2015	US	2015283040	A1	08 October 2015
US	20150342857	A1	03 December 2015	WO	2015181064	A1	03 December 2015
CN	1683484	A	19 October 2005	CN	100465256	C	04 March 2009
JP	60-184599	A	20 September 1985	None			