(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
02 January 2020 (02.01.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/002588 A1

(51) International Patent Classification:
A61K 8/36 (2006.01) *A61Q 5/06* (2006.01)
A61Q 5/00 (2006.01) *A61K 8/73* (2006.01)
A61K 8/60 (2006.01)

(21) International Application Number:
PCT/EP2019/067310

(22) International Filing Date:
28 June 2019 (28.06.2019)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1856005 29 June 2018 (29.06.2018) FR

(71) Applicant: **L'OREAL** [FR/FR]; 14, Rue Royale, 75008 PARIS (FR).

(72) Inventor: **GREAVES, Andrew**; 12 Chemin Louis Pontet, 77144 MONTEVRAIN (FR).

(74) Agent: **LE ROY, Gwennhael** et al.; CASALONGA, 8 Avenue Percier, 75008 PARIS (FR).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

WO 2020/002588 A1

(54) Title: PROCESS FOR TREATING KERATIN FIBRES USING A MONOSACCHARIDE AND A POLYSACCHARIDE BEARING AMINE GROUPS

(57) Abstract: The present invention relates to a process for treating keratin fibres, in particular human keratin fibres such as the hair, using a) at least one monosaccharide and b) at least one polysaccharide bearing amine group(s), followed by a heat treatment of said keratin fibres. The present invention also relates to a composition at acidic pH (C) comprising a) at least one monosaccharide and b) at least one polysaccharide bearing amine group(s), in salified or non-salified form. Finally, the present invention relates to a kit comprising a multi-compartment device containing a) at least one monosaccharide and b) at least one polysaccharide bearing amine group(s), and to a device for heating keratin fibres.

Process for treating keratin fibres using a monosaccharide and a polysaccharide bearing amine groups

The present invention relates to a process for treating keratin fibres, in particular human keratin fibres such as the hair, using a) at least one monosaccharide and b) at least one polysaccharide bearing amine group(s), in salified or non-salified form, followed by a heat treatment of said keratin fibres.

The present invention also relates to a composition at acidic pH (C) comprising a) at least one monosaccharide and b) at least one polysaccharide bearing amine group(s), in salified or non-salified form.

Finally, the present invention relates to a kit comprising a multi-compartment device containing a) at least one monosaccharide and b) at least one polysaccharide bearing amine group(s), and to a device for heating keratin fibres.

The hair is generally damaged and weakened by the action of external atmospheric agents such as light and bad weather, and also by mechanical or chemical treatments, such as brushing, combing, dyeing, bleaching, permanent-waving and/or relaxing and repeated washing.

The hair is thus damaged by these various factors and may in the long run become dry, coarse, brittle, dull, split and/or limp.

Thus, to overcome these drawbacks, it is common practice to resort to hair treatments which make use of compositions intended for conditioning the hair appropriately by giving it satisfactory cosmetic properties, especially smoothness, sheen, a soft feel (a natural feel; the hair is no longer coarse), suppleness, a lightweight feel, good disentangling properties leading to easy combing, and good manageability of the hair which is thus easy to shape.

These hair care compositions can, for example, be conditioning shampoos, hair conditioners, masks or serums. However, the conditioning effect obtained fades out in the course of successive shampooing operations and does not show satisfactory persistence on shampooing.

It is known practice to employ care compositions comprising reducing sugars such as monosaccharides, used as conditioning agents, especially to repair keratin fibres which have been damaged by harsh treatments.

Indeed, patent application US 2002/0193264 describes a process for conditioning keratin fibres, in which at least one sugar chosen from C_3-C_5 monosaccharides is applied to said fibres, and a step of heating the keratin fibres is carried out.

Similarly, patent application US 2002/0172653 discloses a process for conditioning keratin fibres comprising a step of applying to said fibres a sugar chosen from specific C_5-C_7 monosaccharides and a step of heating the keratin fibres.

However, the use of reducing sugars followed by a heat treatment may lead to an undesired modification of the colour of the keratin fibres. Furthermore, the keratin fibres are not always sufficiently protected, repaired or cosmetically transformed in a long-lasting manner.

Patent application WO 2016/142551 also describes the use of oxidized polysaccharide with a monosaccharide bearing an amine group. Nevertheless, the results obtained are not always satisfactory in terms of repairing or preventing breakage of the keratin fibres, in particular split keratin fibres, when a treatment with heat is carried out.

Reducing sugars in general degrade easily, and in particular under the action of shampoos. Consequently, the cosmetic properties conferred on the fibres are not generally persistent. Thus, the keratin fibres are not protected, repaired or cosmetically transformed in a long-lasting manner.

There is therefore a real need to develop a composition and a process for treating keratin fibres, in particular human keratin fibres such as the hair, which are capable of protecting and/or repairing said fibres, if possible in a long-lasting manner, with respect to external agents and/or heat.

Moreover, it is advantageous to find a means for treating damaged keratin fibres by repairing them, that is to say by improving the cosmetics of damaged keratin fibres intrinsically, while retaining or even improving the manageability, the anti-frizz properties and/or the persistence of the styling of said fibres, and also the repairing of split ends.

It is also advantageous to prevent the breakage of natural keratin fibres, while maintaining or even improving the manageability, the anti-frizz properties and/or the persistence of the styling of said fibres.

It has been discovered, surprisingly, that the application to the keratin fibres of at least one monosaccharide and at least one particular polysaccharide, followed by

heat treatment of said fibres, makes it possible to achieve these objectives, and in particular to repair and/or protect the keratin fibres, in a long-lasting manner with respect to external agents.

Thus, a subject of the invention relates to a process for treating keratin fibres, in particular human keratin fibres such as the hair, comprising:

(i) a step consisting in applying to said keratin fibres a) one or more monosaccharide(s);

(ii) a step consisting in applying, to said keratin fibres, b) one or more polysaccharide(s) bearing amine group(s), in salified or non-salified form, preferably having an average molecular weight of less than or equal to 400 kDa;

(iii) optionally a drying step;

(iv) then a step of heat treatment at a temperature of greater than or equal to 80°C, preferably at a temperature of between 100°C and 250°C, and preferably with an iron;

it being understood that the steps (i) and (ii) may be carried out simultaneously, or sequentially, preferably steps (i) and (ii) are carried out simultaneously, and that the drying step (iii), when it is present, precedes the heat treatment step (iv) and follows the steps (i) and (ii).

Another subject of the invention is an aqueous composition at acidic pH (pH < 7), also referred to as composition (C), comprising:

a) one or more monosaccharide(s) as defined previously,

b) one or more polysaccharide(s) bearing amine group(s), as defined previously, in salified or non-salified form, preferably having an average molecular weight of less than or equal to 400 kDa, and

c) optionally one or more mineral or organic acids preferably different from the following acids: aspartic acid, glutamic acid, gluconic acid, pyrrolidonecarboxylic acid, 100 OE and 500 OE ethoxylated stearic acid, linoleic acid, succinic acid.

Another subject of the invention relates to a process for treating keratin fibres, in particular human keratin fibres such as the hair, comprising a step of applying to said keratin fibres an aqueous composition (C) at acidic pH as described previously, followed by a step of heat treatment of said keratin fibres at a temperature of greater than 80°C, in particular of between 100 and 250°C, and preferably with an iron.

Another subject of the invention is a process for treating keratin fibres, in particular human keratin fibres such as the hair, comprising:

(i) a step consisting in applying, to said keratin fibres, a cosmetic composition (ca) containing a) one or more monosaccharide(s);

(ii) a step consisting in applying, to said keratin fibres, a cosmetic composition (cb) containing b) one or more polysaccharide(s) bearing amine group(s), in salified or non-salified form, preferably having an average molecular weight of less than or equal to 400 kDa;

(iii) optionally a step of drying said keratin fibres;

(iv) then a step of heat treatment of said keratin fibres at a temperature of greater than or equal to 80°C, preferably at a temperature of between 100°C and 250°C, and preferably with an iron;

it being understood that the steps (i) and (ii) may be carried out simultaneously, or sequentially, preferably steps (i) and (ii) are carried out simultaneously, and that the drying step (iii), when it is present, precedes the heat treatment step (iv) and follows the steps (i) and (ii).

The combination of a monosaccharide and a polysaccharide bearing amine group(s), followed by a heat treatment step, makes it possible to repair damaged keratin fibres, and in particular to repair split ends, while preserving the manageability thereof. These properties are also persistent with respect to several shampooing operations.

Moreover, the process of the invention makes it possible to control the anti-frizz properties of keratin fibres and to maintain them over time, while in particular making them persistent with respect to several shampooing operations.

The keratin fibres thus treated are repaired and/or protected, in a long-lasting manner, with respect to external agents.

In particular, hair treated via the process according to the invention remains well-behaved since no presence of frizz is observed. Thus, the hairs are aligned and smooth and disentangle easily, which makes them easier to comb.

The hair treated by means of the process of the invention also has more body (it is not limp) and is thus easier to style. It is easy to shape, this shaping of the hair persisting even after several shampooing operations.

Moreover, the hair treated according to the present invention is also shiny and soft to the touch. It is stronger and less brittle.

The process according to the invention has the advantage of giving good persistence of these good hair-conditioning cosmetic properties after at least one shampooing operation, and in particular after five successive shampooing operations. Thus, the treated hair is conditioned in a long-lasting manner. After heat treatment, the hair is not laden, and has a natural feel.

The process and the composition (C) of the invention make it possible to repair the split ends of keratin fibres, in particular human keratin fibres such as the hair.

Finally, the present invention relates to a kit comprising:

- a multi-compartment device comprising a first compartment containing a cosmetic composition (ca) comprising a) at least one monosaccharide; and a second compartment containing a cosmetic composition (cb) comprising b) at least one polysaccharide bearing amine group(s) and optionally c) one or more organic or mineral acids; and
- a device for heating the keratin fibres to a temperature of at least 80°C.

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

In the following text, unless indicated otherwise:

- the term "monosaccharides" is understood to mean a monosaccharide sugar comprising at least 5 carbon atoms of formula $C_x(H_2O)_x$ with x an integer greater than or equal to 5, preferably x is greater than or equal to 6, in particular x is between 5 and 7 inclusive, preferably x = 6, they may be of D or L configuration, and of alpha or beta anomer, and also the salts thereof and the solvates thereof such as hydrates;
- the term "polysaccharides" refers to a polysaccharide sugar which is a polymer constituted of several monosaccharides bonded together via O-saccharide bonds, said polymers being constituted of monosaccharide units as defined previously, said monosaccharide units comprising at least 5 carbon atoms, preferably 6; in particular, the monosaccharide units are linked together via a 1,4 or 1,6 bond, α (alpha) or β (beta) anomerically, it being possible for each saccharide unit to be of L or D configuration, and also the salts thereof and the solvates thereof such as the hydrates of said monosaccharides; more particularly, they are polymers formed from a certain number of monosaccharides having the general formula: $-[C_x(H_2O)_y)]_n-$ where x is an integer greater than or equal to 5, preferably x is greater than or equal to 6, in particular x is between 5 and 7 inclusive and preferably x = 6, and y is an integer which represents x - 1, and n is an integer greater than or equal to 2, particularly of between 3 and 3000 inclusive, more particularly between 5 and 2500 and preferentially between 10 and 2300;
- the term "bearing amine group(s)" is intended to mean that the polysaccharide(s) b) is (are) substituted with one or more amino group(s) NR_1R_2 i.e. at least one of

the hydroxyl groups of at least one saccharide unit is replaced with a group NR_1R_2 with R_1 and R_2, which may be identical or different, representing i) a hydrogen atom, ii) a (C_1-C_6)alkyl group that is optionally substituted, preferably with one or more hydroxyl or NH_2 groups, iii) an aryl group such as phenyl, iv) an aryl(C_1-C_4)alkyl group such as benzyl, v) a (hetero)cyclo(C_5-C_7)alkyl group such as cyclohexyl, morpholinyl, piperazinyl, piperidyl, vi) a (hetero)cyclo(C_5-C_7)alkyl(C_1-C_4)alkyl group such as cyclohexylmethyl, vii) $-C(Y)-(Y')_p-R'_1$ with Y and Y', which may be identical or different, representing an oxygen atom, a sulfur atom or N(R'$_2$), preferably oxygen, p = 0 or 1, preferably 0; and R'_1 and R'_2 representing i) to vi) of R_1 and R_2 defined previously, and in particular R'_1 denoting a (C_1-C_6)alkyl group such as methyl. Preferably, R_1 and R_2 represent a hydrogen atom or a (C_1-C_4)alkylcarbonyl group such as acetyl;

- the term "low molecular weight" is intended to mean that the polysaccharide bearing amine group has an average molecular weight of less than 400 000 Da;
- the term "organic or mineral acid salt" is more particularly intended to mean organic or mineral acid salts in particular chosen from a salt derived from i) hydrochloric acid HCl, ii) hydrobromic acid HBr, iii) sulfuric acid H_2SO_4, iv) alkylsulfonic acids: Alk-$S(O)_2OH$ such as methylsulfonic acid and ethylsulfonic acid; v) arylsulfonic acids: Ar-$S(O)_2OH$ such as benzenesulfonic acid and toluenesulfonic acid; vi) alkoxysulfinic acids: Alk-O-S(O)OH such as methoxysulfinic acid and ethoxysulfinic acid; vii) aryloxysulfinic acids such as tolueneoxysulfinic acid and phenoxysulfinic acid; viii) phosphoric acid H_3PO_4; ix) triflic acid CF_3SO_3H and x) tetrafluoroboric acid HBF_4; xi) organic monocarboxylic acids of formula (I)

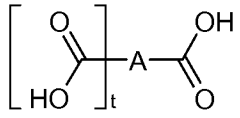
(I) R-C(O)-OH (I)

in which formula (I):

R representing a (hetero)aryl group such as phenyl, a (hetero)aryl(C_1-C_4)alkyl group such as benzyl, or (C_1-C_{30})alkyl group or an unsaturated C_2-C_{30} radical (i.e. comprising at least one ethylenic unsaturation, preferably one ethylenic unsaturation) said alkyl group or unsaturated C_2-C_{30} radical being optionally interrupted and/or optionally substituted preferably with one or more hydroxyl groups and not substituted with one or more amino radicals, R preferably denoting a (C_1-C_6)alkyl group optionally interrupted and/or optionally substituted with 1, 2 or 3 hydroxyl groups, more preferentially, R represents a (C_1-C_4)alkyl group such

as methyl or ethyl; in particular the organic monocarboxylic acids (I) are chosen from acetic acid, glycolic acid and lactic acid, and mixtures thereof, and more particularly from acetic acid and lactic acid;

xii) the polycarboxylic acids of formula (II) below:



(II)

in which formula (II):

A represents a saturated or unsaturated, cyclic or non-cyclic, aromatic or non-aromatic polyvalent hydrocarbon-based group comprising from 1 to 30 carbon atoms, optionally interrupted with one or more heteroatoms such as oxygen and/or optionally substituted notably with one or more hydroxyl groups and t represents an integer between 1 and 5 inclusive; preferably, A represents a divalent (C_1-C_6)alkylene group optionally substituted notably with one or more hydroxyl groups and not substituted with at least one amino radical, and t is equal to 1, 2 or 3, the polycarboxylic acids of formula (II) are preferably chosen from tartaric acid, succinic acid, fumaric acid and citric acid, and mixtures thereof; and

xiii) amino acids including more carboxylic acid radicals than amino groups, such as gamma-carboxyglutamic acid, aspartic acid, glutamic acid, in particular gamma-carboxyglutamic acid; in particular, salts of monocarboxylic acids other than pyrrolidonecarboxylic acid, 100 OE and 500 OE ethoxylated stearic acids, and linoleic acid;

- an "alkyl radical" is a linear or branched C_1-C_{10}, preferably C_1-C_6 and in particular C_1-C_4 hydrocarbon-based radical, such as methyl or ethyl, unless otherwise indicated;
- a (Cx-Cy)alkyl radical is a linear or branched Cx-Cy hydrocarbon-based radical;
- the expression "optionally interrupted" attributed to the alkyl radical or to the polyvalent hydrocarbon-based group A as defined previously means that said radical may be interrupted with one or more groups or heteroatoms chosen from O, S, CO or combinations thereof such as -CO-O- or -O-CO-, preferably interrupted with one or more non-adjacent oxygen atoms;
- the expression "optionally substituted" attributed to the alkyl radical or to the polyvalent hydrocarbon-based group A as defined previously means that said radical may be substituted with one or more radicals chosen from the following

radicals: i) hydroxyl, ii) C_1-C_4 alkoxy, iii) carboxyl, iv) acylamino, v) amino optionally substituted with one or two identical or different C_1-C_4 alkyl radicals, said alkyl radicals possibly forming, with the nitrogen atom that bears them, a 5- to 7-membered heterocycle, optionally comprising another nitrogen or non-nitrogen heteroatom;

- an "alkoxy radical" is an alkyl-oxy radical for which the alkyl radical is a linear or branched C_1-C_{10}, preferentially C_1-C_6 and more particularly C_1-C_4 hydrocarbon-based radical such as methoxy or ethoxy;
- when the alkoxy group is optionally substituted, this implies that the alkyl group is optionally substituted as defined hereinabove;
- the "aryl" or "heteroaryl" radicals or the aryl or heteroaryl part of a radical may be substituted with at least one substituent borne by a carbon atom, chosen from one of the following atoms or groups:
  - halogen;
  - optionally substituted C_1-C_6, preferably C_1-C_4, alkyl;
  - hydroxyl;
  - C_1-C_2 alkoxy;
  - C_1-C_4 (poly)hydroxyalkoxy;
  - amino;
  - 5- or 6-membered heterocycloalkyl;
  - 5- or 6-membered heteroaryl, optionally substituted with a (C_1-C_4)alkyl radical, preferentially methyl;
  - amino substituted with one or two optionally substituted, identical or different C_1-C_6 alkyl radicals:
  - acylamino (-NR-C(O)-R') in which the radical R is a hydrogen atom or a C_1-C_4 alkyl radical optionally bearing at least one hydroxyl group and the radical R' is a C_1-C_2 alkyl radical;
  - carbamoyl ($(R)_2N$-C(O)-) in which the radicals R, which may be identical or different, represent a hydrogen atom or a C_1-C_4 alkyl radical optionally bearing at least one hydroxyl group;
  - alkylsulfonylamino (R'-$S(O)_2$-N(R)-) in which the radical R represents a hydrogen atom or a C_1-C_4 alkyl radical optionally bearing at least one hydroxyl group and the radical R' represents a C_1-C_4 alkyl radical, or a phenyl radical;

- aminosulfonyl ($(R)_2N-S(O)_2-$) in which the radicals R, which may be identical or different, represent a hydrogen atom or a C_1-C_4 alkyl radical optionally bearing at least one hydroxyl group;
- cyano;
- nitro or nitroso; and
- polyhaloalkyl, preferentially trifluoromethyl;

the cyclic or heterocyclic part of a non-aromatic group may be substituted with at least one substituent chosen from the following groups:

- hydroxyl;
- C_1-C_4 alkoxy or C_2-C_4 (poly)hydroxyalkoxy;
- C_1-C_4 alkyl;
- alkylcarbonylamino (R-C(O)-N(R')-), in which the radical R' is a hydrogen atom or a C_1-C_4 alkyl radical optionally bearing at least one hydroxyl group and the radical R is a C_1-C_2 alkyl group or an amino optionally substituted with one or two identical or different C_1-C_4 alkyl groups which themselves optionally bear at least one hydroxyl group;
- alkylcarbonyloxy (R-C(O)-O-), in which the radical R is a C_1-C_4 alkyl radical or an amino group optionally substituted with one or two identical or different C_1-C_4 alkyl groups which themselves optionally bear at least one hydroxyl group;
- alkoxycarbonyl (R-G-C(O)-), in which the radical R is a C_1-C_4 alkoxy radical and G is an oxygen atom, or an amino group optionally substituted with a C_1-C_4 alkyl group which itself optionally bears at least one hydroxyl group;

- a cyclic or heterocyclic radical, or a non-aromatic part of an aryl or heteroaryl radical, may also be substituted with one or more oxo groups;
- an "aryl" radical represents a monocyclic or fused or non-fused polycyclic carbon-based group, comprising from 6 to 22 carbon atoms, at least one ring of which is aromatic; such as phenyl, biphenyl, naphthyl, indenyl, anthracenyl or tetrahydronaphthyl, preferentially phenyl;
- a "heteroaryl radical" represents an optionally cationic, 5- to 22-membered, monocyclic or fused or non-fused polycyclic group, comprising from 1 to 6 heteroatoms chosen from nitrogen, oxygen, sulfur and selenium atoms, at least one ring of which is aromatic; preferentially, a heteroaryl radical is chosen from

acridinyl, (benz)imidazolyl, (benzo)bistriazolyl, (benzo)pyrazolyl, (benzo)pyridazinyl, (benzo)quinolyl, (benzo)thiazolyl, (benzo)triazolyl, (benz)oxazolyl, pyridinyl, tetrazolyl, dihydrothiazolyl, imidazopyridyl, indolyl, isoquinolyl, naphthoimidazolyl, naphthoxazolyl, naphthopyrazolyl, oxadiazolyl, oxazolyl, oxazolopyridyl, phenazinyl, phenoxazolyl, pyrilyl, pyrazoyltriazyl, pyridyl, pyridinoimidazolyl, pyrrolyl, quinolyl, tetrazolyl, thiadiazolyl, thiazolopyridyl, thiazoylimidazolyl, thiopyrylyl, triazolyl and xanthylyl;

- a "heterocyclic radical" is a fused or non-fused, 5- to 22-membered monocyclic or polycyclic non-aromatic radical, possibly containing one or two unsaturations, comprising from 1 to 6 heteroatoms chosen from nitrogen, oxygen, sulfur and selenium atoms;
- a “heterocycloalkyl radical" is a heterocyclic radical comprising at least one saturated ring;
- the term “limp” keratin fibres or “limp” hair is understood to mean that said fibres or hair are elastic, have no body, do not hold shape, and the head of hair is flat without volume;
- the expression “at least one” is equivalent to “one or more”;
- the limits of a range of values are included in that range, notably in the expressions "between ... and ..." and "ranging from ... to ..."; and
- the term "inclusive" for a range of concentrations means that the limits of that range are included in the defined range.

The monosaccharides

The process according to the present invention comprises a step consisting in applying to keratin fibres a) one or more monosaccharide(s), and also the α or β anomers thereof, the optical isomers thereof of L or D configuration and the solvates thereof such as hydrates, and mixtures thereof, also referred to as ingredients a).

According to a particular form of the invention, the monosaccharide(s) a) denote a mixture of monosaccharides, one of which is xylose or the α or β anomers thereof, the optical isomers thereof of L or D configuration and the solvates thereof such as hydrates.

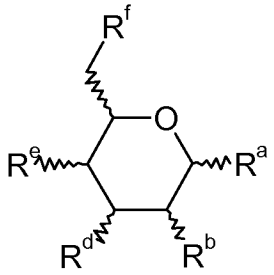
According to another particular form of the invention, the monosaccharide(s) a) denote a single monosaccharide, in particular xylose or the α or β anomers thereof,

the optical isomers thereof of L or D configuration and the solvates thereof such as hydrates.

According to a first embodiment of the invention, the monosaccharide(s) a) are chosen from C_7 monosaccharides: heptoses, such as aldoheptoses and ketoheptoses, and also the α or β anomers thereof, the optical isomers thereof of L or D configuration and the solvates thereof such as hydrates.

According to a second preferred embodiment of the invention, the monosaccharide(s) a) is (are) C_6 monosaccharides: hexoses, and also the α or β anomers thereof, the optical isomers thereof of L or D configuration and the solvates thereof such as hydrates, and mixtures thereof.

More preferentially, the monosaccharide(s) a) are chosen from hexoses of formula (A1), and also the α or β anomers thereof, the optical isomers thereof of L or D configuration and the solvates thereof such as hydrates, and mixtures thereof:

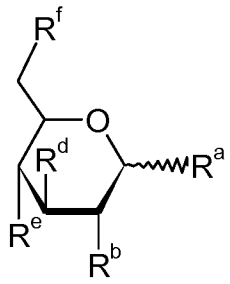


(A1)

in which formula (A1) R^a, R^b, R^d, R^e and R^f, which may be identical or different, represent i) a hydroxyl group, ii) a (C_1-C_4)alkoxy group, the alkyl chain of which may be optionally substituted, notably with one or more hydroxyl groups, or iii) a carboxyl group; more preferentially, R^a, R^b, R^d, R^e and R^f represent a hydroxyl group.

Preferably, the monosaccharide(s) a) are chosen from the hexoses of formula (A1) of D configuration, also known as D-glucopyrans, and better still from the hexoses of formula (A1) of β (beta) anomeric configuration.

Even better still, the monosaccharide(s) a) are chosen from hexoses of formula (A1') below, and also the α or β anomers thereof, the optical isomers thereof of L or D configuration, preferably D configuration, and the solvates thereof such as hydrates, and mixtures thereof:



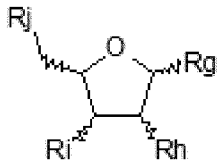
(A1')

in which formula (A1') R^a, R^b, R^d, R^e and R^f are as defined previously for (A1).

The monosaccharide(s) a) are advantageously chosen from aldohexoses and ketohexoses, preferably from glucose, galactose, allose, altrose, mannose, gulose, idose and talose, and also the alpha or beta anomers thereof, the optical isomers thereof of L or D configuration, the solvates thereof such as hydrates, and mixtures thereof, more preferentially from glucose and galactose, better still glucose, and even better still glucose of D configuration.

According to yet a third particular embodiment, the monosaccharide(s) a) of the invention is (are) C_5 monosaccharides: pentoses, and also the α or β anomers thereof, the optical isomers thereof of L or D configuration and the solvates thereof such as hydrates, and mixtures thereof.

According to this particular embodiment of the invention, the monosaccharide(s) a) are chosen from the pentoses of formula (A2), and also the α or β anomers thereof, the optical isomers thereof of L or D configuration and the solvates thereof such as hydrates, and mixtures thereof:



(A2)

in which formula (A2), Rg, Rh, Ri and Rj, which may be identical or different, represent i) a hydroxyl group, or ii) a (C_1-C_4)alkoxy group, the alkyl chain of which may be optionally substituted, notably with one or more hydroxyl groups.

More preferentially, the monosaccharide(s) a) are chosen from the pentoses of formula (A2) of D configuration, and better still from the pentoses of formula (A2) of β (beta) anomeric configuration.

Preferably, the monosaccharide(s) a) are chosen from aldopentoses and ketopentoses, and more preferentially from xylose, arabinose, lyxose, ribose, ribulose and xylulose, and also the α or β anomers thereof, the optical isomers thereof of L or D configuration and the solvates thereof such as hydrates, and mixtures thereof. Preferably, the monosaccharide a) is xylose, and more preferentially xylose of D configuration.

The monosaccharide(s) a) are advantageously chosen from xylose and glucose, and mixtures thereof.

The polysaccharides bearing amine group(s)

The process according to the present invention also comprises a step consisting in applying to keratin fibres b) one or more polysaccharide(s) bearing amine group(s), and also the organic or mineral acid salts thereof, the α or β anomers thereof, the optical isomers thereof of L or D configuration and the solvates thereof such as hydrates, also referred to as ingredients b).

Preferably, the polysaccharide(s) bearing amine group(s) b) has (have) an average molecular weight (MW) of less than or equal to 400 kDa and more preferentially less than 200 kDa.

Advantageously, the polysaccharide(s) bearing amine group(s) b) have a low average molecular weight MW, i.e. they have a molecular weight of less than 100 kDa, preferably less than 40 kDa; more preferentially, they have an average MW of between 1 kDa and 30 kDa and better still between 3 kDa and 28 kDa.

The polysaccharide(s) bearing amine group(s) b) is (are) preferably of natural animal or plant origin, or else are derived from synthesis, semisynthesis or biosynthesis.

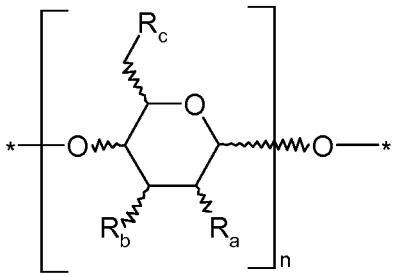
According to a particular embodiment of the invention, the polysaccharide(s) bearing amine group(s) b) is (are) chosen from polysaccharides bearing C_5-C_7 saccharide units bearing amine group(s), and also the organic or mineral acid salts thereof, the α or β anomers thereof, the optical isomers thereof of L or D configuration, and the solvates thereof such as hydrates, and mixtures thereof.

More particularly, the polysaccharide(s) bearing amine group(s) b) bear(s) a C_6 saccharide unit bearing amine group(s), these polysaccharides bearing amine group(s) are then referred to as polyhexosamines.

According to a particular embodiment, the saccharide units of the polysaccharide bearing amine group(s) b) are of β (beta) anomeric configuration and/or D configuration.

According to a particular embodiment, the saccharide units of the polysaccharide bearing amine group(s) b) are connected together between the atoms of carbon 1 of one saccharide unit and of carbon 4 of the other saccharide unit, denoted (1→4).

According to this embodiment, the polysaccharide(s) bearing amine group(s) are preferably chosen from polysaccharides bearing a saccharide unit of formula (B) below, and also the organic or mineral acid salts thereof, the α or β anomers thereof, the optical isomers thereof of L or D configuration, and the solvates thereof such as hydrates, and mixtures thereof:



(B)

in which formula (B):

- n is an integer greater than or equal to 2, particularly between 3 and 3000 inclusive, more particularly between 5 and 2500, preferentially between 10 and 2300;
- R_a, R_b and R_c, which may be identical or different for each saccharide unit, represent (1) a hydroxyl group, (2) a (C_1-C_4)alkoxy group, the alkyl chain of which may be optionally substituted notably with one or more hydroxyl and/or carboxyl groups, (3) a carboxyl group, or (4) a group NR_1R_2 with R_1 and R_2, which may be identical or different, representing i) a hydrogen atom, ii) a (C_1-C_6)alkyl group that is optionally substituted, preferably with one or more hydroxyl or NH_2 groups, iii) an aryl group such as phenyl, iv) an aryl(C_1-C_4)alkyl group such as benzyl, v) a (hetero)cyclo(C_5-C_7)alkyl group such as cyclohexyl, morpholinyl, piperazinyl or piperidyl, vi) a (hetero)cyclo(C_5-C_7)alkyl(C_1-C_4)alkyl group such as cyclohexylmethyl, vii) –C(Y)-

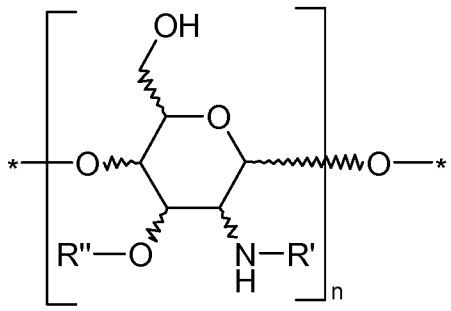
$(Y')_p$-R'_1 with Y and Y', which may be identical or different, representing an oxygen atom, a sulfur atom or $N(R'_2)$, preferably oxygen, p = 0 or 1, preferably 0; and R'_1 and R'_2 representing i) to vi) of R_1 and R_2 defined previously, and in particular R'_1 denoting a $(C_1$-$C_6)$alkyl group such as methyl;

it being understood that at least one of the radicals R_a, R_b or R_c of at least one saccharide unit represents a group NR_1R_2 and that at least one of the groups NR_1R_2 of at least one saccharide unit represents an NH_2 group.

Preferably, R_1 and R_2 are chosen from a hydrogen atom and –C(O)-R'_1 in which R'_1 is as defined previously; and more preferentially R_1 and R_2 represent i) a hydrogen atom or ii) –C(O)-R'_1, with R'_1 representing a $(C_1$-$C_4)$alkyl group such as methyl.

Preferably, R_a of at least one saccharide unit represents a group NR_1R_2 with R_1 which represents a hydrogen atom and R_2 is chosen from i) a hydrogen atom or ii) a group –C(O)-R'_1, and R_b and R_c represent a hydroxyl group, it being understood that at least one of the groups NR_1R_2 of at least one saccharide unit represents an NH_2 group.

More particularly, the polysaccharide(s) bearing amine group(s) b) is (are) chosen from polysaccharides bearing saccharide units of formula (B1) below, and also the organic or mineral acid salts thereof, the α or β anomers thereof, the optical isomers thereof of L or D configuration, and the solvates thereof such as hydrates, and mixtures thereof:



(B1)

in which formula (B1):

- R' represents a hydrogen atom or a $(C_1$-$C_4)$alkylcarbonyl group such as acetyl CH_3-C(O)-;
- R'' represents a hydrogen atom or a $(C_1$-$C_4)$alkyl group optionally substituted with a carboxyl group such as –$CH(CO_2H)$-CH_3;

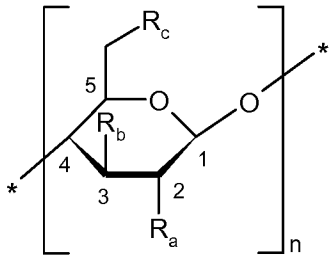
- n is an integer greater than or equal to 2, preferably between 3 and 3000, more preferentially between 5 and 2500, and better still between 10 and 2300;

it being understood that at least one saccharide unit bears an NH_2 amino group and at least one other saccharide unit bears at least one N(H)-R' group with R' representing a $(C_1$-$C_4)$alkylcarbonyl group such as acetyl CH_3-C(O)-.

Preferably, the saccharide units of formula (B) or (B1) are of D configuration, also referred to as D-glucopyran.

Particularly, the saccharide units of formula (B) or (B1) are of β (beta) anomeric configuration.

According to one particular embodiment, the polysaccharide(s) b) is (are) chosen from the polysaccharides bearing a saccharide unit of formula (B2) below and also the organic or mineral acid salts thereof, and the solvates thereof such as hydrates, and mixtures thereof:



(B2)

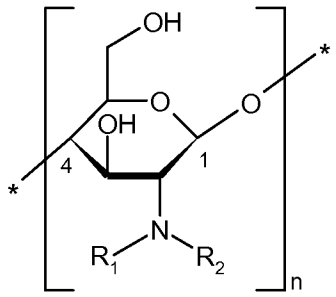
in which formula (B2):

- R_a, R_b and R_c are as defined for (B) previously; and the radicals R_a, R_b and R_c of each saccharide unit may be identical or different; and
- n is an integer greater than or equal to 2, preferably between 3 and 3000, more preferentially between 5 and 2500, and better still between 10 and 2300;

it being understood that at least one of the radicals R_a, R_b or R_c of at least one saccharide unit represents a group NR_1R_2, with R_1 and R_2 as defined previously for (B), and that at least one of the groups NR_1R_2 of at least one saccharide unit represents an NH_2 group; preferably, at least one saccharide unit bears a group R_a representing an NH_2 amino group and at least one other saccharide unit bears a group R_a representing a group -N(H)-R' with R' representing a $(C_1$-$C_4)$alkylcarbonyl group such as acetyl CH_3-C(O)-.

Preferably, the polysaccharide(s) bearing amine group(s) b) is (are) chosen from chitin and chitosan, and derivatives thereof, and more preferentially chitosan.

More particularly, the polysaccharide(s) bearing amine group(s) b) is (are) chosen from polysaccharides bearing a saccharide unit of formula (B3) below, and also the organic or mineral acid salts thereof, and the solvates thereof such as hydrates, and mixtures thereof:



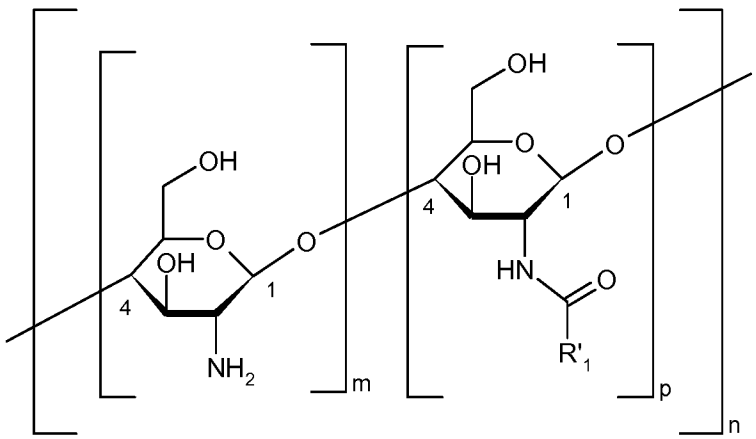
(B3)

in which formula (B3):

- R_1 and R_2 are as defined previously in formulae (B) and (B2); and
- n is an integer greater than or equal to 2, preferably between 3 and 3000, more preferentially between 5 and 2500, and better still between 10 and 2300;

it being understood that at least one saccharide unit bears an NH_2 amino group and that at least one other saccharide unit bears a group N(H)-R' with R' representing a (C_1-C_4)alkylcarbonyl group such as acetyl CH_3-C(O)-.

More particularly, the polysaccharide(s) bearing amine group(s) b) is (are) chosen from the chitosans of formula (B4) below, and also the organic or mineral acid salts thereof, and the solvates thereof such as hydrates, and mixtures thereof:



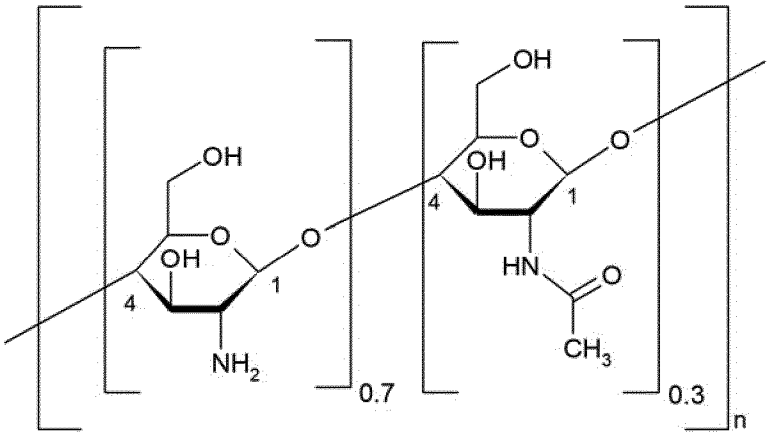
(B4)

in which formula (B4):

- R'_1 representing a (C_1-C_4)alkyl group such as methyl; and
- n is an integer greater than or equal to 2, preferably between 3 and 3000, more preferentially between 5 and 2500, and better still between 10 and 2300;
- p is greater than 0 and ranges up to 0.5, preferably from 0.05 to 0.3, and better still from 0.1 to 0.20 such as 0.15 with m+p being equal to 1;

it being understood that, in the chitosan, at least one saccharide unit bears an amino group NH_2 and at least one other saccharide unit bears a group N(H)-R'_1 with R'_1 representing a (C_1-C_4)alkylcarbonyl group such as acetyl CH_3-C(O)-.

For example, when m = 0.7 and p = 0.3, this means that 70% of the amine groups are free (unsubstituted) and 30% of the amino groups are N-alkyl(C_1-C_4)carbonyl groups, in particular N-acetyl groups, corresponding to the chitosan polymer of formula:



with n as defined previously.

Preferably, the polysaccharide(s) bearing amine group(s) b) is (are) salified, or in salified form, using one or more organic or mineral acids, and preferably using one or more organic acids.

The organic or mineral acid(s) that can be used correspond to the mineral and organic acids described previously in the “organic or mineral acid salt” section.

Preferably, the polysaccharide(s) bearing amine group(s) b) is (are) salified using one or more organic acid(s) chosen from:

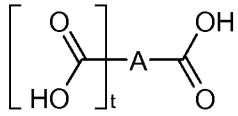
- the monocarboxylic acids of formula (I):

R-C(O)-OH (I)

in which formula (I), R represents a (hetero)aryl radical such as phenyl, a (hetero)aryl(C_1-C_4)alkyl radical such as benzyl, a (C_1-C_{30})alkyl radical or an

unsaturated C_2-C_{30} radical (i.e. comprising at least one ethylenic unsaturation, preferably one ethylenic unsaturation); said C_2-C_{30} alkyl radicals being optionally interrupted and/or optionally substituted preferably with one or more hydroxyl groups and not substituted with one or more amino radicals; R preferably denoting a (C_1-C_6)alkyl group optionally interrupted and/or optionally substituted with 1, 2 or 3 hydroxyl groups; preferably, R represents a (C_1-C_4)alkyl group such as methyl or ethyl;

- the polycarboxylic acids of formula (II):



(II)

in which formula (II), A represents a saturated or unsaturated, cyclic or non-cyclic, aromatic or non-aromatic polyvalent hydrocarbon-based group comprising from 1 to 30 carbon atoms, optionally interrupted with one or more heteroatoms such as oxygen and/or optionally substituted notably with one or more hydroxyl groups and t represents an integer between 1 and 5 inclusive; preferably, A represents a divalent (C_1-C_6)alkylene group optionally substituted notably with one or more hydroxyl groups and not substituted with at least t amino radicals, and t is equal to 1, 2 or 3; and

- amino acids including more carboxylic acid radicals than amino groups.

Preferably, the monocarboxylic organic acids of formula (I) are chosen from acetic acid, glycolic acid, lactic acid, and mixtures thereof, and more preferentially from acetic acid, lactic acid, and mixtures thereof.

Preferably, the polycarboxylic acids of formula (II) are chosen from tartaric acid, succinic acid, fumaric acid, maleic acid, citric acid, and mixtures thereof.

Preferably, the amino acids including more carboxylic acid radicals than amino groups are chosen from gamma-carboxyglutamic acid, aspartic acid, glutamic acid, and mixtures thereof, and more preferentially gamma-carboxyglutamic acid.

More preferentially, the organic acid(s) that may be used is (are) chosen from acetic acid, glycolic acid, lactic acid, tartaric acid, succinic acid, fumaric acid, maleic acid, citric acid, gamma-carboxyglutamic acid, aspartic acid, glutamic acid, and mixtures thereof, and preferably, the organic acid is lactic acid.

Particularly, the polysaccharide(s) bearing amine group(s) b) is (are) chosen from chitosans, salified using organic acid, preferentially using monocarboxylic acid of formula (I) as defined previously or polycarboxylic acid of formula (II) as defined

previously, even more preferentially salified using carboxylic acid of formula (I) such as lactic acid.

According to one particular form of the invention, the polysaccharide(s) bearing amine group(s) b) denote(s) a mixture of polysaccharide(s) bearing amine group(s), one of which is a chitosan or the organic or mineral acid salts thereof, preferably the salts thereof of an organic acid such as lactic acid, the α or β anomers thereof, the optical isomers thereof of L or D configuration, and the solvates thereof such as hydrates.

According to another particular form of the invention, the polysaccharide(s) bearing amine group(s) b) denote(s) a single polysaccharide bearing amine group(s), in particular a mixture of chitosan or the organic or mineral acid salts thereof or more particularly the organic acid salts thereof such as the lactic acid salt thereof, the α or β anomers thereof, the optical isomers thereof of L or D configuration, and the solvates thereof such as hydrates.

According to yet another particular form of the invention, the polysaccharide(s) bearing amine group(s) b) denote(s) a single polysaccharide bearing amine group(s), in particular a chitosan or the organic or mineral acid salts thereof or more particularly the organic acid salts thereof such as the lactic acid salt thereof, the α or β anomers thereof, the optical isomers thereof of L or D configuration, and the solvates thereof such as hydrates.

The compositions

Another subject of the present invention is an aqueous composition (C) at acidic pH comprising:

a) one or more monosaccharide(s) as defined previously,

b) one or more polysaccharide(s) bearing amine group(s), in salified or non-salified form, as defined previously, preferably having an average molecular weight of less than or equal to 400 kDa, and

c) optionally one or more mineral or organic acid(s) preferably different from the following acids: aspartic acid, glutamic acid, gluconic acid, pyrrolidonecarboxylic acid, 100 OE and 500 OE ethoxylated stearic acid, linoleic acid, succinic acid.

According to one particular mode of the invention, the ingredients a) and b) as defined previously are applied sequentially and are preferably included in two distinct compositions (ca) and (cb). In other words, the composition (ca) comprises a)

one or more monosaccharides as defined previously, and the composition (cb) comprises b) one or more polysaccharide(s) bearing amine group(s), in salified or non-salified form, as defined previously, and optionally c) one or more mineral or organic acid(s), preferably different from the following acids: aspartic acid, glutamic acid, gluconic acid, pyrrolidonecarboxylic acid, 100 OE and 500 OE ethoxylated stearic acid, linoleic acid, succinic acid.

The organic or mineral acid(s) that may be used in the compositions (C) and (cb) of the invention correspond to the mineral and organic acids described previously in the "organic or mineral acid salt" section.

The content of the monosaccharide(s) present in the compositions (C) or (ca) preferably ranges from 0.05% to 15% by weight, more preferentially from 0.1% to 10% by weight and even better still from 0.2% to 6% by weight, relative to the total weight of the composition comprising it (them).

The content of the polysaccharide(s) bearing amine group(s), present in the compositions (C) or (cb), preferably ranges from 0.01% to 20% by weight, more preferentially from 0.05% to 10% by weight and even better still from 0.1% to 5% by weight, relative to the total weight of the composition comprising it (them).

The weight ratio of the content of the monosaccharide(s) a) to the content of the polysaccharide(s) bearing amine group(s) b), present in the composition (C), preferably ranges from 0.5 to 5, and is more preferentially equal to 1.

The composition of the invention (C) or composition(s) (ca) and/or (cb) are cosmetic compositions, i.e. they contain a physiologically acceptable medium, that is to say a medium compatible with human keratin materials such as the skin (of the body, face, area around the eyes, or the scalp), the hair, the eyelashes, the eyebrows, bodily hair, the nails or the lips.

The physiologically acceptable medium of the composition(s) (C), (ca) and/or (cb) is advantageously an aqueous medium. It may for example contain water or a mixture of water and at least one cosmetically acceptable organic solvent.

Examples of cosmetically acceptable organic solvents that may be mentioned include C_2-C_4 lower alcohols, such as ethanol and isopropanol; polyols, especially those containing from 2 to 6 carbon atoms, for instance glycerol, propylene glycol, butylene glycol, pentylene glycol, hexylene glycol, dipropylene glycol or diethylene glycol; polyol ethers, for instance 2-butoxyethanol, propylene glycol monomethyl

ether and diethylene glycol monomethyl ether or monoethyl ether; and mixtures thereof.

Preferably, the cosmetic composition(s) (C), (ca) and/or (cb) each comprise from 50% to 99.8% by weight of water, relative to the total weight of each composition.

The pH values of the compositions (C), (ca) and (cb) of the invention may be adjusted with an organic or mineral acid, or with an alkaline agent chosen from mineral, organic or hybrid alkaline agents or mixtures thereof.

The pH values may be adjusted with c) one or more organic or mineral acids as defined previously in *"organic or mineral acid salt"*.

Preferably, the composition (ca) which comprises a) one or more monosaccharides as defined previously, and in particular glucose or xylose, is at an acidic pH, i.e. less than 7, and in particular less than or equal to 6. More particularly, the pH of the composition (ca) is between 2 and 6, preferentially between 2.5 and 5.5 and more preferentially between 3.5 and 5, such as 4.5.

Preferably, the monosaccharide(s) a), present in the composition (ca) are in the presence of one or more mineral acid(s), and more particularly hydrochloric acid.

Preferably, the composition (cb) which comprises b) one or more polysaccharide(s) bearing amine group(s) as defined previously, and in particular a polysaccharide comprising saccharide units of formula (B), (B1), (B2), (B3) or (B4) as defined previously, such as chitosan, is at an acidic pH, i.e. less than 7, and in particular less than or equal to 6. More particularly, the pH of the composition (cb) is between 2 and 6, preferentially between 2.5 and 5.5 and more preferentially between 3.5 and 5, such as 4.5.

Preferably, the polysaccharide(s) bearing amine group(s) b), present in the composition (cb), are in the presence of one or more organic acid(s), preferentially chosen from the monocarboxylic acids of formula (I) or the polycarboxylic acids of formula (II) as defined previously, and even more preferentially from the carboxylic acids of formula (I), such as lactic acid.

According to a first particular embodiment of the invention, the composition (C) comprises:

- a) one or more monosaccharides as defined previously, preferably glucose or xylose, in the presence of one or more mineral acid(s), preferably hydrochloric acid, and
- b) one or more polysaccharide(s) bearing amine group(s) as defined previously, preferably a polysaccharide comprising saccharide units of formula (B), (B1), (B2),

(B3) or (B4) as defined previously, more preferentially chitosan, and even better still chitosan having an average molecular weight of less than or equal to 400 kDa, in the presence of one or more mineral acid(s), preferably lactic acid,

- and optionally c) one or more mineral or organic acid(s), preferably different from the following acids: aspartic acid, glutamic acid, gluconic acid, pyrrolidonecarboxylic acid, 100 OE and 500 OE ethoxylated stearic acid, linoleic acid and succinic acid;

the pH of said composition (C) is acidic, i.e. less than 7, preferably less than or equal to 6, more preferentially between 2 and 6, even better still between 2.5 and 5.5, and even more preferentially between 3.5 and 5, such as 4.5.

According to a second particular embodiment of the invention, the composition (C) comprises:

- a) one or more monosaccharides as defined previously, preferably glucose or xylose, in the absence of organic or mineral acid(s), and
- b) one or more polysaccharide(s) bearing amine group(s) as defined previously, preferably a polysaccharide comprising saccharide units of formula (B), (B1), (B2), (B3) or (B4) as defined previously, more preferentially chitosan, in the presence of one or more mineral acid(s), preferably lactic acid,
- and optionally c) one or more mineral or organic acid(s), preferably different from the following acids: aspartic acid, glutamic acid, gluconic acid, pyrrolidonecarboxylic acid, 100 OE and 500 OE ethoxylated stearic acid, linoleic acid and succinic acid;

the pH of said composition (C) is acidic, i.e. less than 7, preferably less than or equal to 6, more preferentially between 2 and 6, even better still between 2.5 and 5.5, and even more preferentially between 3.5 and 5, such as 4.5.

According to a third particular embodiment of the invention, the composition (C) comprises:

- a) one or more monosaccharides as defined previously, preferably glucose or xylose, in the presence of one or more mineral acid(s), preferably hydrochloric acid, and
- b) one or more polysaccharide(s) bearing amine group(s) as defined previously, preferably a polysaccharide comprising saccharide units of formula (B), (B1), (B2), (B3) or (B4) as defined previously, more preferentially chitosan, and even better still chitosan having an average molecular weight of less than or equal to 400 kDa, in the absence of organic or mineral acid(s),

- and optionally c) one or more mineral or organic acid(s), preferably different from the following acids: aspartic acid, glutamic acid, gluconic acid, pyrrolidonecarboxylic acid, 100 OE and 500 OE ethoxylated stearic acid, linoleic acid and succinic acid;

the pH of said composition (C) is acidic, i.e. less than 7, preferably less than or equal to 6, more preferentially between 2 and 6, even better still between 2.5 and 5.5, and even more preferentially between 3.5 and 5, such as 4.5.

According to a fourth particular embodiment of the invention, the composition (C) comprises:

- a) one or more monosaccharides as defined previously, preferably glucose or xylose, in the absence of mineral acid(s),
- b) one or more polysaccharide(s) bearing amine group(s) as defined previously, preferably a polysaccharide comprising saccharide units of formula (B), (B1), (B2), (B3) or (B4) as defined previously, more preferentially chitosan, and even better still chitosan having an average molecular weight of less than or equal to 400 kDa, in the absence of organic or mineral acid(s), and
- c) one or more mineral or organic acid(s) different from the following acids: aspartic acid, glutamic acid, gluconic acid, pyrrolidonecarboxylic acid, 100 OE and 500 OE ethoxylated stearic acid, linoleic acid and succinic acid, said acid c) preferably being chosen from hydrochloric acid, the organic monocarboxylic acids of formula (I) as defined previously, the polycarboxylic acids of formula (II) as defined previously, and more preferentially from hydrochloric acid, lactic acid, citric acid, fumaric acid and maleic acid, and mixtures thereof;

the pH of said composition (C) is acidic, i.e. less than 7, preferably less than or equal to 6, more preferentially between 2 and 6, even better still between 2.5 and 5.5, and even more preferentially between 3.5 and 5, such as 4.5.

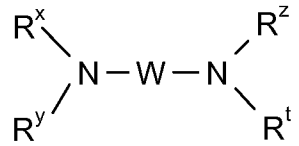
The pH values of the compositions (C), (ca) and (cb) may be adjusted with one or more mineral alkaline agents which are preferably chosen from aqueous ammonia, alkali metal carbonates or bicarbonates such as sodium or potassium carbonates and sodium or potassium bicarbonates, sodium hydroxide or potassium hydroxide, or mixtures thereof.

The pH values may also be adjusted with one or more organic alkaline agents which are organic amines, i.e. they contain at least one substituted or unsubstituted amino group. The organic alkaline agent(s) are more preferentially chosen from organic amines with a pK_b at 25°C of less than 12, preferably of less than 10 and even

more advantageously of less than 6. It should be noted that it is the pK_b corresponding to the function of highest basicity.

The pH values may also be adjusted with one or more hybrid compounds. 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 alkanolamines, oxyethylenated and/or oxypropylenated ethylenediamines, amino acids and the compounds of formula (III) below:



(III)

in which formula (III):

- W is a divalent C_1-C_6 alkylene radical optionally substituted by a hydroxyl group or a C_1-C_6 alkyl radical and/or optionally interrupted by one or more heteroatoms, such as oxygen or NR^u;
- R^x, R^y, R^z, R^t and R^u, which may be identical or different, represent a hydrogen atom, a C_1-C_6 alkyl radical, a C_1-C_6 hydroxyalkyl radical or a C_1-C_6 aminoalkyl radical.

The polysaccharide(s) bearing amine group(s), present in the composition (C) of the invention may be salified or non-salified.

According to a first variant of the invention, the composition (C) corresponds to the composition (C') at acidic pH and comprises:

- a) one or more monosaccharide(s) as defined previously;
- b) one or more salified polysaccharide(s) bearing amine group(s) as defined previously, preferably having an average molecular weight of less than or equal to 400 kDa;
- and optionally c) one or more mineral or organic acid(s), preferably different from the following acids: aspartic acid, glutamic acid, gluconic acid, pyrrolidonecarboxylic acid, 100 OE and 500 OE ethoxylated stearic acid, linoleic acid and succinic acid.

According to another variant of the invention, the composition (C) corresponds to the composition (C'') at acidic pH and comprises:

- a) one or more monosaccharide(s) as defined previously; and

- b) one or more non-salified polysaccharide(s) bearing amine group(s) as defined previously, preferably having an average molecular weight of less than or equal to 400 kDa,
- and optionally c) one or more mineral or organic acid(s), preferably different from the following acids: aspartic acid, glutamic acid, gluconic acid, pyrrolidonecarboxylic acid, 100 OE and 500 OE ethoxylated stearic acid, linoleic acid or succinic acid.

Process for treating keratin fibres

The process for treating keratin fibres, in particular human keratin fibres such as the hair, comprises:

(i) a step consisting in applying to said keratin fibres a) one or more monosaccharide(s) as defined previously;

(ii) a step consisting in applying, to said keratin fibres, b) one or more polysaccharide(s) bearing amine group(s), in salified or non-salified form, as defined previously, preferably having an average molecular weight of less than or equal to 400 kDa;

(iii) optionally a step of drying said keratin fibres;

(iv) then a step of heat treatment of said keratin fibres at a temperature of greater than or equal to 80°C, preferably of between 100°C and 250°C, and preferably with an iron;

it being understood that the steps (i) and (ii) may be carried out simultaneously, or sequentially, preferably steps (i) and (ii) are carried out simultaneously, and that the drying step (iii), when it is present, precedes the heat treatment step (iv) and follows the steps (i) and (ii).

In other words, whether or not the drying step (iii) is present, steps (i) and (ii) precede the heat treatment step (iv).

According to a first particular embodiment of the process of the invention, steps (i) and (ii) are carried out simultaneously, that is to say together. In other words, a) the monosaccharide(s) as defined previously and b) the polysaccharide(s) bearing amine group(s), in salified or non-salified form, as defined previously, are applied together or else the process of the invention comprises a first step of applying, to the keratin fibres, an aqueous composition (C) as defined previously.

Preferably, the process of the invention comprises a first step consisting in applying, to the keratin fibres, the composition (C) as defined previously, optionally followed by a step of drying said keratin fibres, followed by a step of heat treatment of

said keratin fibres at a temperature of greater than 80°C, preferably of between 100°C and 250°C, and preferably with an iron.

According to a first advantageous variant of the invention, the composition (C) is the composition (C') as defined previously.

According to another advantageous variant of the invention, the composition (C) represents a composition (C") as defined previously.

In other words, according to a first variant of this embodiment, the process of the invention comprises:

- a step consisting in simultaneously applying, to the keratin fibres, a) the monosaccharide(s) and b) the polysaccharide(s) bearing amine group(s), as defined previously, followed by a leave-on time of between 1 and 60 minutes,
- then a step of drying said keratin fibres,
- then a step of heat treatment of said keratin fibres at a temperature of greater than or equal to 80°C, preferably of between 100°C and 250°C.

According to a second variant of this embodiment, the process of the invention comprises:

- a step consisting in applying, to the keratin fibres, a composition (C), (C') or (C'') as defined previously, followed by a leave-on time of between 1 and 60 minutes,
- then a step of drying said keratin fibres,
- then a step of heat treatment of said keratin fibres at a temperature of greater than or equal to 80°C, preferably of between 100°C and 250°C.

According to this particular embodiment of the process of the invention, the ingredients a) and b) as defined previously are present in the same cosmetic composition (C), (C') or (C"). They are therefore applied simultaneously to the keratin fibres. According to this embodiment, the preferred contents are:

- for the monosaccharide(s) a) as defined previously, the content ranges from 0.05% to 15% by weight, preferably from 0.1% to 10% by weight, and more preferentially from 0.2% to 6% by weight, relative to the total weight of the composition comprising it (them); and
- for the polysaccharide(s) bearing amine group(s) b) as defined previously, the content ranges from 0.01% to 20% by weight, preferably from 0.05% to 10% by weight, and more preferentially from 0.1% to 5% by weight, relative to the total weight of the composition comprising it (them).

According to a second particular embodiment of the process of the invention, the ingredients a) and b) as defined previously are applied sequentially. In other words, the ingredients a) and b) are applied separately in two distinct application steps and/or two distinct compositions.

According to a first variant of this embodiment, the process of the invention comprises:

- a first step consisting in applying, to said fibres, a) one or more monosaccharide(s) as defined previously, preferably in salified form,
- then optionally a step of drying said keratin fibres,
- then a second step consisting in applying, to said fibres, b) one or more polysaccharide(s) bearing amine group(s), in salified or non-salified form, preferably salified form, as defined previously, and preferably having an average molecular weight of less than or equal to 400 kDa;
- then optionally a step of drying said keratin fibres,
- then a step of heat treatment of said keratin fibres at a temperature of greater than or equal to 80°C, preferably of between 100°C and 250°C.

According to a second variant of this embodiment, the process of the invention comprises:

- a first step consisting in applying, to said fibres, b) one or more polysaccharide(s) bearing amine group(s), in salified or non-salified form, preferably salified form, as defined previously, and preferably having an average molecular weight of less than or equal to 400 kDa;
- then optionally a step of drying said keratin fibres,
- then a second step consisting in applying, to said fibres, a) one or more monosaccharide(s) as defined previously;
- then optionally a step of drying said keratin fibres,
- then a step of heat treatment of said keratin fibres at a temperature of greater than or equal to 80°C, preferably of between 100°C and 250°C.

According to yet a third variant of this embodiment, the process of the invention comprises:

(i) a step consisting in applying, to said keratin fibres, a cosmetic composition (ca) containing a) one or more monosaccharide(s) as defined previously;

(ii) a step consisting in applying, to said keratin fibres, a cosmetic composition (cb) containing b) one or more polysaccharide(s) bearing amine group(s) as defined

previously, preferably having an average molecular weight of less than or equal to 400 kDa;

(iii) optionally a step of drying said keratin fibres;

(iv) then a step of heat treatment of said keratin fibres at a temperature of greater than or equal to 80°C, preferably at a temperature of between 100°C and 250°C, and preferably with an iron;

it being understood that the steps (i) and (ii) may be carried out simultaneously, or sequentially, preferably steps (i) and (ii) are carried out simultaneously, and that the drying step (iii), when it is present, precedes the heat treatment step (iv) and follows the steps (i) and (ii).

In other words, whether or not the drying step (iii) is present, steps (i) and (ii) precede the heat treatment step (iv).

According to yet a fourth variant of this embodiment, the process of the invention comprises:

- a first step consisting in applying, to said keratin fibres, a) the monosaccharide(s) as defined previously or a composition (ca) as defined previously, followed by a leave-on time of between 1 and 30 minutes,
- then a second step consisting in applying b) the polysaccharide(s) bearing amine group(s) as defined previously or a composition (cb) as defined previously, followed by a leave-on time of between 1 and 30 minutes,
- then a step of drying said keratin fibres,
- then a step of heat treatment of said keratin fibres at a temperature of greater than or equal to 80°C, preferably of between 100°C and 250°C.

Preferably, the composition (ca) applied to said fibres is acidic and comprises one or more organic or mineral acid(s) preferably c) as defined previously.

According to one particular variant of the invention, the process of the invention does not use oxidized polysaccharide, more generally the process of the invention does not use a compound comprising at least one aldehyde group.

According to one preferred embodiment of the invention, the composition(s) (cb), (C), (C') or (C") as defined previously does not (do not) contain oxidized polysaccharide and more generally the composition(s) (cb), (C), (C') or (C") does not (do not) contain a compound comprising at least one aldehyde group.

According to one particular embodiment, the process of the invention is carried out after permanent waving, smoothing, dyeing and/or bleaching of the keratin fibres, in particular human keratin fibres such as the hair.

The process according to the invention may also comprise an additional step (iii) of drying the keratin fibres after the application of the monosaccharide(s) a) as defined previously and of the polysaccharide(s) bearing amine group(s) b) as defined previously or after application of the cosmetic compositions containing it (them) and before the step of heat treatment (iv) of the keratin fibres carried out at a temperature of at least 80°C.

Preferably, the process of the invention carries out a step (iii) of drying the keratin fibres, in particular human keratin fibres such as the hair, before the heat treatment step (iv).

The drying step (iii) is in particular performed using a hairdryer, a hood, or else with a towel, an absorbent or by drying naturally. This drying step (iii) is advantageously carried out at a temperature ranging from 20°C to 70°C.

The keratin fibre heat treatment step (iv) of the process of the invention is preferably carried out at a temperature of between 80°C and 250°C, it being understood that the temperature is that of the heating means, in particular of the iron, and not the temperature of the keratin fibres.

According to one preferred form of the invention, the heat treatment step (iv) is carried out on dry keratin fibres.

Preferably, the keratin fibre heat treatment step (iv) is carried out at a temperature of at least 100°C, in particular at a temperature of between 100°C and 250°C, inclusive.

Advantageously, the keratin fibre heat treatment step (iv) is carried out at a temperature ranging from 150°C to 220°C, preferably ranging from 160°C to 220°C, more preferentially ranging from 160°C to 200°C, and even better still ranging from 130°C to 190°C.

It is understood that the heat treatment temperatures correspond to the temperatures of the heating means, in particular of the iron when an iron is involved, and not the temperature of the keratin fibres.

This heat treatment step (iv) is advantageously carried out using an iron.

For the purposes of the present invention, the term "iron" is intended to mean a device for heating keratin fibres by placing said fibres in contact with the heating device.

For the purposes of the present invention, the iron is other than a heating comb.

The end of the iron which comes into contact with the keratin fibres generally has two surfaces. These two surfaces may be made of metal or of ceramic. In particular, these two surfaces may be smooth or crimped or curved.

The heat treatment step may be carried out by means of a straightening iron, a curling iron, a crimping iron or a steam iron such as the Steampod. Preferably, the heat treatment step is performed by means of a straightening iron.

For the purposes of the present invention, the term "*steam irons*" is intended to mean irons which comprise a device which emits steam and which applies this steam before, during or after the straightening/relaxing.

As examples of irons that may be used in the process according to the invention, mention may be made of any type of flat iron, and in particular, in a nonlimiting manner, those described in patents US 5 957 140 and US 5 046 516.

The iron may be applied by successive separate strokes lasting a few seconds or by gradual movement or sliding along the keratin fibres, in particular along human keratin fibres such as the hair.

Preferably, the iron is applied in the process according to the invention by a continuous movement from the root to the end of the keratin fibres, especially human keratin fibres such as the hair, in one or more passes, in particular in one to twenty passes. Each pass of the iron may last from 2 seconds to 1 minute for a length of the treated keratin fibres of 30 cm ± 3 cm.

Step (iv) of heat treatment of the keratin fibres is carried out for a time that may range advantageously from 100 milliseconds to 30 minutes, preferably from 1 second to 15 minutes, more preferentially from 2 seconds to 10 minutes, even better still from 3 seconds to 5 minutes and even better still from 4 seconds to 1 minute.

The bath ratio of the composition(s) applied before the heat treatment step of the process preferably ranges from 0.1 to 10, and more preferentially from 0.2 to 5. For the purposes of the present invention, the term "bath ratio" is intended to mean the ratio between the total weight of the applied composition and the total weight of keratin fibres to be treated.

After the heat treatment step (iv) of the process, the keratin fibres may be optionally rinsed with water or washed with a shampoo. The keratin fibres are then optionally dried using a hairdryer or a hood or left to dry naturally.

According to one embodiment of the invention, the process is carried out on keratin fibres, in particular human keratin fibres, such as the hair, in particular natural keratin fibres, especially natural hair.

According to another embodiment, the process is carried out on keratin fibres, in particular human keratin fibres such as the hair, which are damaged. The term "*damaged fibres*" is intended to mean dry, rough, brittle, split and/or limp fibres.

According to another embodiment, the treatment process according to the invention is preferably carried out on keratin fibres, in particular human keratin fibres such as the hair, which are sensitized, such as bleached, artificially dyed, relaxed or permanent-waved fibres.

The process according to the invention may be carried out on keratin fibres, in particular human keratin fibres such as the hair, which are dry or wet. Preferentially, the process is carried out on dry keratin fibres, and in particular dry hair.

After application of the cosmetic composition(s) to the keratin fibres, said fibres may be wrung out to remove the excess composition.

After application to the keratin fibres of the ingredient a) and/or the ingredient b) as defined previously, or of a cosmetic composition containing the same, and before carrying out the keratin fibre heat treatment step (iv), the ingredient(s) a) as defined previously and/or the ingredient(s) b) as defined previously or the composition(s) containing the same may be left on for a time ranging advantageously from 1 to 60 minutes, preferably ranging from 2 to 50 minutes and more preferentially ranging from 5 to 45 minutes. The leave-on time may take place at a temperature ranging advantageously from 15°C to 45°C, and preferably at ambient temperature (25°C).

Preferably, when the process of the invention carries out the steps (i) and (ii) simultaneously, the leave-on time of the ingredients a) and b) is then between 1 second and 60 minutes.

The treatment process according to the invention may be carried out before, during and/or after an additional process of cosmetic treatment of the keratin fibres, such as a process for temporarily shaping (shaping with curlers, a crimping iron or a straightening iron) or a process for durably shaping (permanent-waving or relaxing) the keratin fibres.

The treatment process may also be carried out as a pre-treatment to a dyeing or relaxing process and/or a permanent-waving process so as to cosmetically protect the keratin fibres against these treatments. In other words, this process is performed to preserve the cosmetic properties of the keratin fibres before a dyeing, relaxing and/or permanent-waving cosmetic treatment process.

The treatment process according to the invention may also be performed as a post-treatment to a bleaching, artificial dyeing or relaxing process and/or a permanent-waving process so as to repair the damaged keratin fibres. The keratin fibres may be damaged by overexposure to the environment (for example natural long hair may be photodegraded, or degraded mechanically by repeated brushing or combing).

In particular, the treatment process according to the invention may be carried out on damaged keratin fibres.

In other words, the treatment process according to the invention is preferably carried out on sensitized keratin fibres such as bleached, dyed, relaxed or permanent-waved fibres.

In particular, the treatment process may be carried out before a bleaching, dyeing or relaxing process and/or a permanent-waving process on keratin fibres.

The kit

A subject of the invention is also a kit comprising:

- a multi-compartment device comprising a first compartment containing a cosmetic composition (ca) comprising a) at least one monosaccharide as defined previously; and a second compartment containing a cosmetic composition (cb) comprising b) at least one polysaccharide bearing amine group(s) as defined previously and optionally c) one or more organic or mineral acids as defined previously; and
- a device for heating keratin fibres to a temperature of at least 80°C, preferably to a temperature of at least 100°C, and more preferentially to a temperature of between 100 and 250°C.

The content of each compartment of the kit may be released either sequentially or simultaneously.

The composition packaging assembly, i.e. the multi-compartment device, is, in a known manner, any packaging that is suitable for storing cosmetic compositions (notably a bottle, tube, spray bottle or aerosol bottle).

Such a kit allows the process for treating keratin fibres according to the invention to be performed.

The examples that follow serve to illustrate the invention without, however, being limiting in nature.

5

EXAMPLES

In the examples that follow, all the amounts are indicated as weight percentages relative to the total weight of the composition.

Example 1: repair of split ends

a) Compositions tested

The compositions (A1) to (A4) according to the invention and the comparative compositions (B1) to (B10) were prepared from the ingredients, the amounts of which are indicated, as percentage by weight relative to the total weight of each of the compositions, in the tables below.

	B1	B2	B3	B4	B5
Xylose	1	-	-	-	-
Glucose	-	1	-	-	-
Chitosan, molecular weight 310 000-375 000, η = 800-2000 Cp	-	-	1	-	-
Chitosan, molecular weight 28 000, η < 100Cp	-	-	-	1	-
Chitosan, molecular weight 5000, η < 100Cp	-	-	-	-	1
Lactic acid	-	-	qs pH = 4.5±0.5	qs pH = 4.5±0.5	qs pH = 4.5±0.5
Water	qs 100	qs 100	qs 100	qs 100	qs 100

	B6	B7	B8	B9	B10
Xylose	2	-	-	-	-
Glucose	-	2	-	-	-
Chitosan, molecular weight 310 000-375 000, η = 800-2000 Cp	-	-	2	-	-
Chitosan, molecular weight 28 000, η < 100Cp	-	-	-	2	-
Chitosan, molecular weight 5000, η < 100Cp	-	-	-	-	2
Lactic acid	-	-	qs pH = 4.5±0.5	qs pH = 4.5±0.5	qs pH = 4.5±0.5
Water	qs 100	qs 100	qs 100	qs 100	qs 100

	A1	A2	A3	A4
Xylose	1	1	1	-
Glucose	-	-	-	1
Chitosan, molecular weight 310 000-375 000, η = 800-2000 Cp	1	-	-	-
Chitosan, molecular weight 28 000, η < 100Cp	-	1	-	-
Chitosan, molecular weight 5000, η < 100Cp	-	-	1	1
Lactic acid	qs pH = 4.5±0.5	qs pH = 4.5±0.5	qs pH = 4.5±0.5	qs pH = 4.5±0.5
Water	qs 100	qs 100	qs 100	qs 100

b) Procedure

The evaluation of the repair of the keratin fibres was carried out using a magnifying optical microscope (Model 175 X optical "MightyScope 1.3M Digital Microscope" sold by Aven Inc, USA - aveninc.com).

The fibres used are fibres that are natural and naturally split in two longitudinally at the end ("split-end hair", sold by IHIP (Glendale, NY 11385, United States)).

The end of each fibre is observed under a microscope before treatment and after treatment.

The treatment of the fibres consists in dipping each fibre in one of the compositions according to the invention (A1)-(A4) and comparative compositions (B1)-(B10) for 30 seconds.

Each fibre is then left to dry naturally, before undergoing a heat treatment comprising three successive passes of the straightening iron at 190°C (Babyliss PRO, EP Technology 5.0 sold by the company Babyliss).

This procedure is repeated five times for each of the compositions according to the invention (A1)-(A4) and comparative compositions (B1)-(B10) on various fibres split longitudinally at their end.

At the outcome of the treatment, the repair of the fibres is evaluated by optical microscopy. If the fibre is repaired, *i.e.* if the two parts of the end of the fibre are reunited, the result is equal to 1. Conversely, if the fibre is not repaired, the result is equal to 0.

c) Results

The results obtained are given in the following tables.

	Comparatives						
	B1	B2	B3	B4	B5	B6	B7
Number of fibres repaired (/5)	0/5	0/5	0/5	0/5	0/5	0/5	0/5

	Comparatives			Invention			
	B8	B9	B10	A1	A2	A3	A4
Number of fibres repaired (/5)	1/5	1/5	0/5	4/5	5/5	4/5	4/5

The results thus obtained show that the process of the invention, comprising the application of a composition comprising a monosaccharide and a polysaccharide bearing amine group(s), followed by a heat treatment, makes it possible to repair keratin fibres, and in particular split ends, contrary to the comparative processes which use only a monosaccharide or only a polysaccharide bearing amine group(s).

Example 2: reduction of frizz

a) Compositions tested

Compositions (A1) to (A4) according to the invention and comparative compositions (B1) to (B10) were prepared from the ingredients indicated in the tables of Example 1 (point a).

b) Procedure

Compositions (A1)-(A4) and (B1)-(B10) thus obtained were applied to sensitized locks of hair in a proportion of 1 g of composition per gram of lock (bath ratio 1:1). After a leave-on time of 5 minutes at 33°C, the locks of hair were dried with a hairdryer.

Each lock was then brushed (20 brush strokes), then straightened using a straightening iron at 190°C (5 passes of the iron for 9 seconds along the length of the lock).

The locks were then washed with a shampoo according to the following protocol: after 10 seconds of rinsing of the locks with water at 38°C, 0.4 g of shampoo (aqueous solution of sodium lauryl ether sulfate at 28% by weight) were applied per gram of lock. The locks were then massaged from the root to the end 10 times, before being rinsed with water at 38°C, wrung, combed, then dried in a proportion of 10 minutes of drying per gram of lock at 60°C under a hood.

At the outcome of this washing protocol, the brushing/straightening process was repeated a second time.

Finally, the locks were washed 5 times with a shampoo according to the same protocol as that mentioned previously.

At the outcome of this process, the locks were suspended in a closed box with a relative humidity at 80%. Photographs were taken before this exposure to humidity (T0) and 3 hours afterwards (T3h) in order to evaluate the shape of the locks before and after exposure to humidity.

The control of the frizz was evaluated by measuring the difference in mid-height width (ΔL_{T3h-T0}) of the locks before (L_{T0}) and after (L_{T3h}) exposure to humidity. The lower the value of (ΔL_{T3h-T0}), the better the control of the frizz at high hygrometry.

c) Results

The results obtained are given in the following tables.

		Mid-height width of the lock at T0 (L_{T0}) - mm	Mid-height width of the lock at T3h (L_{T3h}) - mm	(ΔL_{T3h-T0}) mm
Comparatives	Composition B1	27	51	24
	Composition B2	31	54	23
	Composition B3	28	48	20
	Composition B4	30	54	24
	Composition B5	31	53	22
	Composition B6	30	53	23
	Composition B7	31	51	20
	Composition B8	28	53	25
	Composition B9	29	52	23
	Composition B10	31	51	20
Invention	Composition A1	28	41	13
	Composition A2	28	44	16
	Composition A3	29	40	11
	Composition A4	32	47	15

The results above show that the process claimed, comprising the application of a composition comprising a monosaccharide and a polysaccharide bearing amine group(s) makes it possible to control, and in particular to reduce, the frizz of the hair after 3 hours at high hygrometry, this being even after 5 shampooing operations.

CLAIMS

1. Process for treating keratin fibres, in particular human keratin fibres such as the hair, comprising:

(i) a step consisting in applying to said keratin fibres a) one or more monosaccharide(s);

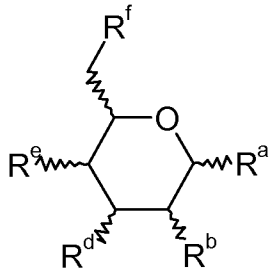
(ii) a step consisting in applying to said keratin fibres b) one or more polysaccharide(s) bearing amine group(s), in salified or non-salified form;

(iii) optionally a step of drying said keratin fibres;

(iv) then a step of heat treatment of said keratin fibres at a temperature of greater than or equal to 80°C, preferably with an iron;

it being understood that the steps (i) and (ii) may be carried out simultaneously, or sequentially, preferably steps (i) and (ii) are carried out simultaneously, and that the drying step (iii), when it is present, precedes the heat treatment step (iv) and follows the steps (i) and (ii).

2. Process according to the preceding claim, characterized in that the monosaccharide(s) a) is (are) chosen from hexoses and also the α or β anomers thereof, the optical isomers thereof of L or D configuration, the solvates thereof such as hydrates, and mixtures thereof; and preferably from the hexoses of formula (A1) and also the α or β anomers thereof, the optical isomers thereof of L or D configuration, the solvates thereof such as hydrates, and mixtures thereof:

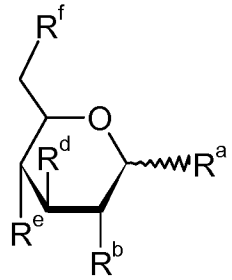


(A1)

in which formula (A1):

- R^a, R^b, R^d, R^e and R^f, which may be identical or different, represent i) a hydroxyl group, ii) a (C_1-C_4)alkoxy group, the alkyl chain of which may be optionally substituted, notably with one or more hydroxyl groups, or iii) a carboxyl group; preferably, R^a, R^b, R^d, R^e and R^f represent a hydroxyl group.

3. Process according to the preceding claim, characterized in that the monosaccharide(s) a) is (are) chosen from hexoses of formula (A1'), and also the α or β anomers thereof, the optical isomers thereof of L or D configuration, preferably D configuration, the solvates thereof such as hydrates, and mixtures thereof:

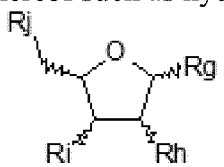


(A1')

in which formula (A1') R^a, R^b, R^d, R^e and R^f are as defined in the preceding claim.

4. Process according to the preceding claim, characterized in that the monosaccharide(s) a) is (are) chosen from aldohexoses and ketohexoses, preferably from glucose, galactose, allose, altrose, mannose, gulose, idose, talose, and mixtures thereof, more preferentially from glucose and galactose, and also the α or β anomers thereof, the optical isomers thereof of L or D configuration and the solvates thereof such as hydrates, and mixtures thereof; better still, the monosaccharide a) is glucose, and even better still glucose of D configuration.

5. Process according to Claim 1, characterized in that the monosaccharide(s) a) is (are) chosen from pentoses and also the α or β anomers thereof, the optical isomers thereof of L or D configuration, the solvates thereof such as hydrates, and mixtures thereof; and preferably from the pentoses of formula (A2) and also the organic or mineral acid salts thereof, the α or β anomers thereof, the optical isomers thereof of L or D configuration, the solvates thereof such as hydrates, and mixtures thereof:



(A2)

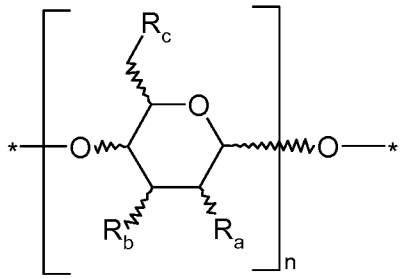
in which formula (A2):

- Rg, Rh, Ri and Rj, which may be identical or different, represent (i) a hydroxyl group, or (ii) a (C_1-C_4)alkoxy group, the alkyl chain of which may be optionally substituted, notably with one or more hydroxyl groups.

6. Process according to the preceding claim, characterized in that the monosaccharide(s) a) is (are) chosen from aldopentoses and ketopentoses, preferably from xylose, arabinose, lyxose, ribose, ribulose and xylulose, and also the α or β anomers thereof, the optical isomers thereof of L or D configuration, the solvates thereof such as hydrates, and mixtures thereof; more preferentially, the monosaccharide a) is xylose, and even better still xylose of D configuration.

7. Process according to any one of the preceding claims, characterized in that the polysaccharide(s) bearing amine group(s) b) is (are) chosen from C_6 saccharide units bearing amine group(s); preferably, the saccharide units of the polysaccharide bearing amine group(s) are of β (beta) anomeric configuration and/or D configuration; and more preferentially, the saccharide units of the polysaccharide bearing amine group(s) are connected together in (1→4).

8 Process according to any one of the preceding claims, characterized in that the polysaccharide(s) bearing amine group(s) b) is (are) chosen from polysaccharides bearing saccharide units of formula (B), and also the organic or mineral acid salts thereof, the α or β anomers thereof, the optical isomers thereof of L or D configuration, and the solvates thereof such as hydrates, and mixtures thereof:



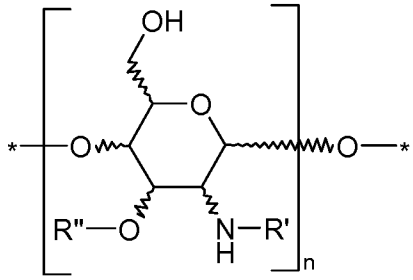
(B)

in which formula (B):

- n is an integer greater than or equal to 2, particularly between 3 and 3000 inclusive, and more particularly between 5 and 2500, preferentially between 10 and 2300;

- R_a, R_b and R_c, which may be identical or different for each saccharide unit, represent (1) a hydroxyl group, (2) a (C_1-C_4)alkoxy group, the alkyl chain of which may be optionally substituted in particular with one or more hydroxyl and/or carboxyl groups, (3) a carboxyl group, and (4) a group NR_1R_2 with R_1 and R_2, which may be identical or different, representing i) a hydrogen atom, ii) a (C_1-C_6)alkyl group that is optionally substituted, preferably with one or more hydroxyl or NH_2 groups, iii) an aryl group such as phenyl, iv) an aryl(C_1-C_4)alkyl group such as benzyl, v) a (hetero)cyclo(C_5-C_7)alkyl group such as cyclohexyl, morpholinyl, piperazinyl, piperidyl, vi) a (hetero)cyclo(C_5-C_7)alkyl(C_1-C_4)alkyl group such as cyclohexylmethyl, vii) a –C(Y)-$(Y')_p$-R'_1 group with Y and Y', which may be identical or different, representing an oxygen atom, a sulfur atom or N(R'_2), p is equal to 0 or 1, and R'_1 and R'_2 representing i) to vi) of R_1 and R_2 defined previously, it being understood that at least one of the radicals R_a, R_b or R_c of at least one saccharide unit represents a group NR_1R_2 and that at least one of the groups NR_1R_2 of at least one saccharide unit represents an NH_2 group.

9. Process according to any one of the preceding claims, characterized in that the polysaccharide(s) bearing amine group(s) is (are) chosen from polysaccharides bearing saccharide units of formula (B1), and also the organic or mineral acid salts thereof, the α or β anomers thereof, the optical isomers thereof of L or D configuration, the solvates thereof such as hydrates, and mixtures thereof:



(B1)

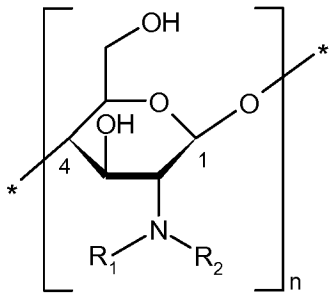
in which formula (B1):

- R' represents a hydrogen atom or a (C_1-C_4)alkylcarbonyl group such as acetyl CH_3-C(O)-;
- R'' represents a hydrogen atom or a (C_1-C_4)alkyl group optionally substituted with a carboxyl group such as –$CH(CO_2H)$-CH_3; and

- n is an integer greater than or equal to 2, preferably between 3 and 3000, more preferentially between 5 and 2500, and better still between 10 and 2300;

it being understood that at least one saccharide unit bears an NH_2 amino group and at least one other saccharide unit bears a group N(H)-R' with R' representing a (C_1-C_4)alkylcarbonyl group such as acetyl CH_3-C(O)-.

10. Process according to any one of the preceding claims, characterized in that the polysaccharide(s) bearing amine group(s) b) is (are) chosen from polysaccharides bearing saccharide units of formula (B3), and also the organic or mineral acid salts thereof, the solvates thereof such as hydrates, and mixtures thereof:



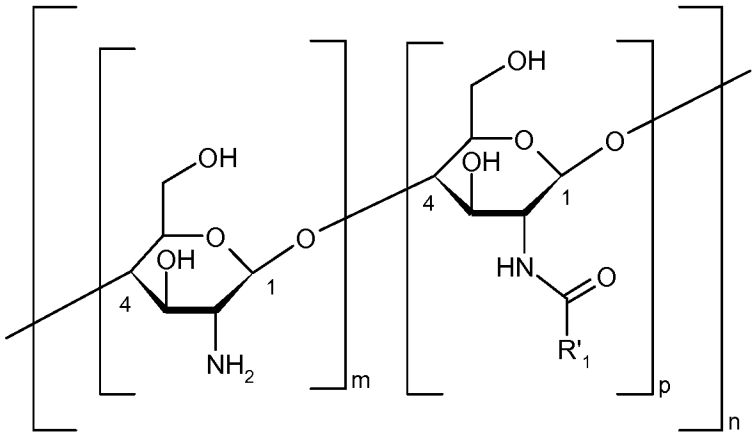
(B3)

in which formula (B3):

- R_1 and R_2 are as defined in Claim 8; and
- n is an integer greater than or equal to 2, preferably between 3 and 3000, more preferentially between 5 and 2500, and better still between 10 and 2300;

it being understood that at least one saccharide unit bears an NH_2 amino group and at least one other saccharide unit bears a group N(H)-R' with R' representing a (C_1-C_4)alkylcarbonyl group such as acetyl CH_3-C(O)-.

11. Process according to any one of the preceding claims, characterized in that the polysaccharide(s) bearing amine group(s) b) is (are) chosen from the chitosans of formula (B4), and also the organic or mineral acid salts thereof, the solvates thereof such as hydrates, and mixtures thereof:



(B4)

in which formula (B4):

- R'_1 representing a (C_1-C_4)alkyl group such as methyl; and
- p is greater than 0 and ranges up to 0.5, preferably from 0.05 to 0.3, and more preferentially from 0.1 to 0.20 such as 0.15 with m+p being equal to 1;
- n is an integer greater than or equal to 2, preferably between 3 and 3000, more preferentially between 5 and 2500, and better still between 10 and 2300;

it being understood that at least one saccharide unit bears an NH_2 amino group and at least one other saccharide unit bears a group N(H)-R'_1 with R'_1 representing a (C_1-C_4)alkylcarbonyl group such as acetyl CH_3-C(O)-.

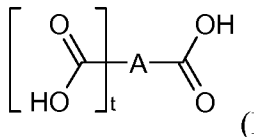
12. Process according to any one of the preceding claims, characterized in that the polysaccharide(s) bearing amine group(s) b) is (are) salified with one or more organic acid(s), preferably chosen from:

- the monocarboxylic acids of formula (I):

R-C(O)-OH (I)

in which formula (I), R represents a (hetero)aryl radical such as phenyl, a (hetero)aryl(C_1-C_4)alkyl radical such as benzyl, a (C_1-C_{30})alkyl radical or an unsaturated C_2-C_{30} radical, said alkyl or unsaturated C_2-C_{30} radicals being optionally interrupted and/or optionally substituted, preferably with one or more hydroxyl groups and not substituted with one or more amino radicals;

- the polycarboxylic acids of formula (II):



(II)

in which formula (II), A represents a saturated or unsaturated, cyclic or non-cyclic, aromatic or non-aromatic polyvalent hydrocarbon-based group comprising from 1 to 30 carbon atoms, optionally interrupted with one or more heteroatoms such as oxygen and/or optionally substituted notably with one or more hydroxyl groups and t represents an integer between 1 and 5 inclusive; and

- amino acids comprising more carboxylic acid radicals than amino groups.

13. Process according to the preceding claim, characterized in that the organic acid(s) are chosen from acetic acid, glycolic acid, lactic acid, tartaric acid, succinic acid, fumaric acid, maleic acid, citric acid, gamma-carboxyglutamic acid, aspartic acid, glutamic acid, and mixtures thereof, and preferably, the organic acid is lactic acid.

14. Process according to any one of the preceding claims, characterized in that the polysaccharide(s) bearing amine group(s) b) has (have) an average molecular weight MW of less than or equal to 400 kDa, preferably less than 200 kDa, more preferentially less than 100 kDa, even better still less than 40 kDa, even better still between 1 kDa and 30 kDa, and even more preferentially between 3 kDa and 28 kDa.

15. Process according to any one of the preceding claims, characterized in that steps (i) and (ii) are carried out simultaneously or by applying to the keratin fibres a cosmetic composition (C) at acidic pH comprising one or more monosaccharide(s) a), one or more polysaccharide(s) bearing amine group(s) b), in salified or non-salified form, and optionally one or more organic or mineral acid(s) c).

16. Process according to any one of Claims 1 to 14, characterized in that steps i) and ii) are carried out sequentially.

17. Process according to the preceding claim, characterized in that the monosaccharide(s) a) and the polysaccharide(s) bearing amine group(s) b) are respectively included in two distinct compositions (ca) and (cb).

18. Process according to Claim 15 or 17, characterized in that the content of the monosaccharide(s), present in the composition (C) or the composition (ca), ranges from 0.05% to 15% by weight, preferably from 0.1% to 10% by weight and more preferentially from 0.2% to 6% by weight, relative to the total weight of the composition comprising it (them).

19. Process according to any one of Claims 15, 17 or 18, characterized in that the content of the polysaccharide(s) bearing amine group(s), present in the composition (C) or the composition (cb), ranges from 0.01% to 20% by weight, preferably from 0.05% to 10% by weight and more preferentially from 0.1% to 5% by weight, relative to the total weight of the composition comprising it (them).

20. Process according to any one of the preceding claims, characterized in that step (iv) of heat treatment of the keratin fibres is carried out at a temperature of at least 100°C, preferably at a temperature ranging from 100 to 250°C; more preferentially from 150 to 220°C, even better still from 160 to 220°C, even better still from 160 to 200°C, and even more preferentially from 130 to 190°C.

21. Process according to any one of the preceding claims, characterized in that it comprises a step (iii) of drying the keratin fibres before the heat treatment step (iv), said drying step being carried out using a hairdryer, a hood, or else with a towel, an absorbent or by natural drying; the drying step is preferably carried out at a temperature ranging from 20°C to 70°C.

22. Cosmetic composition (C), at acidic pH, comprising:

a) one or more monosaccharide(s) as defined in any one of Claims 1 to 6 and 18,

b) one or more polysaccharide(s) bearing amine group(s), in salified or non-salified form, as defined in any one of Claims 1, 6 to 11, 14 and 19,

and optionally c) one or more mineral or organic acid(s), as defined in either one of Claims 12 and 13.

23. Kit comprising:

- a multi-compartment device comprising a first compartment containing a cosmetic composition (ca) comprising a) one or more monosaccharide(s) as defined in any one of Claims 1 to 6 and 18; and a second compartment containing a cosmetic composition (cb) comprising b) one or more polysaccharide(s) bearing amine group(s) as defined in any one of Claims 1, 7 to 11, 14 and 19, and optionally c) one or more organic or mineral acids as defined in either one of Claims 12 and 13; and
- a device for heating the keratin fibres to a temperature of at least 80°C.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/067310

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K8/36 A61Q5/00 A61K8/60 A61Q5/06 A61K8/73
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61K A61Q

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE GNPD [Online] MINTEL; 15 January 2010 (2010-01-15), anonymous: "Styling Juice", XP055586784, retrieved from www.gnpd.com Database accession no. 1253168	22
A	abstract -----	1-21,23
X	DATABASE GNPD [Online] MINTEL; 14 April 2008 (2008-04-14), anonymous: "Repair & Restore Concentrate", XP055586787, retrieved from www.gnpd.com Database accession no. 893398	22
A	abstract -----	1-21,23
	-/--	

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

[X] 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	Date of mailing of the international search report
5 September 2019	17/09/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Szarek, Sophie

1

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/067310

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/311655 A1 (ROSS VALERIE MARIE [US]) 22 December 2011 (2011-12-22)	22
A	paragraphs [0010], [0011], [0012], [0013], [0015], [0018], [0019]; claim 1	1-21,23
A	US 7 815 900 B1 (CANNELL DAVID W [US] ET AL) 19 October 2010 (2010-10-19) claims 1-3; example 9	1-23
A	US 2018/049964 A1 (GREAVES ANDREW [FR] ET AL) 22 February 2018 (2018-02-22) paragraphs [0076] - [0084], [0179]; claims 42, 44	1-23

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2019/067310

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011311655 A1	22-12-2011	US 2011311655 A1	22-12-2011
		US 2015209261 A1	30-07-2015
US 7815900 B1	19-10-2010	AR 028798 A1	21-05-2003
		AU 8130901 A	21-01-2002
		BR 0112398 A	27-05-2003
		CA 2415430 A1	17-01-2002
		CN 1441663 A	10-09-2003
		CN 1442025 A	10-09-2003
		EP 1311228 A2	21-05-2003
		ES 2369349 T3	29-11-2011
		JP 4111964 B2	02-07-2008
		JP 5383057 B2	08-01-2014
		JP 2004502711 A	29-01-2004
		JP 2005343902 A	15-12-2005
		JP 2008163037 A	17-07-2008
		MX PA03000020 A	14-07-2003
		US 7815900 B1	19-10-2010
		WO 0203937 A2	17-01-2002
		ZA 200300201 B	20-10-2003
US 2018049964 A1	22-02-2018	BR 112017017218 A2	03-04-2018
		EP 3268088 A1	17-01-2018
		FR 3033498 A1	16-09-2016
		US 2018049964 A1	22-02-2018
		WO 2016142551 A1	15-09-2016