Abstract: The invention relates to the cosmetic use of at least one C-glycoside derivative in a composition comprising a physiologically acceptable medium, the C-glycoside derivative or the composition comprising it being intended to modify the shape of keratinous fibres. It also relates to a cosmetic method for the treatment of keratinous fibres in a mammal for the purpose of modifying their shape, characterized in that at least one C-glycoside derivative is applied to keratinous fibres or their substrate.
Use of C-glycoside derivatives and method for the treatment of keratinous fibres

The present invention relates to a method for the cosmetic treatment of keratinous fibres and their substrate, such as hairy skin, in particular the hair and the scalp, for the purpose of modifying on a long-lasting basis the shape of the keratinous fibres, more specifically for straightening them and smoothing them.

It is known that two techniques are conventionally used to obtain permanent deformation of the hair. They are based on cleaving the disulphide bonds present in the keratin (cystine):

- the first consists, in a first step, in carrying out this opening of the disulphide bonds using a composition comprising a reducing agent and then, preferably after having rinsed the hair, in reconstituting, in a second step, the said disulphide bonds by applying, to hair placed under tension beforehand using curlers or other devices, or shaped or smoothed beforehand by other means, an oxidizing composition, also known as fixative, so as to give the desired shape to the hair. This technique makes it possible without distinction to wave the hair or to straighten or smooth it.

- The second consists in carrying out a "lanthionization" operation using a composition comprising a base belonging to the family of hydroxides. It results in the replacement of the disulphide (-CH₂-S-S-CH₂-) bonds by lanthionine (-CH₂-S-CH₂⁻) bonds. This technique does not require a fixing reaction and thus takes place in a single stage.

These techniques give good results and the new shape imposed on the hair is lasting over time and is resistant in particular to the action of operations in which it is washed with water or by shampoos. However, they involve the use of substances having a smell which may be regarded as unpleasant by the user and can be problematic to implement. In some cases, these treatments can result in embhttlement of the individual hairs. There thus still exists a need to find novel methods suited to the cosmetic field which are not very aggressive to the individual hair and the scalp and which make it possible to modify their natural shape on a long-lasting basis.
Glycosaminoglycans (GAGs) are anionic polysaccharides grafted to protein cores. GAGs combine Chondroitin Sulphates (CS), Heparan Sulphates (HS), Keratan Sulphates (KS) and Dermatan Sulphates (DS), according to their chemical structure.

Glycosylated proteins have for a long time been regarded as structural compounds of the extracellular matrix. It is only recently that their involvement in numerous functions, such as cell communication, proliferation or differentiation, has been demonstrated.

Unexpectedly, it has been found, in the context of the present invention, that, in individuals having curly hair, the distribution of the glycosaminoglycans (or GAGs) in the bulb of the hair follicle is asymmetrical. The inventors have thus demonstrated that glycoside derivatives, which stimulate the synthesis of GAGs, make it possible to adjust the shape of the hair shaft, in particular freshly synthesised by the follicle, and in particular to straighten the individual hair.

This is why a subject-matter of the present invention is the use, as agent for adjusting the shape of keratinous fibres, in particular for straightening them or smoothing them, of at least one C-glycoside derivative; the C-glycoside derivative stimulating the synthesis and/or the secretion of proteoglycans (PGs) and/or glycosaminoglycans (GAGs). A subject-matter of the invention is in particular the use of a C-glycoside derivative as agent for obtaining permanent deformation of the keratinous fibre and in particular of the individual hair. One of its subject-matters is thus the use of at least one C-glycoside derivative as agent for straightening and/or smoothing the individual hair, in particular the frizzy individual hair.

Another subject-matter of the invention is a method for the cosmetic treatment of the keratinous fibres of a mammal for the purpose of modifying their shape, comprising the application, to the keratinous fibres or to their substrate, of at least one C-glycoside derivative, in particular of a C-glycoside derivative which stimulates the synthesis and/or the secretion of proteoglycans and/or glycosaminoglycans.

The method and the use according to the invention are particularly suited to
adjusting/modifying the shape of the freshly synthesised hair shaft. This constitutes an advantage of the invention, according to which, rather than straightening a fibre which has grown while curly, it is seen to that the fibre grows while straight from its root.

Compositions suited to this implementation are also included in the invention.

Application WO 99/24009 provides the use of D-xylose or of some of its esters for improving the functionality of epidermal cells, by stimulating the synthesis of PGs and of GAGs.

EP 531 111 relates to compositions for promoting the growth of the hair comprising a monosaccharide derivative which is a glycosaminoglycanase inhibitor.

EP 0 277 428 relates to the use of inhibitors of proteoglycanase and glycosaminoglycanases for improving hair growth.

EP 0 398 669 relates to sugar lactone glucuronide derivatives for improving hair growth.

EP 0 348 184 relates to glycosaminoglycanase inhibitors of aldononomonolactone, alduronomonolactone and acetylated monosaccharide type for improving the growth of the individual hair.

EP 2 11 610 and EP 354 595 describe the use of oligosaccharides, in particular of disaccharides, comprising a uronic acid residue for promoting the growth of the hair.

WO 02/051 828 describes novel C-glycoside derivatives and their use, in particular for stimulating the synthesis of GAGs. Provision is made in particular to incorporate them in a lotion or gel for combating hair loss.

WO 2006/090307 relates the use of C-glycoside derivatives for improving the mechanical strength of keratinous fibres and in particular for preventing the hair from breaking.

However, to the knowledge of the Applicant Company, the proposal has never been made to use compounds which stimulate the synthesis of GAGs and/or of PGs, in particular C-glycoside derivatives, to straighten and/or smooth the hair, non-scalp hair and/or eyelashes. The term
"straightening" or "smoothing" is understood here to mean the modification of the shape of the fibre and more specifically during the production thereof by the hair follicle. Preferably, the invention excludes any modification in shape on the fibre already synthesised before the treatment.

The term "keratinous fibres" is understood to mean, according to the invention, fibres of human or animal origin, such as the hair, non-scalp hair, eyelashes, wool, angora, cashmere or fur. Although the invention is not limited to specific keratinous fibres, reference will nevertheless more particularly be made to the hair.

This is because it has now been demonstrated that the distribution of GAGs in the hair follicle is not uniform and that the expression of some of them greatly decreases under the cells of the matrix, that is to say under the proliferative compartment of the follicle. This is the case in particular for perlecan and heparan sulphate chains, which are greatly under-represented in the basal membrane. Likewise, sulphate-free chondroitins, chondroitin 4-sulphates, chondroitins of type D and keratan sulphates are greatly reduced in the connective tissue sheath. This decrease in expression might be correlated with the proliferative capability of the cells of the matrix.

In addition, surprisingly, the inventors have demonstrated that the distribution of these glycosaminoglycans is asymmetrical in the curly hair bulb or in the curved eyelash follicle. This asymmetry relates in particular to the following compounds: perlecan, heparan sulphates, sulphate-free chondroitins, chondroitin 4-sulphates, chondroitins of type D and keratan sulphates. The decrease in expression of the GAGs reported above is greater on the convex side of the curvature of the follicle.

The use of the C-glycoside derivatives, in particular of xylose derivatives, makes it possible, by rendering uniform the synthesis of the GAGs in the bulb of the individual hair, in particular of the individual curly hair, to equalize their distribution. The use of C-glycoside derivatives according to the invention will thus result in a stiffening of the freshly synthesised individual hair and, in the case of the curly or frizzy individual hair, a
smoothing and/or straightening of the latter.

A subject-matter of the invention is thus the cosmetic use of at least one C-glycoside in a composition comprising a physiologically acceptable medium, the C-glycoside derivative or the composition comprising it being intended to modify the shape of keratinous fibres.

The C-glycoside derivatives of use according to the invention are more particularly derivatives of following general formula (I):

\[
\begin{array}{c}
\text{S} \\
\text{(D)}
\end{array}
\]

in which:

- \( R \) represents:
  - a saturated linear \( \text{C}_1 \) to \( \text{C}_{20} \), in particular \( \text{C}_1 \) to \( \text{C}_{10} \), alkyl radical, an unsaturated linear \( \text{C}_2 \) to \( \text{C}_{20} \), in particular \( \text{C}_2 \) to \( \text{C}_{10} \), alkyl radical or a saturated or unsaturated, branched or cyclic, \( \text{C}_3 \) to \( \text{C}_{20} \), in particular \( \text{C}_3 \) to \( \text{C}_{10} \), alkyl radical;
  - a saturated linear \( \text{C}_1 \) to \( \text{C}_{20} \), in particular \( \text{C}_1 \) to \( \text{C}_{10} \), hydrofluoroalkyl or perfluoroalkyl radical, an unsaturated linear \( \text{C}_2 \) to \( \text{C}_{20} \), in particular \( \text{C}_2 \) to \( \text{C}_{10} \), hydrofluoroalkyl or perfluoroalkyl radical or a saturated or unsaturated, branched or cyclic, \( \text{C}_3 \) to \( \text{C}_{20} \), in particular \( \text{C}_3 \) to \( \text{C}_{10} \), hydrofluoroalkyl or perfluoroalkyl radical;

it being possible for the hydrocarbon chain constituting the said radicals to be, if appropriate, interrupted by 1, 2, 3 or more heteroatoms chosen from:

- an oxygen,
- a sulphur,
- a nitrogen, and
- a silicon,

and it being possible for the hydrocarbon chain constituting the said radicals optionally to be substituted by at least one radical chosen from:

- \(-\text{OR}_4\),
- \(-\text{SR}_4\),
- 6 -
- \( \text{NR}_4 \text{R}_5 \),
- \( \text{COOR}_4 \),
- \( \text{CONHR}_4 \),
- \( \text{CN} \),
- a halogen atom,
- a \( \text{C}_1 \text{to C}_6 \) hydrofluoroalkyl or perfluoroalkyl radical, and/or
- a \( \text{C}_3 \text{to C}_8 \) cycloalkyl radical,

with it being possible for \( \text{R}_4 \) and \( \text{R}_5 \) to represent, independently of one another, a hydrogen atom, a saturated linear \( \text{C}_1 \text{to C}_6 \) alkyl, perfluoroalkyl or hydrofluoroalkyl radical, an unsaturated linear \( \text{C}_2 \text{to C}_30 \), in particular \( \text{C}_2 \text{to C}_12 \) alkyl, perfluoroalkyl or hydrofluoroalkyl radical, a saturated or unsaturated, branched or cyclic, \( \text{C}_3 \text{to C}_30 \), in particular \( \text{C}_3 \text{to C}_12 \), alkyl, perfluoroalkyl or hydrofluoroalkyl radical or a \( \text{C}_6 \text{to C}_10 \) aryl radical,

- \( \text{X} \) represents a radical chosen from the groups:

\[
\begin{align*}
&\text{O} \\
&\text{C} \\
&\text{H} \\
&\text{N} \\
&\text{R}_2 \\
&\text{R}_i \\
&\text{H} \\
&\text{C} \\
&\text{R}_i' \\
&\text{H} \\
&\text{C} \\
&\text{R}_3
\end{align*}
\]

with \( \text{R}_i \), \( \text{R}_2 \) and \( \text{R}_3 \) representing, independently of one another, a hydrogen atom or an \( \text{R} \) radical, with \( \text{R} \) as defined above, and \( \text{R}i' \) representing a hydrogen atom, an -OH group or an \( \text{R} \) radical as defined above, it being possible for \( \text{R}_i \) also to denote a \( \text{C}_6 \text{to C}_10 \) aryl radical,

- \( \text{S} \) represents a monosaccharide or a polysaccharide...
comprising up to 20 sugar units, in particular up to 6 sugar units, in a pyranose and/or furanose form and of the L and/or D series, it being possible for the said mono- or polysaccharide to be substituted by a necessarily free hydroxyl group and optionally one or more optionally protected amine functional group(s), and

- the S-CH₂-X bond represents a bond of C-anomeric nature, which can be α or β,

and their cosmetically acceptable salts, their solvates, such as hydrates, and their isomers.

In the context of the present invention, the term "halogen" is understood to mean chlorine, fluorine, bromine or iodine.

The term "aryl" denotes an aromatic ring, such as phenyl, optionally substituted by one or more C₁-C₄ alkyl radicals.

The term "C₃ to C₈ cycloalkyl" denotes an aliphatic ring having from 3 to 8 carbon atoms, including, for example, cyclopropyl, cyclopentyl and cyclohexyl.

Mention may in particular be made, among the alkyl groups suitable for the implementation of the invention, of the methyl, ethyl, isopropyl, n-propyl, n-butyl, t-butyl, isobutyl, sec-butyl, pentyl, n-hexyl, cyclopropyl, cyclopentyl, cyclohexyl and allyl groups.

According to one embodiment of the invention, use may be made of a C-glycoside derivative corresponding to the formula (I) in which S can represent a monosaccharide or polysaccharide comprising up to 6 sugar units, in the pyranose and/or furanose form and of the L and/or D series, the said mono- or polysaccharide exhibiting at least one necessarily free hydroxyl group and/or optionally one or more necessarily protected amine functional groups, X and R furthermore retaining all of the definitions given above.

Advantageously, a monosaccharide of the invention can be chosen from D-glucose, D-galactose, D-mannose, D-xylose, D-lyxose, L-fucose, L-arabinose, L-rhamnose, D-glucuronic acid, D-galacturonic acid, D-iduronic acid, N-acetyl-D-glucosamine or N-acetyl-D-galactosamine and advantageously denotes D-glucose, D-xylose, N-acetyl-D-glucosamine or L-fucose, in particular D-xylose.
More particularly, a polysaccharide of the invention comprising up to 6 sugar units can be chosen from D-maltose, D-lactose, D-cellobiose, D-maltotriose, a disaccharide combining a uronic acid chosen from D-iduronic acid or D-glucuronic acid with a hexosamine chosen from D-galactosamine, D-glucosamine, N-acetyl-D-galactosamine or N-acetyl-D-glucosamine, or an oligosaccharide comprising at least one xylose which can advantageously be chosen from xylobiose, methyl β-xylobioside, xylotriose, xylotetraose, xylopentaose and xylohexaose and in particular xylobiose, which is composed of two xylose molecules connected via a 1,4-bond.

More particularly, S can represent a monosaccharide chosen from D-glucose, D-xylose, L-fucose, D-galactose or D-maltose and in particular D-xylose.

Preferably, use is made of xyloside derivatives.

According to another embodiment of the invention, use may be made of C-glycoside derivatives corresponding to the formula (I) for which X represents a group chosen from -CO-, -CH(OH)-, -CH(NRiR2)- or -CH(R)-, in particular -CO-, -CH(OH)-, -CH(NH2)-, -CH(NHCH2CH2OH)-, -CH(NHPh)- or -CH(CH3)-, and more particularly a -CO-, -CH(OH)- or -CH(NH2)- group and in particular a -CH(OH)- group, S and R furthermore retaining all of the definitions given above.

According to another embodiment of the invention, use may be made of a C-glycoside derivative corresponding to the formula (I) in which R represents a saturated linear C1 to C20, in particular C1 to C6, alkyl radical, an unsaturated linear C2 to C20, in particular C2 to C6, alkyl radical or a saturated or unsaturated, branched or cyclic, C3 to C20, in particular C3 to C6, alkyl radical optionally substituted as described above, S and R furthermore retaining all of the definitions given above. Preferably, R denotes a linear CrC4, in particular CrC3, radical optionally substituted by -OH, -COOH or -COOR"2, R"2 being a saturated CrC4 alkyl radical, in particular ethyl. Preferably, R denotes an unsubstituted linear CrC4, in particular CrC2, alkyl radical, in particular ethyl.

Preferably, the compounds according to the invention are such that:
- S represents a monosaccharide or a polysaccharide comprising up to 5 sugar units, in the pyranose and/or furanose form and of the L and/or D series, the said mono- or polysaccharide exhibiting at least one necessarily free hydroxyl functional group and/or optionally one or more optionally protected amine functional groups;

- R represents a saturated or unsaturated and linear or branched alkyl chain or a cycloalkyl ring comprising from 1 to 14 carbon atoms or a phenyl radical, it being possible for the said chain, the said ring or the said radical optionally to be substituted by at least one radical chosen from -OR'i, -NFT.R'2, -COOR'2 or -CONHR'2

- R', R1 and R2, which are identical or different, have the same definition as that given for R and can also represent a hydrogen and a hydroxyl radical, it not being possible for R1 and R2 simultaneously to be a hydroxyl radical;

- R'2 and R'''2, which are identical or different, represent a hydrogen atom or a radical chosen from a saturated or unsaturated and linear or branched alkyl radical comprising from 1 to 8 carbon atoms or a hydroxyl radical, it not being possible for R'''1 and R'2 simultaneously to be a hydroxyl radical;

- R'i, R"i, R''2 and R'''i, which are identical or different, represent a hydrogen atom or a radical chosen from a saturated or unsaturated and linear or branched alkyl radical comprising from 1 to 8 carbon atoms;

the definitions of the other substituents of the general formula (I) remaining unchanged.

According to another alternative form, preference is given to the compounds of general formula (I) such that:

- S represents a monosaccharide or a polysaccharide comprising up to 2 sugar units, in the pyranose and/or furanose form and of the L and/or D series, the said mono- or polysaccharide exhibiting at least one necessarily free hydroxyl functional group and/or optionally one or more optionally protected amine functional groups;

- X represents a group chosen from: -CO-, -CH(NRiR 2)- or -CHR';

the definitions of the other substituents of the general formula (I) remaining unchanged.
unchanged or assuming the preferred values above.

Use is particularly made, among the C-glycoside derivatives of formula (I), of those for which:

- \( R \) represents a saturated linear \( C_i \) to \( C_{26} \), in particular \( C_i \) to \( C_{10} \), alkyl radical, an unsaturated linear \( C_2 \) to \( C_{26} \), in particular \( C_2 \) to \( C_{10} \), alkyl radical or a saturated or unsaturated, branched or cyclic, \( C_3 \) to \( C_{20} \), in particular \( C_3 \) to \( C_{10} \), alkyl radical optionally substituted as described above;
  - \( S \) represents a monosaccharide as described above;
- \( X \) represents \(-\text{CO-}, -\text{CH(OH)-}, -\text{CH(NR}_1\text{R}_2)-\) or \(-\text{CH(R)-}\) as described above.

In particular, use is made of a C-glycoside derivative of formula (I) for which:

- \( R \) denotes a linear \( \text{CrC}_4 \), in particular \( \text{CrC}_3 \), radical optionally substituted by \(-\text{OH}, -\text{COOH}\) or \(-\text{COOR}^\prime_2\), \( R^\prime_2 \) being a saturated \( \text{CrC}_4 \) alkyl radical, in particular ethyl;
  - \( S \) represents a monosaccharide as described above;
- \( X \) represents a group chosen from \(-\text{CO-}, -\text{CH(OH)-}, -\text{CH(NH}_2\text{-)}, -\text{CH(NHCH}_2\text{CH}_2\text{OH)-}, -\text{CH(NHPh)-}\) or \(-\text{CH(CH}_3\text{-)}\), more particularly a \(-\text{CO-}, -\text{CH(OH)-}\) or \(-\text{CH(NH}_2\text{-)}\) group and preferably a \(-\text{CH(OH)-}\) group.

More particularly, use is made of a C-glycoside derivative of formula (I) for which:

- \( R \) denotes an unsubstituted linear \( \text{CrC}_4 \), in particular \( \text{d-C}_2 \), alkyl radical, in particular ethyl;
  - \( S \) represents a monosaccharide as described above, in particular \( \text{D-glucose}, \text{D-xylose}, \text{N-acetyl-D-glucosamine}\) or \( \text{L-fucose}\) and especially \( \text{D-xylose}\);
- \( X \) represents a group chosen from \(-\text{CO-}, -\text{CH(OH)-}\) or \(-\text{CH(NH}_2\text{-)}\), and preferably a \(-\text{CH(OH)-}\) group.

The salts acceptable for nontherapeutic use of the compounds described in
the present invention comprise conventional nontoxic salts of the said compounds, such as those framed from organic or inorganic acids.

Mention may be made, by way of example, of salts of inorganic acids, such as sulphuric acid, hydrochloric acid, hydrobromic acid, phosphoric acid or boric acid.

Mention may also be made of salts of organic acids, which can comprise one or more carboxylic, sulphonic or phosphonic acid groups. They can be linear, branched or cyclic aliphatic acids or also aromatic acids. These acids can additionally comprise one or more heteroatoms chosen from O and N, for example in the form of hydroxyl groups. Mention may in particular be made of propionic acid, acetic acid, terephthalic acid, citric acid and tartaric acid.

When the compound of formula (I) comprises an acid group, the acid group or groups can be neutralized with an inorganic base, such as LiOH, NaOH, KOH, Ca(OH)\(_2\), NH\(_4\)OH, Mg(OH)\(_2\) or Zn(OH)\(_2\); or with an organic base, such as a primary, secondary or tertiary alkylamine, for example triethylamine or butylamine. This primary, secondary or tertiary alkylamine can comprise one or more nitrogen and/or oxygen atoms and can thus comprise, for example, one or more alcohol functional groups; mention may in particular be made of 2-amino-2-methylpropanol, theanolamine, 2-(dimethylamino)propanol or 2-amino-2-(hydroxymethyl)-1,3-propanediol.

Mention may also be made of lysine or 3-(dimethylamino)propylamine.

The solvates acceptable for the compounds described in the present invention comprise conventional solvates, such as those formed during the final stage of preparation of the said compounds as a result of the presence of solvents. Mention may be made, by way of example, of the solvates due to the presence of water or of linear or branched alcohols, such as ethanol or isopropanol.

Consideration may very particularly be given, among the C-glycoside derivatives of formula (I) used according to the invention, to:

1. C-β-D-xylopyranoside-n-propan-2-one;
2. C-α-D-xylopyranoside-n-propan-2-one;
3. 1-[2-(3-hydroxypropylamino)propyl]-C- β-D-xylopyranose;
4. 1-[2-(3-hydroxypropylamino)propyl]-C- α-D-xylopyranose;
5. C-β-D-xylopyranoside-2-hydroxypropane;
6. C-α-D-xylopyranoside-2-hydroxypropane;
7. C-β-D-xylopyranoside-2-aminopropane;
8. C-α-D-xylopyranoside-2-aminopropane;
9. C-β-D-xylopyranoside-2-phenylaminopropane;
10. C-α-D-xylopyranoside-2-phenylaminopropane;
11. ethyl ester of 3-methyl-4-(C-β-D-xylopyranoside)butyric acid;
12. ethyl ester of 3-methyl-4-(C-α-D-xylopyranoside)butyric acid;
13. 6-(C-β-D-xylopyranoside)-5-ketoheptanoic acid;
14. 6-(C-α-D-xylopyranoside)-5-ketoheptanoic acid;
15. 6-(C-β-D-xylopyranoside)-5-hydroxyhexanoic acid;
16. 6-(C-α-D-xylopyranoside)-5-hydroxyhexanoic acid;
17. 6-(C-β-D-xylopyranoside)-5-aminoheptanoic acid;
18. 6-(C-α-D-xylopyranoside)-5-aminoheptanoic acid;
19. 6-(C-β-D-xylopyranoside)-5-phenylaminohexanoic acid;
20. 6-(C-α-D-xylopyranoside)-5-phenylaminohexanoic acid;
21. 1-(C-β-D-xylopyranoside)hexane-2,6-diol;
22. 1-(C-α-D-xylopyranoside)hexane-2,6-diol;
23. 5-(C-β-D-xylopyranoside)-4-ketopentanoic acid;
24. 5-(C-α-D-xylopyranoside)-4-ketopentanoic acid;
25. 5-(C-β-D-xylopyranoside)-4-hydroxypentanoic acid;
26. 5-(C-α-D-xylopyranoside)-4-hydroxypentanoic acid;
27. 5-(C-β-D-xylopyranoside)-4-aminopentanoic acid;
28. 5-(C-α-D-xylopyranoside)-4-aminopentanoic acid;
29. 5-(C-β-D-xylopyranoside)-4-phenylaminopentanoic acid;
30. 5-(C-α-D-xylopyranoside)-4-phenylaminopentanoic acid;
31. 1-(C-β-D-xylopyranoside)pentane-2,5-diol;
32. 1-(C-α-D-xylopyranoside)pentane-2,5-diol;
33. 1-(C-β-D-fucopyranoside)propan-2-one;
34. 1-(C-α-D-fucopyranoside)propan-2-one;
35. 1-(C-β-L-fucopyranoside)propan-2-one;
36. 1-(C-α-L-fucopyranoside)propan-2-one;
37. 1-(C-\(\beta\)-D-fucopyranoside)-2-hydroxypropane;
38. 1-(C-\(\alpha\)-D-fucopyranoside)-2-hydroxypropane;
39. 1-(C-\(\beta\)-L-fucopyranoside)-2-hydroxypropane;
40. 1-(C-\(\alpha\)-L-fucopyranoside)-2-hydroxypropane;

41. 1-(C-\(\beta\)-D-fucopyranoside)-2-aminopropane;
42. 1-(C-\(\alpha\)-D-fucopyranoside)-2-aminopropane;
43. 1-(C-\(\beta\)-L-fucopyranoside)-2-aminopropane;
44. 1-(C-\(\alpha\)-L-fucopyranoside)-2-aminopropane;
45. 1-(C-\(\beta\)-D-fucopyranoside)-2-phenylaminopropane;
46. 1-(C-\(\alpha\)-D-fucopyranoside)-2-phenylaminopropane;
47. 1-(C-\(\beta\)-L-fucopyranoside)-2-phenylaminopropane;
48. 1-(C-\(\alpha\)-L-fucopyranoside)-2-phenylaminopropane;

49. ethyl ester of 3-methyl-4-(C-\(\beta\)-D-fucopyranoside)butyric acid;
50. ethyl ester of 3-methyl-4-(C-\(\alpha\)-D-fucopyranoside)butyric acid;

51. ethyl ester of 3-methyl-4-(C-\(\beta\)-L-fucopyranoside)butyric acid;
52. ethyl ester of 3-methyl-4-(C-\(\alpha\)-L-fucopyranoside)butyric acid;
53. 6-(C-\(\beta\)-D-fucopyranoside)-5-ketohexanoic acid;
54. 6-(C-\(\alpha\)-D-fucopyranoside)-5-ketohexanoic acid;
55. 6-(C-\(\beta\)-L-fucopyranoside)-5-ketohexanoic acid;
56. 6-(C-\(\alpha\)-L-fucopyranoside)-5-ketohexanoic acid;

57. 6-(C-\(\beta\)-D-fucopyranoside)-5-hydroxyhexanoic acid;
58. 6-(C-\(\alpha\)-D-fucopyranoside)-5-hydroxyhexanoic acid;
59. 6-(C-\(\beta\)-L-fucopyranoside)-5-hydroxyhexanoic acid;
60. 6-(C-\(\alpha\)-L-fucopyranoside)-5-hydroxyhexanoic acid;

61. 6-(C-\(\beta\)-D-fucopyranoside)-5-aminohexanoic acid;
62. 6-(C-\(\alpha\)-D-fucopyranoside)-5-aminohexanoic acid;
63. 6-(C-\(\beta\)-L-fucopyranoside)-5-aminohexanoic acid;
64. 6-(C-\(\alpha\)-L-fucopyranoside)-5-aminohexanoic acid;
65. 1-(C-\(\beta\)-D-fucopyranoside)hexane-2,6-diol;
66. 1-(C-\(\alpha\)-D-fucopyranoside)hexane-2,6-diol;
67. 1-(C-\(\beta\)-L-fucopyranoside)hexane-2,6-diol;
68. 1-(C-\(\alpha\)-L-fucopyranoside)hexane-2,6-diol;
69. 5-(C-\(\beta\)-D-fucopyranoside)-4-ketopentanoic acid;
70. 5-(C-\(\alpha\)-D-fucopyranoside)-4-ketopentanoic acid;
71. 5-(C-\(\beta\)-L-fucopyranoside)hexane-2,6-diol)-4-ketopentanoic acid;
72. 5-(C-\(\alpha\)-L-fucopyranoside)hexane-2,6-diol)-4-ketopentanoic acid;
73. 5-(C-\(\beta\)-D-fucopyranoside)-4-hydroxypentanoic acid;
74. 5-(C-\(\alpha\)-D-fucopyranoside)-4-hydroxypentanoic acid;
75. 5-(C-\(\beta\)-L-fucopyranoside)-4-hydroxypentanoic acid;
76. 5-(C-\(\alpha\)-L-fucopyranoside)-4-hydroxypentanoic acid;
77. 5-(C-\(\beta\)-D-fucopyranoside)-4-aminopentanoic acid;
78. 5-(C-\(\alpha\)-D-fucopyranoside)-4-aminopentanoic acid;
79. 5-(C-\(\beta\)-L-fucopyranoside)-4-aminopentanoic acid;
80. 5-(C-\(\alpha\)-L-fucopyranoside)-4-aminopentanoic acid;
81. 1-(C-\(\beta\)-D-fucopyranoside)pentane-2,5-diol;
82. 1-(C-\(\alpha\)-D-fucopyranoside)pentane-2,5-diol;
83. 1-(C-\(\beta\)-L-fucopyranoside)pentane-2,5-diol;
84. 1-(C-\(\alpha\)-L-fucopyranoside)pentane-2,5-diol;
85. 1-(C-\(\beta\)-D-glucopyranosyl)-2-hydroxypropane;
86. 1-(C-\(\alpha\)-D-glucopyranosyl)-2-hydroxypropane;
87. 1-(C-\(\beta\)-D-glucopyranosyl)-2-aminopropane;
88. 1-(C-\(\alpha\)-D-glucopyranosyl)-2-aminopropane;
89. 1-(C-\(\beta\)-D-glucopyranosyl)-2-phenylaminopropane;
90. 1-(C-\(\alpha\)-D-glucopyranosyl)-2-phenylaminopropane;
91. ethyl ester of 3-methyl-4-(C-\(\beta\)-D-glucopyranosyl)butyric acid;
92. ethyl ester of 3-methyl-4-(C-\(\alpha\)-D-glucopyranosyl)butyric acid;
93. 6-(C-\(\beta\)-D-glucopyranosyl)-5-ketohexanoic acid;
94. 6-(C-\(\alpha\)-D-glucopyranosyl)-5-ketohexanoic acid;
95. 6-(C-\(\beta\)-D-glucopyranosyl)-5-hydroxyhexanoic acid;
96. 6-(C-\(\alpha\)-D-glucopyranosyl)-5-hydroxyhexanoic acid;
97. 6-(C-\(\beta\)-D-glucopyranosyl)-5-aminohexanoic acid;
98. 6-(C-\(\alpha\)-D-glucopyranosyl)-5-aminohexanoic acid;
99. 6-(C-β-D-glucopyranosyl)-5-phenylaminohexanoic acid;
100. 6-(C-α-D-glucopyranosyl)-5-phenylamino-hexanoic acid;
101. 1-(C-β-D-glucopyranosyl)hexane-2,6-diol;
102. 1-(C-α-D-glucopyranosyl)hexane-2,6-diol;
103. 6-(C-β-D-glucopyranosyl)-5-ketopentanoic acid;
104. 6-(C-α-D-glucopyranosyl)-5-ketopentanoic acid;
105. 6-(C-β-D-glucopyranosyl)-5-hydroxypentanoic acid;
106. 6-(C-α-D-glucopyranosyl)-5-hydroxypentanoic acid;
107. 6-(C-β-D-glucopyranosyl)-5-aminopentanoic acid;
108. 6-(C-α-D-glucopyranosyl)-5-hydroxypentanoic acid;
109. 6-(C-β-D-glucopyranosyl)-5-phenylaminopentanoic acid;
110. 6-(C-α-D-glucopyranosyl)-5-phenylaminopentanoic acid;
111. 1-(C-β-D-glucopyranosyl)pentane-2,5-diol;
112. 1-(C-α-D-glucopyranosyl)pentane-2,5-diol;
113. 1-(C-β-D-galactopyranosyl)-2-hydroxypropane;
114. 1-(C-α-D-galactopyranosyl)-2-hydroxypropane;
115. 1-(C-β-D-galactopyranosyl)-2-aminopropane;
116. 1-(C-α-D-galactopyranosyl)-2-aminopropane;
117. 1-(C-β-D-galactopyranosyl)-2-phenylaminopropane;
118. 1-(C-α-D-galactopyranosyl)-2-phenylaminopropane;
119. ethyl ester of 3-methyl-4-(β-D-galactopyranosyl)butyric acid;
120. ethyl ester of 3-methyl-4-(α-D-galactopyranosyl)butyric acid;
121. 6-(C-β-D-galactopyranosyl)-5-ketohexanoic acid;
122. 6-(C-α-D-galactopyranosyl)-5-ketohexanoic acid;
123. 6-(C-β-D-galactopyranosyl)-5-hydroxyhexanoic acid;
124. 6-(C-α-D-galactopyranosyl)-5-hydroxyhexanoic acid;
125. 6-(C-β-D-galactopyranosyl)-5-aminohexanoic acid;
126. 6-(C-α-D-galactopyranosyl)-5-aminohexanoic acid;
127. 6-(C-β-D-galactopyranosyl)5-phenylaminohexanoic acid;
128. 6-(C-α-D-galactopyranosyl)5-phenylaminohexanoic acid;
129. 1-(C-β-D-galactopyranosyl)hexane-2,6-diol;
130. 1-(C-α-D-galactopyranosyl)hexane-2,6-diol;
131. 6-(C-β-D-galactopyranosyl)-5-ketopentanoic acid;
132. 6-(C-α-D-galactopyranosyl)-5-ketopentanoic acid;
133. 6-(C-β-D-galactopyranosyl)-5-hydroxypentanoic acid;
134. 6-(C-α-D-galactopyranosyl)-5-hydroxypentanoic acid;
135. 6-(C-β-D-galactopyranosyl)-5-aminopentanoic acid;
136. 6-(C-α-D-galactopyranosyl)-5-aminopentanoic acid;
137. 6-(C-β-D-galactopyranosyl)-5-phenylaminopentanoic acid;
138. 6-(C-α-D-galactopyranosyl)-5-phenylaminopentanoic acid;
139. 1-(C-β-D-galactopyranosyl)pentane-2,6-diol;
140. 1-(C-α-D-galactopyranosyl)pentane-2,6-diol;
141. 1-(C-β-D-fucofuranosyl)propan-2-one;
142. 1-(C-α-D-fucofuranosyl)propan-2-one;
143. 1-(C-β-L-fucofuranosyl)propan-2-one;
144. 1-(C-α-L-fucofuranosyl)propan-2-one;
145. 3′-(acetamido-C-β-D-glucopyranosyl)propan-2′-one;
146. 3′-(acetamido-C-α-D-glucopyranosyl)propan-2′-one;
147. 1-(acetamido-C-β-D-glucopyranosyl)-2-hydroxylpropane;
148. 1-(acetamido-C-β-D-glucopyranosyl)-2-anninopropene;
149. 1-(acetamido-C-β-D-glucopyranosyl)-2-phenyllannino-
propane;
150. 1-(acetamido-C-α-D-glucopyranosyl)-2-phenyllaminopropane;
151. ethyl ester of 3-methyl-4-(acetamido-C-β-D-
  glucopyranosyl)-butyric acid;
152. ethyl ester of 3-methyl-4-(acetamido-C-α-D-
  glucopyranosyl)-butyric acid;
153. 6-(acetamido-C-β-D-glucopyranosyl)-5-ketohexanoic acid;
154. 6-(acetamido-C-α-D-glucopyranosyl)-5-ketohexanoic acid;
155. 6-(acetamido-C-β-D-glucopyranosyl)-5-hydroxyhexanoic acid;
156. 6-(acetamido-C-α-D-glucopyranosyl)-5-hydroxyhexanoic acid;
157. 6-(acetamido-C-β-D-glucopyranosyl)-5-aminohexanoic acid;
158. 6-(acetamido-C-α-D-glucopyranosyl)-5-anninohexanoic acid;
159. 6-(acetamido-C-β-D-glucopyranosyl)-5-phenylannino-hexanoic acid;
160. 6-(acetamido-C-α-D-glucopyranosyl)-5-phenylannino-
161. i^acetamido-C-β-D-glucopyranosyOhexane^e-dioly
162. 1-(acetamido-C-α-D-glucopyranosyl)hexane-2,6-dioly;
163. 6-(acetamido-C-β-D-glucopyranosyl)-5-ketopentanoic acid;
164. 6-(acetamido-C-α-D-glucopyranosyl)-5-ketopentanoic acid;
165. 6-(acetamido-C-β-D-glucopyranosyl)-5-hydroxypentanoic acid;
166. 6-(acetamido-C-α-D-glucopyranosyl)-5-hydroxypentanoic acid;
167. 6-(acetamido-C-β-D-glucopyranosyl)-5-aminopentanoic acid;
168. 6-(acetamido-C-α-D-glucopyranosyl)-5-aminopentanoic acid;
169. 6-(acetamido-C-β-D-glucopyranosyl)-5-phenylannino-
pentanoic acid;
170. 6-(acetamido-C-α-D-glucopyranosyl)-5-phenylannino-
pentanoic acid;
171. 1-(acetamido-C-β-D-glucopyranosyl)-pentane-2,5-dioly;
172. ^acetamido-C-α-D-glucopyranosyO-pentane^S-dioly.

Mention may in particular be made, by way of illustration and without implied limitation of the C-glycoside derivatives more particularly suitable for the invention, of the following derivatives:
Compounds which are particularly suitable for the implementation of the invention are chosen from the C-glycoside derivatives, namely:

- C-β-D-xylopyranoside-n-propan-2-one;
- C-α-D-xylopyranoside-n-propan-2-one;
- 1-[2-(3-hydroxypropylamino)propyl]-C-β-D-xylopyranose;
- 1-[2-(3-hydroxypropylamino)propyl]-C-α-D-xylopyranose;
According to one embodiment, C-β-D-xylopyranoside-2-hydroxypropane or C-α-D-xylopyranoside-2-hydroxypropane, and better still C-β-D-xylopyranoside-2-hydroxypropane can advantageously be employed. Of course, according to the invention, a C-glycoside derivative can be used
alone or as a mixture with other C-glycoside derivatives and in all proportions.

According to one specific embodiment, the C-glycoside derivative is C-β-D-xylopyranoside-2-hydroxypropane in the form of a 30% by weight solution of active material in a water/propylene glycol (60/40% by weight) mixture, such as the product manufactured by Chimex under the trade name "Mexoryl SBB®".

A C-glycoside derivative suitable for the invention can in particular be obtained by the method of synthesis described in the document WO 02/051 828.

Preferably, the C-glycoside derivative is a compound which stimulates the synthesis and/or the secretion of proteoglycans and/or glycosaminoglycans.

The cosmetic use according to the invention is more particularly suited to keratinous fibres, which are human hair, eyelashes and/or non-scalp hair. More particularly, the C-glycoside derivative or the composition comprising it is intended to smooth and/or straighten the hair and/or eyelashes. The term "straightening" encompasses, according to the invention, the straightening or smoothing of Caucasian, Asiatic, North African or African hair.

Another subject-matter of the invention is the use of at least one C-glycoside derivative as defined above in the preparation of a composition intended to modify on a long-lasting basis the shape of keratinous fibres. According to one of the embodiments of the invention, the composition comprising the C-glycoside derivative is a composition intended for administration via the external topical route. It can in particular be a composition, comprising a physiologically acceptable medium, suitable for caring for, conditioning, making up, removing makeup from, protecting, cleaning or washing keratinous fibres.

Another subject-matter of the invention is the cosmetic use of at least one C-glycoside derivative as defined above as agent for straightening and/or
smoothing the hair. In particular, it relates to the use of at least one compound from C-glycoside derivatives in a composition intended to be ingested or applied to the skin, mucous membranes or keratinous fibres, as agent for straightening and/or smoothing the hair.

Advantageously, the C-glycoside derivative according to the invention is applied in the form of a composition comprising a physiologically acceptable medium, that is to say a medium compatible with the skin and/or mucous membranes. The compositions according to the invention are in particular cosmetic or dermatological compositions; they are in particular compositions suitable for caring for, conditioning, making up, removing makeup from, protecting, cleaning or washing keratinous fibres.

For oral administration, the composition of the invention can be provided in any suitable form, particularly in the form of a solution to be taken orally, of a tablet, of a capsule, including a hard gelatin capsule, of a nutritional food or of a nutritional supplement. The said composition additionally comprises at least one appropriate excipient suitable for oral administration.

In these compositions, the concentration of C-glycoside derivative can be between 10⁻⁴ and 30% by weight; it is generally greater than or equal to 0.01% by weight, with respect to the total weight of the composition; the effective amounts will be adjusted by a person skilled in the art according to the result desired, the C-glycoside derivative used and the method of administration but are generally less than or equal to 30% by weight, in particular less than or equal to 15% by weight, indeed even less than or equal to 10% by weight. Concentrations of 0.05 to 1% by weight can thus be employed.

The compositions can be provided in all the forms suitable for caring for the hair and/or scalp, in particular in the form of a hair care lotion, for example for daily or twice-weekly application, or a shampoo or a hair conditioner, in particular for weekly or twice-weekly application, of a liquid or solid soap for cleaning the scalp for daily application, of a product for shaping the hairstyle (lacquer, styling gel), of a treatment mask, of a cream or of a
foaming gel for cleaning the hair.

A composition suitable for the implementation of the invention can have the form of an aqueous, alcoholic or aqueous/alcoholic solution or suspension or of an oily suspension, of an emulsion with a more or less fluid consistency and in particular a liquid, semiliquid or solid consistency, obtained by dispersion of a fatty phase in an aqueous phase (O/W) or vice versa (W/O), or of a multiple emulsion, of an aqueous, aqueous/alcoholic or oily gel, of a loose or compact powder to be used as is or to be incorporated in a physiologically acceptable medium, of microcapsules or microparticles, or of ionic or nonionic dispersions.

Advantageously, the C-glycoside derivative is applied in the form of a formulation favouring the penetration of the agent at the hair follicle.

The compositions can in some cases comprise penetration accelerators, in particular chosen from noncyclic mono- and dialcohols, ethyl acetate, butyl acetate, isopropyl myristate, fatty acids, phospholipids, terpenes, azone and derivatives, propylene glycol and glycolic derivatives, cyclodextrins, octyl salicylate, cyclopentadecanolide, polysorbates, or polyvinylpyrrolidone and derivatives, this list not being limiting.

The C-glycoside derivative or derivatives can in particular be used in a formulation including discrete porous particles, characterized in that they exhibit a mean diameter, by volume, of less than or equal to 10 µm and a specific surface of greater than or equal to 1 m²/g, as described in French Patent 2 856 594.

According to one embodiment, the compositions also comprise a surface-active agent of nonionic, anionic, cationic or amphoteric type and mention may be made, among these, of alkyl sulphates, alkylbenzene sulphates, alkyl ether sulphates, alkylsulphonates, quaternary ammonium salts, alkyl betaines, oxyethylenated alkylphenols, fatty acid alkanolamides, oxyethylenated fatty acid esters and other nonionic surfactants of the hydroxypropyl ether type.

When the compositions comprise at least one surface-active agent, the
latter is generally present at a maximum concentration of 30% by weight and preferably of between 0.5 and 10% by weight, with respect to the total weight of the composition.

With the aim of improving the cosmetic properties of the hair or alternatively of lessening or preventing damage thereto, the composition can also comprise a treating agent of cationic, anionic, nonionic or amphoteric nature. Mention may in particular be made, among the particularly preferred treating agents, of those described in French Patents No. 2 598 613 and No. 2 470 596. Use may also be made, as treating agents, of volatile or nonvolatile and linear or cyclic silicones and their mixtures, polydimethylsiloxanes, quaternized polyorganosiloxanes, such as those described in French Patent Application No. 2 535 730, polyorganosiloxanes with aminoalkyl groups modified by alkoxy carbonylalkyl groups, such as those described in US Patent No. 4 749 732, polyorganosiloxanes, such as the polydimethylsiloxane-polyoxyalkyl copolymer of the dimethicone copolyol type, a polydimethylsiloxane with stearoxy end groups (stearoxydimethicone), a polydimethylsiloxane-dialkylammonium acetate copolymer or a polydimethylsiloxane-poly(alkyl betaine) copolymer which are described in British Patent No. 2 197 352, polysiloxanes organomodified by mercapto or mercapto-alkyl groups, such as those described in French Patent No. 1 530 369 and in European Patent Application No. 295 780, and silanes, such as stearoxythymethylsilane.

The compositions according to the invention can also comprise other treating ingredients, such as cationic polymers, such as those used in the compositions of French Patents Nos. 79.32078 (2 472 382) and 80.26421 (2 495 931), or cationic polymers of the ionene type, such as those used in the compositions of Luxembourgian Patent No. 83 703, basic amino acids (such as lysine or arginine) or acidic amino acids (such as glutamic acid or aspartic acid), peptides and their derivatives, protein hydrolysates, waxes, swelling and penetrating agents, such as the SiO2/PDMS (polydimethylsiloxane) mixture, dimethylosorbitol, urea and its derivatives,
pyrrolidone, N-alkylpyrrolidones, thiamorpholinone, or alkyl ethers of alkylene glycol or of dialkylene glycol, such as, for example, propylene glycol monomethyl ether, dipropylene glycol monomethyl ether, ethylene glycol monoethyl ether and diethylene glycol monoethyl ether, 2-imidazolidinone and other compounds, such as fatty alcohols, lanolin derivatives, active ingredients, such as pantothenic acid, agents for combating hair loss, antidandruff agents, thickeners, suspending agents, sequestering or complexing agents, opacifying agents or sunscreens, as well as fragrances and preservatives.

The compositions according to the invention can additionally comprise at least one adjuvant chosen from silicones in the soluble, dispersed or microdispersed form, nonionic, anionic, cationic and amphoteric surface-active agents, ceramides, glycoceramides and pseudoceramides, vitamins and provitamins, including panthenol, vegetable, animal, mineral and synthetic oils, waxes other than ceramides, glycoceramides and pseudoceramides, water-soluble and fat-soluble sunscreens which may or may not comprise a silicone portion, pearlescent and opacifying agents, sequestering agents, plasticizing agents, solubilizing agents, acidifying agents, inorganic and organic thickening agents, antioxidants, hydroxy acids, penetrating agents, fragrances and preservatives. Mention may be made, among solubilizing agents, for example, of lower alcohols, such as, for example, ethanol, propanol or isopropanol.

The compositions suitable for the invention comprise at least one and in particular at least two C-glycoside derivatives. According to a specific embodiment, the compositions additionally comprise at least one other active principle beneficial for the health and the vigour of the hair and non-scalp hair, in particular at least one active principle which promotes regrowth and/or which limits loss of the hair. It can in particular be an inhibitor of the enzyme 15-hydroxyprostaglandin dehydrogenase, such as those described in Application WO 2004/073594, or esters of vitamin F and of glucose described in Application EP 1 371 658.
The invention also relates to a method for the cosmetic treatment of keratinous fibres in a mammal for the purpose of modifying their shape, characterized in that at least one C-glycoside derivative or one composition comprising it, such as are defined above, is administered to the mammal. The mammal is preferably a human being.

According to one of the embodiments, the C-glycoside derivative or the composition comprising it is applied to keratinous fibres or to their substrate, preferably on their substrate, in particular to the hair and/or the scalp, preferably to the scalp. The method and/or the use of the C-glycoside according to the invention will therefore smooth and/or straighten the fibres during its production, by action on a viable hair follicle, and not on the lengths of the fibres, which are already produced.

The method according to the invention can, for example, be carried out by applying the C-glycoside derivative or derivatives or the compositions comprising them, such as are defined above, to the hair and/or the scalp, daily or twice daily, for a period preferably of at least one week and in particular from 2 to 6 weeks. The C-glycoside derivative or the composition can be rinsed out after a sufficient contact time, in particular of 5 to 60 minutes, or else can be applied, for example, in the form of a nourishing cream or of a leave-in lotion and can remain in contact with the hair and/or the scalp until the next shampooing. The method according to the invention makes it possible to obtain a longlasting modification to the shape of the individual hair as it acts on the structure of the individual hair, from its formation. It will be particularly suitable for individuals having naturally curly or frizzy hair; in a specific embodiment, the hair will be placed under tension or shaped or smoothed by appropriate means.

According to another embodiment, the C-glycoside derivative or the composition comprising it will be administered orally to the mammal.

Other characteristics and advantages of the invention will become apparent
Example 1:

Demonstration of the asymmetrical distribution of the GAGs over an individual curly hair

1. a) Dissection of the hair follicles
Hair follicles originating from biopsies of human scalps are dissected according to the method described in Patent FR 2 736 721 A1 of 17/01/97 or US 5 712 169 A of 28/01/98.

1. b) Preparation of the cryosections
Longitudinal sections with a thickness of 7 µm are prepared from isolated hair follicles or biopsies of scalps using the CM3050 cryostat (Leica, Rueil Malmaison, France) for which the temperature of the object is maintained at -40 °C and that of the chamber at -35°C. The sections are fixed in the air and then stored at +4°C for 24 hours.

1. c) Immunolabelling
The sections are fixed in acetone at -20 °C for 10 minutes and then rinsed in a phosphate buffer saline (PBS) (Sigma, Saint-Quentin Fallavier, France). The endogenous peroxidases are saturated using 0.1 % hydrogen peroxide (Sigma, Saint-Quentin Fallavier, France).

List of the antibodies used:

<table>
<thead>
<tr>
<th>Primary antibodies</th>
<th>Ig class</th>
<th>Specificity</th>
<th>Dilution</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>F58-10E4</td>
<td>Mouse IgM</td>
<td>Heparan sulphate</td>
<td>1/50</td>
<td>Seikagaku Corporation, Tokyo, Japan</td>
</tr>
<tr>
<td>HepSS-1</td>
<td>Mouse IgM</td>
<td>Heparan sulphate</td>
<td>1/30, 1/100</td>
<td>Seikagaku Corporation, Tokyo, Japan</td>
</tr>
<tr>
<td>1-B-5</td>
<td>Mouse IgG1</td>
<td>Unsulphated chondroitin or Dermatan (chABC)</td>
<td>1/50</td>
<td>Seikagaku Corporation, Tokyo, Japan</td>
</tr>
</tbody>
</table>
The labelling is subsequently analysed using a Zeiss Axioscope microscope (Carl Zeiss, Oberkochen, Germany).

The results are represented in Figure 1.
An asymmetrical distribution of the heparan sulphate chains in the frizzy individual hair bulb is observed, compared with a straight individual hair. Figure 1B shows the asymmetrical proliferation which results therefrom.

**Example 2:**

**Increase in the synthesis of the GAGs by a xyloside derivative**

Cultuing of the fibroblasts:
The fibroblasts are cultured in DMEM medium comprising 10% of foetal calf...
serum (Gibco, Invitrogen), 1 mM MEM pyruvate (Gibco, Invitrogen) and 25 Units/ml of penicillin-streptomycin (Gibco, Invitrogen). The dermal papilla fibroblasts (P6), connective tissue sheath fibroblasts (P6) and dermal fibroblasts are then counted using a Coulter Counter Z2 (Beckman Coulter Inc., Fullerton, USA) and inoculated at 2 x 10^5 cells per well in a 12-well plate comprising 1.5 ml of medium alone, "control" condition, or treated with 3 mM of 1,5-anhydro-6,8-dideoxy-L-gluco-octitol. After 7 days, the supernatant is recovered and stored at -80°C until the GAGs are assayed. The cells are lysed with 130 µl of 100 mM Ths-HCl buffer comprising 1% Triton, 10% glycerol and 2% antiproteases, at pH 7.2, proceeding to three freezing -80°C/thawing 37°C cycles, mechanical scraping of the cells, followed by a stage of treatment with ultrasound.

The proteins present in the lysate are assayed using the Dc Protein assay kit (Biorad). The amount of glycosaminoglycans is measured in the supernatant and the lysate.

Assaying of the glycosaminoglycan sulphates:
The glycosaminoglycans are assayed using Blyscan glycosaminoglycan isolation & concentration kits (Biocolor, Newtownabbey, Northern Ireland) and Blyscan sulphated glycosaminoglycan assay kits. Assaying is carried out on 700 µl and 400 µl of supernatant, 50 µl of lysate and a range of 0, 0.5, 1, 2, 3, 4 and 5 µg of chondroitin 4-sulphate supplied. Each sample be measured is mixed with 700 µl of the cetylpyridinium chloride solution in a 1.5 ml centrifuge tube and then incubated on a rotary shaker, thermostatically controlled at 37°C, at 250 rpm for 2 hours. The tubes are centrifuged at 10 000 rpm for 15 min in an Eppendorf 5415C centrifuge.

The pellet is mixed with 1 ml of 95% ethanol and incubated in a rotary shaker, thermostatically controlled at 37°C, at 250 rpm for 5 min. The tube is again centrifuged at 10 000 rpm for 15 min. The ethanol is discarded and the tube is dried in the open air for a few minutes. 1 ml of Blyscan dye reagent is added directly to the pellet and vortexed at ambient temperature for 30 min before being centrifuged at 14 000 rpm for 15 min. 1 ml of Blyscan dissociation reagent is added to the pellet. The combined mixture is vortexed for 15 min until dissolution is complete. The absorbence of the solution is measured at 656 nm using a polystyrene semimicrocuvette on a
Biomate 5 spectrometer (Thermo). The amount of glycosaminoglycan present is subsequently measured.

The results are represented in Figure 2.

An increase in the synthesis of the GAGs by the fibroblasts which is proportional to the concentration of 1,5-anhydro-6,8-dideoxy-L-gluco-octitol is observed.

Example 3:

Composition for straightening the hair

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonium polyacryloyldimethyl taurate</td>
<td>0.5 g</td>
</tr>
<tr>
<td>Porous particles of Nylon-1 2*</td>
<td>4.7 g</td>
</tr>
<tr>
<td>5-(n-Octanoyl)salicylic acid</td>
<td>0.3 g</td>
</tr>
<tr>
<td>Poloxamer 338</td>
<td>0.25 g</td>
</tr>
<tr>
<td>C-β-D-Xylopyranoside-2-hydroxypropane</td>
<td>5 g</td>
</tr>
<tr>
<td>Demineralized water</td>
<td>89.25 g</td>
</tr>
</tbody>
</table>

*The porous particles of Nylon-1 2 are sold under the name "Orgasol 2002 UD Nat Cos" by Atofina.
1- Cosmetic use of at least one C-glycoside derivative in a composition comprising a physiologically acceptable medium, the C-glycoside derivative or the composition comprising it being intended to modify the shape of keratinous fibres.

2- Use according to Claim 1, characterized in that the C-glycoside derivative corresponds to the following general formula (I):

\[ X-R \]

\[ S \]

\[ (D) \]

10 in which:

- \( R \) represents:
  - a saturated linear \( C_1 \) to \( C_{20} \), in particular \( C_1 \) to \( C_{10} \), alkyl radical, an unsaturated linear \( C_2 \) to \( C_{20} \), in particular \( C_2 \) to \( C_{10} \), alkyl radical or a saturated or unsaturated, branched or cyclic, \( C_3 \) to \( C_{20} \), in particular \( C_3 \) to \( C_{10} \), alkyl radical;
  - a saturated linear \( C_1 \) to \( C_{20} \), in particular \( C_1 \) to \( C_{10} \), hydrofluoroalkyl or perfluoroalkyl radical, an unsaturated linear \( C_2 \) to \( C_{20} \), in particular \( C_2 \) to \( C_{10} \), hydrofluoroalkyl or perfluoroalkyl radical or a saturated or unsaturated, branched or cyclic, \( C_3 \) to \( C_{20} \), in particular \( C_3 \) to \( C_{10} \), hydrofluoroalkyl or perfluoroalkyl radical;

it being possible for the hydrocarbon chain constituting the said radicals to be, if appropriate, interrupted by 1, 2, 3 or more heteroatoms chosen from:

- an oxygen,
- a sulphur,
- a nitrogen, and
- a silicon,

and it being possible for the hydrocarbon chain constituting the said radicals optionally to be substituted by at least one radical chosen from:

- \(-\text{OR}_4\),
- \(-\text{SR}_4\),
-NR₄R₅,
-COOR₄,
-CONHR₄,
-CN,

- a halogen atom,
- a Cᵢ to C₆ hydrofluoroalkyl or perfluoroalkyl radical, and/or
- a C₃ to C₈ cycloalkyl radical,

with it being possible for R₄ and R₅ to represent, independently of one another, a hydrogen atom, a saturated linear Cᵢ to C₆, in particular Cᵢ to C₂, alkyl, perfluoroalkyl or hydrofluoroalkyl radical, an unsaturated linear C₂ to C₃₀, in particular C₂ to C₁₂, alkyl, perfluoroalkyl or hydrofluoroalkyl radical, a saturated or unsaturated, branched or cyclic, C₃ to C₃₀, in particular C₃ to C₁₂, alkyl, perfluoroalkyl or hydrofluoroalkyl radical or a C₆ to C₁₀ aryl radical,

- X represents a radical chosen from the groups:

\[
\begin{align*}
&\text{O} \\
&\text{C} \\
&\text{H} \\
&\text{N} \\
&\text{R}_2 \\
&\text{R}_1
\end{align*}
\]

with Rᵢ, R₂ and R₃ representing, independently of one another, a hydrogen atom or an R radical, with R as defined above, and R'i representing a hydrogen atom, an -OH group or an R radical as defined above, it being possible for R₁ also to denote a C₆ to C₁₀ aryl radical,

- S represents a monosaccharide or a polysaccharide
comprising up to 20 sugar units, in particular up to 6 sugar units, in a pyranose and/or furanose form and of the L and/or D series, it being possible for the said mono- or polysaccharide to be substituted by a necessarily free hydroxyl group and optionally one or more optionally protected amine functional group(s), and

- the S-CH₂-X bond represents a bond of C-anomeric nature, which can be α or β,

and their cosmetically acceptable salts, their solvates, such as hydrates, and their isomers.

3- Use according to either of Claims 1 and 2, characterized in that the C-glycoside derivative is a C-xyloside derivative.

4- Use according to at least one of the preceding claims, characterized in that the C-glycoside derivative is a compound which stimulates the synthesis and/or the secretion of proteoglycans and/or glycosaminoglycans.

5- Use according to at least one of the preceding claims, characterized in that the keratinous fibres are human hair, eyelashes and/or non-scalp hair.

6- Use according to at least one of the preceding claims, characterized in that the C-glycoside derivative or the composition comprising it is intended to smooth and/or straighten the hair and/or eyelashes.

7- Use according to at least one of Claims 2 to 6, characterized in that the C-glycoside derivative corresponds to the formula I in which S represents a monosaccharide chosen from D-glucose, D-xylose, L-fucose, D-galactose or D-maltose and in particular D-xylose.

8- Use according to one of Claims 2 to 7, characterized in that, in the formula I, X represents a group chosen from -CO-, -CH(OH)- or -CH(NH₂)₂-, and preferably a -CH(OH)- group.

9- Use of a C-glycoside derivative of formula I according to any one of Claims 2 to 8, in which R denotes a linear CrC₄, in particular C₁-C₃, radical optionally substituted by -OH, -COOH or -COOFT₂, R"₂ being a saturated C₁-C₄ alkyl radical, in particular ethyl.

10- Use of at least one C-glycoside derivative according to at least one
of the preceding claims, characterized in that the C-glycoside derivative is chosen from the following group:

- C-β-D-xylopyranoside-n-propan-2-one,
- C-α-D-xylopyranoside-n-propan-2-one,
- C-β-D-xylopyranoside-2-hydroxypropane,
- C-α-D-xylopyranoside-2-hydroxypropane,
- 1-(C-β-D-fucopyranoside)propan-2-one,
- 1-(C-α-D-fucopyranoside)propan-2-one,
- 1-(C-β-L-fucopyranoside)propan-2-one,
- 1-(C-β-L-fucopyranoside)propan-2-one,
- 1-(C-α-L-fucopyranoside)propan-2-one,
- 1-(C-β-D-fucopyranoside)-2-hydroxypropane,
- 1-(C-α-D-fucopyranoside)-2-hydroxypropane,
- 1-(C-β-L-fucopyranoside)-2-hydroxypropane,
- 1-(C-α-L-fucopyranoside)-2-hydroxypropane,
- 1-(C-β-D-glucofuranosyl)-2-hydroxypropane,
- 1-(C-α-D-glucofuranosyl)-2-hydroxypropane,
- 1-(C-β-D-galactopyranosyl)-2-hydroxypropane,
- 1-(C-α-D-galactopyranosyl)-2-hydroxypropane,
- 1-(C-β-D-glucofuranosyl)propan-2-one,
- 1-(C-α-D-glucofuranosyl)propan-2-one,
- 1-(C-β-L-glucofuranosyl)propan-2-one,
- 1-(C-α-L-glucofuranosyl)propan-2-one,
- C-β-D-maltopyranoside-n-propan-2-one,
- C-α-D-maltopyranoside-n-propan-2-one,
- C-β-D-maltopyranoside-2-hydroxypropane,
- C-α-D-maltopyranoside-2-hydroxypropane, their isomers and their mixtures.

11- Use of at least one C-glycoside derivative as defined in the preceding claims in the preparation of a composition intended to modify on a long-lasting basis the shape of keratinous fibres.

12- Use according to any one of the preceding claims, characterized in that the composition comprising the C-glycoside derivative is a
composition intended for administration via the external topical route.

13- Use according to the preceding claim, characterized in that the composition, comprising a physiologically acceptable medium, is suitable for caring for, conditioning, making up, removing makeup from, protecting, cleaning or washing keratinous fibres.

14- Use according to one of the preceding claims, characterized in that the C-glycoside derivative is in a composition which favours its penetration at the hair follicle.

15- Use according to at least one of the preceding claims, characterized in that the composition additionally comprises at least one adjuvant chosen from silicones in the soluble, dispersed or microdispersed form, nonionic, anionic, cationic and amphoteric surface-active agents, ceramides, glycosceramides and pseudoceramides, vitamins and provitamins, including panthenol, vegetable, animal, mineral and synthetic oils, waxes other than ceramides, glycosceramides and pseudoceramides, water-soluble and fat-soluble sunscreens which may or may not comprise a silicone portion, pearlescent and opacifying agents, sequestering agents, plasticizing agents, solubilizing agents, acidifying agents, inorganic and organic thickening agents, antioxidants, hydroxy acids, penetrating agents, fragrances and preservatives.

16- Use according to any one of Claims 1 to 12, characterized in that the composition comprising the C-glycoside derivative is a composition suitable for oral administration.

17- Use according to any one of the preceding claims, characterized in that the composition comprising the C-glycoside derivative is a cosmetic composition.

18- Use according to at least one of the preceding claims, characterized in that the composition additionally comprises at least one active principle which promotes regrowth and/or which limits loss of the hair.

19- Method for the cosmetic treatment of keratinous fibres in a mammal for the purpose of modifying their shape, characterized in that at
least one C-glycoside derivative or one composition comprising it, such as are defined in at least one of the preceding claims, is administered to the mammal.

20- Cosmetic treatment method according to Claim 19, characterized in that the C-glycoside derivative or the composition comprising it is applied to keratinous fibres or to their substrate.
Figure 2

Concentration of xylose derivative
## A. CLASSIFICATION OF SUBJECT MATTER

INV. A61K8/60 A61Q5/O4

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 practical, search terms used)

EPO-Internal

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C

See patent family annex

### Special categories of cited documents

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<td>Document member of the same patent family</td>
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### Date of the actual completion of the international search

3 April 2009

### Date of mailing of the international search report

14/04/2009

Name and mailing address of the ISA:

European Patent Office, P B 5818 Patentlaan 2
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Authorized officer

Boeker, Ruth

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