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(54) Title: COMPOSITION FOR TREATING KERATIN FIBERS AND METHOD FOR TREATING KERATIN FIBERS

(57) Abstract: The disclosure relates to compositions and methods for treating keratin fibers, such as hair. The compositions comprise (a) at least one amino acid or salts thereof, (b) at least one osmolyte, (c) optionally, at least one carboxylic acid, (d) at least one solvent, (e) optionally at least one surfactant; (f) optionally at least one ester; and (g) optionally at least one fatty compound other than (f). The methods comprise applying the compositions to the keratin fibers.

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COMPOSITION FOR TREATING KERATIN FIBERS AND METHOD FOR TREATING KERATIN FIBERS

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is a continuation-in-part of International Applications Nos. PCT/BR2023/050471, filed on December 20, 2023, PCT/BR2023/050484, filed on December 20, 2023, PCT/BR2023/050473, filed on December 20, 2023, and PCT/BR2023/050477, filed on December 20, 2023, from which all priority is claimed and the entire contents of each of which are incorporated herein by reference.

FIELD OF THE INVENTION

The present disclosure relates to compositions and methods for treating keratin fibers, such as hair, for example for preventing, reducing and/or repairing damaged keratin fibers, providing strength to keratin fibers, and/or for reducing elasticity of keratin fibers and enhancing and reshaping curls.

BACKGROUND OF THE INVENTION

Consumers use cosmetic compositions and processes to change or enhance the appearance of their hair, e.g., by changing the color, style, and/or shape of the hair, and/or by imparting various properties to hair, such as shine and conditioning. However, many compositions and processes for changing the appearance of the hair, such as compositions and processes for permanently altering the color or shape of the hair, involve harsh chemical treatments. Additionally, repeated styling can lead to damaged hair, for example due to repeated use of heat and styling tools. All these processes can break bonds within the hair fibers, which if not reformed results in damaged hair.

For example, hair lightening and dyeing compositions and processes generally require the presence of a strong alkalizing agent such as ammonia, as well as additional compounds such as oxidizing agents. In order to alter the color of the hair, these components must first break down the natural components in the hair fibers. Similarly, hair straightening, relaxing, and permanent waving compositions also involve harsh chemicals to change the shape of the hair by breaking the disulfide bonds in the hair fibers.

It is known that, while such processes effectively alter the color and shape of the hair, the chemical agents used inherently result in damage to the hair and negatively impact the strength, elasticity, and porosity of the hair fibers. For example,

hair that has been bleached, dyed, relaxed, straightened, waved, repeatedly styled, etc., is often dry, frizzy, and generally unhealthy in feel and appearance. Additionally, the damaged hair is brittle and/or has increased elasticity, which result in greater incidence of hair breakage. In hair that is naturally curvy or wavy, such damage also tends to manifest as loss of curl shape and/or curl definition. As such, consumers seek hair compositions and processes for preventing or minimizing such damage and/or for repairing hair that has been damaged by these treatments and processes. In particular, consumers desire hair that is strong, does not break easily, is able to be stretched or manipulated while retaining the ability to return to its original state without breakage (i.e. has decreased elasticity), and that feels soft and healthy to the touch and also appears shiny and healthy.

Curly hair has challenges that are even more significant than with straight hair. For example, curly hair tends to be weaker and more prone to damage than straight hair. Thus, such hair treatments and processes tend to impart even greater damage to curly hair than to straight hair.

In addition, consumers with curly or wavy hair desire hair compositions and processes that restore and/or enhance curl shape and/or definition. Consumers also increasingly desire compositions that contain natural components and are free or substantially free of components that are considered to be disadvantageous to hair such as silicones.

However, formulating hair compositions that satisfactorily address the necessities of the consumers has proven to be challenging. For example, some hair compositions that attempt to address the problem simply coat the hair with compounds that can improve the feel and appearance of the hair; however, this approach is only temporary and superficial. Instead of preventing or repairing hair damage, this approach simply masks the damage until the hair is next rinsed or washed. Other hair compositions attempt to address the damage within the hair fiber, but to date have not been satisfactory.

Also, as consumers wish to exclude certain components such as silicones, components from non-renewable sources, and components that may have a negative environmental impact, and include certain components such as those that are natural or naturally sourced, finding a combination of components that is both effective at meeting consumers' needs and satisfies consumers' desires has been difficult.

The present inventors have now achieved a synergistic combination of components that is surprisingly effective for preventing or minimizing hair damage, treating damaged hair, and restoring or enhancing curls. Hair treated with hair compositions according to the disclosure exhibit surprisingly reduced signs of damage, including greater strength and/or decreased elasticity, in particular hair that has been damaged by harsh chemical treatments such as bleaching, dyeing, permanent waving, straightening, relaxing, etc., and more visible curl shape and definition.

SUMMARY OF THE INVENTION

The present disclosure relates to hair compositions and methods for treating keratin fibers, e.g., human hair, including wavy or curly hair, for example for preventing, minimizing, or repairing hair damage such as damage caused by harsh chemical compositions and processes, and for reshaping curly hair and enhancing curl recovery. The hair compositions, which may be in a variety of galenic forms, for example an elixir, a hair mask, a conditioner, or a deep conditioning treatment, comprise a synergistic combination of one or more amino acids, preferably one or more basic amino acids, one or more osmolytes, optionally one or more carboxylic acids, one or more solvents, optionally one or more surfactants, optionally one or more esters, and optionally one or more fatty compounds other than esters, and the methods comprise applying a composition according to the disclosure to the keratin fibers, for example hair that has been or will be chemically treated. The hair compositions preferably include components that are natural or naturally sourced and are preferably free or substantially free of silicone compounds, non-renewable ingredients (e.g., mineral oil and petrol-based ingredients), and/or ingredients that have negative environmental impacts (e.g., compounds that mobilize heavy metals).

The hair compositions according to the present disclosure are surprisingly stable with a lasting texture even when subjected to high temperatures.

In various embodiments, the disclosure relates to compositions for treating keratin fibers, such as hair, comprising (a) at least one amino acid, (b) at least one osmolyte, (c) at least one carboxylic acid or salts thereof, (d) at least one solvent; (e) optionally at least one surfactant; (f) optionally at least one ester; and (g) optionally at least one fatty compound other than (f).

In another embodiment, the disclosure relates to compositions for treating keratin fibers, such as hair, comprising (a) at least one amino acid, (b) at least one osmolyte, (c) at least one carboxylic acid or salts thereof, (d) at least one solvent;

(e) optionally at least one surfactant; (f) at least one ester; and (g) optionally at least one fatty compound other than (f).

In yet another embodiment, the disclosure relates to compositions for treating keratin fibers, such as hair, comprising (a) at least one amino acid, (b) at least one osmolyte, (c) optionally at least one carboxylic acid or salts thereof, (d) at least one solvent; (e) optionally at least one surfactant; (f) optionally at least one ester; and (g) optionally at least one fatty compound other than (f).

In yet another embodiment, the disclosure relates to compositions for treating keratin fibers, such as hair, comprising (a) at least one amino acid, (b) at least one osmolyte, (c) at least one carboxylic acid or salts thereof, (d) at least one solvent; (e) at least one cationic surfactant; (f) optionally at least one ester; and (g) optionally at least one fatty compound other than (f). The pH of the hair compositions is generally less than 7 or less than about 6, for example ranging from about 2 to about 5, or from about 3 to about 4. The compositions are surprisingly stable.

In one embodiment, the compositions have a weight ratio of the total amount of amino acid(s) and salts thereof to the total amount of osmolytes that is greater than about 0.1, for example ranging from about 0.1 to about 10, from about 0.2 to about 8, from about 0.5 to about 6, from about 1 to about 5, from about 1.2 to about 4, or from about 1.5 to about 3.5.

In some embodiments the hair compositions comprise at least one amino acid chosen from basic amino acids, for example arginine, histidine, lysine, salts thereof, or combinations thereof. In various embodiments, the total amount of basic amino acids and salts thereof ranges from about 0.1% to about 15%, preferably from about 1% to about 12%, more preferably from about 2% to about 10%, more preferably still from about 3% to about 7%, and most preferably from about 4% to about 6% by weight, relative to the total weight of the hair composition. In further embodiments the hair compositions comprise at least one amino acid chosen from acidic or neutral amino acids and salts thereof, for example serine. In various embodiments, the total amount of acidic and/or neutral amino acids and salts thereof ranges from about 0.01% to about 5%, preferably from about 0.05% to about 4%, more preferably from about 0.1% to about 3%, and most preferably from about 0.25% to about 2.5% by weight, relative to the total weight of the hair composition. In still further embodiments, the hair compositions comprise a mixture of basic, acidic, and/or neutral amino acids, for example the hair compositions may comprise arginine and serine. In various

embodiments, the total amount of amino acids and salts thereof present in the hair composition ranges from about 0.1% to about 15%, preferably from about 1% to about 12%, more preferably from about 2% to about 10%, more preferably still from about 3% to about 7%, and most preferably from about 4% to about 6% by weight, relative to the total weight of the hair composition.

In some preferred embodiments, hair compositions according to the disclosure comprise one or more amino acids chosen from glycine, proline, methionine, serine, arginine, lysine, histidine, salts of any of the foregoing (in particular alkali metal, alkaline earth metal, or zinc salts), and combinations of two or more thereof.

In various embodiments, the hair compositions comprise at least one osmolyte chosen from carbohydrate sugars, methylsulfonium compounds, polyamines, and/or amino acid derivatives such as betaines, preferably chosen from compounds of formula (II). In various embodiments, the total amount of osmolytes present in the hair composition ranges from about 0.01% to about 10%, preferably from about 1% to about 5%, more preferably from about 1.25% to about 4%, more preferably still from about 1.5% to about 3%, and most preferably from about 2% to about 2.5% by weight, relative to the total weight of the hair composition. In various embodiments, the hair composition has a weight ratio of the total amount of amino acids to the total amount of osmolytes that is equal to or greater than about 0.5, such as greater than about 1, preferably ranging from about 1.25 to about 3.5, more preferably from about 1.5 to about 3, more preferably still from about 1.75 to about 2.5, and most preferably from about 1.75 to about 2.25.

In particularly preferred embodiments, the amino acids are chosen from basic amino acids and salts thereof, for example arginine, and the osmolytes are chosen from compounds of formula (II), for example glycine betaine, and the hair compositions have a weight ratio of basic amino acids to compounds of formula (II), for example of arginine and salts thereof to glycine betaine, that is greater than about 0.1, for example ranging from about 0.1 to about 10, such as from about 0.2 to about 8, from about 0.5 to about 6, from about 1 to about 5, from about 1.2 to about 4, or from about 1.5 to about 3.5.

In some embodiments, the total amount of osmolytes present in the composition ranges from about 0.01% to about 10%, preferably from about 1% to about 5%, more preferably from about 1.25% to about 4%, more preferably still from about

1.5% to about 3%, and most preferably from about 2% to about 2.5% by weight, relative to the total weight of the composition.

In various embodiments, the hair compositions comprise at least one carboxylic acid chosen from oxalic acid, malonic acid, glutaric acid, succinic acid, adipic acid, glycolic acid, citric acid, tartaric acid, malic acid, maleic acid, lactic acid, salts thereof, or combinations of two or more thereof, and preferably citric acid, lactic acid, salts thereof, or combinations of two or more thereof. In various embodiments, the total amount of carboxylic acids and salts thereof may range from about 0.5% to about 20%, preferably from about 1% to about 15%, more preferably from about 2% to about 12%, more preferably still from about 3% to about 10%, and most preferably from about 4% to about 7% by weight, and most preferably from about 5% to about 7% by weight, relative to the total weight of the hair composition, relative to the total weight of the hair composition.

In various embodiments, the hair composition has a weight ratio of the total amount of amino acids and salts thereof to the total amount of carboxylic acids and salts thereof of greater than about 0.5, such as greater than about 0.7, preferably ranging from about 0.75 to about 2, and more preferably from about 0.8 to about 1.5.

The solvent may comprise water and/or at least one non-aqueous solvent, and in some embodiments comprises water and at least one non-aqueous solvent. Optionally, the hair compositions comprise water and at least one non-aqueous solvent and have a total amount of non-aqueous solvents ranging from about 1% to about 20%, preferably from about 5% to about 20%, more preferably from about 5% to about 15%, and most preferably from about 8% to about 12% by weight, relative to the total weight of the hair composition. Optionally, the hair compositions comprise water and at least one non-aqueous solvent, preferably comprising at least one polyol, and have a total amount of non-aqueous solvents ranging from about 1% to about 20%, preferably from about 2% to about 18%, more preferably from about 3% to about 15%, and most preferably from about 4% to about 10% by weight, relative to the total weight of the hair composition.

The hair compositions optionally comprise at least one surfactant, preferably at least one cationic surfactant. In some preferred embodiments, the hair compositions comprise at least one alkylamidoamine, for example brassicamidopropyl dimethylamine. In various embodiments, the hair compositions comprise a total amount of surfactants ranging from about 0.1% to about 15%, preferably from about

0.5% to about 12%, more preferably from about 1% to about 10%, and most preferably from about 1.5% to about 6% by weight, relative to the total weight of the hair composition.

In various embodiments, cationic surfactants may, for example, be
5 chosen from optionally polyoxyalkylenated primary, secondary, or tertiary fatty amine salts, quaternary ammonium salts, or combinations of two or more thereof. Useful quaternary ammonium salts include those of formulae (III)-(VI), for example cetrimonium chloride and/or behentrimonium chloride, and useful fatty amine salts include, for example, stearamidopropyl dimethylamine, palmitamidopropyl
10 dimethylamine, lauramidopropyl dimethylamine, behenamidopropyl dimethylamine, or combinations of two or more thereof, preferably stearamidopropyl dimethylamine. Optionally, the total amount of cationic surfactants may range from about 0.01% to about 10%, preferably from about 0.5% to about 8%, more preferably from about 1% to about 6%, and most preferably from about 2% to about 5% by weight, relative to the
15 total weight of the hair composition. In various embodiments, the hair composition has a weight ratio of the total amount of [amino acids and salts thereof + osmolytes] to the total amount of cationic surfactants greater than about 1 and up to about 20, for example from about 1 to about 10, preferably from about 1.25 to about 8, more preferably from about 1.5 to about 6, more preferably still from about 1.75 to about 5,
20 and most preferably from about 2 to about 4.

In one embodiment, the composition is free or substantially free of behentrimonium chloride.

In some embodiments, the hair composition has a weight ratio of the total amount of [amino acids and salts thereof + osmolytes] to the total amount of cationic
25 surfactants, if present, that is greater than about 0.5, greater than about 0.75, or greater than about 1, and up to about 20, for example from about 1 to about 10, preferably from about 1.25 to about 8, more preferably from about 1.5 to about 6, more preferably still from about 1.75 to about 5, and most preferably from about 2 to about 4.

The hair composition optionally comprises esters, including branched or
30 straight-chain, ionic or non-ionic esters, for example mono-, di-, tri-, and/or tetra-esters. In preferred embodiments, the esters are chosen from esters of C₂₂-C₃₀, preferably C₂₄-C₂₈ branched fatty acids or fatty alcohols, and optionally have a molecular weight greater than about 500 g/mol, greater than about 750 g/mol, or greater than about 1000 g/mol, such as pentaerythrityl tetraisostearate. The total amount of esters present may

range from about 0.1% to about 10%, preferably from about 0.5% to about 8%, more preferably from about 0.75% to about 5%, and most preferably from about 1% to about 3% by weight, relative to the total weight of the hair composition.

The hair compositions optionally comprise at least one fatty compound other than esters described herein. The fatty compound may be chosen from lower alkanes, fatty alcohols, fatty acids, oils such as mineral, vegetable, or animal oils, waxes, or combinations of any two or more thereof. In some preferred embodiments, the hair compositions comprise ucuuba butter, lauric acid, cetearyl alcohol, and/or cetyl esters. In various embodiments, the hair compositions comprise a total amount of fatty compounds ranging from about 0.1% to about 18%, preferably from about 0.5% to about 15%, more preferably from about 1% to about 12%, and most preferably from about 1.5% to about 10% by weight, relative to the total weight of the hair composition.

Preferably, the hair compositions are free or substantially free of silicones.

In some embodiments, the hair compositions further comprise at least one film former. The film former may, for example, be chosen from anionic compounds or polymers, non-ionic compounds or polymers, amphoteric compounds or polymers, zwitterionic compounds or polymers, cationic compounds or polymers, proteins, viscosity modifiers, polyacrylates, polymethacrylates, polyacrylate copolymers, polymethacrylate copolymers, polyamides, polyaminoamides, polyesters, polysaccharides, polyacrylamides, starches, gums, or combinations of two or more thereof. If present, the total amount of film former can range from about 0.05% to about 15%, for example from about 0.1% to about 12%, preferably from about 0.5% to about 10%, or may range from about 0.05% to about 5%, such as from about 0.1% to about 3% by weight, relative to the total weight of the hair composition. In some preferred embodiments, the film former is natural or naturally sourced, such as a cellulose or derivative thereof, e.g. hydroxyethyl cellulose and/or cetyl hydroxyethyl cellulose.

The hair compositions may optionally also include at least one additional component chosen from fatty compounds, surfactants, such as amphoteric surfactants, thickening agents, direct dyes or combinations of two or more thereof.

In certain embodiments, the hair composition may comprise (a) at least one amino acid and/or a salt thereof, (b) at least one betaine, preferably at least one compound of formula (II), for example glycine betaine, in an amount ranging from about 0.5% to about 5% by weight, relative to the total weight of the hair composition, (c) at

least one carboxylic acid and/or a salt thereof, (d) at least one solvent, and (e) optionally at least one surfactant; (f) optionally at least one ester; and (g) optionally at least one fatty compound other than (f).

5 The hair composition of the present disclosure may also comprise additional component(s) such as chosen from fatty compounds, surfactants, film-formers, thickening agents preferably chosen from natural or naturally-sourced non-ionic polymers and derivative thereof, direct dyes, or combinations thereof.

10 In certain embodiments, the composition may comprise (a) at least one amino acid and/or a salt thereof, preferably at least one basic amino acid and/or a salt thereof, (b) at least one amino acid derivative, preferably at least one betaine, more preferably at least one compound of formula (II), for example glycine betaine, in an amount ranging from about 0.5% to about 5% by weight, relative to the total weight of the composition, (c) at least one carboxylic acid and/or a salt thereof, (d) at least one ester, (e) at least one surfactant, (f) at least one fatty compound other than (d), (g) at
15 least one solvent, preferably comprising at least one polyol, and (h) optionally at least one additional component chosen from film formers and/or thickening agents, preferably chosen from natural or naturally-sourced non-ionic polymers and derivatives thereof.

20 For example, in at least some embodiments, the hair composition comprises arginine and the total amount of amino acids ranges from about 1% to about 10% by weight, relative to the total weight of the hair composition, and wherein the total amount of carboxylic acids ranges from about 0.5% to about 20% by weight, relative to the total weight of the hair composition. The pH of the hair compositions is generally less than 7, for example ranging from about 2 to about 5, or from about 3 to
25 about 4. In various embodiments, the total amount of non-aqueous solvents ranges from about 1% to about 20%, preferably from about 2% to about 18%, more preferably from about 3% to about 15%, and most preferably from about 4% to about 12% by weight, relative to the total weight of the hair composition. In some embodiments, the hair composition has a weight ratio of the total amount of amino acids and salts thereof,
30 for example arginine, serine, salts thereof, or combinations thereof, to the total amount of betaines, preferably chosen from compounds of formula (II) and salts thereof, for example glycine betaine, that is greater than or equal to about 0.5, such as greater than about 1, preferably from about 1.25 to about 3.5, more preferably from about 1.5 to about 3, more preferably still from about 1.75 to about 2.5, and most preferably from

about 1.75 to about 2.25. In some embodiments, the hair composition has a weight ratio of the total amount of amino acids and salts thereof to the total amount of carboxylic acids and salts thereof that is greater than about 0.5 or greater than about 0.7, preferably ranging from about 0.75 to about 2, and more preferably from about 0.8 to about 1.5.

In certain embodiments, the hair composition may comprise (a) at least one amino acid and/or a salt thereof, preferably at least one basic amino acid and/or a salt thereof, (b) at least one amino acid derivative, preferably at least one betaine, more preferably at least one compound of formula (II), for example glycine betaine, in an amount ranging from about 0.5% to about 5% by weight, relative to the total weight of the hair composition, (c) at least one carboxylic acid and/or a salt thereof, (d) at least one solvent, preferably comprising at least one polyol, (e) at least one surfactant, (f) at least one ester, (g) at least one fatty compound other than (f), and (h) optionally at least one additional component chosen from film formers and/or thickening agents, preferably chosen from natural or naturally-sourced non-ionic polymers and derivatives thereof. For example, in at least some embodiments, the hair composition comprises arginine and the total amount of amino acids ranges from about 1% to about 10% by weight, relative to the total weight of the hair composition, and the total amount of carboxylic acids ranges from about 0.5% to about 20% by weight, relative to the total weight of the hair composition. The pH of the hair compositions is generally less than 7, for example ranging from about 2 to about 5, or from about 3 to about 4. In various embodiments, the total amount of non-aqueous solvents ranges from about 1% to about 20%, preferably from about 2% to about 18%, more preferably from about 3% to about 15%, and most preferably from about 4% to about 12% by weight, relative to the total weight of the hair composition. In some embodiments, the hair composition has a weight ratio of the total amount of amino acids and salts thereof, for example arginine, serine, salts thereof, or combinations thereof, to the total amount of betaines, preferably chosen from compounds of formula (II) and salts thereof, for example glycine betaine, that is greater than or equal to about 0.5, such as greater than about 1, preferably from about 1.25 to about 3.5, more preferably from about 1.5 to about 3, more preferably still from about 1.75 to about 2.5, and most preferably from about 1.75 to about 2.25. In some embodiments, the hair composition has a weight ratio of the total amount of amino acids and salts thereof to the total amount of carboxylic acids

and salts thereof that is greater than about 0.5 or greater than about 0.7, preferably ranging from about 0.75 to about 2, and more preferably from about 0.8 to about 1.5.

In preferred embodiments, the hair compositions comprise (a) at least one amino carboxylic acid or a salt thereof, preferably chosen from arginine and/or a salt thereof, (b) at least one betaine derivative, preferably chosen from glycine betaine, (c) at least one carboxylic acid, preferably chosen from citric acid, lactic acid, and/or salts thereof, (d) water. For example, the hair composition may comprise (a) from about 2% to about 6% of arginine and/or a salt thereof, (b) from about 0.5% to about 3.5% of glycine betaine, (c) at least one carboxylic acid, preferably chosen from citric acid, lactic acid, and/or salts thereof, (d) water and at least one non-aqueous solvent, and (e) optionally serine, wherein the total amount of carboxylic acids and salts thereof ranges from about 2% to about 10%, and wherein all amounts are by weight, relative to the total weight of the hair composition. The pH of the hair compositions is generally less than 7, for example ranging from about 2 to about 5, or from about 3 to about 4.

In various embodiments, the total amount of non-aqueous solvents ranges from about 1% to about 20%, preferably from about 5% to about 20%, preferably from about 2% to about 18%, more preferably from about 3% to about 15%, preferably from about 5% to about 15%, more preferably from about 4% to about 12% by weight, and most preferably from about 8% to about 12% by weight, relative to the total weight of the hair composition.

In some embodiments, the hair composition has a weight ratio of the total amount of amino acids and salts thereof to glycine betaine of greater than about 0.5, such as greater than about 1, preferably from about 1.25 to about 3.5, more preferably from about 1.5 to about 3, more preferably still from about 1.75 to about 2.5, and most preferably from about 1.75 to about 2.25.

In some embodiments, the hair composition has a weight ratio of the total amount of amino acids and salts thereof to the total amount of carboxylic acids and salts thereof of greater than about 0.5, such as greater than about 0.7, preferably ranging from about 0.75 to about 2, more preferably from about 0.8 to about 1.5.

In some embodiments, the hair compositions include at least one additional component chosen from fatty compounds, surfactants, thickening agents, or combinations thereof.

If present, the hair compositions comprise serine in an amount ranging from about 0.01% to about 2%, preferably from about 0.05% to about 1.5%, more

preferably from about 0.05% to about 1%, and most preferably from about 0.05% to about 0.5% by weight, relative to the total weight of the hair composition. When the hair compositions comprise serine, the hair compositions may optionally have a weight ratio of the total amount of amino acids to serine of greater than about 2, preferably ranging from about 2 to about 15, more preferably from about 4 to about 14, more preferably still from about 6 to about 13, and most preferably from about 8 to about 12. When the hair compositions comprise serine, the hair compositions may optionally have a weight ratio of glycine betaine to serine of greater than about 2, preferably ranging from about 2 to about 10, more preferably from about 3 to about 8, more preferably still from about 3.5 to about 7, and most preferably from about 4 to about 6.

In preferred embodiments, the hair compositions comprise (a) at least one amino carboxylic acid or a salt thereof, preferably chosen from arginine and/or a salt thereof, (b) at least one betaine derivative, preferably chosen from glycine betaine, (c) at least one carboxylic acid, preferably chosen from citric acid, lactic acid, and/or salts thereof, (d) water, and (e) at least one cationic surfactant. For example, the hair composition may comprise (a) from about 4% to about 6% of arginine and/or a salt thereof, (b) from about 0.5% to about 3.5% of glycine betaine, (c) at least one carboxylic acid, preferably chosen from citric acid, lactic acid, and/or salts thereof, (d) water and at least one non-aqueous solvent, (e) at least one cationic surfactant, and (h) optionally serine, wherein the total amount of carboxylic acids and salts thereof ranges from about 2% to about 10%, and wherein all amounts are by weight, relative to the total weight of the hair composition. The pH of the hair compositions is generally less than 7, for example ranging from about 2 to about 5, or from about 3 to about 4. In various embodiments, the total amount of non-aqueous solvents ranges from about 1% to about 20%, preferably from about 5% to about 20%, more preferably from about 5% to about 15%, and most preferably from about 8% to about 12% by weight, relative to the total weight of the hair composition.

In some embodiments, the hair composition has a weight ratio of the total amount of amino acids and salts thereof to glycine betaine of greater than 1, preferably from about 1.25 to about 3.5, more preferably from about 1.5 to about 3, more preferably still from about 1.75 to about 2.5, and most preferably from about 1.75 to about 2.25. In some embodiments, the hair composition has a weight ratio of the total amount of amino acids and salts thereof to the total amount of carboxylic acids and salts thereof that is greater than about 0.5 such as greater than about 0.7,

preferably ranging from about 0.75 to about 2, more preferably from about 0.8 to about 1.5. In some embodiments, the hair composition has a weight ratio of the total amount of [amino acids and salts thereof + osmolytes] to the total amount of cationic surfactants that is greater than about 0.5, greater than about 0.75, or greater than about 1, and up to about 20, for example from about 1 to about 10, preferably from about 1.25 to about 8, more preferably from about 1.5 to about 6, more preferably still from about 1.75 to about 5, and most preferably from about 2 to about 4. In some embodiments, the hair compositions include at least one additional component chosen from fatty compounds, additional surfactants, thickening agents, or combinations thereof. If present, the hair compositions comprise serine in an amount ranging from about 0.01% to about 2%, preferably from about 0.05% to about 1.5%, more preferably from about 0.05% to about 1%, and most preferably from about 0.05% to about 0.5% by weight, relative to the total weight of the hair composition. When the hair compositions comprise serine, the hair compositions may optionally have a weight ratio of the total amount of amino acids to serine of greater than about 2, preferably ranging from about 2 to about 15, more preferably from about 4 to about 14, more preferably still from about 6 to about 13, and most preferably from about 8 to about 12. When the hair compositions comprise serine, the hair compositions may optionally have a weight ratio of glycine betaine to serine of greater than about 2, preferably ranging from about 2 to about 10, more preferably from about 3 to about 8, more preferably still from about 3.5 to about 7, and most preferably from about 4 to about 6.

In preferred embodiments, the hair compositions comprise (a) at least one amino carboxylic acid or a salt thereof, preferably chosen from arginine and/or a salt thereof, (b) at least one betaine derivative, preferably chosen from glycine betaine, (c) at least one carboxylic acid, preferably chosen from citric acid, lactic acid, and/or salts thereof, (d) water. For example, the hair composition may comprise (a) from about 2% to about 6% of arginine and/or a salt thereof, (b) from about 0.5% to about 3.5% of glycine betaine, (c) at least one carboxylic acid, preferably chosen from citric acid, lactic acid, and/or salts thereof, (d) water and optionally at least one non-aqueous solvent, preferably comprising at least one polyol, (e) at least one surfactant, preferably chosen from brassicamidopropyl dimethylamine, (f) at least one ester, preferably chosen from esters of C₂₂-C₃₀, preferably C₂₄-C₂₈ branched fatty acids or fatty alcohols, such as pentaerythrityl tetraisoostearate, (g) at least one fatty compound other than (f), preferably comprising ucuuba butter, lauric acid, cetearyl alcohol, and/or cetyl esters,

and (h) optionally at least one film former and/or thickening agent, preferably chosen from natural or naturally-sourced non-ionic polymers and derivatives thereof, wherein the total amount of carboxylic acids and salts thereof ranges from about 2% to about 10%, and wherein all amounts are by weight, relative to the total weight of the hair composition. The pH of the hair compositions is generally less than 7, for example ranging from about 2 to about 5, or from about 3 to about 4. In various embodiments, the total amount of non-aqueous solvents ranges from about 1% to about 20%, preferably from about 2% to about 18%, more preferably from about 3% to about 15%, and most preferably from about 4% to about 12% by weight, relative to the total weight of the hair composition. In some embodiments, the hair composition has a weight ratio of the total amount of amino acids and salts thereof to glycine betaine of greater than about 0.5, such as greater than about 1, preferably from about 1.25 to about 3.5, more preferably from about 1.5 to about 3, more preferably still from about 1.75 to about 2.5, and most preferably from about 1.75 to about 2.25. In some embodiments, the hair composition has a weight ratio of the total amount of amino acids and salts thereof to the total amount of carboxylic acids and salts thereof of greater than about 0.5, such as greater than about 0.7, preferably ranging from about 0.75 to about 2, more preferably from about 0.8 to about 1.5. In some embodiments, the hair compositions include at least one additional component chosen from fatty compounds, surfactants, thickening agents, or combinations thereof.

In preferred embodiments, the hair compositions are in the form of a hair mask or deep conditioning treatment composition that comprises (a) from about 1% to about 8%, such as from about 2% to about 6%, of basic amino acids and/or salts thereof, preferably comprising arginine and/or a salt thereof, (b) from about 0.1% to about 5%, such as from about 0.5% to about 3.5%, of osmolytes, preferably chosen from compounds of formula (II), more preferably comprising glycine betaine, (c) from about 1% to about 10%, such as from about 2.5% to about 7.5%, of carboxylic acids and/or salts thereof, (d) water and optionally at least one non-aqueous solvent, preferably comprising at least one polyol such as propylene glycol and/or dipropylene glycol, (e) at least one surfactant, preferably chosen from cationic surfactants, for example brassicamidopropyl dimethylamine and/or lauric acid, (f) esters of C₂₂-C₃₀, preferably C₂₄-C₂₈ branched fatty acids or fatty alcohols, preferably comprising pentaerythrityl tetraisostearate, (g) at least one fatty compound other than (f), preferably comprising ucuuba butter, lauric acid, cetearyl alcohol, and/or cetyl esters,

and (h) optionally at least one additional component chosen from film formers and/or thickening agents, preferably chosen from natural or naturally-sourced non-ionic polymers and derivatives thereof, for example cellulose or derivatives thereof such as hydroxyethyl cellulose, wherein all amounts are by weight, relative to the total weight of the hair composition. Preferably, the components of the hair composition are natural or naturally sourced, and the hair composition is free and/or substantially free of silicone compounds, components from non-renewable sources, and components that have a negative environmental impact. The pH of the hair composition is generally less than 7, for example ranging from about 2 to about 5, or from about 3 to about 4.

The disclosure further relates to methods of treating keratin fibers, preferably hair, particularly curly or wavy hair, comprising applying a hair composition according to the disclosure to the keratin fibers. The methods may be methods for reshaping curly hair and/or enhancing curl or wave recovery, and/or methods for reducing or preventing hair damage, protecting hair from damage, restoring hair fiber moisture equilibrium, providing hair fiber strength, and/or improving hair fiber elasticity, particularly hair that has been or will be subjected to compositions or processes that are known to damage hair. The compositions may be left on the hair for an optional leave-in period, and optionally rinsed from the hair.

BRIEF DESCRIPTION OF THE FIGURES

FIGS. 1A-1B are graphs showing the elasticity of hair fibers of swatches S1-S8 after one treatment (1A) and five treatments (1B).

FIGS. 2A-2B are graphs showing the elasticity of hair fibers of swatches S9-S16 after one treatment (2A) and five treatments (2B).

FIG. 3 is a graph showing the elasticity of hair fibers of swatches S17-S21 after five treatments.

FIGS. 4A-4B are graphs showing the break stress of hair fibers treated with compositions according to the present invention and comparative compositions.

FIGS. 5A-5B show the structures of certain exemplary osmolytes that can be included in compositions according to the disclosure.

FIGS. 6A, 6B and 6C show images of curly hair before and after treatment with a composition according to the disclosure.

FIGS. 7A-7B show images of previously bleached curly hair before and after treatment with a composition according to the disclosure.

DETAILED DESCRIPTION OF THE INVENTION

The present disclosure relates to compositions and methods for treating keratin fibers, such as hair and in some embodiments curly or wavy hair, for example for preventing, reducing and/or repairing damaged keratin fibers; providing strength to keratin fibers; reducing elasticity of keratin fibers; enhancing and/or reshaping curls or wave recovery. The hair compositions are surprisingly stable with a lasting texture even when subjected to high temperatures. Hair that has been treated with hair compositions and methods described herein surprisingly demonstrates recovery of curls that were noticeably diminished due to various hair treatments and processes.

I. HAIR COMPOSITIONS

The hair compositions according to the present disclosure comprise (a) at least one amino acid and salts thereof, (b) at least one osmolyte, (c) optionally at least one compound chosen from carboxylic acids or salts thereof, and (d) at least one solvent, (e) optionally at least one surfactant, which may be at least one cationic surfactant, (f) optionally at least one ester; and (g) optionally at least one fatty compound other than (f). The hair compositions may further comprise one or more additional components, such as film formers, thickening agents, preservatives, etc. Preferably, the components of the compositions are natural or naturally-sourced, and from renewable sources. In one embodiment, the compositions have a weight ratio of amino acids to osmolytes that is greater than about 0.1, for example ranging about 0.1 to about 10, from about 0.2 to about 8, from about 0.5 to about 6, from about 1 to about 5, from about 1.2 to about 4, or from about 1.5 to about 3.5.

Amino Acids

Hair compositions according to the disclosure comprise at least one amino acid. Optionally, in various embodiments, hair compositions according to the present invention can comprise one, two, or three amino acids. Amino acids that can be chosen include those that are basic, acidic, or neutral at neutral pH. In preferred embodiments, hair compositions include at least one basic amino acid.

As used herein, the term "amino acid" includes amino carboxylic acids and salts thereof as well as amino sulfonic acids and salts thereof. As used herein, amino acids are understood to refer to organic compounds containing a carboxylic acid group (—COOH) (amino carboxylic acids) and/or sulfonic acid group ($\text{—S(=O)}_2\text{—OH}$) (amino sulfonic acids) and an amino group (—NH_2) which may be primary or secondary, or may be intra-cyclic, along with a side chain (R group) specific to each amino acid.

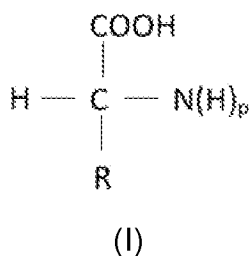
Amino carboxylic acids that may be chosen include, for example, alanine, arginine, asparagine, aspartic acid, cysteine, glutamic acid, glutamine, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tryptophan, tyrosine, valine, and combinations of two or more thereof.

5 Exemplary amino sulfonic acids include aminomethane sulfonic acid, 2-aminoethane sulfonic acid (taurine), aminopropane sulfonic acid, aminobutane sulfonic acid, aminohexane sulfonic acid, aminoisopropyl sulfonic acid, aminododecyl sulfonic acid, aminobenzene sulfonic acid, aminotoluene sulfonic acid, sulfanilic acid, chlorosulfanilic acid, diamino benzene sulfonic acid, amino phenol sulfonic acid, amino propyl benzene
10 sulfonic acid, amino hexyl benzene sulfonic acid, and combinations of two or more thereof.

Salts of amino acids are also included in the term “amino acid”, whether or not so stated. By way of non-limiting example, salts that may be chosen include salts with organic or mineral bases, for example the salts of alkali metals, such as the
15 lithium, sodium, or potassium salts; the salts of alkaline earth metals, such as the magnesium or calcium salts, and the zinc salts.

Furthermore, amino acids can be in either the D-, L-, or DL- configuration. In some preferred embodiments, it is advantageous to choose amino acids in the L- configuration, for example L-proline, L-methionine, L-serine, L-arginine, L-lysine, or
20 combinations of two or more thereof.

In some embodiments it is particularly advantageous to choose one or more amino carboxylic acids. Thus, in various embodiments, the hair compositions according to the present invention comprise one or more amino acids of formula (I):



25

wherein:

p is an integer equal to 1 or 2, and

when p = 1, R forms, together with the nitrogen atom, a saturated heterocycle comprising from 5 to 8 ring members, preferably 5 ring members, it being
30 possible for this ring to be substituted by one or more groups chosen from hydroxyl or (C₁-C₄)alkyl; or

when $p = 2$, R represents a hydrogen atom or a saturated, linear, or branched (C_1 - C_{12})alkyl group, preferably a (C_1 - C_4)alkyl group, optionally interrupted by one or more heteroatoms or groups chosen from $-S-$, $-NH-$, or $-C(NH)-$, and/or optionally substituted by one or more groups chosen from hydroxyl ($-OH$), amino ($-NH_2$), $-SH$, $-COOH$, $-CONH_2$, $-NH-C(NH)-NH_2$, or an imidazole ring.

In some embodiments when $p = 1$, R forms, together with the nitrogen atom, a saturated heterocycle comprising 5 ring members, this ring not being substituted.

In some embodiments when $p = 2$, R represents a hydrogen atom or a saturated, linear, or branched (C_1 - C_4)alkyl group, optionally substituted by one or more groups chosen from hydroxyl ($-OH$), amino ($-NH_2$), $-CONH_2$, or $-NH-C(NH)-NH_2$, or an imidazole ring. In some embodiments p is preferably 2.

In some embodiments, the hair compositions comprise one or more amino acids chosen from glycine, proline, methionine, serine, arginine, lysine, histidine, salts of any of the foregoing (in particular alkali metal, alkaline earth metal, or zinc salts), or combinations of two or more thereof. In at least certain embodiments, the amino acid compounds in the hair composition consist essentially of or consist of amino acids chosen from glycine, proline, methionine, serine, arginine, lysine, histidine, salts of any of the foregoing (in particular alkali metal, alkaline earth metal, or zinc salts), or combinations of two or more thereof.

In some embodiments, the amino acid(s) useful in the hair compositions may comprise, consist essentially of, or consist of glycine and/or salts thereof. In other embodiments, the amino acid(s) useful in the hair compositions may comprise, consist essentially of, or consist of arginine and/or salts thereof. In other embodiments, the amino acid(s) useful in the hair compositions may comprise, consist essentially of, or consist of proline and/or salts thereof. In still other embodiments, the amino acid(s) useful in the hair compositions may comprise, consist essentially of, or consist of methionine and/or salts thereof. In other embodiments, the amino acid(s) useful in the hair compositions may comprise, consist essentially of, or consist of serine and/or salts thereof. In still other embodiments, the amino acid(s) useful in the hair compositions may comprise, consist essentially of, or consist of histidine and/or salts thereof. In still other embodiments, the amino acid(s) useful in the hair compositions may comprise, consist essentially of,

or consist of lysine and/or salts thereof. In still further embodiments, the amino acid(s) useful in the hair compositions may comprise, consist essentially of, or consist of basic amino acids and/or salts thereof.

In various embodiments, the total amount of amino acids may range from
5 about 0.1% to about 15%, such as about 0.1% to about 12%, about 0.1% to about 10%, about 0.1% to about 9%, about 0.1% to about 8%, about 0.1% to about 7%, about 0.1% to about 6%, about 0.1% to about 5.5%, about 0.1% to about 5%, about 0.1% to about 4.5%, about 0.1% to about 4%, about 0.1% to about 3.5%, about 0.1% to about 3%, about 0.1% to about 2.5%, about 0.1% to about 2%, about 0.1% to about 1.5%,
10 about 0.1% to about 1%, about 0.5% to about 15%, about 0.5% to about 12%, about 0.5% to about 10%, about 0.5% to about 9%, about 0.5% to about 8%, about 0.5% to about 7%, about 0.5% to about 6%, about 0.5% to about 5.5%, about 0.5% to about 5%, about 0.5% to about 4.5%, about 0.5% to about 4%, about 0.5% to about 3.5%, about 0.5% to about 3%, about 0.5% to about 2.5%, about 0.5% to about 2%, about
15 0.5% to about 1.5%, about 0.5% to about 1%, about 1% to about 15%, about 1% to about 12%, about 1% to about 10%, about 1% to about 9%, about 1% to about 8%, about 1% to about 7%, about 1% to about 6%, about 1% to about 5.5%, about 1% to about 5%, about 1% to about 4.5%, about 1% to about 4%, about 1% to about 3.5%, about 1% to about 3%, about 1% to about 2.5%, about 1% to about 2%, about 1% to
20 about 1.5%, about 1.5% to about 15%, about 1.5% to about 12%, about 1.5% to about 10%, about 1.5% to about 9%, about 1.5% to about 8%, about 1.5% to about 7%, about 1.5% to about 6%, about 1.5% to about 5.5%, about 1.5% to about 5%, about 1.5% to about 4.5%, about 1.5% to about 4%, about 1.5% to about 3.5%, about 1.5% to about 3%, about 1.5% to about 2.5%, about 1.5% to about 2%, about 2% to about 15%, about
25 2% to about 12%, about 2% to about 10%, about 2% to about 9%, about 2% to about 8%, about 2% to about 7%, about 2% to about 6%, about 2% to about 5.5%, about 2% to about 5%, about 2% to about 4.5%, about 2% to about 4%, about 2% to about 3.5%, about 2% to about 3%, about 2% to about 2.5%, about 2.5% to about 15%, about 2.5% to about 12%, about 2.5% to about 10%, about 2.5% to about 9%, about 2.5% to about
30 8%, about 2.5% to about 7%, about 2.5% to about 6%, about 2.5% to about 5.5%, about 2.5% to about 5%, about 2.5% to about 4.5%, about 2.5% to about 4%, about 2.5% to about 3.5%, about 2.5% to about 3%, about 3% to about 15%, about 3% to about 12%, about 3% to about 10%, about 3% to about 9%, about 3% to about 8%, about 3% to about 7%, about 3% to about 6%, about 3% to about 5.5%, about 3% to

about 5%, about 3% to about 4.5%, about 3% to about 4%, about 3% to about 3.5%, about 3.5% to about 15%, about 3.5% to about 12%, about 3.5% to about 10%, about 3.5% to about 9%, about 3.5% to about 8%, about 3.5% to about 7%, about 3.5% to about 6%, about 3.5% to about 5.5%, about 3.5% to about 5%, about 3.5% to about 4.5%, about 3.5% to about 4%, about 4% to about 15%, about 4% to about 12%, about 4% to about 10%, about 4% to about 9%, about 4% to about 8%, about 4% to about 7%, about 4% to about 6%, about 4% to about 5.5%, about 4% to about 5%, about 4% to about 4.5%, about 4.5% to about 15%, about 4.5% to about 12%, about 4.5% to about 10%, about 4.5% to about 9%, about 4.5% to about 8%, about 4.5% to about 7%, about 4.5% to about 6%, about 4.5% to about 5.5%, or about 4.5% to about 5% by weight, relative to the total weight of the hair composition. In preferred embodiments, the total amount of amino acids ranges from about 2.5% to about 7.5%, about 3% to about 7%, about 3.5% to about 6.5%, about 3.75% to about 6.25%, about 4% to about 6%, about 4.25% to about 5.75%, about 4.5% to about 5.5%, about 4.75% to about 5.25%, or about 4.8% to about 5.2% by weight, relative to the total weight of the hair composition. For example, the total amount of amino acids may be about 4.5%, about 4.6%, about 4.7%, about 4.8%, about 4.9%, about 5.0%, about 5.1%, about 5.2%, about 5.3%, about 5.4%, or about 5.5% by weight, relative to the total weight of the hair composition, including all ranges and subranges using any of the foregoing as upper and lower limits. In some preferred embodiments, the hair compositions comprise a total amount of basic amino acids in any of the foregoing ranges and amounts.

In one preferred embodiment, the hair compositions comprise arginine and/or a salt thereof. In another preferred embodiment, where more than one amino acid is present, arginine is present in the hair composition in an amount greater than the combined amounts of the other amino acid(s) present, for example arginine comprises greater than about 50%, such as greater than about 60%, greater than about 70%, greater than about 80%, greater than about 90%, greater than about 95%, greater than about 98%, or greater than about 99% of all amino acids present in the hair composition. In a further preferred embodiment, arginine is the only the basic amino acid in the hair composition.

In various preferred embodiments, the hair composition comprises arginine in an amount ranging from about 1% to about 10%, such as from about 2.5% to about 7.5%, preferably from about 3% to about 7%, more preferably from about

3.5% to about 6.5%, more preferably from about 3.75% to about 6.25%, more preferably from about 4% to about 6%, more preferably from about 4.25% to about 5.75%, more preferably still from about 4.5% to about 5.5%, yet more preferably from about 4.75% to about 5.25%, and most preferably from about 4.8% to about 5.2%, or
5 may be present in an amount of about 4.5%, about 4.6%, about 4.7%, about 4.8%, about 4.9%, about 5.0%, about 5.1%, about 5.2%, about 5.3%, about 5.4%, or about 5.5% by weight, relative to the total weight of the hair composition, including all ranges and subranges using any of the foregoing as upper and lower limits.

In another preferred embodiment, hair compositions according to the
10 present invention comprise serine and/or a salt thereof. If present, the amount of serine may range from about 0.01% to about 2%, such as from about 0.01% to about 1.5%, about 0.01% to about 1%, about 0.01% to about 0.5%, about 0.01% to about 0.4%, about 0.01% to about 0.3%, about 0.01% to about 0.2%, about 0.01% to about 0.1%, about 0.05% to about 2%, about 0.05% to about 1.5%, about 0.05% to about
15 1%, about 0.05% to about 0.5%, about 0.05% to about 0.4%, about 0.05% to about 0.3%, about 0.05% to about 0.2%, about 0.05% to about 0.1%, about 0.1% to about 2%, about 0.1% to about 1.5%, about 0.1% to about 1%, or about 0.1% to about 0.5% by weight, relative to the total weight of the hair composition. For example, in some preferred embodiments, the hair compositions may comprise serine in an amount
20 ranging from about 0.05% to about 1.5%, preferably from about 0.1% to about 1%, more preferably from about 0.25% to about 0.75%, and most preferably from about 0.4% to about 0.6%, such as about 0.1%, about 0.25%, about 0.5%, about 0.75%, or about 1% by weight, relative to the total weight of the hair composition, including all ranges and subranges using any of the foregoing as upper and lower limits.

25 In some embodiments, it may be advantageous to choose at least one basic amino acid and at least one additional amino acid chosen from acidic and/or neutral amino acids. For example, in preferred embodiments it may be advantageous to include at least one basic amino acid and serine in hair compositions according to the present invention, and to choose total amounts of basic amino acids and serine
30 such that the hair composition has a weight ratio of the total amount of basic amino acids to the total amount of serine that is greater than about 2, such as greater than about 3, greater than about 4, greater than about 5, or greater than about 6. For example, the hair composition may have a weight ratio of the total amount of basic amino acids to the total amount of serine ranging from about 2 to about 15, such as

from about 4 to about 14, from about 6 to about 13, from about 8 to about 12, or from about 9 to about 11. In further examples, the weight ratio of the total amount of basic amino acids to serine may be about 8, about 9, about 10, about 11, or about 12. In some preferred embodiments, the hair composition comprises serine and has a weight ratio of the total amount of basic amino acids to serine ranging from about 2 to about 15, preferably from about 8 to about 12, more preferably from about 9 to about 11, or is about 8, about 9, about 10, about 11, or about 12, including all ranges and subranges using any of the foregoing as upper and lower limits.

In still further preferred embodiments, the hair compositions comprise serine and arginine, and have a weight ratio of arginine to serine ranging from about 2 to about 15, preferably from about 8 to about 12, more preferably from about 9 to about 11, or is about 8, about 9, about 10, about 11, or about 12, including all ranges and subranges using any of the foregoing as upper and lower limits.

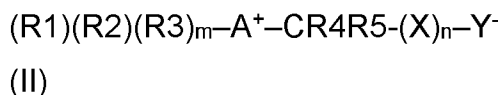
Osmolytes

Osmolytes are molecules, typically of lower molecular weight, used by cells to maintain cell volume, regulate osmotic pressure, and maintain cellular homeostasis, for example in response to environmental stressors. Organic osmolytes include amino carboxylic acids, amino sulfonic acids, salts thereof, and derivatives thereof, carbohydrates such as sugars and sugar alcohols (polyols), polyamines, betaines, methylsulfonium compounds (e.g. dimethylsulfonopropionate), and urea. For purposes of the present invention, "osmolytes" includes derivatives of amino carboxylic acids, derivatives of amino sulfonic acids, and salts of the derivatives (referred to herein collectively as "amino acid derivatives"), but does not include amino carboxylic acids, amino sulfonic acids, or salts thereof which are described above, and does not include polyols.

Hair compositions according to the present invention comprise one or more osmolytes, preferably one or more organic osmolytes. In some embodiments, the hair compositions comprise more than one osmolyte. Without intending to be bound by theory, it is believed that the use of osmolytes according to the present invention permits treated hair to maintain moisture equilibrium, thus reducing potential damage to the hair, or restores moisture equilibrium to already-damaged hair, thereby allowing the treated hair to recover strength and/or reduced elasticity associated with healthy hair.

In preferred embodiments, useful osmolytes are chosen from

carbohydrate sugars, polyamines, amino acid derivatives such as betaines, and more preferably are chosen from compounds of formula (II) or salts thereof:



5 wherein:

- R1, R2, and R3 are independently chosen from C₁-C₄ alkyl groups, preferably C₁-C₂ alkyl groups, more preferably methyl;

- A is N or S;

- m and n are independently 0 or 1;

10 - X is a divalent alkyl group (= an alkylene group), linear or branched, saturated or unsaturated, having 1 to 6 carbon atoms, preferably 1 to 4 carbon atoms, optionally substituted by one or more groups chosen from hydroxyl (–OH) or amino (–NH₂); and

- Y[–] is –COO[–] or –OSO₃[–];

15 with the provisos that:

○ when A is S, then m = 0 and R4 and R5 are independently chosen from a hydrogen atom or a saturated, unsaturated, linear, branched, and/or cyclic (including aromatic and polycyclic chains), (C₁-C₁₀) hydrocarbon chain, preferably (C₁-C₆), more preferably (C₁-C₄); optionally interrupted by one or more heteroatoms or groups chosen from –S–, –N=, –NH– or –C(NH)– and/or optionally substituted by one or more groups chosen from hydroxyl (–OH), amino (–NH₂), –SH, –COOH, or –CONH₂;

○ when A is N and m = 0, R4 represents a hydrogen atom or a saturated, linear or branched (C₁-C₈)alkyl, preferably (C₁-C₄)alkyl, group; and R5 forms, with the nitrogen atom, a saturated heterocycle comprising from 5 to 8 ring members, preferably 5 to 6 ring members, it being possible for this ring to be substituted by one or more groups chosen from hydroxyl or (C₁-C₄)alkyl; and

○ when A is N and m = 1, then R4 and R5 are independently chosen from a hydrogen atom or a saturated, unsaturated, linear, branched and/or cyclic (including aromatic and polycyclic chains) (C₁-C₁₀) hydrocarbon chain, preferably (C₁-C₆), more preferably (C₁-C₄); optionally interrupted by one or more heteroatoms or groups chosen from –S–, –N=, –NH– or –C(NH)– and/or optionally substituted by one or more groups chosen from hydroxyl (–OH), amino (–NH₂), –SH, –COOH, or –CONH₂.

Useful and non-limiting polyamine compounds may comprise primary and/or secondary and/or tertiary and/or quaternary amine functional groups. By way of example, polyamines that can be chosen include diamines, triamines, tetramines, pentamines, and polymeric polyamines or polyimines, such as, for example, hexamethylenediamine, diethylenetetramine, diethylenetriamine, polyethyleneimine (PEI), polyvinyl amine, polyether amine, polylysine, ethylene diamine, 1,3-diaminopropane, cadaverine, spermidine, spermine, putrescine, tetraethylmethylenediamine, triethylenetetramine, or combinations of two or more thereof. In some embodiments, useful polyamines are chosen from putrescine, spermidine, and/or spermine.

Useful and nonlimiting examples of betaines include glycine betaine, valine betaine, alanine betaine, proline betaine, hydroxyproline betaine, etc. Salts of betaines can also be used and are expressly included in the term "betaine" unless expressly stated otherwise. In particularly preferred embodiments, betaines are chosen from those corresponding to formula (II). Exemplary useful compounds of formula (II) include the compounds shown in FIGS. 5A-5B. As shown in FIG. 5A, in some embodiments the compounds of formula (II) are in zwitterionic form, and as shown in FIG. 5B, in some embodiments the compounds of formula (II) have a corresponding counterion, X^- . The counterion is not limited, and can be any suitable counterion, for example a chloride ion, bromide ion, iodide ion, sulfate anion, sulfonate anion, methyl sulfate anion, phosphate anion, nitrate anion, etc. Thus, as used herein a "compound of formula (II)" expressly includes both the ionic form of the compound as well as salt forms, whether or not so stated.

As shown in FIGS. 5A-5B, exemplary useful compounds of formula (II) include betaine and betaine derivatives (referred to herein as "betaines"), for example valine betaine, glutamic acid betaine, glutamine betaine, trimethyl lysine, glycine betaine (trimethyl glycine), histidine betaine, N-methyl histidine betaine, alanine betaine, beta-alanine betaine, choline sulfate, pipecolic acid betaine, proline betaine, hydroxyproline betaine, tyrosine betaine, phenylalanine betaine, tryptophan betaine, leucine betaine, isoleucine betaine, and/or dimethylsulfoniopropionate. In a preferred embodiment, the osmolyte is glycine betaine (trimethyl glycine), alone or in combination with one or more additional osmolytes, for example one or more additional compounds of formula (II).

In some preferred embodiments, hair compositions according to the

present invention comprise at least one compound of formula (II). In additional preferred embodiments, hair compositions according to the present invention comprise one or more compounds of formula (II) that is a zwitterionic amino acid derivative bearing a quaternary ammonium group and comprising in total from 1 to 12 carbon atoms, such as from 2 to 10 carbon atoms, or from 3 to 8 carbon atoms.

In some preferred embodiments, hair compositions according to the present invention comprise at least one compound of formula (II) wherein $R_1 = R_2 =$ methyl; A is N; and/or Y is COO^- . In some other preferred embodiments, hair compositions according to the present invention comprise at least one compound of formula (II) wherein R_3 is methyl. In other preferred embodiments, hair compositions according to the present invention comprise at least one compound of formula (II) wherein X is a divalent alkyl group, linear or branched, preferably saturated, having from 1 to 6 carbon atoms, preferably 1 to 4 carbon atoms, optionally substituted by one group chosen from hydroxyl or amino. In still other preferred embodiments, hair compositions according to the present invention comprise at least one compound of formula (II) wherein X is a divalent alkyl group, linear or branched, preferably saturated, having from 1 to 6 carbon atoms, preferably 1 to 4 carbon atoms, more preferably 1 to 2 carbon atoms (not substituted), such as methylene or ethylene. In other preferred embodiments, hair compositions according to the present invention comprise at least one compound of formula (II) wherein R_4 and R_5 , which may be the same or different, are chosen from a hydrogen atom, a saturated, linear or branched ($\text{C}_1\text{-C}_{10}$) alkyl group, preferably ($\text{C}_1\text{-C}_6$)alkyl, more preferably ($\text{C}_1\text{-C}_4$) alkyl; a phenyl group; a benzyl group; an alkyl group substituted by a cyclic group (saturated or not, mono or bi-cyclic); a cyclic group (saturated or not, mono or bi-cyclic) substituted by an alkyl group; all these groups being optionally interrupted by one or more heteroatoms or groups chosen from $-\text{S}-$, $-\text{N}=\text{}$, $-\text{NH}-$, or $-\text{C}(\text{NH})-$ and/or optionally substituted by one or more groups chosen from hydroxyl ($-\text{OH}$), amino ($-\text{NH}_2$), $-\text{SH}$, $-\text{COOH}$, $-\text{CONH}_2$; more preferably where R_4 is hydrogen and/or where R_5 is a hydrogen atom or a saturated, linear or branched ($\text{C}_1\text{-C}_6$)alkyl, more preferably ($\text{C}_1\text{-C}_4$) alkyl; optionally substituted by one group chosen from hydroxyl ($-\text{OH}$), amino ($-\text{NH}_2$), $-\text{COOH}$, or $-\text{CONH}_2$. In some preferred embodiments, when A is N and $m = 0$, R_5 forms, together with the nitrogen atom, a saturated heterocycle comprising from 5 to 8 ring members, preferably 5 to 6 ring members, optionally substituted by one hydroxy group. In further preferred embodiments, $R_1 = R_2 =$ methyl, A is N, Y is COO^- , and X (if present) is a divalent

alkyl group that may be linear or branched, saturated or unsaturated, having from 1 to 6 carbon atoms, preferably from 1 to 4 carbon atoms, more preferably from 1 to 2 carbon atoms.

In one preferred embodiment, the hair composition comprises at least one compound of formula (II) wherein R1 = R2 = R3 = methyl; A is N; Y is COO⁻; X is a divalent alkyl group, linear or branched, preferably saturated, having from 1 to 4 carbon atoms, optionally substituted by one group chosen from hydroxyl or amino, more preferably 1 to 2 carbon atoms (not substituted), such as methylene or ethylene; R4 is hydrogen; and R5 forms, together with the nitrogen atom, a saturated heterocycle comprising from 5 to 8 ring members, preferably 5 to 6 ring members, optionally substituted by one hydroxy group.

In preferred embodiments, the osmolyte in the hair composition comprises, consists essentially of, or consists of one or more of the compounds shown in FIGS. 5A-5B. In more preferred embodiments, hair compositions according to the present invention comprise trimethyl glycine (referred to interchangeably as glycine betaine), optionally in combination with at least one additional osmolyte, and in particularly preferred embodiments the osmolyte in the hair composition comprises, consists essentially of, or consists of glycine betaine optionally with at least one additional compound of formula (II).

Useful and non-limiting examples of carbohydrate sugars that can be used include C₃-C₆ monosaccharides, for example pentoses and/or derivatives thereof, or hexoses and/or derivatives thereof. For example, the sugars may optionally be chosen from xylose, arabinose, ribose, 2-deoxy-ribose, ribulose, deoxy-ribulose, arabinose, xylulose, allose, altrose, glucose (including dextrose), glucosamine, mannose, gulose, idose, galactose, talose, sorbose, psicose, fructose, tagatose, or combinations of two or more thereof. In at least some embodiments, the sugars are chosen from disaccharides, for example sucrose (also saccharose), maltose, lactose, cellobiose, trehalose, dextran, or from polysaccharides, for example maltotriose, starch, dextrans, cellulose, glycogen, or combinations of two or more thereof. In some embodiments, the sugars are preferably chosen from trehalose, glucose, sucrose, fructose, fructans, or combinations of two or more thereof.

In various embodiments, the total amount of osmolytes present in the hair composition may range from about 0.01% to about 15%, such as, for example, from about 0.1% to about 10%, from about 0.1% to about 9%, from about 0.1% to about

8%, from about 0.1% to about 7%, from about 0.1% to about 6%, from about 0.1% to about 5%, from about 0.1% to about 4%, from about 0.1% to about 3%, from about 0.1% to about 2%, from about 0.1% to about 1%, from about 0.5% to about 10%, from about 0.5% to about 9%, from about 0.5% to about 8%, from about 0.5% to about 7%,
5 from about 0.5% to about 6%, from about 0.5% to about 5%, from about 0.5% to about 4%, from about 0.5% to about 3%, from about 0.5% to about 2%, from about 0.5% to about 1%, from about 1% to about 10%, from about 1% to about 9%, from about 1% to about 8%, from about 1% to about 7%, from about 1% to about 6%, from about 1% to about 5%, from about 1% to about 4%, from about 1% to about 3%, from about 1% to about 2%, from about 1.5% to about 10%, from about 1.5% to about 9%, from about 1.5% to about 8%, from about 1.5% to about 7%, from about 1.5% to about 6%, from about 1.5% to about 5%, from about 1.5% to about 4%, from about 1.5% to about 3%, from about 1.5% to about 2%, from about 2% to about 10%, from about 2% to about 9%, from about 2% to about 8%, from about 2% to about 7%, from about 2% to about 6%, from about 2% to about 5%, from about 2% to about 4%, from about 2% to about 3%, from about 2.25% to about 10%, from about 2.25% to about 9%, from about 2.25% to about 8%, from about 2.25% to about 7%, from about 2.25% to about 6%, from about 2.25% to about 5%, from about 2.25% to about 4%, from about 2.25% to about 3%, from about 2.5% to about 10%, from about 2.5% to about 9%, from about 2.5% to about 8%, from about 2.5% to about 7%, from about 2.5% to about 6%, from about 2.5% to about 5%, from about 2.5% to about 4%, from about 2.5% to about 3% by weight, relative to the total weight of the hair composition. For example, the total amount of osmolytes present in the hair composition may be about 2.0%, about 2.1%, about 2.2%, about 2.3%, about 2.4%, about 2.5%, about 2.6%, about 2.7%, about 2.8%, about 2.9%, or about 3.0% by weight, relative to the total weight of the hair composition, including all ranges and subranges using any of the foregoing as upper and lower limits.

In preferred embodiments the hair compositions comprise at least one betaine, and the total amount of betaines ranges from about 0.5% to about 5%, for
30 example from about 1% to about 5%, preferably from about 1.25% to about 4%, more preferably from about 1.5% to about 3.5%, more preferably from about 2% to about 3% or from about 2% to about 2.5%, more preferably still from about 2.25% to about 2.75%, and most preferably from about 2.3% to about 2.6%, or may be about 2.0%, about 2.1%, about 2.2%, about 2.3%, about 2.4%, about 2.5%, about 2.6%, about

2.7%, about 2.8%, about 2.9%, or about 3.0% by weight, relative to the total weight of the hair composition, including all ranges and subranges using any of the foregoing as upper and lower limits.

In a particularly preferred embodiment, the hair composition comprises
5 glycine betaine in an amount ranging from about 0.5% to about 5%, for example about 1% to about 5%, preferably from about 1.25% to about 4%, more preferably from about 1.5% to about 3.5%, more preferably from about 2% to about 3% or from about 2% to about 2.5%, more preferably still from about 2.25% to about 2.75%, and most preferably from about 2.3% to about 2.6%, or the glycine betaine may be present in an
10 amount of about 2.0%, about 2.1%, about 2.2%, about 2.3%, about 2.4%, about 2.5%, about 2.6%, about 2.7%, about 2.8%, about 2.9%, or about 3.0% by weight, relative to the total weight of the hair composition, including all ranges and subranges using any of the foregoing as upper and lower limits.

It may be advantageous, in some embodiments, to choose amounts of
15 amino acids and osmolytes to provide a weight ratio of the total amount of amino acid(s) and salts thereof in the hair composition to the total amount of osmolytes in the hair composition that is greater than about 0.1, for example greater than about 0.2, greater than about 0.5, greater than about 1, greater than about 1.25, greater than about 1.5, greater than about 1.75, or greater than about 2. In various embodiments,
20 the weight ratio of the total amount of amino acid(s) and salts thereof to the total amount of osmolytes may range from about 0.1 to about 10, such as from about 0.2 to about 8, from about 0.5 to about 6, from about 1 to about 5, from about 1.2 to about 4, or from about 1.5 to about 3.5. In other embodiments, the weight ratio of the total amount of amino acid(s) and salts thereof to the total amount of osmolytes may range
25 from greater than 1 to about 4, such as from about 1.25 to about 3.5, from about 1.5 to about 3, from about 1.75 to about 2.5, from about 1.75 to about 2.25, or from about 1.8 to about 2.2. For example, the weight ratio of the total amount of amino acid(s) in the hair composition to the total amount of osmolytes in the hair composition may be about 1, about 1.1, about 1.2, about 1.3, about 1.4, about 1.5, about 1.6, about 1.7,
30 about 1.8, about 1.9, about 2, about 2.1, about 2.2, about 2.3, about 2.4, about 2.5, about 2.6, about 2.7, about 2.8, about 2.9, about 3, about 3.1, about 3.2, about 3.3, about 3.4, about 3.5, about 3.6, about 3.7, about 3.8, about 3.9, about 4, about 4.1, about 4.2, about 4.3, about 4.4, about 4.5, about 4.6, about 4.7, about 4.8, about 4.9, or about 5, including all ranges and subranges using any of the foregoing as upper and

lower limits.

In some embodiments, the hair compositions comprise a total amount of amino acids chosen from compounds of formula (I) and a total amount of osmolytes chosen from compounds of formula (II) such that a weight ratio of compounds of formula (I):compounds of formula (II) is greater than about 0.5, greater than about 0.75, or greater than about 1, for example greater than about 1.25, greater than about 1.5, greater than about 1.75, or greater than about 2. In some embodiments, the weight ratio of compounds of formula (I):compounds of formula (II) in the hair composition may range from about 0.5 to about 6, for example from about 1 to about 4, from about 1.25 to about 3.5, from about 1.5 to about 3, from about 1.75 to about 2.5, from about 1.75 to about 2.25, or from about 1.8 to about 2.2. For example, the weight ratio of compounds of formula (I):compounds of formula (II) in the hair composition may be about 0.5, about 0.6, about 0.7, about 0.8, about 0.9, about 1, about 1.1, about 1.2, about 1.3, about 1.4, about 1.5, about 1.6, about 1.7, about 1.8, about 1.9, about 2, about 2.1, about 2.2, about 2.3, about 2.4, about 2.5, about 2.6, about 2.7, about 2.8, about 2.9, about 3, about 3.1, about 3.2, about 3.3, about 3.4, about 3.5, about 3.6, about 3.7, about 3.8, about 3.9, about 4, about 4.1, about 4.2, about 4.3, about 4.4, about 4.5, about 4.6, about 4.7, about 4.8, about 4.9, or about 5, including all ranges and subranges using any of the foregoing as upper and lower limits.

In a particularly preferred embodiment, the hair composition comprises arginine and glycine betaine and has a weight ratio of arginine to glycine betaine of greater than 1, for example greater than about 1.25, greater than about 1.5, greater than about 1.75, or greater than about 2, for example ranging from greater than 1 to about 4, preferably from about 1.5 to about 3, more preferably from about 1.75 to about 2.5, and most preferably from about 1.75 to about 2.25 or may be about 1, about 1.1, about 1.2, about 1.3, about 1.4, about 1.5, about 1.6, about 1.7, about 1.8, about 1.9, about 2, about 2.1, about 2.2, about 2.3, about 2.4, about 2.5, about 2.6, about 2.7, about 2.8, about 2.9, about 3, about 3.1, about 3.2, about 3.3, about 3.4, about 3.5, about 3.6, about 3.7, about 3.8, about 3.9, about 4, about 4.1, about 4.2, about 4.3, about 4.4, about 4.5, about 4.6, about 4.7, about 4.8, about 4.9, or about 5, including all ranges and subranges using any of the foregoing as upper and lower limits. In another particularly preferred embodiment, the hair composition comprises arginine, serine, and glycine betaine and has a weight ratio of the total amount of [arginine + serine] to glycine betaine of greater than 1, for example greater than about 1.25,

greater than about 1.5, greater than about 1.75, or greater than about 2, for example ranging from greater than 1 to about 4, preferably from about 1.5 to about 3, more preferably from about 1.75 to about 2.5, and most preferably from about 1.75 to about 2.25.

5

Carboxylic Acids

Hair compositions according to the present invention include at least one carboxylic acid. Optionally, the hair compositions may comprise at least two carboxylic acids, at least three carboxylic acids, etc. According to various embodiments of the present invention, useful carboxylic acids include organic compounds that include, for example, one (mono-), two (di-), three (tri-), or more acid functional groups and at least one carbon atom.

Carboxylic acids that can be used may optionally have a molecular weight of less than about 500 g/mol, less than about 400 g/mol, less than about 300 g/mol, or less than about 200 g/mol. In preferred embodiments, the carboxylic acids have a molecular weight of less than about 300 g/mol, or less than about 200 g/mol.

Salts of carboxylic acids can also be used and are expressly included in the term "carboxylic acid" unless expressly stated otherwise. The salts include salts with organic or mineral bases, for example the salts of alkali metals, such as the lithium, sodium, or potassium salts; the salts of alkaline earth metals, such as the magnesium or calcium salts, and the zinc salts. The alkali metal or alkaline earth metal salts are preferred in some embodiments, and in particular the sodium salts.

In preferred embodiments, carboxylic acids comprise from 2 to 20 carbon atoms, such as from 2 to 18 carbon atoms, from 3 to 16 carbon atoms, or from 3 to 14 carbon atoms. In some preferred embodiments, the hair compositions comprise one or more hydroxylated (poly)carboxylic acids comprising from 2 to 10 carbon atoms, such as from 2 to 8 carbon atoms, or from 3 to 6 carbon atoms, and may be saturated or unsaturated, and linear or branched, and/or a salt thereof. These (poly)acids are different from the compounds of amino acids type described above. Useful (poly)acids comprise at least one -COOH group (in acid or salified form); they can thus comprise a single -COOH group (monoacid) or can comprise more than one, for example two -COOH groups (in acid or salified form), or two or three -COOH groups (in acid or salified form) (polyacids). Useful (poly)acids also comprise at least one -OH group, such as from one to three or from two to three -OH groups, for example one, two, or three -OH groups. Preferably, the (poly)acids comprise in total from 2 to 8 or from 3 to

6 carbon atoms, and from two to three –OH groups, and their hydrocarbon chain is saturated or unsaturated, linear or branched, and preferably saturated and linear. In some preferred embodiments, the hydroxylated (poly)carboxylic acids and/or their salts comprise in total from 3 to 6 carbon atoms, from one to three –OH groups, and
5 from two to three –COOH groups (in acid or salified form). Unless stated otherwise, as used herein the term “(poly)acid” includes both monoacids and polyacids.

Non-limiting examples of mono-carboxylic acids that can be chosen include formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, enanthic acid, caprylic acid, lactic acid, salts thereof, or combinations of two or more
10 thereof. In some embodiments, the carboxylic acid may comprise, consist essentially of, or consist of lactic acid and/or a salt thereof.

Non-limiting examples of di-carboxylic acids that can be chosen include oxalic acid, malonic acid, malic acid, glutaric acid, citraconic acid, succinic acid, adipic acid, tartaric acid, fumaric acid, maleic acid, salts thereof, or combinations of two or
15 more thereof. In some embodiments, the hair compositions may include oxalic acid, malonic acid, malic acid, maleic acid, salts thereof, or combinations of two or more thereof.

Non-limiting examples of tricarboxylic acids include citric acid, isocitric acid, aconitic acid, propane-1,2,3-tricarboxylic acid, salts thereof, or combinations of
20 two or more thereof. In some embodiments, the carboxylic acid may comprise, consist essentially of, or consist of citric acid and/or a salt thereof.

In some embodiments, the carboxylic acid(s) may be chosen from oxalic acid, malonic acid, glutaric acid, succinic acid, adipic acid, glycolic acid, citric acid, tartaric acid, malic acid, maleic acid, lactic acid, salts thereof, or combinations of two
25 or more thereof. In particularly preferred embodiments, the carboxylic acids are chosen from α -hydroxy acids and their salts, and in particular from lactic acid, glycolic acid, tartaric acid, or citric acid, and their salts, in particular alkali metal or alkaline earth metal salts. It may in some embodiments be particularly advantageous to choose citric acid, lactic acid, and/or tartaric acid and/or their salts, in particular alkali metal or
30 alkaline earth metal salts, such as sodium citrate and/or sodium tartrate; preferably citric acid and/or its salts, in particular alkali metal or alkaline earth metal salts, such as sodium citrate.

The total amount of carboxylic acid(s) may range from about 0.5% to about 20% by weight, relative to the total weight of the hair composition. For example,

in some embodiments, the total amount of carboxylic acids ranges from about 1% to about 15%, such as about about 1% to about 12%, about 1% to about 10%, about 1% to about 9%, about 1% to about 8%, about 1% to about 7%, about 1% to about 6%, about 1% to about 5.5%, about 1% to about 5%, about 1% to about 4.5%, about 1% to about 4%, about 1% to about 3.5%, about 1% to about 3%, about 1% to about 2.5%, about 1% to about 2%, about 1% to about 1.5%, about 1.5% to about 15%, about 1.5% to about 12%, about 1.5% to about 10%, about 1.5% to about 9%, about 1.5% to about 8%, about 1.5% to about 7%, about 1.5% to about 6%, about 1.5% to about 5.5%, about 1.5% to about 5%, about 1.5% to about 4.5%, about 1.5% to about 4%, about 1.5% to about 3.5%, about 1.5% to about 3%, about 1.5% to about 2.5%, about 1.5% to about 2%, about 2% to about 15%, about 2% to about 12%, about 2% to about 10%, about 2% to about 9%, about 2% to about 8%, about 2% to about 7%, about 2% to about 6%, about 2% to about 5.5%, about 2% to about 5%, about 2% to about 4.5%, about 2% to about 4%, about 2% to about 3.5%, about 2% to about 3%, about 2% to about 2.5%, about 2.5% to about 15%, about 2.5% to about 12%, about 2.5% to about 10%, about 2.5% to about 9%, about 2.5% to about 8%, about 2.5% to about 7%, about 2.5% to about 6%, about 2.5% to about 5.5%, about 2.5% to about 5%, about 2.5% to about 4.5%, about 2.5% to about 4%, about 2.5% to about 3.5%, about 2.5% to about 3%, about 3% to about 15%, about 3% to about 12%, about 3% to about 10%, about 3% to about 9%, about 3% to about 8%, about 3% to about 7%, about 3% to about 6%, about 3% to about 5.5%, about 3% to about 5%, about 3% to about 4.5%, about 3% to about 4%, about 3% to about 3.5%, about 3.5% to about 15%, about 3.5% to about 12%, about 3.5% to about 10%, about 3.5% to about 9%, about 3.5% to about 8%, about 3.5% to about 7%, about 3.5% to about 6%, about 3.5% to about 5.5%, about 3.5% to about 5%, about 3.5% to about 4.5%, about 3.5% to about 4%, about 4% to about 15%, about 4% to about 12%, about 4% to about 10%, about 4% to about 9%, about 4% to about 8%, about 4% to about 7%, about 4% to about 6%, about 4% to about 5.5%, about 4% to about 5%, about 4% to about 4.5%, about 4.5% to about 15%, about 4.5% to about 12%, about 4.5% to about 10%, about 4.5% to about 9%, about 4.5% to about 8%, about 4.5% to about 7%, about 4.5% to about 6%, about 4.5% to about 5.5%, about 4.5% to about 5%, about 5% to about 15%, about 5% to about 12%, about 5% to about 10%, about 5% to about 9%, about 5% to about 8%, about 5% to about 7%, about 5% to about 6.5%, about 5% to about 6%, about 5% to about 5.5%, about 5.5% to about 15%, about 5.5% to about 12%, about 5.5% to about

10%, about 5.5% to about 9%, about 5.5% to about 8%, about 5.5% to about 7%, about 5.5% to about 6.5%, about 5.5% to about 6%, about 6% to about 15%, about 6% to about 12%, about 6% to about 10%, about 6% to about 9%, about 6% to about 8%, about 6% to about 7%, or about 6% to about 6.5% by weight, relative to the total weight

5 of the hair composition.

In preferred embodiments, the total amount of carboxylic acid(s) ranges from about 0.5% to about 20%, such as from about 2% to about 15%, from about 4% to about 10%, about 4.5% to about 8%, about 5% to about 7%, about 5.5% to about 6.5%, about 5.7% to about 6.3%, or about 5.8% to about 6.2% by weight, relative to the total weight of the hair composition. For example, in some preferred embodiments, the hair composition comprises at least one carboxylic acid chosen from citric acid, lactic acid, tartaric acid, salts thereof, or combinations thereof, and has a total amount of carboxylic acids and salts ranging from about 0.5% to about 20%, such as from about 2% to about 15%, from about 4% to about 10%, preferably from about 4.5% to about 8%, more preferably from about 5% to about 7%, more preferably from about 5.5% to about 6.5%, more preferably still from about 5.7% to about 6.3%, and most preferably from about 5.8% to about 6.2% by weight, relative to the total weight of the hair composition.

It may be advantageous in some embodiments to choose amounts of amino acids and carboxylic acids such that the hair composition has a weight ratio of the total amount of amino acids to the total amount of carboxylic acids of greater than about 0.75. For example, in various embodiments, the hair composition has a weight ratio of the total amount of amino acids to the total amount of carboxylic acids of greater than about 0.8, such as greater than about 0.9, greater than about 1, greater than about 1.1, greater than about 1.2, greater than about 1.3, greater than about 1.4, or greater than about 1.5. In some embodiments, the hair composition has a weight ratio of the total amount of amino acids to the total amount of carboxylic acids ranging from about 0.75 to about 2, such as from about 0.8 to about 1.5, from about 0.8 to about 1.35, or from about 0.8 to about 1.2. In some preferred embodiments, the hair composition comprises arginine and at least one carboxylic acid chosen from citric acid, lactic acid, tartaric acid, salts thereof, or combinations thereof, and has a weight ratio of the total amount of amino acids and salts thereof to the total amount of carboxylic acids and salts thereof ranging from about 0.75 to about 2, preferably from about 0.8 to about 1.5, more preferably from about 0.8 to about 1.35, and most

preferably from about 0.8 to about 1.2.

Solvents

Hair compositions according to the disclosure comprise at least one solvent. In various embodiments, solvents may be chosen from water, non-aqueous
5 solvents, or a combination thereof.

In preferred embodiments, the solvent includes water. In certain embodiments, the hair composition comprises from about 50% to about 98% of water, by weight, relative to the total weight of the hair composition. In certain embodiments, the hair composition comprises water in an amount ranging from about 50% to about
10 95% water by weight, such as from about 50% to about 90%, about 55% to about 90%, about 60% to about 90%, or about 60% to about 80% by weight, relative to the total weight of the hair composition.

In further embodiments, the solvent may include at least one non-aqueous solvent. Exemplary and non-limiting non-aqueous solvents that can be used
15 include, for example, glycerin, C₁₋₄ alcohols, organic solvents, fatty alcohols, fatty ethers, fatty esters, polyols, glycols, vegetable oils, mineral oils, liposomes, laminar lipid materials, or combinations thereof. The non-aqueous solvent may be chosen from organic solvents, for example, monoalcohols and polyols such as ethyl alcohol, isopropyl alcohol, propyl alcohol, benzyl alcohol, and phenylethyl alcohol, or glycols or
20 glycol ethers such as, for example, monomethyl, monoethyl and monobutyl ethers of ethylene glycol, propylene glycol or ethers thereof such as, for example, monomethyl ether of propylene glycol, butylene glycol, hexylene glycol, dipropylene glycol as well as alkyl ethers of diethylene glycol, for example monoethyl ether or monobutyl ether of diethylene glycol.

25 Preferably, the hair compositions comprise at least one polyol. The polyols can be chosen from diols and triols. In other embodiments, the polyols can be chosen from C₂-C₁₆ polyols, such as C₂-C₁₂ polyols, C₂-C₈ polyols, or C₃-C₈ polyols. In various embodiments, the polyols that can be used are linear or branched, saturated or unsaturated, and substituted or unsubstituted polyols. Thus, in various
30 embodiments, one or more polyols can be chosen from C₂-C₁₆, C₂-C₁₂, C₂-C₈, or C₃-C₈ diols, or C₂-C₁₆, C₂-C₁₂, C₂-C₈, or C₃-C₈ triols, any of which may be linear or branched, saturated or unsaturated, and substituted or unsubstituted.

By way of non-limiting example, polyols such as isopropyl alcohol, propyl alcohol, benzyl alcohol, and phenylethyl alcohol, or glycols or glycol ethers such as,

for example, monomethyl, monoethyl, and monobutyl ethers of ethylene glycol, propylene glycol or ethers thereof such as, for example, monomethyl ether of propylene glycol, butylene glycol, hexylene glycol, dipropylene glycol as well as alkyl ethers of diethylene glycol, for example monoethyl ether or monobutyl ether of diethylene glycol may be chosen. In some embodiments, the polyols are chosen from

5 propanediol, butanediol, pentanediol, hexanediol, heptanediol, octanediol, 1,2,6-hexanetriol, 1,2,4-butanetriol, trimethylolpropane, 2-butene-1,4-diol, 2-ethyl-1,3-hexanediol, 2-methyl-2,4-pentanediol, caprylyl glycol, 1,2-hexanediol, 1,2-pentanediol, 2-ethyl-2-methyl-1,3-propanediol, 3,3-dimethyl-1,2-butanediol, 2,2-diethyl-1,3-

10 propanediol, 2-methyl-2-propyl-1,3-propanediol, 2,4-dimethyl-2,4-pentanediol, 2,5-dimethyl-2,5-hexanediol, 5-hexene-1,2-diol, 2-ethyl-1,3-hexanediol, 4-methyl-1,2-pentanediol, or combinations of two or more thereof. In some preferred embodiments, the polyols are chosen from glycols such as ethylene glycol, propylene glycol, butylene glycol, hexylene glycol, pentylene glycol, 1,3-propanediol, diethylene glycol, triethylene

15 glycol, tetraethylene glycol, pentaethylene glycol, dipropylene glycol, caprylyl glycol, glycerin, diglycerin, and combinations of two or more thereof. In a particularly preferred embodiment, the solvent comprises at least one polyol chosen from propylene glycol, dipropylene glycol, tripropylene glycol, propanediol, propylene carbonate, PPG-3 methyl ether, dimethyl isosorbide, hexylene glycol, ethanol, glycerin, or combinations

20 of two or more thereof. In at least certain preferred embodiments, the solvent comprises water and at least one polyol, wherein the polyol(s) comprises, consists essentially of, or consists of one or more C₂-C₁₆ diols and/or C₂-C₁₆ triols, for example C₂-C₈ diols and/or C₂-C₈ triols. In other preferred embodiments, the solvent comprises water and at least one polyol, wherein the polyol(s) comprises, consists essentially of,

25 or consists of one or more glycols, for example propylene glycol and/or dipropylene glycol, and in particularly preferred embodiments, the solvent comprises water and at least one polyol, wherein the polyol(s) comprises, consists essentially of, or consists of dipropylene glycol.

If present, the total amount of the non-aqueous solvents in the hair

30 composition may range from about 0.1% to about 20%, such as from about 1% to about 20%, from about 1.5% to about 15%, or from about 2% to about 12% by weight, relative to the total weight of the hair composition. In some preferred embodiments, the solvent comprises water and at least one non-aqueous solvent, preferably chosen from polyols. In some embodiments, the hair composition comprises water and at least one

non-aqueous solvent, wherein the total amount of non-aqueous solvents ranges from about 0.5% to about 18%, preferably from about 1% to about 15%, more preferably from about 1.5% to about 12%, more preferably still from about 2% to about 11%, and most preferably from about 3% to about 10% by weight, relative to the total weight of the hair composition, and optionally further wherein the non-aqueous solvent comprises at least one solvent chosen from propylene glycol, dipropylene glycol, tripropylene glycol, propanediol, propylene carbonate, PPG-3 methyl ether, dimethyl isosorbide, hexylene glycol, ethanol, or mixtures of two or more thereof, preferably chosen from propylene glycol, dipropylene glycol, or a mixture of two or more thereof.

Surfactants

Hair compositions according to the disclosure may optionally comprise at least one surfactant. For example, the hair compositions may comprise one or more cationic surfactants and/or amphoteric surfactants, and in some embodiments the hair compositions may comprise mixtures of surfactants having the same or different ionicities.

Although the hair compositions may optionally include one or more anionic surfactants and/or nonionic surfactants, in at least some embodiments, the hair compositions are free or substantially free of anionic surfactants and/or nonionic surfactants. For example, in some embodiments the hair compositions comprise less than about 3%, such as less than about 2.5%, less than about 2%, less than about 1.75%, less than about 1.5%, less than about 1.25%, less than about 1%, less than about 0.75%, less than about 0.5%, less than about 0.25%, less than about 0.2%, less than about 0.1%, less than about 0.05%, less than about 0.01%, or less than about 0.001% of anionic surfactants and/or nonionic surfactants.

In at least some embodiments, the hair compositions comprise at least one cationic surfactant. The presence of active components such as amino acids and osmolytes causes destabilization of compositions in which they are present, but it has been discovered including cationic surfactants in the compositions in a weight ratio of [osmolytes + amino acids]:cationic surfactants that is greater than about 0.5, preferably greater than about 0.75, more preferably greater than about 1, provides stability to the compositions.

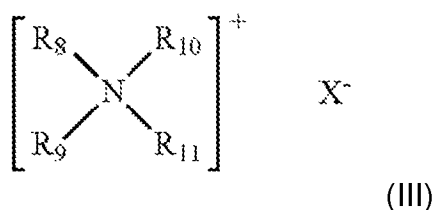
The term "cationic surfactant" means a surfactant that is positively charged when it is contained in the composition(s) according to the disclosure. This surfactant may bear one or more positive permanent charges or may contain one or

more functions that are cationizable in the hair composition according to the disclosure.

Non-limiting examples of cationic surfactants that may be used include optionally polyoxyalkylenated primary, secondary, or tertiary fatty amine salts, quaternary ammonium salts, and combinations thereof.

5 Non-limiting examples of useful fatty amine salts include oleyl hydroxyethyl imidazoline, linoleamidopropyl dimethylamine, isostearamidopropyl dimethylamine, oleamidopropyl dimethylamine, stearamidopropyldimethylamine, behenamido-propyldimethylamine, behenamidopropyldiethylamine, behenamidoethyldiethylamine, behenamidoethyldimethylamine, 10 arachidamidopropyldimethylamine, arachidamido-propyldiethylamine, arachidamidoethyldiethylamine, arachidamidoethyldi-methylamine, or combinations of two or more thereof. In some embodiments, the cationic surfactant comprises stearamidopropyl dimethylamine, palmitamidopropyl dimethylamine, lauramidopropyl dimethylamine, behenamidopropyl dimethylamine, or combinations of two or more 15 thereof.

As quaternary ammonium salts, quaternary ammonium salts of formula (III) may be chosen:



wherein:

20 - groups R_8 to R_{11} are independently chosen from linear or branched aliphatic groups containing from 1 to 30 carbon atoms, or an aromatic group such as aryl or alkylaryl, at least one of the groups R_8 to R_{11} including from 8 to 30 carbon atoms, such as from 12 to 24 carbon atoms, it being possible for the linear or branched aliphatic groups to include heteroatoms such as, for example, oxygen, nitrogen, and/or 25 sulfur, these heteroatoms not being adjacent, and halogens; and

- X^- is an anion chosen from the group consisting of halides such as bromides, chlorides, iodides, fluorides, phosphates, acetates, lactates,

(C_1 - C_4)alkyl sulfates, (C_1 - C_4)alkyl sulfonates or (C_1 - C_4)alkylaryl sulfonates; C_1 - C_{30} alkyl, C_1 - C_{30} alkoxy, (C_2 - C_6)polyoxyalkylene, C_1 - C_{30} alkylamide, 30 (C_{12} - C_{22})alkyl-(C_2 - C_6)alkylamido, (C_{12} - C_{22})alkyl acetate, and C_1 - C_{30} hydroxyalkyl groups.

Mention may be made as exemplary embodiments of formula (III) of tetraalkylammonium halides, such as chlorides, for example dialkyldimethylammonium or alkyltrimethylammonium chlorides in which the alkyl group comprises from 12 to 22 carbon atoms, such as from 14 to 20 carbon atoms. By way of example,

5 behenyltrimethylammonium chloride (behentrimonium chloride), distearyltrimethylammonium chloride, cetyltrimethylammonium chloride (cetrimonium chloride), or benzyldimethylstearyltrimethylammonium chloride may be chosen.

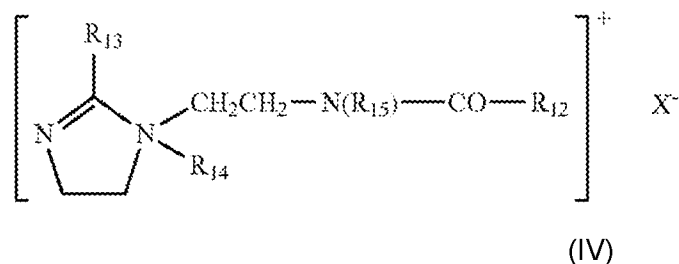
Mention may also be made of palmitylamidopropyltrimethylammonium or stearamidopropyltrimethylammonium (myristyl acetate)-ammonium halides, such as chlorides, for

10 example the product sold under the name Ceraphyl® 70 by the company Van Dyk.

In certain embodiments, cationic surfactants of formula (III) are preferably chosen from alkyltrimethylammonium halides whose alkyl group includes from 12 to 22 carbon atoms, such as from 14 to 20 carbon atoms, may be chosen. For example, alkyltrimethylammonium chlorides, such as behenyltrimethylammonium chloride and

15 cetyltrimethylammonium chloride, may be particularly useful.

In further embodiments, quaternary ammonium salts of imidazoline of formula (IV) may be chosen:



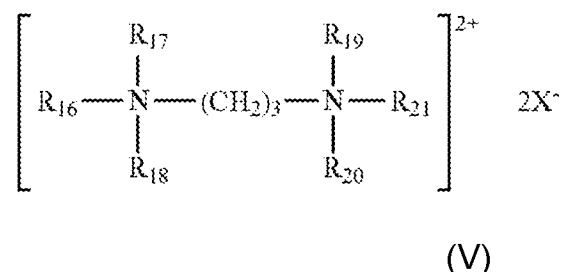
20 wherein:

- R₁₂ represents an alkenyl or alkyl group comprising from 8 to 30 carbon atoms, for example derived from tallow fatty acids,
- R₁₃ represents a hydrogen atom, a C₁-C₄ alkyl group or an alkenyl or alkyl group comprising from 8 to 30 carbon atoms,
- 25 - R₁₄ represents a C₁-C₄ alkyl group,
- R₁₅ represents a hydrogen atom or a C₁-C₄ alkyl group, and
- X⁻ is an anion chosen from the group consisting of halides, phosphates, acetates, lactates, (C₁-C₄)alkyl sulfates, and (C₁-C₄)alkyl- or (C₁-C₄)alkylarylsulfonates.

30 In one exemplary embodiment of formula (IV), R₁₂ and R₁₃ denote a mixture of alkenyl or alkyl groups comprising from 12 to 21 carbon atoms, for example

derived from tallow fatty acids, R_{14} denotes a methyl group, and R_{15} denotes a hydrogen atom. Such a product is sold, for example, under the name Rewoquat® W75 or W90 by the company Evonik.

In yet further embodiments, di- or triquaternary ammonium salts of formula (V) may be chosen:

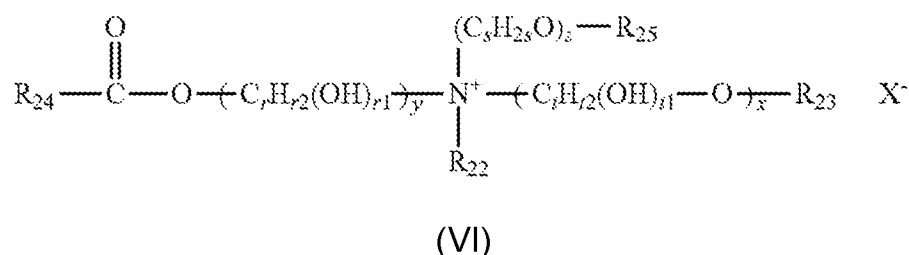


wherein:

- R_{16} represents an alkyl group comprising from 16 to 30 carbon atoms, which is optionally hydroxylated and/or optionally interrupted with one or more oxygen atoms,
- R_{17} represents hydrogen, an alkyl group comprising from 1 to 4 carbon atoms, or a group $-(CH_2)_3-N^+(R_{16a})(R_{17a})(R_{18a})$,
- R_{16a} , R_{17a} and R_{18a} , which may be identical or different, represent hydrogen or an alkyl group comprising from 1 to 4 carbon atoms,
- R_{18} , R_{19} , R_{20} , and R_{21} , which may be identical or different, represent hydrogen or an alkyl group comprising from 1 to 4 carbon atoms, and
- X^- is an anion chosen from the group consisting of halides, acetates, phosphates, nitrates, (C₁-C₄)alkyl sulfates, and (C₁-C₄)alkyl- and (C₁-C₄)alkylarylsulfonates, for example methyl sulfate or ethyl sulfate.

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

In still further embodiments, quaternary ammonium salts containing one or more ester functions, such as those of formula (VI) may be chosen:



wherein:

- R_{22} is chosen from C₁-C₆ alkyl groups and C₁-C₆ hydroxyalkyl or

dihydroxyalkyl groups,

- R_{23} is chosen from the group $R_{26}-C(=O)-$; linear or branched, saturated or unsaturated C_1-C_{22} hydrocarbon-based groups; and a hydrogen atom,

- R_{25} is chosen from the group $R_{28}-C(=O)-$; linear or branched, saturated or unsaturated C_1-C_6 hydrocarbon-based groups; and a hydrogen atom,

- R_{24} , R_{26} and R_{28} , which may be identical or different, are chosen from saturated or unsaturated, linear or branched, C_7-C_{21} hydrocarbon-based groups,

- r , s and t , which may be identical or different, are integers ranging from 2 to 6,

- r_1 and t_1 , which may be identical or different, are equal to 0 or 1,

- y is an integer ranging from 1 to 10,

- x and z , which may be identical or different, are integers ranging from 0 to 10, and

- X^- is an anion,

where $r_2 + r_1 = 2r$ and $t_1 + t_2 = 2t$, and the sum $x + y + z$ ranges from 1 to 15, with the provisos that when $x = 0$ then R_{23} is chosen from C_1-C_{22} hydrocarbon-based groups, and that when $z = 0$ then R_{25} denotes a linear or branched, saturated or unsaturated C_1-C_6 hydrocarbon-based group.

In exemplary embodiments of formula (VI), the alkyl groups R_{22} may be linear or branched, and are preferably linear. Preferably, R_{22} denotes a methyl, ethyl, hydroxyethyl or dihydroxypropyl group, and more particularly a methyl or ethyl group. Advantageously, the sum $x + y + z$ ranges from 1 to 10. When R_{23} is a C_1-C_{22} hydrocarbon-based groups, it may preferably comprise either from 12 to 22 carbon atoms or from 1 to 3 carbon atoms. Advantageously, R_{24} , R_{26} and R_{28} , which may be identical or different, are chosen from linear or branched, saturated or unsaturated $C_{11}-C_{21}$ hydrocarbon-based groups, and more particularly from linear or branched $C_{11}-C_{21}$ alkyl and alkenyl groups. Preferably, x and z , which may be identical or different, are equal to 0 or 1. Optionally, y is equal to 1. Preferably, r , s , and t , which may be identical or different, are equal to 2 or 3, and optionally are equal to 2.

The anion X^- is preferably a halide, optionally chloride, bromide, or iodide, a (C_1-C_4) alkyl sulfate, a (C_1-C_4) alkylsulfonate, or a (C_1-C_4) alkylarylsulfonate, a methanesulfonate, a phosphate, a nitrate, a tosylate, an anion derived from an organic acid such as an acetate or a lactate, or any other anion that is compatible with the ammonium bearing an ester function. The anion X^- is preferably a chloride, a methyl

sulfate, or an ethyl sulfate.

For example, the ammonium salts of formula (VI) in which R_{22} denotes a methyl or ethyl group, x and y are equal to 1, z is equal to 0 or 1, r , s and t are equal to 2, R_{23} is chosen from the group $R_{26}-C(=O)-$, methyl, ethyl, or $C_{14}-C_{22}$ hydrocarbon-based groups; and a hydrogen atom, R_{25} is chosen from the group

$R_{28}-C(=O)-$; and a hydrogen atom, R_{24} , R_{26} , and R_{28} , which may be identical or different, are chosen from linear or branched, saturated or unsaturated $C_{13}-C_{17}$ hydrocarbon-based groups, and preferably from linear or branched, saturated or unsaturated $C_{13}-C_{17}$ alkyl and alkenyl groups, may be chosen. Advantageously, the hydrocarbon-based groups are linear.

Among the compounds having formula (VI), mention may be made of salts, especially the chloride or methyl sulfate salts, of diacyloxyethyldimethylammonium, diacyloxyethylhydroxyethylmethylammonium, monoacyloxyethyldihydroxyethyl-methylammonium, triacyloxyethylmethylammonium or monoacyloxyethylhydroxy-ethyldimethylammonium, and mixtures thereof. The acyl groups preferably contain 14 to 18 carbon atoms and are obtained more particularly from a plant oil such as palm oil or sunflower oil. When the compound contains several acyl groups, these groups may be identical or different.

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

The one or more cationic surfactants may be chosen from, for example, a mixture of quaternary ammonium monoester, diester and triester salts with a weight majority of diester salts. Use may also be made of the ammonium salts containing at least one ester functional group. Use may also be made of behenoylhydroxypropyltrimethylammonium chloride. Preferably, the ammonium salts containing at least one ester function contain two ester functions.

In at least some embodiments, the hair compositions comprise at least one cationic surfactant chosen from cetrimonium chloride, behenalkonium chloride,

benzethonium chloride, cetylpyridinium chloride, behentrimonium chloride, lauralkonium chloride, cetalkonium chloride, cetrimonium bromide, cethylamine hydrofluoride, chlorallylmethenamine chloride (Quaternium-15), distearyldimonium chloride (Quaternium-5), dodecyl dimethyl ethylbenzyl ammonium chloride (Quaternium-14), Quaternium-22, Quaternium-26, Quaternium-18 hectorite, 5 dimethylaminoethylchloride hydrochloride, cysteine hydrochloride, diethanolammonium POE (10) oleyl ether phosphate, diethanolammonium POE (3)oleyl ether phosphate, tallow alkonium chloride, dimethyl dioctadecylammoniumbentonite, stearalkonium chloride, domiphen bromide, 10 denatonium benzoate, myristalkonium chloride, laurtrimonium chloride, ethylenediamine dihydrochloride, guanidine hydrochloride, pyridoxine HCl, iofetamine hydrochloride, meglumine hydrochloride, methylbenzethonium chloride, myrtrimonium bromide, oleyltrimonium chloride, polyquaternium-1, procainehydrochloride, cocobetaine, stearalkonium bentonite, stearalkoniumhectonite, stearyl trihydroxyethyl 15 propylenediamine dihydrofluoride, tallowtrimonium chloride, hexadecyltrimethyl ammonium bromide, stearamidopropyl dimethylamine, or combinations of two or more thereof.

In some embodiments, non-limiting examples of useful cationic surfactants include alkylamidoamines and esterquats, such as, for example, 20 brassicamidopropyl dimethylamine, lauramidopropyl dimethylamine, myristamidopropyl dimethylamine, stearamidopropyl dimethylamine, cocamidopropyl dimethylamine, ricinolamidopropyl dimethylamine, isostearamidopropyl dimethylamine, oleamidopropyl dimethylamine, behenamidopropyl dimethylamine, palmamidopropyl dimethylamine, behentrimonium chloride, cetrimonium chloride, 25 behenalkonium chloride, benzethonium chloride, cetylpyridinium chloride, lauralkonium chloride, cetalkonium chloride, cetrimonium bromide, cethylamine hydrofluoride, chlorallylmethenamine chloride (Quaternium-15), distearyldimonium chloride (Quaternium-5), dodecyl dimethyl ethylbenzyl ammonium chloride (Quaternium-14), Quaternium-22, Quaternium-26, Quaternium-18 hectorite, 30 dimethylaminoethylchloride hydrochloride, cysteine hydrochloride, diethanolammonium POE (10) oleyl ether phosphate, diethanolammonium POE (3)oleyl ether phosphate, tallow alkonium chloride, dimethyl dioctadecylammoniumbentonite, stearalkonium chloride, domiphen bromide, denatonium benzoate, myristalkonium chloride, laurtrimonium chloride,

ethylenediamine dihydrochloride, guanidine hydrochloride, pyridoxine HCl, iofetamine hydrochloride, meglumine hydrochloride, methylbenzethonium chloride, myrtrimonium bromide, oleyltrimonium chloride, polyquaternium-1, procaine hydrochloride, cocobetaine, stearyltrimonium bentonite, stearyltrimonium hectorite, stearyl trihydroxyethyl propylenediamine dihydrofluoride, tallowtrimonium chloride, hexadecyltrimethyl ammonium bromide, stearamidopropyl dimethylamine, or combinations thereof.

In preferred embodiments, compositions according to the disclosure comprise at least one cationic surfactant chosen from primary, secondary, or tertiary fatty amines and/or one or more quaternary ammonium salts of formula (III). In some preferred embodiments, the composition comprises at least one alkylamidoamine, for example brassicamidopropyl dimethylamine. In preferred embodiments, the compositions comprise at least one cationic surfactant chosen from brassicamidopropyl dimethylamine, behentrimonium chloride, cetrimonium chloride, stearamidopropyl dimethylamine, or combinations of two or more thereof.

In some preferred embodiments, the surfactant does not include behentrimonium chloride. In some preferred embodiments, the surfactant comprises, consists essentially of, or consists of one or more alkylamidoamines, for example brassicamidopropyl dimethylamine.

In one embodiment, the total amount of cationic surfactants ranges from about 0.01% to about 15% by weight, relative to the total weight of the composition. For example, the total amount of cationic surfactants can range from about 0.5% to about 10%, such as from about 0.5% to about 8%, about 0.5% to about 6%, about 0.5% to about 5%, about 0.5% to about 4%, about 0.5% to about 3%, about 1% to about 10%, about 1% to about 8%, about 1% to about 6%, about 1% to about 5%, about 1% to about 4%, about 1% to about 3%, about 1.5% to about 10%, about 1.5% to about 8%, about 1.5% to about 6%, about 1.5% to about 5%, about 1.5% to about 4%, or about 1.5% to about 3% by weight, relative to the total weight of the composition.

If present, the total amount of cationic surfactants may range up to about 15%, such as up to about 9%, up to about 8%, up to about 7%, up to about 6%, up to about 5%, up to about 4%, up to about 3.5%, up to about 3%, up to about 2.5%, up to about 2%, up to about 1.5%, up to about 1%, or up to about 0.5% by weight, relative to the total weight of the hair composition. For example, the total amount of cationic surfactants may range from about 0.001% to about 10%, from about 0.01% to about

15% by weight, from about 0.5% to about 10%, from about 0.01% to about 8%, from about 0.5% to about 8%, from about 0.1% to about 6%, about 0.5% to about 6%, about 0.5% to about 5%, from about 0.5% to about 4% by weight, about 0.5% to about 3%, about 1% to about 10%, about 1% to about 8%, about 1% to about 6%, about 1% to about 5%, about 1% to about 4%, about 1% to about 3%, about 1.5% to about 10%, about 1.5% to about 8%, about 1.5% to about 6%, about 1.5% to about 5%, about 1.5% to about 4%, or about 1.5% to about 3% by weight, relative to the total weight of the hair composition. In at least some preferred embodiments, the hair compositions comprise at least one cationic surfactant and have a total amount of cationic surfactants ranging from about 0.25% to about 8%, preferably from about 0.5% to about 7%, more preferably from about 0.75% to about 6%, and most preferably from about 1% to about 5% by weight, relative to the total weight of the hair composition.

In some embodiments, it may be preferable to choose amounts of osmolytes, amino acids, and cationic surfactants relative to each other to provide stability to the hair compositions. Thus, in preferred embodiments, the hair composition comprises a total amount of osmolytes, amino acids, and cationic surfactants such that the hair composition has a weight ratio of [osmolytes + amino acids]:cationic surfactants that is greater than about 0.5, preferably greater than about 0.75, more preferably greater than about 1, for example ranging from about 1 to about 20, from about 1.5 to about 18, from about 1.7 to about 15, from about 2 to about 12, from about 2.5 to about 10, or from about 3 to about 8. In further preferred embodiments, the hair composition has a weight ratio of [osmolytes + amino acids]:cationic surfactants ranging from about 1 to about 10, from about 1.25 to about 8, from about 1.5 to about 6, from about 1.75 to about 5, or from about 2 to about 4.

In particularly preferred embodiments, the hair composition has a weight ratio of betaines, preferably chosen from compounds of formula (II) + basic amino acids]:cationic surfactants that is greater than about 0.5, preferably greater than about 0.75, more preferably greater than about 1, for example ranging from about 1 to about 20, from about 1.5 to about 18, from about 1.7 to about 15, from about 2 to about 12, from about 2.5 to about 10, or from about 3 to about 8, or that ranges from about 1 to about 10, from about 1.25 to about 8, from about 1.5 to about 6, from about 1.75 to about 5, or from about 2 to about 4. In even more particularly preferred embodiments, the hair composition has a weight ratio of [glycine betaine + arginine]:cationic surfactants that is greater than about 1, for example ranging from about 1 to about 20,

from about 1.5 to about 18, from about 1.7 to about 15, from about 2 to about 12, from about 2.5 to about 10, or from about 3 to about 8, or that ranges from about 1 to about 10, from about 1.25 to about 8, from about 1.5 to about 6, from about 1.75 to about 5, or from about 2 to about 4.

5 In at least some embodiments, the hair compositions comprise at least one amphoteric surfactant. Non-limiting examples of useful amphoteric surfactants include derivatives of aliphatic secondary and tertiary amines where the aliphatic radical can be straight or branched chain and one of the aliphatic substituents contains from about 8 to about 18 carbon atoms and one contains an anionic group such as
10 carboxy, sulfonate, sulfate, phosphate, or phosphonate.

Exemplary amphoteric surfactants include sodium cocaminopropionate, sodium cocaminodipropionate, sodium cocoamphoacetate, sodium cocoamphohydroxypropylsulfonate, sodium cocoamphopropionate, sodium cornamphopropionate, sodium lauraminopropionate, sodium lauroamphoacetate,
15 sodium lauroamphohydroxypropylsulfonate, sodium lauroamphopropionate, sodium cornamphopropionate, sodium lauriminodipropionate, ammonium cocaminopropionate, ammonium cocaminodipropionate, ammonium cocoamphoacetate, ammonium cocoamphohydroxypropylsulfonate, ammonium cocoamphopropionate, ammonium cornamphopropionate, ammonium
20 lauraminopropionate, ammonium lauroamphoacetate, ammonium lauroamphohydroxypropylsulfonate, ammonium lauroamphopropionate, ammonium cornamphopropionate, ammonium lauriminodipropionate, triethanolamine cocaminopropionate, triethanolamine cocaminodipropionate, triethanolamine cocoamphoacetate, triethanolamine cocoamphohydroxypropylsulfonate,
25 triethanolamine cocoamphopropionate, triethanolamine cornamphopropionate, triethanolamine lauraminopropionate, triethanolamine lauroamphoacetate, triethanolamine lauroamphohydroxypropylsulfonate, triethanolamine lauroamphopropionate, triethanolamine cornamphopropionate, triethanolamine lauriminodipropionate, cocoamphodipropionic acid, disodium caproamphodiacetate,
30 disodium caproamphoadipropionate, disodium capryloamphodiacetate, disodium capryloamphodipropionate, disodium cocoamphocarboxyethylhydroxypropylsulfonate, disodium cocoamphodiacetate, disodium cocoamphodipropionate, disodium dicarboxyethylcocopropylenediamine, disodium laureth-5 carboxyamphodiacetate, disodium lauriminodipropionate, disodium

lauroamphodiacetate, disodium lauroamphodipropionate, disodium oleoamphodipropionate, disodium PPG-2-isodecethyl-7 carboxyamphodiacetate, lauraminopropionic acid, lauroamphodipropionic acid, lauryl aminopropylglycine, and lauryl diethylenediaminoglycine.

5 Betaine surfactants may also be used. For example, coco dimethyl carboxymethyl betaine, lauryl dimethyl carboxymethyl betaine, lauryl dimethyl alphacarboxyethyl betaine, cetyl dimethyl carboxymethyl betaine, cetyl dimethyl betaine, lauryl bis-(2-hydroxyethyl) carboxymethyl betaine, stearyl bis-(2-hydroxypropyl) carboxymethyl betaine, oleyl dimethyl gamma-carboxypropyl betaine,
10 lauryl bis-(2-hydroxypropyl) alpha-carboxyethyl betaine, coco dimethyl sulfopropyl betaine, stearyl dimethyl sulfopropyl betaine, lauryl dimethyl sulfoethyl betaine, lauryl bis-(2-hydroxyethyl) sulfopropyl betaine, oleyl betaine, or cocamidopropyl betaine may be chosen.

 If present, the total amount of amphoteric surfactants may range up to
15 about 10%, such as up to about 9%, up to about 8%, up to about 7%, up to about 6%, up to about 5%, up to about 4%, up to about 3.5%, up to about 3%, up to about 2.5%, up to about 2%, up to about 1.5%, up to about 1%, or up to about 0.5% by weight, relative to the total weight of the hair composition. For example, the total amount of amphoteric surfactants may range from about 0.001% to about 6%, from about 0.01%
20 to about 4%, from about 0.1% to about 3%, or from about 0.5% to about 2% by weight, relative to the total weight of the hair composition. In at least some embodiments, the hair compositions are free or substantially free of amphoteric surfactants.

Esters

 Hair compositions according to the disclosure may optionally comprise
25 at least one ester. Esters that can be chosen include, for example, monoesters, diesters, triesters, tetraesters, and combinations thereof. The esters can be branched or straight-chain and may be ionic or nonionic. In at least some embodiments, the esters are chosen from those having a molecular weight greater than about 300 g/mol, such as greater than about 400 g/mol, greater than about 500 g/mol, greater than about
30 600 g/mol, greater than about 700 g/mol, greater than about 800 g/mol, greater than about 900 g/mol, or greater than about 1000 g/mol. Esters that can be chosen may be oils, or may be in the form of waxes or resins which are typically mixtures of different types of esters.

 By way of non-limiting example, monoesters may be chosen from those

comprising from 18 to 40 carbon atoms in total, such as monoesters having the formula R_1COOR_2 , in which R_1 represents a linear or branched fatty acid residue having from 4 to 40 carbon atoms, and R_2 represents a hydrocarbon-based chain that is notably branched, containing from 4 to 40 carbon atoms, wherein $R_1 + R_2$ is greater than or equal to 18. Examples of useful monoesters include but are not limited to isononyl isononanoate, C_{12} - C_{15} alkyl benzoate, 2-ethylhexyl palmitate, octyldodecyl neopentanoate, 2-octyldodecyl stearate, 2-octyldodecyl erucate, isostearyl isostearate, diisopropyl sebacate, 2-octyldodecyl benzoate, alcohol or polyalcohol octanoates, decanoates or ricinoleates, isopropyl myristate, isopropyl palmitate, butyl stearate, hexyl laurate, 2-ethylhexyl palmitate, 2-hexyldecyl laurate, 2-octyldecyl palmitate, 2-octyldodecyl myristate, 2-diethylhexyl succinate, isoamyl laurate, isoamyl stearate, isoamyl cocoate, isoamyl caprylate caprate, or combinations thereof.

Examples of useful diesters include but are not limited to those comprising from 18 to 60 carbon atoms in total, preferably from 18 to 50 carbon atoms. For example, diesters of dicarboxylic acids and of monoalcohols, preferably such as diisostearyl malate, or glycol diesters of monocarboxylic acids, such as neopentyl glycol diheptanoate or polyglyceryl-2 diisostearate, may be chosen.

Non-limiting examples of triesters that can be used include those comprising from 35 to 70 carbon atoms in total, such as triesters of a tricarboxylic acid, for example triisostearyl citrate, or tridecyl trimellitate, glycol triesters of monocarboxylic acids such as polyglyceryl-2 triisostearate, trimethylolpropane triethylhexanoate, triisostearin, trimethylolpropane triisostearate, or combinations thereof.

Examples of useful tetraesters include but are not limited to those with a total carbon number ranging from 35 to 70, such as pentaerythritol or polyglycerol tetraesters of a monocarboxylic acid, for instance pentaerythrityl tetrapelargonate, pentaerythrityl tetraisostearate, pentaerythrityl tetraisononanoate, glyceryl tris(2-decyl)tetradecanoate, polyglyceryl-2 tetraisostearate, pentaerythrityl tetraethylhexanoate, pentaerythrityl tetracaprate, or combinations thereof.

In at least some embodiments, the esters are preferably chosen from esters of C_{22} - C_{30} , preferably C_{24} - C_{28} branched fatty acids or fatty alcohols. For example, the esters may be chosen from triiso arachidyl citrate, pentaerythrityl tetraisononanoate, glyceryl triisostearate, glyceryl tris(2-decyl)tetradecanoate, pentaerythrityl tetraisostearate, polyglyceryl-2 tetraisostearate, pentaerythrityl

tetrakis(2-decyl)tetradecanoate, etc. In some embodiments, the esters are preferably chosen from esters of C₂₂-C₃₀, preferably C₂₄-C₂₈ branched fatty acids or fatty alcohols, and have a molecular weight greater than about 500 g/mol, greater than about 600 g/mol, greater than about 700 g/mol, greater than about 800 g/mol, or greater than about 900 g/mol. In particularly preferred embodiments, the esters comprise, consist essentially of, or consist of one or more esters of C₂₂-C₃₀, preferably C₂₄-C₂₈ branched fatty acids or fatty alcohols, which have a molecular weight greater than about 500 g/mol, greater than about 600 g/mol, greater than about 700 g/mol, greater than about 800 g/mol, or greater than about 900 g/mol, such as pentaerythrityl tetraisostearate.

The total amount of esters present may range from about 0.1% to about 10%, preferably from about 0.5% to about 8%, more preferably from about 0.75% to about 5%, and most preferably from about 1% to about 3% by weight, relative to the total weight of the hair composition. For example, the total amount of esters may range from about 0.1% to about 8%, from about 0.1% to about 7%, from about 0.1% to about 6%, from about 0.1% to about 5%, from about 0.1% to about 4%, from about 0.1% to about 3.5%, from about 0.1% to about 3%, from about 0.1% to about 2.5%, from about 0.1% to about 2%, from about 0.25% to about 8%, from about 0.25% to about 7%, from about 0.25% to about 6%, from about 0.25% to about 5%, from about 0.25% to about 4%, from about 0.25% to about 3.5%, from about 0.25% to about 3%, from about 0.25% to about 2.5%, from about 0.25% to about 2%, from about 0.5% to about 8%, from about 0.5% to about 7%, from about 0.5% to about 6%, from about 0.5% to about 5%, from about 0.5% to about 4%, from about 0.5% to about 3.5%, from about 0.5% to about 3%, from about 0.5% to about 2.5%, from about 0.5% to about 2%, from about 0.75% to about 8%, from about 0.75% to about 7%, from about 0.75% to about 6%, from about 0.75% to about 5%, from about 0.75% to about 4%, from about 0.75% to about 3.5%, from about 0.75% to about 3%, from about 0.75% to about 2.5%, from about 0.75% to about 2%, from about 1% to about 8%, from about 1% to about 7%, from about 1% to about 6%, from about 1% to about 5%, from about 1% to about 4%, from about 1% to about 3.5%, from about 1% to about 3%, from about 1% to about 2.5%, or from about 1% to about 2% by weight, relative to the total weight of the hair composition, or may be about 0.5%, about 0.75%, about 1%, about 1.25%, about 1.5%, about 1.75%, about 2%, about 2.25%, or about 2.5%, including all ranges and subranges using any of the foregoing as lower and upper limits.

In a particularly preferred embodiment, the composition comprises pentaerythrityl tetraisostearate in any of the aforementioned amounts.

Fatty Compounds

Optionally, hair compositions according to the disclosure may include at least one fatty compound. In certain embodiments, the at least one fatty compound may be chosen from lower alkanes, fatty alcohols, fatty acids, esters of fatty acids, esters of fatty alcohols, oils such as mineral, vegetable, animal, silicone and non-silicone oils, silicone and non-silicone waxes, or combinations of any two or more thereof. If present, the hair composition preferably comprises fatty compound(s) that are natural or naturally sourced.

In some embodiments, hair compositions according to the present invention include at least one fatty compound chosen from volatile and non-volatile silicone oils, which may optionally be amino functionalized. Non-limiting examples of silicone oils that can be used include dimethicone, amodimethicone, cyclomethicone, polysilicone-11, phenyl trimethicone, trimethylsilylamodimethicone, and stearoxytrimethylsilane. For example, the hair composition may comprise at least one silicone chosen from amodimethicone, PEG-7 Dimethicone, PEG-8 Dimethicone, PEG-9 Dimethicone, PEG-10 Dimethicone, PEG-12 Dimethicone, PEG-14 Dimethicone, PEG-17 Dimethicone, PEG/PPG-3/10 Dimethicone, PEG/PPG-4/12 Dimethicone, PEG/PPG-17/18 Dimethicone, cetyl PEG/PPG-10/1 dimethicone, Dimethicone PEG-8 Benzoate, Dimethicone PEG-7 Phosphate, Dimethicone PEG-8 Phosphate, Dimethicone PEG-10 Phosphate, or a mixture of two or more thereof. In some preferred embodiments, the hair compositions comprise a silicone oil component that comprises, consists essentially of, or consists of dimethicone, amodimethicone, or a mixture thereof.

As further examples, the silicone oil may be chosen from polydimethylsiloxanes (PDMSs), polydimethylsiloxanes comprising alkyl or alkoxy groups which are pendent and/or at the end of the silicone chain, which groups each contain from 2 to 24 carbon atoms, or phenyl silicones, such as phenyl trimethicones, phenyl dimethicones, phenyl(trimethylsiloxy)diphenylsiloxanes, diphenyl dimethicones, diphenyl(methyl-diphenyl)trisiloxanes, or (2-phenylethyl)trimethylsiloxysilicates.

However, in some preferred embodiments, the hair composition is free or substantially free of silicones.

In some embodiments, hair compositions according to the present invention include at least one fatty compound chosen from fatty alcohols. In certain embodiments, "fatty alcohol" refers to any alcohol with a carbon chain of C₅ or greater, such as, for example, C₈ or greater, C₁₀ or greater, or C₁₂ or greater, such as from 6 to 30 carbon atoms or from 8 to 30 carbon atoms. The fatty alcohols may be alkoxylated or non-alkoxylated, saturated or unsaturated, and linear or branched.

By way of example, fatty alcohols may be chosen from arachidyl alcohol, behenyl alcohol, caprylic alcohol, cetearyl alcohol, cetyl alcohol, coconut alcohol, decyl alcohol, hydrogenated tallow alcohol, jojoba alcohol, lauryl alcohol, myristyl alcohol, oleyl alcohol, palm alcohol, palm kernel alcohol, stearyl alcohol, tallow alcohol, tridecyl alcohol, or combinations of two or more thereof. In some preferred embodiments, the hair compositions comprise a fatty alcohol component that comprises, consists essentially of, or consists of cetyl alcohol, stearyl alcohol, cetearyl alcohol, or mixtures thereof.

Useful and non-limiting fatty acids may be straight or branched chain acids and/or may be saturated or unsaturated. Non-limiting examples of fatty acids include diacids, triacids, and other multiple acids as well as salts of these fatty acids. For example, the fatty acid may optionally include or be chosen from lauric acid, palmitic acid, stearic acid, behenic acid, arichidonic acid, oleic acid, isostearic acid, sebacic acid, or combinations thereof.

In some embodiments, fatty acid esters or fatty alcohol esters may be chosen. For example, esters of saturated or unsaturated, linear or branched C₁-C₂₆ aliphatic mono- or polyacids and of saturated or unsaturated, linear or branched C₁-C₂₆ aliphatic mono- or polyalcohols, the total carbon number of the esters more particularly being greater than or equal to 10 may be used. In other embodiments, esters of C₄-C₂₂ dicarboxylic or tricarboxylic acids and of C₁-C₂₂ alcohols and esters of mono-, di- or tricarboxylic acids and of C₂-C₂₆ di-, tri-, tetra-, or pentahydroxy alcohols may also be used. As non-limiting examples, isostearyl lactate, lauryl lactate, linoleyl lactate, oleyl lactate, (iso)stearyl octanoate, isocetyl octanoate, octyl octanoate, cetyl octanoate, decyl oleate, isocetyl isostearate, isocetyl laurate, isocetyl stearate, isodecyl octanoate, isodecyl oleate, isononyl isononanoate, isostearyl palmitate, methyl acetyl ricinoleate, myristyl stearate, octyl isononanoate, 2-ethylhexyl isononanoate, octyl palmitate, octyl pelargonate, octyl stearate, octyldodecyl erucate, oleyl erucate, ethyl and isopropyl palmitates, 2-ethylhexyl palmitate, 2-octyldecyl

palmitate, alkyl myristates such as isopropyl, butyl, cetyl, 2-octyldodecyl, myristyl or stearyl myristate, hexyl stearate, butyl stearate, isobutyl stearate, dioctyl malate, hexyl laurate, 2-hexyldecyl laurate, diethyl sebacate, diisopropyl sebacate, diisopropyl adipate, di-n-propyl adipate, dioctyl adipate, diisostearyl adipate, dioctyl maleate, glyceryl undecylenate, octyldodecyl stearyl stearate, pentaerythrityl monoricinoleate, pentaerythrityl tetraisononanoate, pentaerythrityl tetrapelargonate, pentaerythrityl tetraisostearate, pentaerythrityl tetraoctanoate, propylene glycol dicaprylate, propylene glycol dicaprinate, tridecyl erucate, triisopropyl citrate, triisostearyl citrate, glyceryl trilactate, glyceryl trioctanoate, trioctyldodecyl citrate, trioleyl citrate, propylene glycol dioctanoate, neopentyl glycol diheptanoate, diethylene glycol diisononanoate, and/or polyethylene glycol distearates may be chosen. In a preferred embodiment, the hair composition comprises at least one fatty acid ester and/or fatty alcohol ester, for example pentaerythrityl tetraisostearate.

In some embodiments, hair compositions according to the disclosure comprise at least one wax. Non-limiting examples of waxes that can be used include beeswax, hydrogenated alkyl olive esters, carnauba wax, candelilla wax, ouricoury wax, Japan wax, cork fibre wax or sugar cane wax, rice wax, rice bran wax, montan wax, paraffin wax, lignite wax or microcrystalline wax, ceresin or ozokerite, palm kernel glycerides/hydrogenated palm glycerides, palm butter, sumac wax, citrus aurantium dulcis (orange) peel wax, theobroma grandiflorum seed butter, helianthus annuus (sunflower) seed wax, siliconyl candellila wax, Chinese wax, cetyl palmitate, lanolin, shellac, spermaceti, cetyl esters, hydrogenated castor wax; triglyceride esters such as tribehenin (glyceryl tribehenate); synthetic waxes such as those of the hydrocarbon type and polyethylene waxes obtained from the polymerization or copolymerization of ethylene, polypropylene waxes, or mixtures of two or more of any of these waxes. In some preferred embodiments, the hair compositions comprise a wax component that comprises, consists essentially of, or consists of cetyl esters.

In some embodiments, the hair composition comprises one or more fatty compounds chosen from oils of animal, vegetable, or mineral origin (e.g. lanolin, squalene, fish oil, perhydrosqualene, mink oil, turtle oil, soybean oil, grape seed oil, sesame oil, maize oil, rapeseed oil, sunflower oil, cottonseed oil, avocado oil, olive oil, castor seed oil, jojoba seed oil, peanut oil, sweet almond oil, palm oil, cucumber oil, hazelnut oil, apricot kernel oil, wheat germ oil, calophyllum oil, macadamia oil, coconut oil, cereal germ oil, candlenut oil, thistle oil, candelilla oil, safflower oil, or shea butter),

linear or branched hydrocarbons (e.g. polybutene, hydrogenated polyisobutene, polyisoprene, polydecenes such as hydrogenated polydecene, or also linear, branched and/or cyclic alkanes which are optionally volatile, such as, for example, isohexadecane, isododecane, isodecane, or isohexadecane), mono- and/or polyesters of fatty acids and/or of fatty alcohols (e.g. mono- and polyesters of hydroxy acids and of fatty alcohols, esters of benzoic acid and of fatty alcohols, polyesters of polyols, dipentaerythrityl C₅-C₉ esters, trimethylolpropane polyesters, propylene glycol polyesters, or polyesters of hydrogenated castor oil), perfluorinated and/or organofluorinated oils, fluorosilicone oils, or mixtures of two or more thereof. Non-limiting examples of fatty acids that may be used include optionally branched and/or unsaturated fatty acids such as myristic acid, palmitic acid, stearic acid, behenic acid, oleic acid, linoleic acid, linolenic acid, isostearic acid, or mixtures of two or more thereof.

If present, the total amount of fatty compounds in the hair composition may range from about 0.1% to about 20%, such as from about 1% to about 20%, from about 2% to about 15%, from about 3% to about 12%, or from about 5% to about 10% by weight, relative to the total weight of the hair composition.

In a further embodiment, the total amount of fatty compounds may range from about 0.1% to about 15%, from about 0.1% to about 10%, from about 0.1% to about 8%, from about 0.1% to about 5%, from about 0.5% to about 15%, from about 0.5% to about 10%, from about 0.5% to about 8%, from about 0.5% to about 5%, from about 1% to about 15%, from about 1% to about 10%, from about 1% to about 8%, from about 1% to about 5%, from about 1.5% to about 15%, from about 1.5% to about 10%, from about 1.5% to about 8%, from about 1.5% to about 5%, from about 2% to about 15%, from about 2% to about 10%, from about 2% to about 8%, or from about 2% to about 5% by weight, relative to the total weight of the hair composition.

In some preferred embodiments, the hair compositions comprise at least one fatty compound chosen from silicone oils, fatty alcohols, waxes, or combinations thereof, where the total amount of fatty compounds in the hair composition ranges from about 1% to about 20%, preferably from about 2% to about 15%, more preferably from about 3% to about 12%, and most preferably from about 5% to about 10% by weight, relative to the total weight of the hair composition.

In further preferred embodiments, the fatty compound comprises, consists essentially of, or consists of ucuuba butter, lauric acid, cetearyl alcohol, cetyl

esters, or combinations of two or more thereof. In particularly preferred embodiments, the fatty compound includes ucuuba butter, which is present in an amount of about 0.1%, about 0.2%, about 0.3%, about 0.4%, about 0.5%, about 0.6%, about 0.7%, about 0.8%, about 0.9%, about 1%, about 1.1%, about 1.2%, about 1.3%, about 1.4%,
5 about 1.5%, about 1.6%, about 1.7%, about 1.8%, about 1.9%, or about 2% by weight, including all ranges and subranges using any of the foregoing as lower and upper limits, relative to the total weight of the hair composition.

It may be particularly advantageous in terms of providing benefits to the hair to choose amounts of esters and fatty compounds relative to each other.
10 Therefore, in some embodiments, the total amount of fatty compounds in the hair composition is greater than the total amount of esters. For example, some embodiments, the hair composition may have a weight ratio of the total amount of fatty compounds to the total amount of esters ranging from about 2 to about 8, such as from about 2.5 to about 7.5, from about 3 to about 7, from about 3.5 to about 6.5, from about
15 4 to about 6, from about 4.25 to about 5.5, from about 4.25 to about 5, or from about 4.4 to about 4.8.

In other embodiments, the hair composition comprises at least one vegetable oil/butter and has a weight ratio of the total amount of vegetable oils/butters to the total amount of esters ranging from about 0.1 to about 1, such as from about
20 0.15 to about 0.9, from about 0.2 to about 0.8, from about 0.25 to about 0.7, from about 0.3 to about 0.6, or from about 0.3 to about 0.5. In further embodiments, the hair composition comprises at least one vegetable oil/butter and at least one ester chosen from esters of C₂₂-C₃₀, preferably C₂₄-C₂₈ branched fatty acids or fatty alcohols, and the hair composition has a weight ratio of the total amount of vegetable oils/butters to
25 the total amount of esters chosen from esters of C₂₂-C₃₀, preferably C₂₄-C₂₈ branched fatty acids or fatty alcohols ranging from about 0.1 to about 1, such as from about 0.15 to about 0.9, from about 0.2 to about 0.8, from about 0.25 to about 0.7, from about 0.3 to about 0.6, or from about 0.3 to about 0.5. As a preferred but non-limiting example, the hair composition may comprise ucuuba butter and pentaerythrityl tetraisostearate,
30 where the weight ratio of ucuuba butter:pentaerythrityl tetraisostearate ranges from about 0.1 to about 1, such as from about 0.15 to about 0.9, from about 0.2 to about 0.8, from about 0.25 to about 0.7, from about 0.3 to about 0.6, or from about 0.3 to about 0.5, or is about 0.15, about 0.2, about 0.25, about 0.3, about 0.35, about 0.4, about 0.45, or about 0.5, including all ranges and subranges using any of the foregoing

as upper and lower limits.

Thickening Agents

Hair compositions according to the disclosure optionally comprise at least one thickening agent. Useful thickening agents include, but are not limited to, semisynthetic polymers, such as semisynthetic cellulose derivatives, synthetic polymers, such as carbomers, poloxamers, and acrylates/behent-25 methacrylate copolymer, acrylates copolymer, polyethyleneimines (e.g., PEI-10), naturally occurring polymers, such as acacia, tragacanth, alginates (e.g., sodium alginate), carrageenan, vegetable gums, such as xanthan gum, guar gum, petroleum jelly, waxes, particulate
10 associate colloids, such as bentonite, colloidal silicon dioxide, and microcrystalline cellulose, celluloses such as hydroxyethylcellulose and hydroxypropylcellulose, and guar gums such as hydroxypropyl guar. If present, the hair composition preferably comprises thickening agent(s) that are natural or naturally sourced.

In some embodiments, the thickening agent may be chosen from
15 associative thickening polymers such as anionic associative polymers, amphoteric associative polymers, cationic associative polymers, or nonionic associative polymers. A non-limiting example of an amphoteric associative polymer is acrylates/behent-25 methacrylate copolymer, and non-limiting examples of anionic associative polymers include acrylates copolymer and acrylates crosspolymer-4.

20 If present, the total amount of thickening agents may range from about 0.01% to about 8%, such as from about 0.05% to about 5%, from about 0.1% to about 4%, from about 0.2% to about 3%, or from about 0.3% to about 2% by weight, relative to the total weight of the hair composition.

Direct Dyes

25 Optionally, hair compositions according to the disclosure comprise one or more direct dyes. Direct dyes, which are different than oxidation dyes, diffuse superficially onto the hair fibers.

Direct dyes that can be chosen include natural and synthetic direct dyes, which may be cationic, anionic, or nonionic. Useful examples of direct dyes include
30 azo direct dyes, (poly)methine dyes such as cyanines, hemicyanines, and styryls, carbonyl dyes, azine dyes, nitro(hetero)aryl dyes, tri(hetero)arylmethane dyes, porphyrin dyes, phthalocyanine dyes, xanthene direct dyes, triarylmethane dyes, natural direct dyes, and combinations of two or more thereof. In some embodiments, the direct dyes are chosen from those that comprise at least one halogenated aromatic

ring.

In some embodiments, direct dyes are selected from anionic direct dyes. The anionic direct dyes are also called "acidic" direct dyes due to their affinity with alkaline substances. Anionic direct dyes may be selected from acid nitrate direct dyes, acid azo dyes, acid azinic dyes, acid triarylmethanic dyes, acid indoaminic dyes, acid anthraquinone dyes, indigoids, natural acid dyes, or combinations of two or more thereof.

Non-limiting examples of anionic direct dyes include Acid Red 1, Acid Red 4, Acid Red 13, Acid Red 14, Acid Red 18, Acid Red 27, Acid Red 28, Acid Red 32, Acid Red 33, Acid Red 35, Acid Red 37, Acid Red 40, Acid Red 41, Acid Red 42, Acid Red 44, Pigment red 57, Acid Red 68, Acid Red 73, Acid Red 135, Acid Red 138, Acid Red 184, Food Red 1, Food Red 13, Acid Orange 6, Acid Orange 7, Acid Orange 10, Acid Orange 19, Acid Orange 20, Acid Orange 24, Yellow 6, Acid Yellow 9, Acid Yellow 36, Acid Yellow 199, Food Yellow 3, Acid Violet 7, Acid Violet 14, Acid Blue 113, Acid Blue 117, Acid Black 1, Acid Brown 4, Acid Brown 20, Acid Black 26, Acid Black 52, Food Black 1, Food Black 2, Food yellow 3 or sunset yellow, Acid Red 111, Acid Red 134, Acid yellow 38, or combinations of two or more thereof. As further examples, azo anionic dyes such as Acid Red 195, Acid Yellow 23, Acid Yellow 27, Acid Yellow 76, and Acid Yellow 17; anthraquinone dyes such as Acid Blue 25, Acid Blue 43, Acid Blue 62, Acid Blue 78, Acid Blue 129, Acid Blue 138, Acid Blue 140, Acid Blue 251, Acid Green 25, Acid Green 41, Acid Violet 42, Acid Violet 43, Mordant Red 3, Purple EXT No. 2, and Acid Black 48; anthraquinone dyes such as Acid Blue 25, Acid Blue 43, Acid Blue 62, Acid Blue 78, Acid Blue 129, Acid Blue 138, Acid Blue 140, Acid Blue 251, Acid Green 25, Acid Green 41, Acid Violet 42, Acid Violet 43, Mordant Red 3, Purple EXT No. 2, and Acid Black 48; triarylmethane dyes such as Acid Blue 1, Acid Blue 3, Acid Blue 7, Acid Blue 9, Acid Violet 49, Acid green 3, Acid green 5, and Acid Green 50; dyes derived from xanthene such as Acid Yellow 73, Acid Red 51, Acid Red 52, Acid Red 87, Acid Red 92, Acid Red 95, and Acid Violet 9; dyes derived from indole such as Acid Blue 74; and dyes derived from quinoline such as Acid Yellow 2, Acid Yellow 3, and Acid Yellow 5, or combinations of two or more thereof, may be chosen.

Non-limiting examples of cationic direct dyes, also called "basic" direct dyes, include Basic Red 51, Basic Yellow 87, Basic Orange 31, Basic Blue 6, Basic Blue 7, Basic Blue 9, Basic Blue 26, Basic Blue 41, Basic Blue 99, Basic Violet 1, Basic

Violet 2, Basic Violet 3, Basic Violet 10, Basic Violet 14, or combinations of two or more thereof.

Among the natural direct dyes, non-limiting mention may be made of lawsone, juglone, alizarin, purpurin, carminic acid, kermesic acid, purpurogallin, protocatechaldehyde, indigo, isatin, curcumin, spinulosin, apigenidin, orceins, or combinations of two or more thereof. Extracts or decoctions containing these natural dyes and in particular henna-based poultices or extracts may also be used.

According to some embodiments, the ionic direct dye(s) are chosen from blue or violet dyes such as Acid Violet 7, Acid Violet 14, Acid Blue 113, Acid Blue 117, Acid Blue 25, Acid Blue 43, Acid Blue 62, Acid Blue 78, Acid Blue 129, Acid Blue 138, Acid Blue 140, Acid Blue 251, Acid Violet 42, Acid Violet 43 (also called EXT violet No. 2), Acid Blue 1, Acid Blue 3, Acid Blue 7, Acid Blue 9, Acid Violet 49, Acid Violet 9, Acid Blue 74, Basic Blue 6, Basic Blue 7, Basic Blue 9, Basic Blue 26, Basic Blue 41, Basic Blue 99, Basic Violet 1, Basic Violet 2, Basic Violet 3, Basic Violet 10, Basic Violet 14, or combinations of two or more thereof, preferably Ext. Violet 2, Acid Blue 62, Acid Blue 9 and Basic Violet 2, more preferentially Ext. Violet 2, Acid Blue 62, Acid Blue 9, or combinations of two or more thereof.

If present, the total amount of direct dyes may range from about 0.001% to about 10%, such as from about 0.001% to about 5%, from about 0.001% to about 3%, from about 0.001% to about 2%, from about 0.001% to about 1%, from about 0.005% to about 5%, from about 0.005% to about 3%, from about 0.005% to about 2%, from about 0.005% to about 1%, from about 0.01% to about 5%, from about 0.01% to about 3%, from about 0.01% to about 2%, or from about 0.01% to about 1%, by weight, relative to the total weight of the hair composition.

Film Formers

Optionally, hair compositions according to the present invention may comprise at least one film former. In a preferred embodiment, hair compositions according to the present invention include at least one film former. As used herein, the terms "film former", "film-forming agent", "film-forming polymer", and variations thereof, mean an agent or polymer capable, by itself or in the presence of an auxiliary film-forming agent, of forming a substantially continuous film that adheres to a support, and especially to keratin materials such as hair.

Among film formers that may be used, mention may be made of, for example, anionic compounds or polymers, non-ionic compounds or polymers,

amphoteric compounds or polymers, zwitterionic compounds or polymers, cationic compounds or polymers, proteins, viscosity modifiers, polyacrylates, polymethacrylates, polyacrylate copolymers, polymethacrylate copolymers, polyamides, polyaminoamides, polyesters, polysaccharides, polyacrylamides, starches, gums, or combinations of two or more of the foregoing. In preferred
5 embodiments, the film formers, if present, are natural or naturally sourced compounds.

For example, in various embodiments, the film former(s) may be chosen from anionic polymers. Without limitation, anionic film forming polymers that can be used include polymers comprising groups derived from carboxylic acid, sulfonic acid,
10 or phosphoric acid and have a number-average molecular weight of ranging from about 500 to about 5,000,000.

By way of non-limiting example, anionic film forming polymers comprising carboxylic groups which may be used include: (A) copolymers of acrylic or methacrylic acid or salts thereof, such as copolymers of acrylic or methacrylic acid with a
15 monoethylenic monomer such as ethylene, styrene, vinyl esters, acrylic or methacrylic acid esters, optionally grafted onto a polyalkylene glycol such as polyethylene glycol and optionally crosslinked, copolymers of acrylic acid and of C₁-C₄ alkyl methacrylate and terpolymers of vinylpyrrolidone, of acrylic acid and of C₁-C₂₀ alkyl methacrylate, for example lauryl methacrylate, copolymers of methacrylic acid and of ethyl acrylate,
20 or copolymers of methacrylic acid and of methyl methacrylate; (B) crotonic acid copolymers, such as those comprising vinyl acetate or propionate units in their chain and optionally other monomers such as allyl esters or methallyl esters, vinyl ether or vinyl ester of a linear or branched saturated carboxylic acid with a long hydrocarbon-based chain, such as those containing at least 5 carbon atoms, it being possible for
25 these polymers optionally to be grafted or crosslinked, or alternatively another vinyl, allyl or methallyl ester monomer of an α - or β -cyclic carboxylic acid; and (C) copolymers of monounsaturated C₄-C₈ carboxylic acids or anhydrides including (i) copolymers comprising (a) one or more maleic, fumaric or itaconic acids or anhydrides, and (b) at least one monomer chosen from vinyl esters, vinyl ethers, vinyl halides, phenylvinyl
30 derivatives, acrylic acid and its esters, the anhydride functions of these copolymers optionally being monoesterified or monoamidated, or (ii) copolymers comprising (a) one or more maleic, citraconic or itaconic anhydride units, and (b) one or more monomers chosen from allyl or methallyl esters optionally comprising one or more acrylamide, methacrylamide, α -olefin, acrylic or methacrylic ester, acrylic or

methacrylic acid or vinylpyrrolidone groups in their chain, the anhydride functions of these copolymers optionally being monoesterified or monoamidated.

In various embodiments, the cationic film forming polymers that can be used include polymers comprising primary, secondary, tertiary and/or quaternary amine groups forming part of the polymer chain or directly attached thereto and having a molecular weight of ranging from about 500 to about 5,000,000 and preferably ranging from about 1000 to about 3,000,000.

For example, the cationic film-forming polymer may be chosen from: (A) homopolymers or copolymers derived from acrylic or methacrylic esters or amides, such as (i) quaternized or non-quaternized vinylpyrrolidone/dialkylaminoalkyl acrylate or methacrylate copolymers, such as the products sold under the name Gafquat® by the company ISP, for instance Gafquat® 734 or Gafquat® 755 or Gafquat® 755N (INCI name Polyquaternium-11), or alternatively the products known as Copolymer® 845, 958 and 937 sold by ISP (INCI name VP/dimethylaminoethyl methacrylate copolymer), (ii) fatty-chain polymers containing a vinylpyrrolidone unit, such as the products sold under the name Styleze® W20L and Styleze® W10 by the company ISP (INCI name Polyquaternium-55), (iii) dimethylaminoethyl methacrylate / vinylcaprolactam / vinylpyrrolidone terpolymers, such as the products sold under the names Advantage HC 37 or Gaffix® VC 713 by the company ISP (INCI name Vinyl caprolactam / VP / dimethylaminoethyl methacrylate copolymer), or (iv) quaternized vinylpyrrolidone/dimethylaminopropylmethacrylamide copolymers, such as the products sold under the name Gafquat® HS 100 by the company ISP (name Polyquaternium-28); (B) cationic guar gum derivatives, preferably containing quaternary ammonium, such as guar gums containing trialkylammonium cationic groups, for example those sold under the trade names Jaguar® C13 S, Jaguar® C 15, and Jaguar® C 17 by the company Rhodia (INCI name Guar hydroxypropyltrimonium chloride); (C) quaternary copolymers of vinylpyrrolidone and of vinylimidazole; mention may be made, for example, of vinylpyrrolidone / methylvinylimidazolium chloride copolymers, such as the products sold by the company BASF under the names Luviquat® FC550 or FC370, Luviquat® Excellence and Luviquat® Style (INCI name Polyquaternium-16), or vinylpyrrolidone / vinylimidazolium methosulfate / vinylcaprolactam terpolymers, such as the product Luviquat® Hold sold by the company BASF (INCI name Polyquaternium-46); (D) chitosans or salts thereof; the salts that can be used are, in particular, chitosan acetate, lactate, glutamate, gluconate or pyrrolidonecarboxylate, such as chitosan

pyrrolidonecarboxylate sold under the name Kytamer® PC by the company Amerchol (INCI name Chitosan PCA); and (E) cationic cellulose derivatives such as copolymers of cellulose or of cellulose derivatives grafted with a water-soluble monomer comprising a quaternary ammonium, such as hydroxyalkylcelluloses, for instance
5 hydroxymethyl-, hydroxyethyl- or hydroxypropylcelluloses grafted in particular with a methacryloyloxyethyltrimethylammonium, methacrylamidopropyltrimethyl-ammonium or dimethyldiallylammonium salt, e.g. the products sold under the name Celquat® L 200 and Celquat® H 100 by the company Akzo Nobel (INCI name Polyquaternium-4).

Exemplary amphoteric film-forming polymers that may be used in
10 accordance with the invention may be selected from polymers comprising units B and C distributed statistically in the polymer chain, where B denotes a unit derived from a monomer comprising at least one basic nitrogen atom and C denotes a unit derived from an acid monomer comprising one or more carboxylic or sulfonic groups, or alternatively B and C may denote groups derived from carboxybetaine or sulfobetaine
15 zwitterionic monomers, or B and C can also denote a cationic polymer chain comprising primary, secondary, tertiary or quaternary amine groups, in which at least one of the amine groups bears a carboxylic or sulfonic group connected via a hydrocarbon-based group, or alternatively B and C form part of a chain of a polymer comprising an α,β -dicarboxylic ethylene unit in which one of the carboxylic groups has
20 been made to react with a polyamine comprising one or more primary or secondary amine groups.

For example, the amphoteric film-forming polymer may be chosen from:
(A) copolymers containing acidic vinyl units and basic vinyl units, such as those resulting from the copolymerization of a monomer derived from a vinyl compound
25 bearing a carboxylic group such as, more particularly, acrylic acid, methacrylic acid, maleic acid, α -chloroacrylic acid, and of a basic monomer derived from a substituted vinyl compound containing at least one basic atom, such as, more particularly, dialkylaminoalkyl methacrylate and acrylate, dialkylaminoalkylmethacrylamide and acrylamide; (B) polymers comprising units deriving from (i) at least one monomer
30 chosen from acrylamides or methacrylamides substituted on the nitrogen atom with an alkyl group (e.g. N-ethylacrylamide, N-tert-butylacrylamide, N-tert-octylacrylamide, N-octylacrylamide, N-decylacrylamide, N-dodecylacrylamide, or the corresponding methacrylamides), (ii) at least one acidic comonomer containing one or more reactive carboxylic groups (e.g. acrylic, methacrylic, crotonic, itaconic, maleic, or fumaric acid

or alkyl monoesters of maleic or fumaric acid or anhydride having 1 to 4 carbon atoms), and (iii) at least one basic comonomer such as esters containing primary, secondary, tertiary and quaternary amine substituents of acrylic and methacrylic acids and the product of quaternization of dimethylaminoethyl methacrylate with dimethyl or diethyl sulfate (e.g. aminoethyl, butylaminoethyl, N,N'-dimethylaminoethyl or N-tert-butylaminoethyl methacrylates); (C) polymers derived from the N-carboxyalkylation of chitosan, such as N-carboxymethyl chitosan or N-carboxybutyl chitosan, for instance the product sold under the name Chitoglycan by the company Sinerga SPA (INCI name Carboxymethyl chitosan); and (D) (C₁-C₅)alkyl vinyl ether/maleic anhydride copolymers partially modified by semiamidation with an N,N-dialkylaminoalkylamine such as N,N-dimethylaminopropylamine or by semiesterification with an N,N-dialkylaminoalkanol.

In preferred embodiments, the hair compositions comprise at least one non-ionic film forming polymer. By way of non-limiting example, non-ionic film-forming polymers may be chosen from polyalkyloxazolines; vinyl acetate homopolymers; vinyl acetate copolymers, for instance copolymers of vinyl acetate and of acrylic ester; copolymers of vinyl acetate and of ethylene, or copolymers of vinyl acetate and of maleic ester, for example of dibutyl maleate; homopolymers and copolymers of acrylic esters, for instance copolymers of alkyl acrylates and of alkyl methacrylates, such as the products provided by the company Rohm GmbH under the name Eudragit® NE 30 D (INCI name Acrylates copolymer); copolymers of acrylonitrile and of a non-ionic monomer, chosen, for example, from butadiene and alkyl (meth)acrylates; styrene homopolymers; styrene copolymers, for instance copolymers of styrene, of alkyl acrylate and of alkyl methacrylate; copolymers of styrene and of butadiene, or copolymers of styrene, of butadiene and of vinylpyridine; polyamides; vinyl lactam homopolymers, such as the vinylpyrrolidone homopolymers sold, for example, under the names Luviskol® K30 powder by the company BASF or PVP K30L or K60 solution or K90 by the company ISP, or such as the polyvinylcaprolactam sold under the name Luviskol® Plus by the company BASF, polyvinylpyrrolidone (INCI name PVP); vinyl lactam copolymers, such as a poly(vinylpyrrolidone/vinyl lactam) copolymer sold under the trade name Luvitec® VPC 55K65W by the company BASF, poly(vinylpyrrolidone/vinyl acetate) copolymers, such as those sold under the name PVP/VA® S630L, E735, E635 and W735 by the company ISP, Luviskol® VA 73, VA 64 and VA 37 by the company BASF (INCI name VP/VA copolymer); and

vinylpyrrolidone/methacrylamide/vinylimidazole terpolymers, for instance the product sold under the name Luviset® Clear by the company BASF (INCI name VP/methacrylamide/vinyl imidazole copolymer).

5 In preferred embodiments, the hair composition comprises at least one non-ionic polymer that is natural or naturally sourced, for example a cellulose such as hydroxyethyl cellulose or a derivative thereof, such as cetyl hydroxyethyl cellulose, may be chosen.

Non-limiting examples of polysaccharides that can be chosen include oxidized inulins, celluloses, starches, guar gums, xanthan gums, pullulan gums,
10 alginate gums, agar-agar gums, carrageenan gums, gellan gums, chitosan, gums arabic, xyloses and tragacanth gums, and derivatives thereof, cellobiose, maltodextrin, scleroglucan, chitosan, ulvan, fucoidan, alginate, pectin, heparin and hyaluronic acid, or mixtures thereof. For example, gums that may be chosen include acacia, agar, algin, alginic acid, ammonium alginate, amylopectin, calcium alginate, calcium carrageenan,
15 carrageenan, dextrin, gelatin, gellan gum, guar gum, gum Arabic, hydroxypropyl guar, guar hydroxypropyltrimonium chloride, hydroxypropyl guar hydroxypropyltrimonium chloride, karaya gum, locust bean gum, natto gum, potassium alginate, potassium carrageenan, propylene glycol alginate, sclerotium gum, sodium carboxymethyl dextran, sodium carrageenan, tragacanth gum, xanthan gum, or any mixtures thereof.

20 Further non-limiting examples of polymers that can be used include non-cellulose cationic polysaccharides, such as guar gums containing trialkylammonium cationic groups. Suitable cationic guar gum derivatives include guar hydroxypropyl trimonium chloride, available commercially for example as JAGUAR C13S. Other suitable materials include that known as JAGUAR C15, JAGUAR C17, and JAGUAR
25 C16 which is a hydroxypropylated cationic guar derivative containing a low level of substituent groups as well as cationic quaternary ammonium groups. Guar hydroxypropyl trimonium chloride, may also be available commercially for example as N-HANCE CG13 from the company Ashland. Also suitable is hydroxypropyl guar hydroxypropyltrimonium chloride, commercially available as JAGUAR 162.

30 In various embodiments, the film former(s) may be chosen from PVM/MA (Poly(methyl vinyl ether-alt-maleic acid) (e.g., sold under the name Gantrez®), carrageenan, gum Arabic, oxidized inulin, alginate, xanthan gum, xylan, chitosan, polyvinylpyrrolidone, polysilicone 8, polydimethylsiloxane, dimethylsiloxane/3-thiopropyl methyl siloxane copolymer, vinylpyrrolidone/vinylacetate copolymer,

polyvinylacetate, starch, cellulose, polyquaternium-4, polyquaternium-11, acrylates/stearate-2 methacrylate crosspolymer, vinylacetate/vinyl neodecanoate copolymer, polyester-5, cetyl ethylhexanoate, vinyl acetate, crotonate/vinyl neodecanoate copolymer, 2-acryamido-2-methyl propane sulfonic acid (AMPS)/acrylic acid (AA) copolymer, AMPS/AA/acryl methacrylate copolymer, polyacrylamide, C13-C14 isoparaffin, laureth-7, octylacrylamide, acrylate/butylaminoethylmethacrylate copolymer, or any mixture thereof.

The total amount of the film former present may vary, but typically ranges from about 0.1% to about 20%, such as from about 0.25% to about 10%, about 0.5% to about 8%, about 0.75% to about 5%, or about 0.75% to about 3%, based on the total weight of the hair composition. For example, the total amount of film former may range from about 0.01% to about 10%, about 0.01% to about 9%, about 0.01% to about 8%, about 0.01% to about 7%, about 0.01% to about 6%, about 0.01% to about 5%, about 0.01% to about 4%, about 0.01% to about 3%, about 0.01% to about 2%, about 0.01% to about 1%, about 0.1% to about 10%, about 0.1% to about 9%, about 0.1% to about 8%, about 0.1% to about 7%, about 0.1% to about 6%, about 0.1% to about 5%, about 0.1% to about 4%, about 0.1% to about 3%, about 0.1% to about 2%, about 0.1% to about 1%, about 0.25% to about 10%, about 0.25% to about 9%, about 0.25% to about 8%, about 0.25% to about 7%, about 0.25% to about 6%, about 0.25% to about 5%, about 0.25% to about 4%, about 0.25% to about 3%, about 0.25% to about 2%, about 0.25% to about 1.5%, about 0.25% to about 1%, or about 0.25% to about 0.75%, including all ranges and sub-ranges there between, based on the total weight of the hair composition. In certain embodiments, the at least one film forming polymer may be present in an amount of ranging from about 0.1% to about 1%, such as about 0.2% to about 0.8%, about 0.3% to about 0.7%, about 0.4% to about 0.6%, or about 0.5%, including all ranges and sub-ranges there between, based on the total weight of the hair composition.

Auxiliary Components

Hair compositions according to the disclosure may optionally include one or more auxiliary components. Non-limiting examples include preservatives, fragrances, pH adjusters, salts, antioxidants, vitamins, vitamin derivatives, ceramides, botanical extracts, proteins, protein hydrolysates, protein isolates, hydrotropes, pearlescent agents, buffers, sequestering agents, and the like.

The total amount of auxiliary components, if present, typically ranges

from about 0.01% to about 10% based on the total weight of the hair composition. For example, in some embodiments the individual amounts of each component or the total amount of components may range from about 0.1% to about 10%, about 0.1% to about 8%, about 0.1% to about 5%, about 0.1% to about 4%, about 0.1% to about 3%, about 0.1% to about 2%, about 1% to about 10%, about 1% to about 8%, about 1% to about 5%, about 1% to about 4%, about 1% to about 3%, or about 1% to about 2% by weight, based on the total weight of the hair composition.

Compositions according to the disclosure typically have a pH of less than or equal to 7, such as less than or equal to about 6, less than or equal to about 5, less than or equal to about 4.5, or less than or equal to about 4. For example, the compositions may have a pH ranging from about 1 to about 7, such as from about 2 to about 6, from about 2.5 to about 5.5, from about 2.5 to about 5, from about 2.5 to about 4.5, or from about 3 to about 4. In some embodiments, the pH of the composition may be, for example, about 3, about 3.25, about 3.5, about 3.75, or about 4, including all ranges and subranges thereof.

The hair compositions may be in any suitable form. For example, the hair compositions may be a liquid, a gel, a gel cream, a high-, medium- or low-density cream, a serum, a lotion, etc. In preferred embodiments, the hair composition is a medium- or high-density cream, such as a hair mask (or masque). In another preferred embodiment, the hair compositions are hair masks or deep conditioning treatments that are in lotion or cream form.

II. METHODS

The disclosure further relates to methods of treating keratin fibers, such as hair, and in some embodiments, curly or wavy hair. The methods of treating hair may be methods of reducing or preventing hair damage; protecting hair from damage; restoring hair fiber moisture equilibrium; providing hair fiber strength; improving hair fiber elasticity; restoring or enhancing curl shape and/or definition; and/or maintaining hair fiber moisture equilibrium, strength, and/or elasticity. In some embodiments, the methods of treating hair prevent hair damage from becoming too great to repair, i.e. prevent irreversible hair damage.

The methods comprise applying a hair composition (which may also be a "curl-enhancing composition") according to the disclosure onto the hair, optionally leaving the hair composition on the hair for a period of time ("processing time," "resting period," or "leave-in period"), and optionally rinsing the hair composition from the hair.

The methods may optionally comprise repeating the treatment at least one time, such as at least two times, at least three times, at least four times, at least five times, etc., or as desired in order to enhance or restore curl definition and/or treat the hair.

Surprisingly, the composition according to the present disclosure also
5 provides long-lasting curl shape and/or definition. For example, the curl shape and/or definition may last through one or more, for example two or more, or even three or more, hair washing cycles.

The leave-in period may last for a period of time deemed appropriate to allow the active agents to provide benefits to the keratin fibers, such as about 30
10 seconds, about 1 minute, about 2 minutes, about 5 minutes, about 10 minutes, about 15 minutes, about 20 minutes, about 30 minutes, about 45 minutes, about 1 hour, about 2 hours, about 4 hours, about 6 hours, about 8 hours, about 10 hours, about 12 hours, about 16 hours, about 20 hours, about 24 hours, etc., or may range from a period of time using any of the foregoing as upper and lower limits.

By way of non-limiting example, the leave-in period may range from about
15 30 seconds to about 60 minutes, from about 30 seconds to about 45 minutes, from about 30 seconds to about 30 minutes, from about 30 seconds to about 20 minutes, from about 30 seconds to about 15 minutes, from about 30 seconds to about 10 minutes, from about 30 seconds to about 5 minutes, from about 1 minute to about 60 minutes, from about 1 minute to about 45 minutes, from about 1 minute to about 30
20 minutes, from about 1 minute to about 20 minutes, from about 1 minute to about 15 minutes, from about 1 minute to about 10 minutes, from about 1 minute to about 5 minutes, from about 2 minutes to about 60 minutes, from about 2 minutes to about 45 minutes, from about 2 minutes to about 30 minutes, from about 2 minutes to about 20 minutes, from about 2 minutes to about 15 minutes, from about 2 minutes to about 10
25 minutes, from about 2 minutes to about 5 minutes, etc. In alternative embodiments, and by way of non-limiting example, the leave-in period may range from about 2 minutes to about 4 hours, from about 5 minutes to about 2 hours, from about 10 minutes to about 1.5 hours, from about 20 minutes to about 1 hour, from about 1 hour to about 12 hours, from about 2 hours to about 10 hours, from about 4 hours to about
30 8 hours, from about 8 hours to about 24 hours, from about 8 hours to about 12 hours, etc.

In some embodiments, the composition may be left on the hair for a period of time lasting several hours, for example overnight, or may be until the hair is

next rinsed or shampooed in the user's ordinary course of hygiene. Thus, the leave-in period may range up to about 24 hours, such as up to about 12 hours, for example may range from about 1 hour to about 12 hours, from about 1 hour to about 10 hours, from about 1 hour to about 8 hours, from about 1 hour to about 6 hours, from about 1
5 hour to about 4 hours, from about 2 hours to about 12 hours, from about 2 hours to about 10 hours, from about 2 hours to about 8 hours, from about 2 hours to about 6 hours, from about 2 hours to about 4 hours, etc.

Methods according to the disclosure include use of the hair compositions described as a standalone treatment, or as part of a routine that includes one or more
10 additional compositions or treatments. Although not required, various treatments using hair compositions according to the present invention may also include a step of heating the hair to which the hair composition has been applied, for example during the resting period while the hair composition is on the hair. For example, a blow dryer, hood dryer, etc., may be used.

By way of example, a hair composition according to the present invention
15 may be applied to hair in order to repair hair that has been previously damaged by a chemical treatment, to improve the general health and appearance of the hair, to improve the elasticity of the hair fibers, etc., by applying a hair composition to wet, damp, or dry hair, leaving the hair composition on the hair for a suitable processing
20 time, optionally rinsing the hair, and then optionally drying and/or styling the hair according to the individual's normal course. This type of treatment may, for example, be performed in a salon or at home on a weekly, bi-weekly, monthly, etc. basis, in order to improve the health and overall appearance of the hair.

In other exemplary embodiments, a hair composition according to the
25 disclosure may be applied to hair before, during, and/or after a treatment process that includes one or more other hair compositions. For example, one such routine may include applying a hair composition according to the disclosure to wet, damp, or dry hair, leaving the hair composition on the hair for a suitable processing time, and then substantially immediately thereafter (i.e. within the same hair cleansing process), with
30 or without intermediate rinsing of the hair, shampooing the hair according to the individual's normal hair cleansing routine. Another such routine may include shampooing the hair according to the individual's normal hair cleansing routine, and substantially immediately thereafter (i.e. within the same hair cleansing process), with or without intermediate rinsing of the hair, applying a hair composition according to the

disclosure to the hair, optionally before and/or after a conditioning composition is applied to the hair. Yet another such routine may include conditioning the hair, for example a deep conditioning treatment, and substantially immediately before and/or after (i.e. within the same hair conditioning process), with or without intermediate
5 rinsing of the hair, applying a hair composition according to the disclosure to the hair, optionally with or without rinsing the hair between steps of applying a conditioning composition and a hair composition according to the disclosure to the hair. Thus, it is contemplated that hair compositions according to the disclosure may be incorporated into a hair cleansing and/or conditioning process.

10 In one exemplary embodiment, a hair composition according to the disclosure may be applied to hair, for example to reshape or enhance curls or waves, to improve the general health and appearance of the curls or waves, to improve the elasticity of the hair fibers, to prevent or reduce damage to the hair fibers, etc., by applying a hair composition to wet, damp, or dry hair, leaving the hair composition on
15 the hair for a suitable processing time, optionally rinsing the hair, and then optionally drying and/or styling the hair according to the individual's normal course.

In still further exemplary embodiments, a hair composition according to the disclosure may be applied to hair before, during, and/or after a chemical hair treatment process. For example, one such routine may include applying a hair
20 composition according to the disclosure to wet, damp, or dry hair, leaving the hair composition on the hair for a suitable processing time, optionally rinsing the hair, and then substantially immediately thereafter (i.e. within the same chemical hair treatment process), with or without intermediate rinsing of the hair, applying a chemical treatment such as a bleaching, dyeing, straightening, relaxing, or permanent waving composition
25 to the hair.

Another such routine may include applying a chemical treatment such as a bleaching, dyeing, straightening, relaxing, or permanent waving composition to the hair, and substantially immediately thereafter (i.e. within the same chemical hair treatment process), with or without intermediate rinsing of the hair, applying a hair
30 composition according to the disclosure to the hair. Thus, it is contemplated that hair compositions according to the present invention may be incorporated into a chemical hair treatment process, thereby reducing, minimizing, or preventing damage to the hair that would otherwise be expected to result from such harsh chemical treatments. By

incorporating such compositions into chemical treatment processes, the curl or wave shape or definition can be preserved.

Surprisingly, hair treated with hair compositions and methods according to the disclosure has less damage and greater curl retention or recovery than hair not treated with hair compositions and methods according to the disclosure. The reduction in damage is particularly notable in hair that has been damaged due to harsh chemical treatments such as bleaching, dyeing, permanent waving, straightening, relaxing, etc., as well as due to repeated styling such as with heat or styling tools. The hair repaired using hair compositions and methods according to the disclosure may have lower elasticity and/or greater tensile strength than hair similarly damaged but not treated according to the disclosure, as well as more defined curls or waves.

Having described the many embodiments of the present invention in detail, it will be apparent that modifications and variations are possible without departing from the scope of the disclosure defined in the appended claims. Furthermore, it should be appreciated that all examples in the present disclosure, while illustrating many embodiments of the disclosure, are provided as non-limiting examples and are, therefore, not to be taken as limiting the various aspects so illustrated. It is to be understood that all definitions herein are provided for the present disclosure only.

In this application, the use of the singular includes the plural unless specifically stated otherwise. The singular forms “a,” “an,” “the,” and “at least one” are understood to encompass the plural as well as the singular unless the context clearly dictates otherwise. The expression “one or more” means “at least one” and thus includes individual components as well as mixtures/combinations. Likewise, the term “a salt thereof” also relates to “salts thereof”. Thus, where the present invention refers to “an element selected from the group consisting of A, B, C, D, E, F, a salt thereof, or mixtures thereof,” it indicates that that one or more of A, B, C, D, and F may be included, one or more of a salt of A, a salt of B, a salt of C, a salt of D, a salt of E, or a salt of F may be included, or a mixture of any two of A, B, C, D, E, F, a salt of A, a salt of B, a salt of C, a salt of D, a salt of E, and a salt of F may be included.

The term “and/or” should be understood to include both the conjunctive and the disjunctive. For example, “amino acids and/or salts thereof” means “amino acids and salts thereof” as well as “amino acids or salts thereof,” and expressly covers instances of either.

As used herein, the term “salts” referred to throughout the present

invention may include salts having a counterion such as an alkali metal, alkaline earth metal, or ammonium counterion. This list of counterions, however, is non-limiting. Salts also include a dissociated form of a compound, e.g. in an aqueous solution.

As used herein, the phrases “and mixtures thereof”, “and mixtures of two or more thereof”, “and a mixture thereof”, “and combinations thereof”, “and a combination thereof”, and combinations of two or more thereof”, “and a combination of two or more thereof”, “or mixtures thereof”, “or a mixture thereof”, “or combinations thereof”, “or combinations of two or more thereof”, “or a combination thereof”, and the like are used interchangeably to denote that the listing of components immediately preceding the phrase, such as “A, B, C, D, or mixtures thereof” signify that the component(s) may be chosen from A, from B, from C, from D, from A+B, from A+B+C, from A+D, from A+C+D, etc., without limitation on the variations thereof. Thus, the components may be used individually or in any combination thereof.

For purposes of the present invention, it should be noted that to provide a more concise description, some of the quantitative expressions given herein are not qualified with the term “about”. It is understood that whether the term “about” is used explicitly or not, every quantity given herein is meant to refer to the actual given value, and it is also meant to refer to the approximation to such given value that would reasonably be inferred based on the ordinary skill in the art, including approximations due to the experimental and/or measurement conditions for such given value, unless otherwise stated.

All ranges and amounts given herein are intended to include sub-ranges and amounts using any disclosed point as an end point, and all endpoints are intended to be included unless expressly stated otherwise. Thus, a range of “1% to 10%, such as 2% to 8%, such as 3% to 5%”, is intended to encompass ranges of “1% to 8%”, “1% to 5%”, “2% to 10%”, and so on. All numbers, amounts, ranges, etc., are intended to be modified by the term “about,” whether or not expressly stated, unless expressly stated otherwise. Similarly, a range given of “about 1% to 10%” is intended to have the term “about” modifying both the 1% and the 10% endpoints. The term “about” is used herein to indicate a difference of up to +/- 10% from the stated number, such as +/- 9%, +/- 8%, +/- 7%, +/- 6%, +/- 5%, +/- 4%, +/- 3%, +/- 2%, or +/- 1%. Unless expressly stated otherwise, “about” means +/- 5%. Likewise, all endpoints of ranges are understood to be individually disclosed, such that, for example, a range of 1:2 to 2:1 is understood to disclose a ratio of both 1:2 and 2:1.

As used herein, if a component is described as being present “in an amount up to” a certain amount, it is intended that such component is, in fact, present in the hair composition, i.e. is present in an amount greater than 0%.

5 All amounts given herein are relative to the amount of active material, unless otherwise indicated.

All percentages, parts and ratios herein are based upon the total weight of the hair compositions of the present invention, unless otherwise indicated.

As used herein, all ranges provided are meant to include every specific range within, and combination of sub ranges between, the given ranges. Thus, a range
10 from 1-5, includes specifically 1, 2, 3, 4 and 5, as well as sub ranges such as 2-5, 3-5, 2-3, 2-4, 1-4, etc.

In this application, the terms “keratin fibers” and “hair” are used interchangeably, without intending to be limiting. A person skilled in the art will understand that keratin fibers include hair, such as hair that grows from the scalp.

15 As used herein, the phrase “applying a composition onto hair” and variations thereof are intended to mean contacting the hair with at least one of the hair compositions of the disclosure, in any manner. It may also mean contacting the hair in an effective amount.

The term “treating hair” (and its grammatical variations) as used herein
20 refers to the application of the hair compositions of the present disclosure onto the surface of hair. The term “treating hair” (and its grammatical variations) as used herein also refers to contacting hair with the hair compositions of the present invention.

The terms “curls,” “curly hair,” “waves,” or the like, which are used interchangeably herein, refer to any hair including a curl or wave. The degree of
25 curliness of the hair may vary and is not limited. The curl may be natural or unnatural, i.e., formed by chemical treatment or physical treatment of the hair, although preferably the curl is natural.

As used herein, the terms “enhancing curls,” “enhancing curl recovery”, “reshaping curls”, “reshaping curly hair”, or the like, are intended to mean that the
30 intensity and/or shape of the curl or wave of the hair that may have been decreased as a result of damage is increased by treatment with hair compositions or methods described herein. An increase in curl or wave can be any increase, for example increased curl shape and/or increased curl definition. It will be understood, however, that an increase in curls provided by hair compositions and methods according to the

present invention is due to the hair compositions and methods restoring curls or waves to hair, rather than providing curls or waves to naturally straight and unpermed hair. As is known, an increase in curl or wave may be observed visually, such as when treated hair appears curlier than the hair before treatment, or the curls or waves appear more defined; may be determined by measuring the length of a lock of hair, where a shorter lock of hair is considered to have greater curl than a longer lock; or may be determined by any other accepted method.

As used herein, the terms “curl-enhancing composition,” “curl-restoring composition,” or the like refer to a composition according to the disclosure. Such compositions may restore or enhance curls to any degree, without limitation. However, in at least some embodiments, the degree of curl enhancement may be at least about 10%, at least about 12%, at least about 15%, at least about 18%, at least about 20%, at least about 22%, or at least about 25%, compared to the hair before treatment.

As used herein, the terms “natural” and “naturally sourced” mean a material of natural origin, such as derived from plants, which may or may not be subsequently chemically or physically modified.

As used herein, the phrase “component that has a negative environmental impact” and variations thereof mean any component that itself may have a negative environmental impact, or any component the harvesting, processing, etc., of which may have a negative environmental impact.

For purposes of the present invention, the terms “vegetable oil” and “vegetable oil/butter” are intended to include both oils and butters (e.g. ucuuba oil and ucuuba butter) unless expressly indicated otherwise.

Unless otherwise defined for any specific embodiment, the term “substantially free” or “essentially free” as used herein means that there is less than about 5% by weight of a specific material added to a composition, based on the total weight of the composition. For example, the compositions may include less than about 4%, less than about 3%, less than about 2%, less than about 1.5%, less than about 1%, less than about 0.5%, less than about 0.1%, less than about 0.01%, less than about 0.001%, or less than about 0.0001% of the specified material. As such, it is contemplated that any component described herein for use in the hair treatment compositions can be present in the compositions in amounts less than about 5%, less than about 4%, less than about 3%, less than about 2%, less than about 1%, less than about 0.5%, less than about 0.1%, less than about 0.01%, less than about 0.001%, or

less than about 0.0001%, and the composition will be considered “substantially free” of such material. A composition that is “free” of a component is understood to contain none of the specified component. However, it is understood that the terms “free” and “substantially free” refer to the amount of a component added to the composition, without including an amount of the component present in the composition as a minor component in a raw material. For example, a composition that is “free” of waxes may not have wax included as an intended component but may nevertheless contain a pigment that is coated with a wax, as such wax would be considered a minor component of the pigment material and would not be expected to provide benefits to the composition that would be expected by including a wax per se as an intended component.

As used herein, a “stable” composition maintains a texture that is substantially unchanged and shows minimal to no phase separation when stored at room temperature for at least one month, preferably at least two months, or at temperatures up to 45 °C for at least two weeks.

Unless otherwise expressly stated, it is in no way intended that any method set forth herein be construed as requiring that its steps be performed in a specific order. Accordingly, where a method claim does not expressly recite an order to be followed by its steps or it is not specifically stated in the claims or descriptions that the steps are to be limited to a specific order, it not intended that any particular order be inferred.

The examples that follow serve to illustrate embodiments of the present invention without, however, being limiting in nature. It will be apparent to those skilled in the art that various modifications and variations can be made in the hair compositions and methods of the invention without departing from the spirit or scope of the invention. Thus, it is intended that the present disclosure covers the modifications and variations that come within the scope of the appended claims and their equivalents.

EXAMPLES

The following Examples are intended to be non-limiting and explanatory in nature only. In the Examples, amounts are expressed in percentage by weight (wt%) of active materials, relative to the total weight of the composition, unless otherwise indicated.

Example 1 – Compositions

Compositions 1A-1G according to the present invention were prepared

as shown in Table 1. The pH of each of compositions 1A-1G was about 3.5.

TABLE 1

	1A	1B	1C	1D	1E	1F	1G
Basic amino acid(s)	5.0	5.0	5.0	5.0	5.0	5.0	2.0
Glycine betaine	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Citric and/or lactic acid	6.1	6.1	6.1	6.1	6.1	6.1	4.1
Neutral amino acid(s)	-	-	-	-		-	0.5
Preservative(s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Solvents (water and/or non-aqueous solvents)	QS	QS	QS	QS	QS	QS	QS
Weight ratio of amino acid(s) to osmolyte(s)	2.0	2.0	2.0	2.0	2.0	2.0	1.7

The compositions contained a synergistic combination of components: carboxylic acids (citric and/or lactic acid), osmolytes (glycine betaine), and amino acids (arginine and/or serine) and had a weight ratio of the total amount of amino acids to the total amount of osmolytes of 2.0 or 1.7.

Example 2 – Evaluation of Damage Repair

In order to evaluate the ability of compositions according to the present invention to minimize, prevent, or repair damage to hair, the following studies were conducted.

Example 2.1 – Ultra Bleached Hair

Eight swatches (S1-S8) of virgin Caucasian hair were bleached with a composition prepared by mixing a commercial bleach powder with a commercial oxidizing composition (40V hydrogen peroxide) at a mixing ratio of 1:1.5 (bleach powder:oxidizing composition) and processed at a temperature of about 55 °C for about 45 minutes. The swatches were rinsed and then seven of the swatches (S1-S7) were subjected to the following treatment routines (swatch S8 did not have any treatment after the bleaching composition was rinsed from the hair).

Swatch S1 was cleansed with a commercially available shampoo by

wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. Immediately, a commercially available conditioner composition was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. This treatment protocol was repeated every day for five days.

Swatches S2-S7 were each cleansed with a commercially available shampoo by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. Immediately, a commercially available conditioner composition was applied and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. Immediately, one of compositions 1A-1F (Table 2) was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. This treatment protocol was repeated every day for five days.

TABLE 2

	1A	1B	1C	1D	1E	1F
Swatch	S2	S3	S4	S5	S6	S7

The integrity of the hair fibers of each of swatches S1-S8 was studied after the first and fifth days. Elasticity was evaluated to determine whether the hair fibers stretched, and if so, whether they returned to their original state (lower elasticity, i.e. healthy), whether the fibers stretched easily and remained stretched (higher elasticity, i.e. damaged), or whether the hair fibers broke upon testing.

The evaluation was performed by stretching a standardized amount of wet hair fibers, with two experts independently evaluating each swatch. The experts were trained to stretch the area of the swatch being evaluated by uniformly applying manual pulling force using the hands/fingers. The behaviour of the swatch was classified by each expert according to a 6-level scale as follows, with the result reported for each swatch as the average of the two:

0 = Natural, healthy hair (no damage);

1 = Low elasticity (when stretched, hair fibers present slight elasticity, returning to the initial state after the test);

2 = Moderate elasticity (when stretched, hair fibers present elasticity, returning to the initial state after the test);

3 = High elasticity (when stretched, hair fibers present elasticity and some of the hair fibers do not return to the initial state after the test);

5 4 = Very high elasticity (when stretched, hair fibers present elasticity and most of the hair fibers do not return to the initial state after the test); and

5 = Immediate break (when stretched, hair fibers present high elasticity and break during the test).

10 The results showed that the hair fibers of swatches S2-S7, treated with one of compositions 1A-1F, surprisingly had lower elasticity than the fibers of swatches S1 or S8 after both day 1 (FIG. 1A) and day 5 (FIG. 1B). In other words, the hair of swatches S1 and S8 was damaged by the harsh bleaching process, leading to increased elasticity, whereas the damage to swatches S2-S7 had been repaired by treatment with one of compositions 1A-1F.

15 **Example 2.2 – Straightened and Ultra Bleached Hair**

Eight swatches (S9-S16) of Caucasian hair that had been previously straightened using formaldehyde were bleached with a composition prepared by mixing a commercial bleach powder with a commercial oxidizing composition (40V hydrogen peroxide) at a mixing ratio of 1:1.5 (bleach powder:oxidizing composition) and processed at a temperature of about 55 °C for about 45 minutes. The swatches were rinsed and then seven of the swatches (S9-S15) were subjected to the following treatment routines.

25 Swatch S9 was cleansed with a commercially available shampoo by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. Immediately, a commercially available conditioner composition was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. A leave-on conditioning product and a leave-on flat iron serum were applied to the hair. The treatment was repeated a second time. This treatment protocol was repeated every day for five days.

Swatches S10-S15 were each cleansed with a commercially available shampoo by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing

the swatch until all shampoo was removed. Immediately, one of compositions 1A-1F (Table 3) was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. Immediately, a commercially available conditioner composition was applied and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. A leave-on conditioning product and a leave-on flat iron serum were applied to the hair. This treatment protocol was repeated every day for five days.

TABLE 3

	1A	1B	1C	1D	1E	1F
Swatch	S10	S11	S12	S13	S14	S15

The integrity of the hair fibers of each of swatches S9-S16 was studied in the same manner as described in Example 2.1. The results showed that the hair fibers of swatches S10-S15, treated with one of compositions 1A-1F, surprisingly had lower elasticity than the fibers of swatches S9 and S16 after both day 1 (FIG. 2A) and day 5 (FIG. 2B).

Examples 2.1 to 2.2 therefore demonstrate that treating hair that has been damaged by harsh chemical processes with a composition according to the disclosure surprisingly repairs the damage, leaving hair less elastic than without treatment.

Example 3 – Compositions

Compositions 2A-2E according to the present invention were prepared as shown in Table 4.

TABLE 4

	2A	2B	2C	2D	2E
Basic amino acid(s)	5.0	5.0	5.0	5.0	5.0
Glycine betaine	2.5	2.5	2.5	2.5	2.5
Citric acid	6.1	6.1	6.1	6.1	6.1
Silicone oil(s) (dimethicone and/or amodimethicone)	3.3	3.3	3.3	3.3	1.0
Fatty alcohol(s) (stearyl alcohol and/or cetearyl alcohol)	4.5	4.5	6.0	5.0	6.0
Cetyl esters	-	-	-	1.0	-
Cationic surfactant(s) (cetrimonium	1.6	1.6	1.6	2.5	1.6

	2A	2B	2C	2D	2E
chloride, behentrimonium chloride, and/or stearamidopropyl dimethylamine)					
Cocamidopropyl betaine	1.1	1.1	1.1	0.2	-
Hydroxyethylcellulose	0.8	1.0	1.5	1.5	0.4
Auxiliary component(s) (pH adjusters, preservatives, vitamins, extracts)	< 2	< 2	< 2	< 2	< 2
Solvents (water and non-aqueous solvents)	QS	QS	QS	QS	QS
Measured pH	3.7	3.7	3.7	3.7	4.0
Weight ratio of [amino acids + osmolytes]:cationic surfactants	4.7	4.7	4.7	3.0	4.7
Weight ratio of amino acids to osmolytes	2.0	2.0	2.0	2.0	2.0

The compositions contained a synergistic combination of components: carboxylic acids (citric acid), osmolytes (glycine betaine), and amino acids (arginine), were surprisingly stable due to the presence of cationic surfactants (cetrimonium chloride, behentrimonium chloride, and/or stearamidopropyl dimethylamine) and had a weight ratio of the total amount of amino acids to the total amount of osmolytes of 2.0.

Example 4 – Evaluation of Damage Repair

In order to evaluate the ability of compositions according to the present invention to minimize, prevent, or repair damage to hair, the following studies were conducted.

A comparative product, C1, had the following listing of ingredients on the package: Water (Aqua/Eau), Bis-Aminopropyl Diglycol Dimaleate, Propylene Glycol, Cetearyl Alcohol, Behentrimonium Methosulfate, Cetyl Alcohol, Phenoxyethanol, Glycerin, Hydroxyethyl Ethylcellulose, Stearamidopropyl Dimethylamine, Quaternium-91, Sodium Benzoate, Cetrimonium Methosulfate, Cetrimonium Chloride, Fragrance (Parfum), Tetrasodium EDTA, Polyquaternium-37, Benzyl Benzoate, Etidronic Acid, Ascorbic Acid, Phytantriol, Tocopheryl Acetate, Aloe Barbadensis Leaf Juice, Panthenol, Simmondsia Chinensis (Jojoba) Seed Oil, Citric Acid, Potassium Sorbate. Composition C1, which is described as a “pre-shampoo hair treatment that reduces

breakage and split ends for visibly healthier hair,” is advertised as part of a system that asserts it can “relink broken disulfide bonds damaged by chemical services, heat, and styling”. The instructions for composition C1 are to use the product prior to using the shampoo (“C1-S”) and conditioner (“C1-C”) that form part of this system, both of which include bis-aminopropyl diglycol dimaleate as the stated active agent.

Example 4.1 – Ultra Bleached Hair: Elasticity and Strength

Five swatches (S17-S21) of virgin Caucasian hair were bleached with a composition prepared by mixing a commercial bleach powder with a commercial oxidizing composition (40V hydrogen peroxide) at a mixing ratio of 1:1.5 (bleach powder:oxidizing composition) and processed at a temperature of about 55 °C for about 45 minutes. The swatches were rinsed and then four of the swatches (S17-S20) were subjected to the following treatment routines (swatch S21 did not have any treatment after the bleaching composition was rinsed from the hair).

Swatch S17 was cleansed with a commercially available shampoo by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. Immediately, a commercially available conditioner composition was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. This treatment protocol was repeated four more times.

Swatches S18 and S19 were each cleansed with a commercially available shampoo by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. Immediately, a commercially available conditioner composition was applied and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. Immediately, one of compositions 2D (S18) or 1B (S19) was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. This treatment protocol was repeated four more times.

Swatch S20 was treated with composition C1 by applying the composition to the swatch and distributing it to ensure the hair was fully coated. Composition C1 was allowed to remain on the hair for a resting period of about five

minutes, and then the swatch was thoroughly rinsed. Immediately, the swatch was cleansed with shampoo C1-S by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. Immediately, conditioner C1-C was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. This treatment protocol was repeated four more times.

Once all five treatments of swatches S17-S21 were completed, the integrity of the hair fibers of each of swatches S17-S21 was studied in the same manner as described in Example 2.1. The results showed that the hair fibers of swatches S18 and S19, treated with compositions 2D and 2B respectively, had lower elasticity than the fibers of swatches S17 and S20-S21 (FIG. 3). In other words, the hair of swatches S17 and S21 was damaged by the harsh bleaching process, leading to increased elasticity, the hair of swatch S20 was damaged by the harsh bleaching process but not repaired with the comparative treatment, leading to increased elasticity, whereas the damage to swatches S18 and S19 had been repaired by treatment with compositions 2D and 2B.

Next, the strength was evaluated using a fiber tensile testing instrument from Dia-Stron known as an MTT (Miniature Tensile Tester). The results showed that the hair of swatches S18 and S19, treated with compositions 2D and 2B respectively, was surprisingly stronger than the hair of swatches S17 and S20-S21, meaning that more force was required to break the individual hair fibers of swatches S18 and S19. FIG. 4A shows the break stress (MPa) for a control swatch (CTL), which was the same hair but unbleached, swatch S17, which was bleached but without subsequent treatment, and swatches S18 and S19, treated with compositions 2D and 2B respectively, and S20, treated with the comparative compositions. As FIG. 4A shows, the break stress of the control swatch (CTL) was more than twice that of swatch S17, demonstrating the significant damage caused by the bleaching process. After five (5) treatments with either composition 2D (swatch S18), 2B (swatch S19), or the comparative compositions (S20), the break stress of the treated swatches was increased compared to swatch S17. Surprisingly, the increase in break stress for swatches S18-S19 was considered to be statistically significant compared to that of swatch S20, meaning that compositions 2D and 2B repaired the hair to a greater degree than the comparative compositions.

Example 4.2 – Straightened and Ultra Bleached Hair: Elasticity

Four swatches (S22-S25) of Caucasian hair that had been previously straightened using formaldehyde were bleached with a composition prepared by mixing a commercial bleach powder with a commercial oxidizing composition (40V hydrogen peroxide) at a mixing ratio of 1:1.5 (bleach powder:oxidizing composition) and processed at a temperature of about 55 °C for about 45 minutes. The swatches were rinsed and for a treatment period of five weeks, all four swatches were subjected to the following routine twice a week.

First, the swatches were cleansed with a commercially available shampoo by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. Immediately, a commercially available conditioner composition was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. A leave-on conditioning product and a leave-on flat iron serum were applied to the hair.

Three of the swatches (S22-S24) were subjected to the following additional treatment routines one time each week for the 5-week period.

Swatch S22 was cleansed with a commercially available shampoo by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. A mask composition was applied to the hair and allowed to remain on the hair, after which the hair was rinsed. Immediately, a commercially available conditioner composition was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. A leave-on conditioning product and a leave-on flat iron serum were applied to the hair.

Swatch S23 was cleansed with a commercially available shampoo by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. Immediately, composition 2C was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. Immediately, a commercially available conditioner composition was applied and

distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. A leave-on conditioning product and a leave-on flat iron serum were applied to the hair.

Swatch S24 was treated with composition C1 by applying the composition to the swatch and distributing it to ensure the hair was fully coated. Composition C1 was allowed to remain on the hair for a resting period of about five minutes, and then the swatch was thoroughly rinsed. Immediately, the swatch was cleansed with shampoo C1-S by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. Immediately, conditioner C1-C was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. A leave-on conditioning product and a leave-on flat iron serum were applied to the hair.

After the five-week treatment period, the elasticity of the hair fibers of each of swatches S22-S25 was studied in the same manner as described in Example 2.1. The results showed that the hair fibers of swatch S23, treated with composition 2C, had lower elasticity than the fibers of any of swatches S22 or S24-S25.

Example 4.3 – Straightened and Ultra Bleached Hair: Strength

Four swatches (S26-S29) of Caucasian hair that had been previously straightened using formaldehyde were bleached with a composition prepared by mixing a commercial bleach powder with a commercial oxidizing composition (40V hydrogen peroxide) at a mixing ratio of 1:1.5 (bleach powder:oxidizing composition) and processed at a temperature of about 55 °C for about 45 minutes. The swatches were rinsed and for a treatment period of five weeks, all four swatches were subjected to the following routine.

First, the swatches were cleansed with a commercially available shampoo by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. Immediately, a commercially available conditioner composition was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. A leave-on conditioning product and a leave-on flat iron serum were applied to the hair.

Three of the swatches (S27-S29) were subjected to the following additional treatment routines one time each week for the 5-week period.

Swatches S27 and S28 were cleansed with a commercially available shampoo by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. One of either composition 2B (S28) or 2D (S27) was applied to the hair and allowed to remain on the hair, after which the hair was rinsed. Immediately, a commercially available conditioner composition was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. A leave-on conditioning product and a leave-on flat iron serum were applied to the hair.

Swatch S29 was treated with composition C1 by applying the composition to the swatch and distributing it to ensure the hair was fully coated. Composition C1 was allowed to remain on the hair for a resting period of about five minutes, and then the swatch was thoroughly rinsed. Immediately, the swatch was cleansed with shampoo C1-S by wetting the swatch, applying the shampoo to the swatch, lathering the shampoo, allowing it to rest on the swatch for a period of about one minute, then rinsing the swatch until all shampoo was removed. Immediately, conditioner C1-C was applied to the swatch and distributed to ensure the hair was fully coated, allowed to remain for a resting period of about five minutes, and then the swatch was thoroughly rinsed. A leave-on conditioning product and a leave-on flat iron serum were applied to the hair.

MTT testing was performed in the same manner as described in Example 4.1. The results showed that the hair of swatches S27 and S28, treated with compositions 2D and 2B respectively, was surprisingly stronger than the hair of swatches S26 or S29, meaning that more force was required to break the individual hair fibers of swatches S27-S28. FIG. 4B shows the break stress (MPa) for a control swatch (CTL), which was the same hair but unbleached, swatch S26, which was bleached but without subsequent treatment, swatches S27 and S28, treated with compositions 2D and 2B respectively, and S29, treated with the comparative compositions. As FIG. 4B shows, the break stress of the control swatch (CTL) was approximately three times that of swatch S26, showing the significant damage caused by the bleaching process. After five (5) treatments with either composition 2B (swatch

S28), 2D (swatch S27), the break stress of the treated swatches was increased compared to swatch S26, and the improvement was considered to be statistically significant. FIG. 4B shows, however, that the break stress of the swatch treated with the comparative composition (S29) had no improvement in break stress.

5 Examples 4.1 to 4.3 thus demonstrate that treating hair that has been damaged by harsh chemical processes with a composition according to the disclosure surprisingly repairs the damage. The damage repair achieved with compositions according to the disclosure is also surprisingly greater than that achieved with a commercial product that asserts to do the same.

10

Example 5 – Evaluation of Damage Repair

Compositions 3A-3F according to the disclosure were prepared as shown in Table 5.

TABLE 5

	3A	3B	3C	3D	3E	3F
Basic amino acid(s)	5.50	5.50	3.80	3.80	5.00	5.00
Thickening agent(s)	0.30		0.90	0.90	1.00	-
Nonionic surfactant(s)	0.30	1.50	0.50	0.50	0.30	0.30
Amphoteric surfactant(s)	0.30	-	-	-	0.50	0.50
Conditioning agent(s)	0.80	-	-	-	2.64	1.20
Cationic surfactant(s)	2.10	3.84	3.00	3.00	4.40	3.00
Glycine betaine	2.50	2.50	1.80	1.80	2.50	2.50
Citric acid	6.00	6.00	5.50	5.50	6.15	6.06
Wax(es)	-	-	0.50	0.50	-	-
Fatty alcohol(s)	-	-	6.30	6.30	6.00	12.0
Vegetable oil(s)	-	-	-	0.50	-	-
Fatty acid ester(s)	-	-	2.50	1.50	2.00	0.70
Additives (preservatives, fragrance)	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2
Solvents (water and non-aqueous solvents)	QS	QS	QS	QS	QS	QS
Weight ratio of [amino acids + osmolytes]:cationic surfactants	3.8	2.1	1.9	1.9	1.7	2.5

	3A	3B	3C	3D	3E	3F
Weight ratio of amino acid(s) to osmolyte(s)	2.2	2.2	2.1	2.1	-	-

Compositions 3A-3D, which contained a synergistic combination of components (carboxylic acids (citric acid), osmolytes (glycine betaine), and amino acids (arginine)), and a weight ratio of amino acids to osmolytes according to the disclosure, are expected to minimize, prevent, and/or repair damage to hair.

5 Compositions 3A-3F, which contained a synergistic combination of active components (carboxylic acids (citric acid), osmolytes (glycine betaine), and amino acids (arginine)) and were stable due to the presence of cationic surfactants (cetrimonium chloride, behentrimonium chloride, and/or stearamidopropyl dimethylamine), are likewise expected to minimize, prevent, and/or repair damage to
10 hair.

The Compositions 3A-3F are also expected to improve elasticity and tensile strength of the treated hair fibers.

Example 6 – Compositions

15 Compositions 4A-4B according to the present invention were prepared as shown in Table 6.

TABLE 6

	4A	4B
Basic amino acid(s)	3.8	3.8
Thickening agent(s)	0.9	0.9
Nonionic surfactant(s)	0.5	0.5
Cationic surfactant(s)	3.0	3.0
Glycine betaine	1.8	1.8
Citric acid	5.5	5.5
Wax(es)	0.5	0.5
Fatty alcohol(s)	6.3	6.3
Vegetable oil(s)	-	0.5
Ester(s)	2.5	1.5
Additives (preservatives, fragrance, vitamins)	≤ 2	≤ 2
Solvents (water and non-aqueous solvents)	QS to 100	QS to 100

20 Compositions 4A and 4B, which include a combination of amino acids (arginine), osmolytes (trimethyl glycine), carboxylic acids (citric acid), esters (pentaerythrityl tetraisostearate), surfactants, and fatty compounds are hair mask compositions that are free of silicone compounds and include greater than 70% of

components that are from renewable sources. Composition 4B includes a vegetable oil (ucuuba butter) in addition to waxes and fatty alcohols.

Example 7 – Evaluation of Curl Recovery and Cosmetic Benefits

5 The following studies were conducted to evaluate the effectiveness of compositions according to the present invention to enhance or recover curls, provide curl definition, and to provide cosmetic benefits to treated hair.

Example 7.1 – Leave-on Treatment

10 Equal amounts of either composition 4A or 4B were applied to three swatches of curly Caucasian hair. The compositions were left on the hair and the swatches were air dried at room temperature.

FIG. 6C shows the swatches prior to treatment, and FIGS. 6A-6B show the swatches after treatment with compositions 4A and 4B, respectively. As FIGS. 6A-6C demonstrate, the degree of curl and curl definition restored to the hair with treatment according to the present invention is significant. In addition, the swatches
15 have significant reduction in frizziness and volume, and increased shine and smoothness.

Example 7.2 – Rinse-off Treatment

20 Equal amounts of composition 4B were applied to six swatches of previously bleached, curly Caucasian hair. The compositions were rinsed from the hair and the swatches were left to air dry at room temperature.

FIG. 7A shows images of three swatches bleached according to a standard bleaching protocol at room temperature (27 °C) before and after treatment with composition 4B, and FIG. 7B shows images of three swatches bleached according to an accelerated bleaching protocol at increased temperature (37 °C) before and after
25 treatment with composition 4B. As FIGS. 7A-7B demonstrate, the bleached hair before treatment had lost curl definition, but the degree of curl and curl definition restored to the hair after treatment is significant. In addition, the swatches have noticeable reduction in frizziness and volume, and increased shine and smoothness after treatment.

30 Example 7 demonstrates that compositions according to the present invention surprisingly and unexpectedly restore curls and curl definition to damaged hair and provide cosmetic benefits to treated hair.

Example 8 – Additional Compositions

The following compositions according to the disclosure can be prepared

and are expected to be similarly stable and to minimize, prevent, or repair damage to hair. The compositions are also expected to improve elasticity and tensile strength of the treated hair fibers.

TABLE 7

	5A	5B	5C	5D	5E	5F
Arginine	2.0	9.8	9.8	2.5	-	-
Lysine	-	-	-	2.5	2.0	10.0
Valine betaine	2.0	4.5	4.5	2.0	1.0	4.0
Citric acid	-	-	-	3.0	2.0	9.8
Lactic acid	2.0	10.0	10.0	2.0	-	-
Serine	0.05	0.5	0.5	-	0.05	0.5
Fatty compound(s)	10.0	8.0	8.0	-	9.0	15.0
Cationic and/or amphoteric surfactant(s)	3.0	-	3.0	0.5	2.5	5.0
Additional component(s) (e.g. pH adjusters, vitamins, preservatives, extracts, thickeners)	< 5	< 5	< 5	< 5	< 5	< 5
Solvent(s) (water and/or non-aqueous solvents)	QS	QS	QS	QS	QS	QS
Weight ratio of amino acid to osmolytes	1.0	2.2	2.2	2.5	2.1	2.6
Weight ratio of [amino acids + osmolytes]:cationic surfactants	1.3	-	4.8	14	1.2	2.8

The above examples demonstrate that the compositions and methods according to the disclosure, comprising synergistic combinations of components in particular weight ratios, surprisingly and unexpectedly repair hair that has been damaged, prevent or minimize damage to hair, enhance and reshape curls, and provide the hair with decreased elasticity benefits. The cationic surfactants surprisingly provide stability to the compositions despite the presence of relatively high amounts of these active components.

SET OF CLAIMS

1. Composition for treating keratin fibers, comprising:

(a) at least one compound chosen from amino acids or salts thereof;

(b) at least one osmolyte;

5 (c) optionally, at least one compound chosen from carboxylic acids or salts thereof;

(d) at least one solvent;

(e) optionally at least one surfactant;

(f) optionally at least one ester; and

10 (g) optionally at least one fatty compound other than (f);

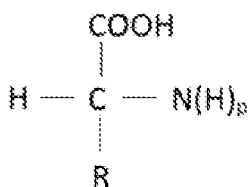
wherein the total amount of amino acids and salts thereof is at least 0.01% by weight, relative to the total weight of the composition,

wherein the total amount of osmolytes is at least 0.01% by weight, relative to the total weight of the composition,

15 wherein the total amount of carboxylic acids and salts thereof, when present, is at least 3% by weight, relative to the total weight of the composition, and

wherein the pH of the composition is less than 7.

2. Composition, according to claim 1, comprising (a) at least one amino acid chosen from compounds of formula (I) or salts thereof:



20

(I)

wherein:

- p is an integer equal to 1 or 2, and

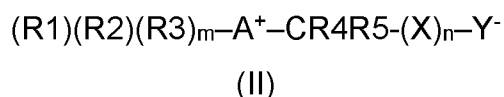
25 - when p = 1, R forms, together with the nitrogen atom, a saturated heterocycle comprising from 5 to 8 ring members, preferably 5 ring members, optionally substituted by one or more groups chosen from hydroxyl or (C₁-C₄)alkyl; or

30 - when p = 2, R represents a hydrogen atom or a saturated, linear, or branched (C₁-C₁₂)alkyl group, preferably a (C₁-C₄)alkyl group, optionally interrupted by one or more heteroatoms or groups chosen from -S-, -NH-, or -C(NH)-, and/or optionally substituted by one or more groups chosen from hydroxyl

(-OH), amino (-NH₂), -SH, -COOH, -CONH₂, -NH-C(NH)-NH₂, or an imidazole ring.

3. Composition, according to any one of claims 1 to 2, comprising (a) at least one amino acid chosen from arginine, glycine, proline, methionine, serine, lysine, histidine, salts thereof, or combinations of two or more thereof.

4. Composition, according to any one of claims 1 to 3, comprising (b) at least one osmolyte chosen from carbohydrate sugars, polyamines, betaines, or combinations of two or more thereof, preferably comprising at least one betaine chosen from compounds of formula (II) or salts thereof:



wherein:

- R1, R2, and R3 are independently chosen from C₁-C₄ alkyl groups;
- A is N or S;
- m and n are independently 0 or 1;
- X is a divalent C₁-C₆ alkyl group, linear or branched, saturated or unsaturated, optionally substituted by one or more groups chosen from hydroxyl (-OH) or amino (-NH₂); and
- Y⁻ is -COO⁻ or -OSO₃⁻;

with the provisos that:

- when A is S, then m = 0 and R4 and R5 are independently chosen from a hydrogen atom or a saturated, unsaturated, linear, branched and/or cyclic (including aromatic and polycyclic chains), (C₁-C₁₀) hydrocarbon chain, optionally interrupted by one or more heteroatoms or groups chosen from -S-, -N=, -NH-, or -C(NH)-, and/or optionally substituted by one or more groups chosen from hydroxyl (-OH), amino (-NH₂), -SH, -COOH, or -CONH₂;
- when A is N and m = 0, R4 represents a hydrogen atom or a saturated, linear, or branched (C₁-C₈)alkyl, and R5 forms, together with the nitrogen atom, a saturated heterocycle comprising from 5 to 8 ring members, optionally substituted by one or more groups chosen from hydroxyl or (C₁-C₄)alkyl; and

- when A is N and $m = 1$, then R4 and R5 are independently chosen from a hydrogen atom or a saturated, unsaturated, linear, branched and/or cyclic (including aromatic and polycyclic chains) (C₁-C₁₀) hydrocarbon chain, optionally interrupted by one or more heteroatoms or groups chosen from -S-, -N=, -NH-, or -C(NH)-, and/or optionally substituted by one or more groups chosen from hydroxyl (-OH), amino (-NH₂), -SH, -COOH, or -CONH₂.

5 5. Composition, according to any one of claims 1 to 4, comprising (a) at least one basic amino carboxylic acid and (b) at least one betaine.

10 6. Composition, according to any one of claims 1 to 5, comprising (b) at least one osmolyte chosen from carbohydrate sugars, preferably from C₃-C₆ monosaccharides, more preferably from pentoses, hexoses, derivatives thereof, or combinations of two or more thereof.

 7. Composition, according to any one of claims 1 to 6, comprising
15 (b) at least one polyamine chosen from diamines, triamines, tetramines, pentamines, or combinations of two or more thereof.

 8. Composition, according to any one of claims 1 to 7, comprising
(b) at least one compound of formula (II) chosen from zwitterionic amino acid derivatives bearing a quaternary ammonium group and comprising from 1 to 12
20 carbon atoms, preferably from 2 to 10 carbon atoms, more preferably from 3 to 8 carbon atoms.

 9. Composition, according to any one of claims 1 to 8, comprising
(b) at least one compound of formula (II) chosen from valine betaine, glutamic acid betaine, glutamine betaine, trimethyl lysine, glycine betaine, histidine betaine, N-
25 methyl histidine betaine, alanine betaine, beta-alanine betaine, choline sulfate, pipercolic acid betaine, proline betaine, hydroxyproline betaine, tyrosine betaine, phenylalanine betaine, tryptophan betaine, leucine betaine, isoleucine betaine, salts thereof, or combinations of two or more thereof, preferably comprising glycine betaine.

30 10. Composition, according to any one of claims 1 to 9, comprising (b) at least one compound of formula (II), wherein:

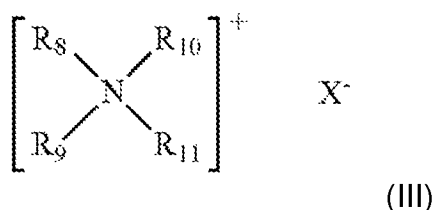
R1 and R2 are methyl;

A is N; and/or

Y is COO-.

11. Composition, according to any one of claims 1 to 10, comprising (c) at least one compound chosen from formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, enanthic acid, caprylic acid, lactic acid, oxalic acid, malonic acid, malic acid, glutaric acid, citraconic acid, succinic acid, adipic acid, tartaric acid, fumaric acid, maleic acid, citric acid, isocitric acid, aconitic acid, propane-1,2,3-tricarboxylic acid, salts thereof, or combinations of two or more thereof.

12. The composition of any one of claims 1 to 11, comprising (e) at least one cationic surfactant chosen from compounds of formula (III):



wherein:

- groups R_8 to R_{11} are independently chosen from linear or branched aliphatic groups containing from 1 to 30 carbon atoms, or an aromatic group such as aryl or alkylaryl, at least one of the groups R_8 to R_{11} including from 8 to 30 carbon atoms, such as from 12 to 24 carbon atoms, it being possible for the linear or branched aliphatic groups to include heteroatoms such as, for example, oxygen, nitrogen, and/or sulfur, these heteroatoms not being adjacent, and halogens; and

- X^- is an anion chosen from the group consisting of halides such as bromides, chlorides, iodides, fluorides, phosphates, acetates, lactates, (C₁-C₄)alkyl sulfates, (C₁-C₄)alkyl sulfonates or (C₁-C₄)alkylaryl sulfonates; C₁-C₃₀ alkyl, C₁-C₃₀ alkoxy, (C₂-C₆)polyoxyalkylene, C₁-C₃₀ alkylamide, (C₁₂-C₂₂)alkyl-(C₂-C₆)alkylamido, (C₁₂-C₂₂)alkyl acetate, and C₁-C₃₀ hydroxyalkyl groups.

13. The composition of any one of claims 1 to 12, comprising (e) at least one surfactant, chosen from cationic surfactants, chosen from optionally polyoxyalkylenated primary, secondary, or tertiary fatty amine salts, quaternary ammonium salts, or combinations of two or more thereof.

14. The composition of any one of claims 1 to 13, comprising (e) at least one cationic surfactant chosen from cetrimonium chloride, behentrimonium chloride stearamidopropyl dimethylamine, palmitamidopropyl dimethylamine,

lauramidopropyl dimethylamine, behenamidopropyl dimethylamine, or combinations of two or more thereof.

15. Composition, according to any one of claims 1 to 14, comprising (f) at least one ester chosen from monoesters, diesters, triesters, tetraesters, or combinations thereof, preferably having a molecular weight greater than 300 g/mol.

16. Composition, according to any one of claims 1 to 15, comprising (f) at least one ester chosen from esters of C₂₂-C₃₀, preferably C₂₄-C₂₈, branched fatty acids or fatty alcohols.

17. Composition of any one of claims 1 to 16, comprising (g) at least one fatty compound chosen from fatty alcohols, fatty acids, waxes, vegetable oils, or combinations of two or more thereof.

18. Composition, according to any one of claims 1 to 17, wherein the total amount of amino acids and salts thereof ranges from 1% to 15%, preferably from 2% to 15%, more preferably from 2.5% to 12%, more preferably from 1.5% to 10%, more preferably from 3% to 10%, more preferably from 3.5% to 8% by weight, preferably from 2% to 8%, preferably from 2.5% to 7.5% by weight, relative to the total weight of the composition.

19. Composition, according to any one of claims 1 to 18, wherein the total amount of osmolytes ranges from 0.5% to 10%, preferably from 1% to 8%, more preferably from 1% to 5%, more preferably from 1% to 3.5% by weight, and most preferably from 1.5% to 3.5% by weight, relative to the total weight of the composition.

20. Composition, according to any one of claims 1 to 19, wherein the total amount of carboxylic acids and salts thereof ranges from 1% to 15%, preferably from 3% to 15%, more preferably from 2% to 12%, more preferably from 3% to 12%, more preferably from 3% to 10%, more preferably from 3.5% to 10%, more preferably from 3.5% to 8% by weight, and most preferably from 4% to 8% by weight, relative to the total weight of the composition.

21. Composition, according to any one of claims 1 to 20, wherein the total amount of surfactants, preferably cationic surfactants, ranges from 0.01% to 10%, preferably from 0.5% to 8%, more preferably from 1% to 6%, and most preferably from 2% to 5% by weight, relative to the total weight of the composition.

22. Composition, according to any one of claims 1 to 21, the weight ratio of the total amount of [amino acids and salts thereof + osmolytes] to the total

amount of cationic surfactants ranges from 1 to 10, preferably from 1.25 to 8, more preferably from 1.5 to 6, and even more preferably from 1.75 to 5 and most preferably from 2 to 4.

23. Composition, according to any one of claims 1 to 22, wherein the
5 total amount of esters ranges from 0.1% to 10%, preferably from 0.5% to 8%, more preferably from 0.75% to 5%, and most preferably from 1% to 3% by weight, relative to the total weight of the composition.

24. Composition, according to any one of claims 1 to 23, wherein the
10 pH of the composition ranges from 2 to 6, preferably from 2.5 to 5, more preferably from 2.5 to 4.5, and most preferably from 3 to 4.

25. Composition, according to any one of claims 1 to 24, wherein the solvent comprises water and at least one non-aqueous solvent, preferably chosen from polyols.

26. Composition, according to any one of claims 1 to 25, comprising:
15 (a) at least one compound chosen from basic amino acids or salts thereof;
(b) at least one compound chosen from compounds of formula (II) or salts thereof;
(c) at least one compound chosen from citric acid or salts thereof;
20 and
(d) water and optionally at least one non-aqueous solvent chosen from polyols.

27. Composition, according to any one of claims 1 to 26, comprising:
(a) at least one compound chosen from arginine or salts thereof;
25 (b) glycine betaine or a salt thereof;
(c) at least one compound chosen from citric acid, lactic acid, or salts thereof;
(d) water and optionally at least one non-aqueous solvent chosen from polyols; and
30 (h) optionally at least one compound chosen from serine or salts thereof.

28. Composition, according to any one of claims 1 to 27, comprising:
(a) at least one compound chosen from basic amino acids or salts thereof;

(b) at least one compound chosen from compounds of formula (II) or salts thereof;

(c) at least one compound chosen from citric acid, lactic acid, or salts thereof;

5 (d) water and optionally at least one non-aqueous solvent chosen from polyols; and

(e) at least one cationic surfactant.

29. Composition, according to any one of claims 1 to 25 or 28, comprising:

10 (a) at least one compound chosen from arginine or salts thereof;

(b) glycine betaine or a salt thereof;

(c) at least one compound chosen from citric acid, lactic acid, or salts thereof;

15 (d) water and optionally at least one non-aqueous solvent chosen from polyols;

(e) at least one cationic surfactant; and

(h) optionally at least one compound chosen from serine or salts thereof.

20 30. Composition, according to any one of claims 1 to 25, wherein the composition comprises:

(a) at least one compound chosen from basic amino acids or salts thereof, preferably comprising arginine or a salt thereof;

(b) at least one compound chosen from compounds of formula (II) or salts thereof, preferably comprising glycine betaine;

25 (c) at least one carboxylic acid or salt thereof, preferably comprising citric acid, lactic acid, or a salt thereof;

(d) water;

(e) at least one surfactant;

30 (f) at least one ester chosen from tetraesters, preferably comprising pentaerythrityl tetraisostearate; and

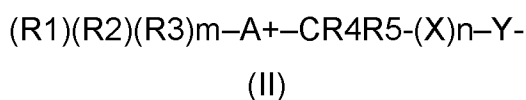
(g) at least one fatty compound chosen from vegetable oils, preferably comprising ucuuba butter.

31. Composition, according to any one of claims 1 to 30, further comprising at least one additional component chosen from amphoteric surfactants, thickening agents, or combinations thereof.

32. Composition for treating keratin fibers, comprising:

(a) at least one compound chosen from basic amino acids or salts thereof;

(b) at least one osmolyte chosen from compounds of formula (II) or salts thereof:



wherein:

- R1, R2, and R3 are independently chosen from C₁-C₄ alkyl groups;

- A is N or S;

- m and n are independently 0 or 1;

- X is a divalent C₁-C₆ alkyl group, linear or branched, saturated or unsaturated, optionally substituted by one or more groups chosen from hydroxyl (-OH) or amino (-NH₂); and

- Y- is -COO- or -OSO₃-;

with the provisos that:

o when A is S, then m = 0 and R4 and R5 are independently chosen from a hydrogen atom or a saturated, unsaturated, linear, branched and/or cyclic (including aromatic and polycyclic chains), (C₁-C₁₀) hydrocarbon chain, optionally interrupted by one or more heteroatoms or groups chosen from -S-, -N=, -NH-, or -C(NH)-, and/or optionally substituted by one or more groups chosen from hydroxyl (-OH), amino (-NH₂), -SH, -COOH, or -CONH₂;

o when A is N and m = 0, R4 represents a hydrogen atom or a saturated, linear, or branched (C₁-C₈)alkyl, and R5 forms, together with the nitrogen atom, a saturated heterocycle comprising from 5 to 8 ring members, optionally substituted by one or more groups chosen from hydroxyl or (C₁-C₄)alkyl; and

o when A is N and m = 1, then R4 and R5 are independently chosen from a hydrogen atom or a saturated, unsaturated, linear, branched and/or cyclic (including aromatic and polycyclic chains) (C₁-C₁₀) hydrocarbon chain, optionally interrupted by one or more heteroatoms or groups chosen from -S-, -N=,

–NH–, or –C(NH)–, and/or optionally substituted by one or more groups chosen from hydroxyl (–OH), amino (–NH₂), –SH, –COOH, or –CONH₂;

(c) at least one compound chosen from carboxylic acids or salts thereof; and

5 (d) water and optionally at least one polyol,

(e) optionally at least one surfactant;

(f) optionally at least one ester having a molecular weight greater than 500 g/mol; and

(g) optionally at least one fatty compound other than (f).

10 33. Composition, according to claim 32, wherein the pH of the composition ranges from 2 to 6,

wherein the total amount of basic amino acids and salts thereof ranges from 2% to 15% by weight, relative to the total weight of the composition, and

15 wherein the total amount of carboxylic acids and salts thereof ranges from 3% to 15% by weight, relative to the total weight of the composition.

34. Composition, according to any one of claims 32 to 33, comprising (b) at least one compound of formula (II) wherein:

R1, R2, and R3 are methyl;

A is N;

20 Y is COO–;

X is a divalent alkyl group, linear or branched, preferably saturated, having from 1 to 4 carbon atoms, optionally substituted by methylene or ethylene;

R4 is hydrogen; and

25 R5 forms, together with the nitrogen atom, a saturated heterocycle comprising from 5 to 8 ring members, preferably 5 to 6 ring members, optionally substituted by one hydroxy group.

35. Composition, according to any one of claims 32 to 34, comprising (c) at least one compound chosen from formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, enanthic acid, caprylic acid, lactic acid, 30 oxalic acid, malonic acid, malic acid, glutaric acid, citraconic acid, succinic acid, adipic acid, tartaric acid, fumaric acid, maleic acid, citric acid, isocitric acid, aconitic acid, propane-1,2,3-tricarboxylic acid, salts thereof, or combinations of two or more thereof.

36. Composition, according to any one of claims 32 to 35, comprising (f) at least one ester chosen from diesters, triesters, tetraesters, or combinations thereof, having a molecular weight greater than 600 g/mol.

37. Composition, according to any one of claims 32 to 36, further
5 comprising (h) at least one compound chosen from serine or salts thereof.

38. Composition, according to any one of claims 32 to 37, further comprising at least one additional component chosen from amphoteric surfactants, thickening agents, or combinations thereof.

39. Composition, according to any one of claims 32 to 38, wherein
10 the pH of the composition ranges from 2.5 to 5, preferably from 2.5 to 4.5, more preferably from 3 to 4.

40. Composition, according to any one of claims 32 to 39, comprising (e) at least one surfactant, preferably chosen from cationic surfactants, more preferably chosen from alkylamidoamines.

15 41. Composition, according to any one of claims 32 to 40, comprising (f) at least one ester chosen from esters of C₂₄-C₂₈ branched fatty acids or fatty alcohols, preferably comprising pentaerythrityl tetraisostearate, and (g) at least one plant oil, preferably comprising ucuuba butter.

42. Composition, according to any one of claims 32 to 41,
20 comprising (g) at least one fatty compound chosen from fatty alcohols, fatty acids, waxes, vegetable oils, or combinations of two or more thereof.

43. Composition, according to any one of claims 1 to 42, wherein the composition comprises ucuuba butter and pentaerythrityl tetraisostearate, and has a weight ratio of ucuuba butter:pentaerythrityl tetraisostearate ranging from 0.1 to 1,
25 preferably from 0.2 to 0.8, more preferably from 0.3 to 0.6, and most preferably from 0.3 to 0.5.

44. Composition, according to any one of claims 1 to 43, wherein the weight ratio of the total amount of amino acids and salts thereof to the total amount of osmolytes ranges from 0.1 to 10, preferably from 1 to 5, and wherein the pH is
30 less than 7.

45. Composition, according to any one of claims 1 to 44, wherein the weight ratio of the total amount of (a) amino acids and salts thereof to the total amount of (b) osmolytes ranges from 0.2 to 8, preferably from 0.5 to 6, more preferably from 1 to 5, and most preferably from 1.5 to 3.5.

46. Composition, according to any one of claims 1 to 45, wherein the composition is free or substantially free of silicone compounds.

47. Composition, according to any one of claims 1 to 46, wherein the composition is free or substantially free of behentrimonium chloride.

5 48. Composition for treating keratin fibers, comprising:

(a) at least one compound chosen from basic amino acids or salts thereof;

(b) at least one osmolyte;

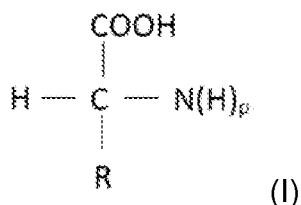
10 (c) at least one compound chosen from carboxylic acids or salts thereof;

(d) water and optionally at least one non-aqueous solvent chosen from polyol; and

(e) optionally at least one cationic surfactant.

wherein the pH of the composition ranges from 2.5 to 4.5.

15 49. Composition, according to claim 48, comprising (a) at least one amino acid chosen from compounds of formula (I) or salts thereof:



wherein:

- p is an integer equal to 1 or 2, and

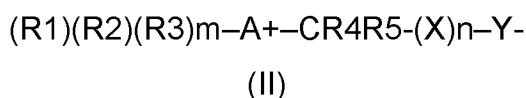
20 - when p = 1, R forms, together with the nitrogen atom, a saturated heterocycle comprising from 5 to 8 ring members, preferably 5 ring members, optionally substituted by one or more groups chosen from hydroxyl or (C₁-C₄)alkyl; or

- when p = 2, R represents a hydrogen atom or a saturated, linear, 25 or branched (C₁-C₁₂)alkyl group, preferably a (C₁-C₄)alkyl group, optionally interrupted by one or more heteroatoms or groups chosen from -S-, -NH-, or -C(NH)-, and/or optionally substituted by one or more groups chosen from hydroxyl (-OH), amino (-NH₂), -SH, -COOH, -CONH₂, -NH-C(NH)-NH₂, or an imidazole ring.

30 50. Composition, according to any one of claims 48 to 49, comprising (a) at least one amino acid chosen from arginine, glycine, proline,

methionine, serine, lysine, histidine, salts thereof, or combinations of two or more thereof.

51. Composition, according to any one of claims 48 to 50, comprising (b) at least one osmolyte chosen from carbohydrate sugars, polyamines, betaines, or combinations of two or more thereof, preferably comprising at least one osmolyte chosen from compounds of formula (II) or salts thereof:



wherein:

- R1, R2, and R3 are independently chosen from C₁-C₄ alkyl groups;
- A is N or S;
- m and n are independently 0 or 1;
- X is a divalent C₁-C₆ alkyl group, linear or branched, saturated or unsaturated, optionally substituted by one or more groups chosen from hydroxyl (-OH) or amino (-NH₂); and
- Y- is -COO- or -OSO₃-;

with the provisos that:

- o when A is S, then m = 0 and R4 and R5 are independently chosen from a hydrogen atom or a saturated, unsaturated, linear, branched and/or cyclic (including aromatic and polycyclic chains), (C₁-C₁₀) hydrocarbon chain, optionally interrupted by one or more heteroatoms or groups chosen from -S-, -N=, -NH-, or -C(NH)-, and/or optionally substituted by one or more groups chosen from hydroxyl (-OH), amino (-NH₂), -SH, -COOH, or -CONH₂;
- o when A is N and m = 0, R4 represents a hydrogen atom or a saturated, linear, or branched (C₁-C₈)alkyl, and R5 forms, together with the nitrogen atom, a saturated heterocycle comprising from 5 to 8 ring members, optionally substituted by one or more groups chosen from hydroxyl or (C₁-C₄)alkyl; and
- o when A is N and m = 1, then R4 and R5 are independently chosen from a hydrogen atom or a saturated, unsaturated, linear, branched and/or cyclic (including aromatic and polycyclic chains) (C₁-C₁₀) hydrocarbon chain, optionally interrupted by one or more heteroatoms or groups chosen from -S-, -N=, -NH-, or -C(NH)-, and/or optionally substituted by one or more groups chosen from hydroxyl (-OH), amino (-NH₂), -SH, -COOH, or -CONH₂.

52. Composition, according to any one of claims 48 to 51, comprising (a) at least one basic amino carboxylic acid and (b) at least one betaine.

53. Composition, according to any one of claims 48 to 52, comprising (b) at least one carbohydrate chosen from sugars, preferably from C₃-C₆ monosaccharides, more preferably from pentoses, hexoses, derivatives thereof, or combinations of two or more thereof.

54. Composition, according to any one of claims 48 to 53, comprising (b) at least one polyamine chosen from diamines, triamines, tetramines, pentamines, or combinations of two or more thereof.

55. Composition, according to any one of claims 48 to 54, comprising (b) at least one compound of formula (II) chosen from zwitterionic amino acid derivatives bearing a quaternary ammonium group and comprising from 1 to 12 carbon atoms, preferably from 2 to 10 carbon atoms, more preferably from 3 to 8 carbon atoms.

56. Composition, according to any one of claims 48 to 55, comprising (b) at least one compound of formula (II) chosen from valine betaine, glutamic acid betaine, glutamine betaine, trimethyl lysine, glycine betaine, histidine betaine, N-methyl histidine betaine, alanine betaine, beta-alanine betaine, choline sulfate, pipercolic acid betaine, proline betaine, hydroxyproline betaine, tyrosine betaine, phenylalanine betaine, tryptophan betaine, leucine betaine, isoleucine betaine, salts thereof, or combinations of two or more thereof, preferably glycine betaine.

57. Composition, according to any one of claims 48 to 56, comprising (b) at least one compound of formula (II), wherein:

R1 and R2 are methyl;
A is N; and/or
Y is COO—.

58. Composition, according to any one of claims 48 to 57, comprising (c) at least one compound chosen from formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, enanthic acid, caprylic acid, lactic acid, oxalic acid, malonic acid, malic acid, glutaric acid, citraconic acid, succinic acid, adipic acid, tartaric acid, fumaric acid, maleic acid, citric acid, isocitric acid, aconitic acid, propane-1,2,3-tricarboxylic acid, salts thereof, or combinations of two or more thereof.

59. Composition, according to any one of claims 48 to 58, comprising (e) at least one cationic surfactant chosen from optionally polyoxyalkylenated primary, secondary, or tertiary fatty amine salts, quaternary ammonium salts, or combinations of two or more thereof.

5 60. Composition, according to any one of claims 48 to 59, wherein the total amount of amino acids and salts thereof ranges from 2% to 15%, preferably from 2.5% to 12%, more preferably from 3% to 10%, and most preferably from 3.5% to 8% by weight, relative to the total weight of the composition.

10 61. Composition, according to any one of claims 48 to 60, wherein the total amount of osmolytes ranges from 0.5% to 10%, preferably from 1% to 8%, more preferably from 1% to 5%, and most preferably from 1.5% to 3.5% by weight, relative to the total weight of the composition.

15 62. Composition, according to any one of claims 48 to 61, wherein the total amount of carboxylic acids and salts thereof ranges from 3% to 15%, preferably from 3% to 12%, more preferably from 3.5% to 10%, and most preferably from 4% to 8% by weight, relative to the total weight of the composition.

63. Method for treating keratin fibers, the method comprising:

(i) applying to the keratin fibers a composition, as defined in any one of claims 1 to 62; and

20 (ii) optionally rinsing the composition from the keratin fibers.

64. Method, according to claim 63, wherein the composition is left on the keratin fibers for a leave-in period of time ranging from:

25 30 seconds to 60 minutes, preferably from 30 seconds to 30 minutes, more preferably from 30 seconds to 15 minutes, and most preferably from 2 minutes to 10 minutes, or

1 hour to 24 hours, preferably 1 hour to 12 hours, preferably 1 hour to 10 hours, more preferably from 2 hours to 10 hours.

and the keratin fibers are optionally rinsed after the leave-in period of time.

30 65. Method, according to any one of claims 63 to 64, further comprising:

(iii) shampooing and/or conditioning the keratin fibers before and/or after steps (i) and/or (ii).

66. Method, according to any one of claims 63 to 65, which is a method of reducing or preventing hair damage or breakage, protecting hair from damage, restoring hair fiber moisture equilibrium, providing hair fiber strength, and/or improving hair fiber elasticity.

5 67. Method, according to any one of claims 63 to 66, wherein the hair to which the composition is applied is hair that has been bleached and/or dyed.

68. Method, according to any one of claims 63 to 64 or 67, which is a method of reshaping curly hair and/or enhancing curl recovery.

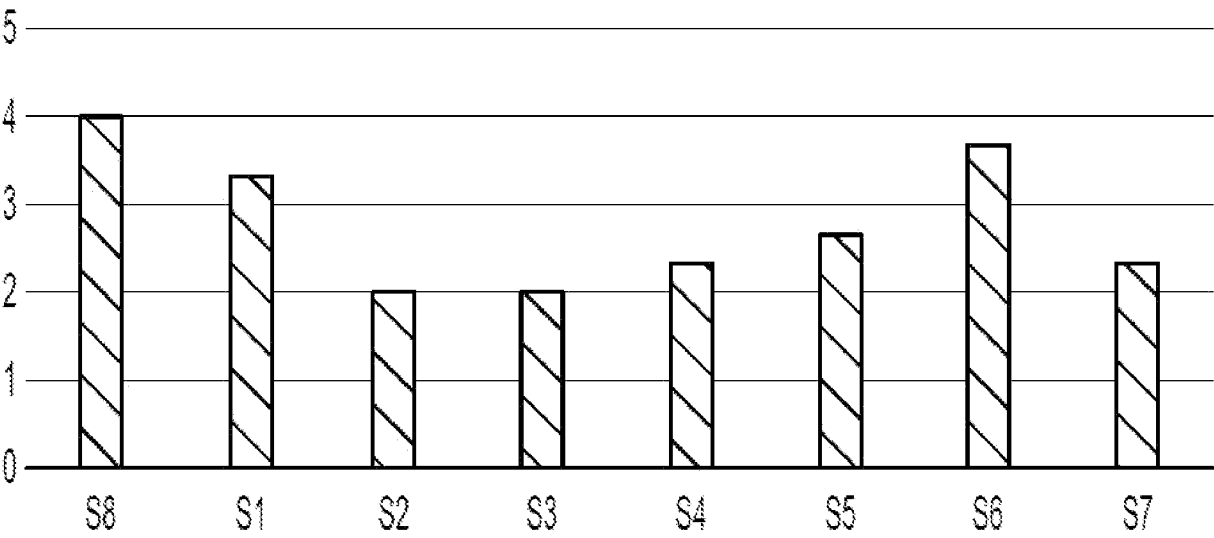


FIG. 1A

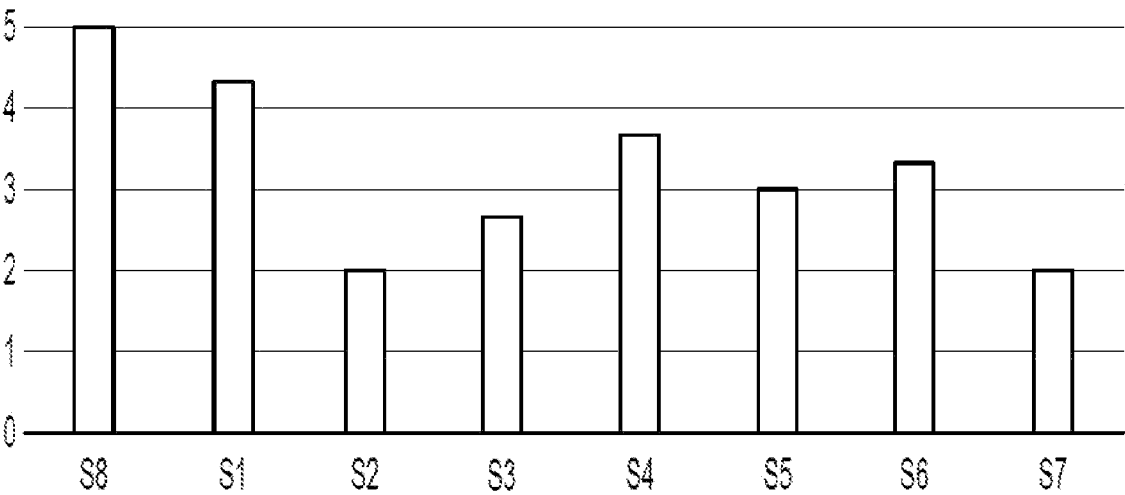


FIG. 1B

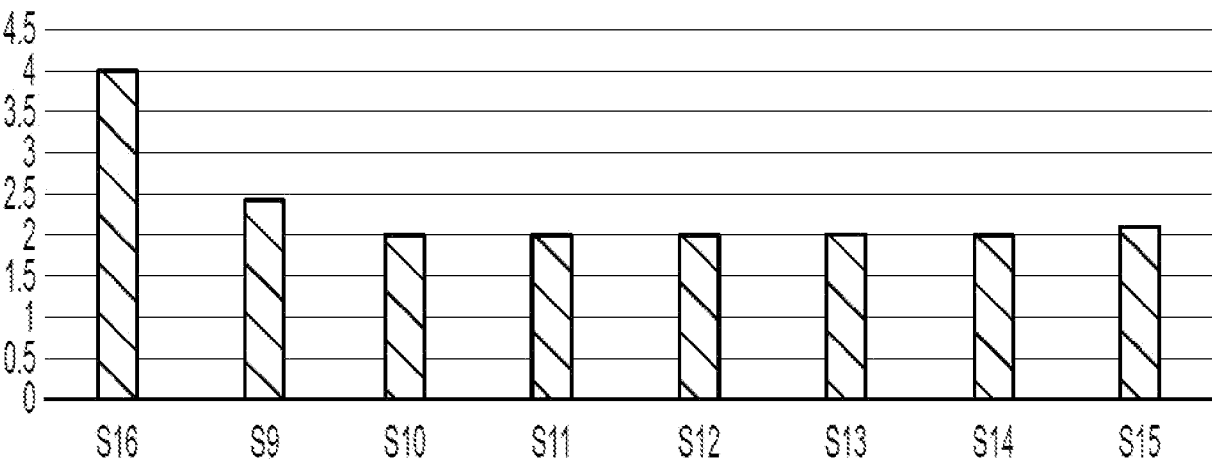


FIG. 2A

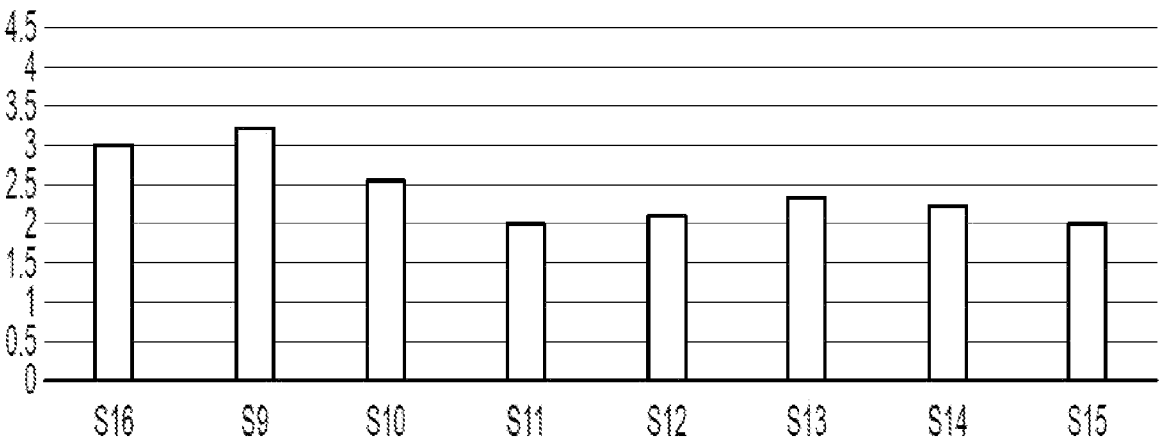


FIG. 2B

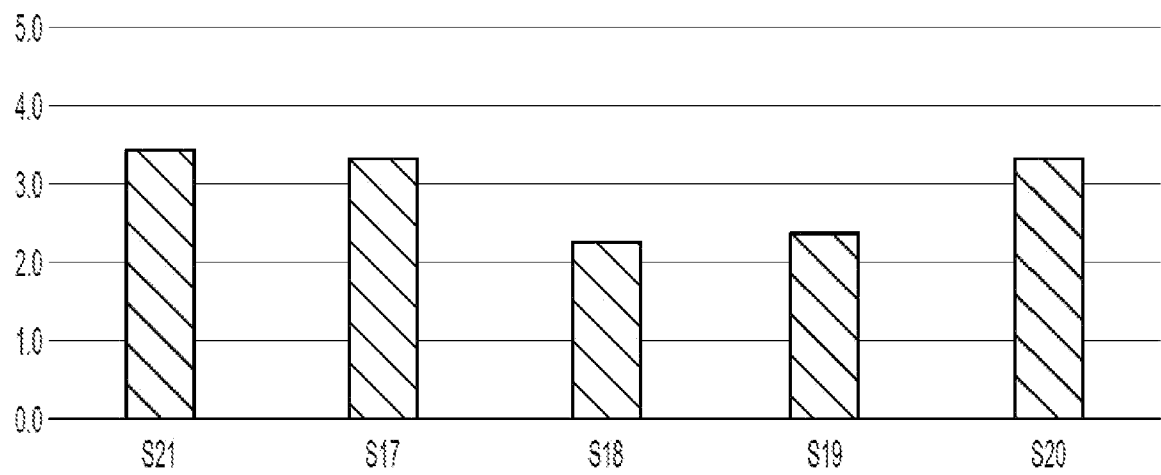


FIG. 3

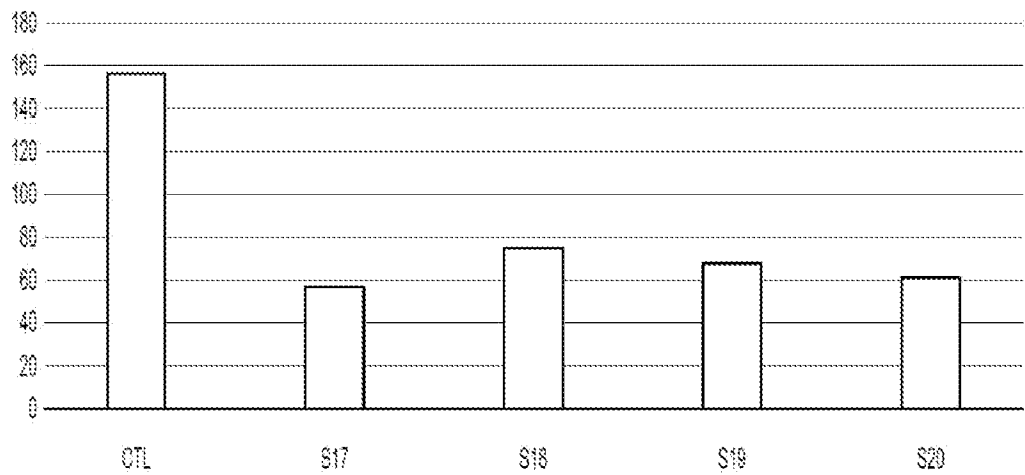


FIG. 4A

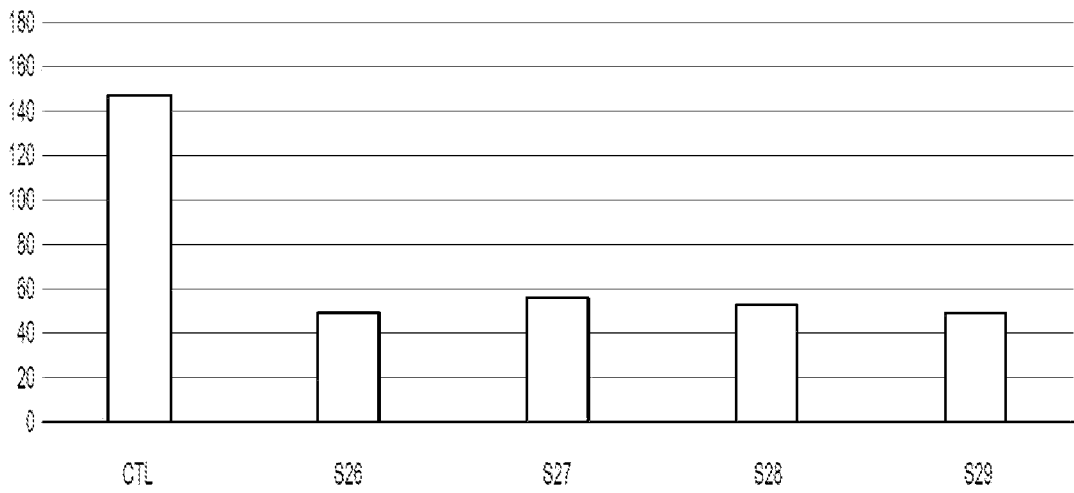


FIG. 4B

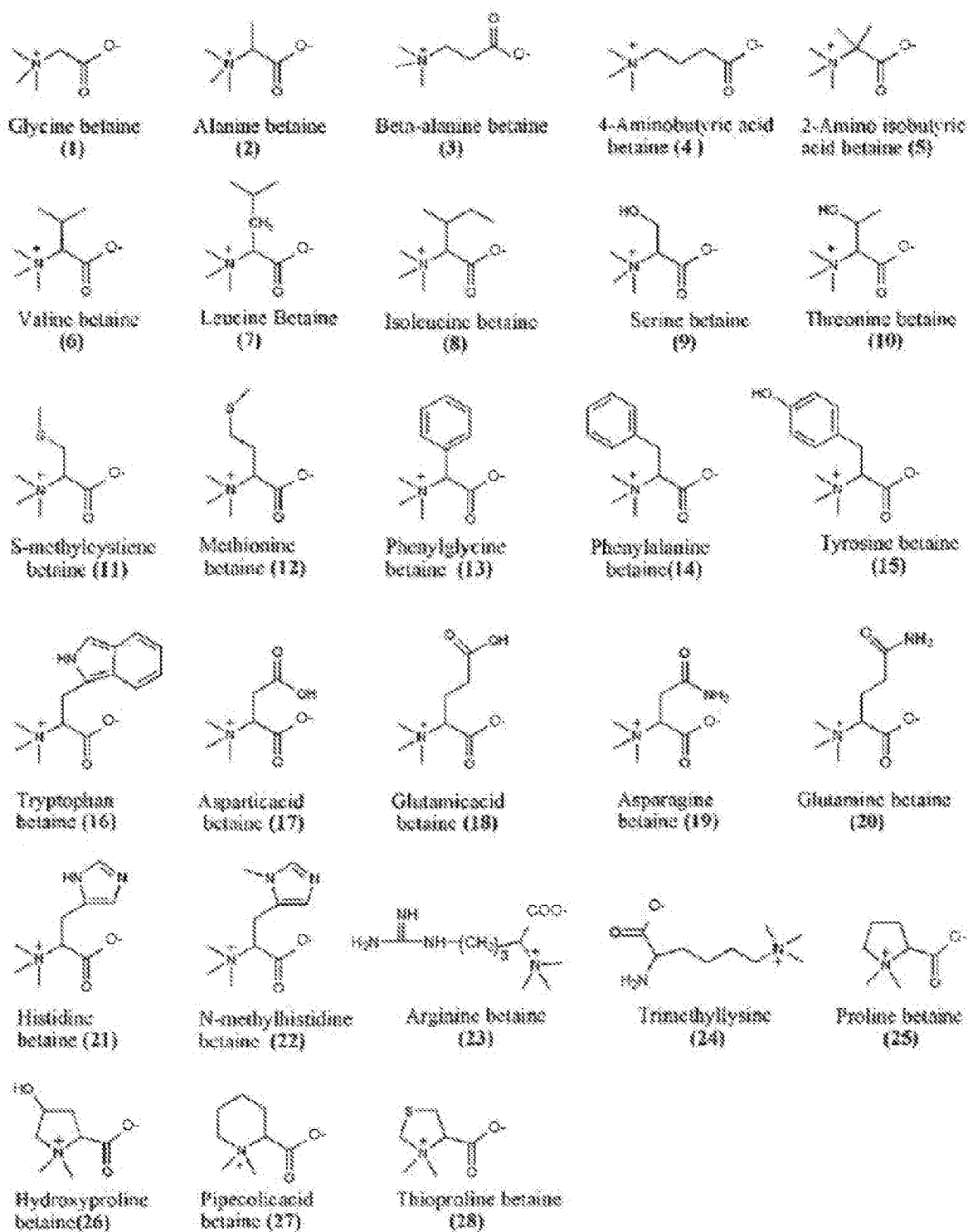


FIG. 5A

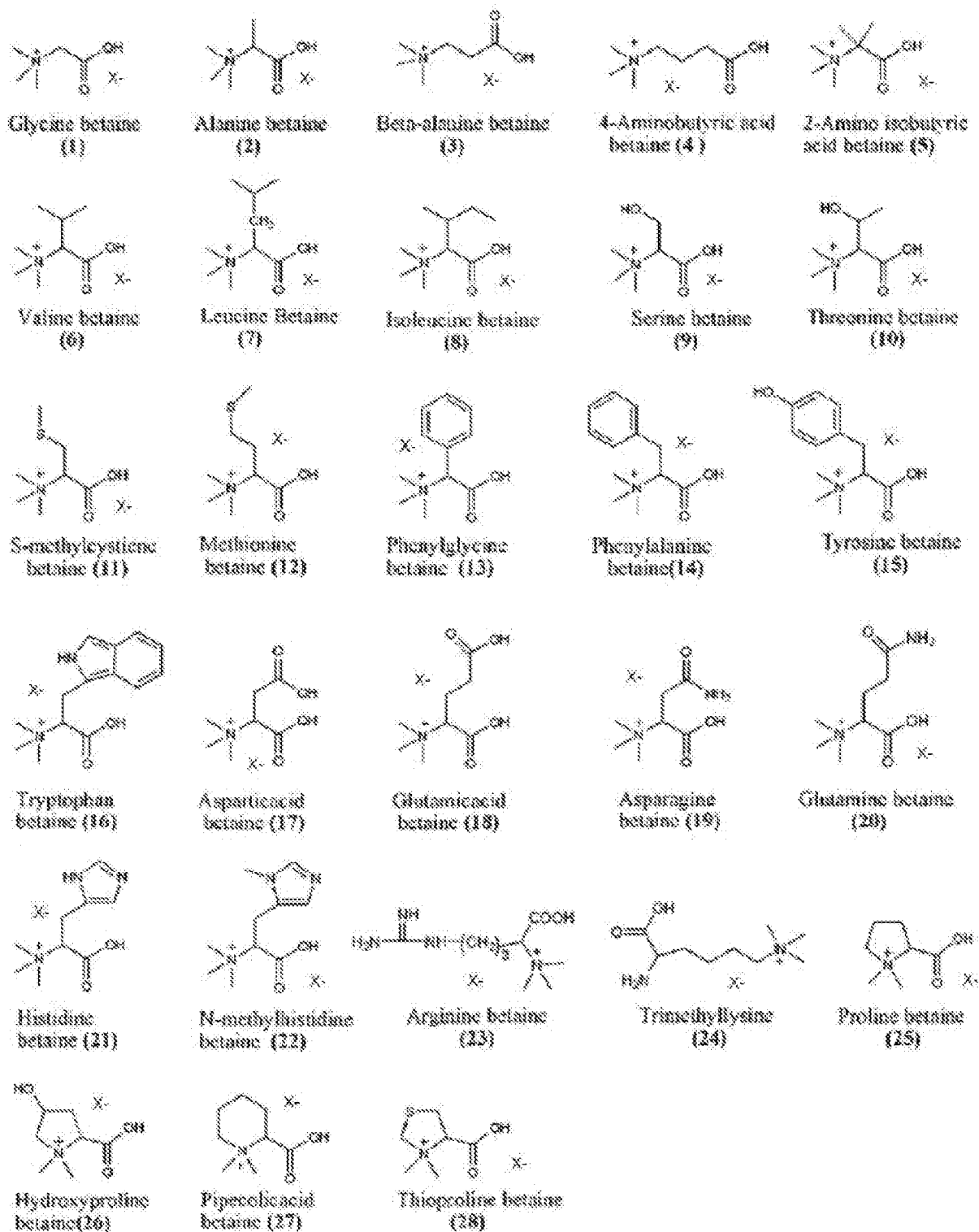


FIG. 5B

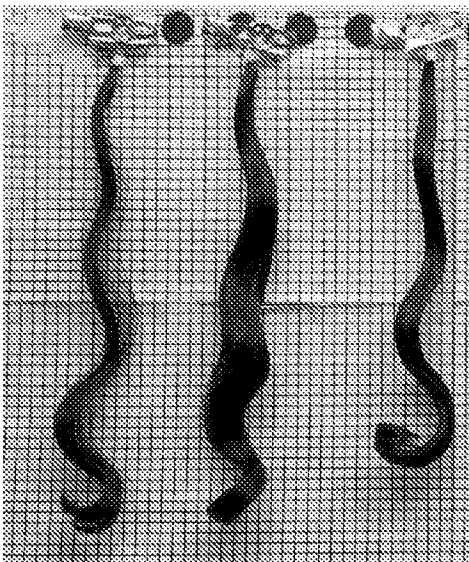


FIG. 6A

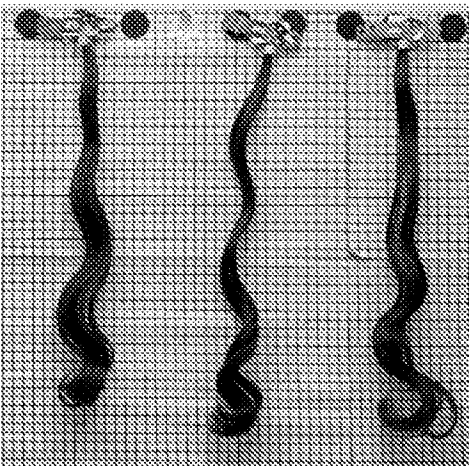


FIG. 6B



FIG. 6C

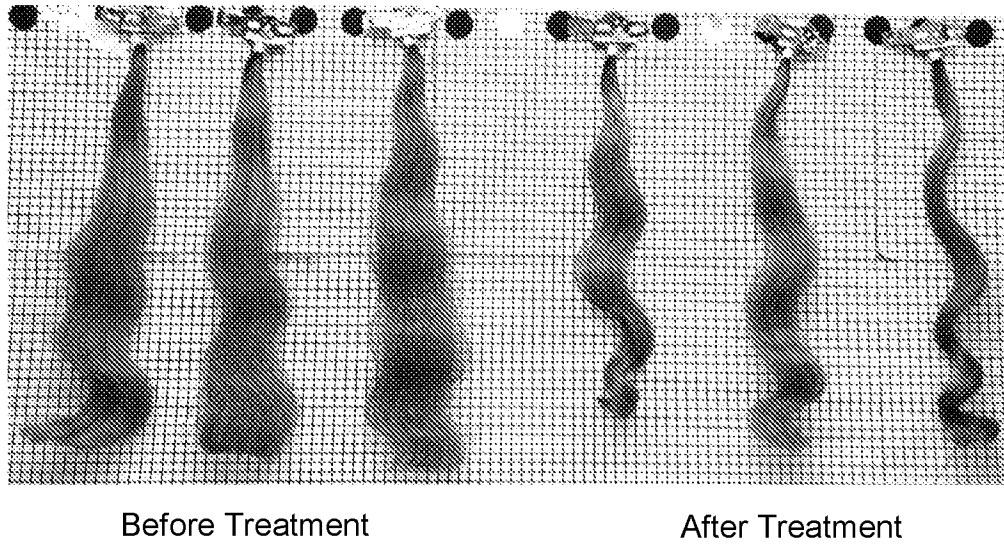


FIG. 7A

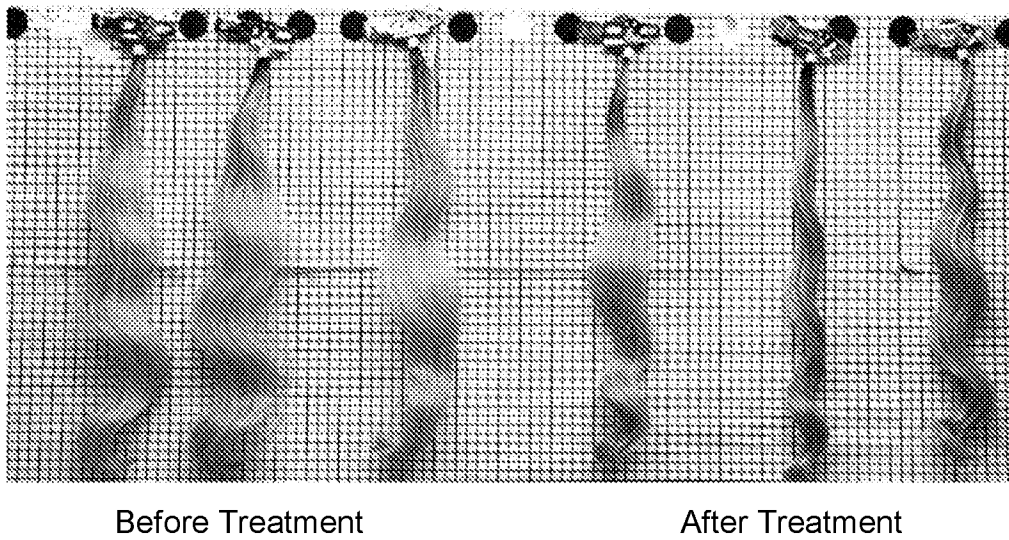


FIG. 7B

INTERNATIONAL SEARCH REPORT

International application No
PCT/BR2024/050481

A. CLASSIFICATION OF SUBJECT MATTER					
INV.	A61K8/365	A61K8/41	A61K8/44	A61Q5/00	A61K8/36
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					
C. DOCUMENTS CONSIDERED TO BE RELEVANT					
Category*	Citation of document, with indication, where appropriate, of the relevant passages				Relevant to claim No.
Y	WO 2023/232840 A1 (OREAL [FR]) 7 December 2023 (2023-12-07) page 45, line 35 - line 36; examples 1-B -----				1 - 68
Y	WO 2023/164280 A1 (RUGHANI RONAK [US]; KHINE CHO CHO [US] ET AL.) 31 August 2023 (2023-08-31) claim 1; examples 5-A -----				1 - 68
Y	WO 2023/232894 A1 (OREAL [FR]) 7 December 2023 (2023-12-07) examples 2-A3 ----- - / - -				1 - 68
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.					
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family					
Date of the actual completion of the international search 8 January 2025			Date of mailing of the international search report 28/01/2025		
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016			Authorized officer Bader, Karl Günther		

INTERNATIONAL SEARCH REPORT

International application No

PCT/BR2024/050481

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DATABASE GNPD [Online] MINTEL; 21 November 2023 (2023-11-21), anonymous: "Conditioner", XP093171949, Database accession no. 11283226 abstract -----	1 - 68
Y	DATABASE GNPD [Online] MINTEL; 21 November 2023 (2023-11-21), anonymous: "Shampoo", XP093171945, Database accession no. 11283224 abstract -----	1 - 68

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/BR2024/050481

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2023232840 A1	07-12-2023	FR 3136161 A1 WO 2023232840 A1	08-12-2023 07-12-2023
WO 2023164280 A1	31-08-2023	EP 4486289 A1 US 2023285256 A1 WO 2023164280 A1	08-01-2025 14-09-2023 31-08-2023
WO 2023232894 A1	07-12-2023	FR 3136163 A1 WO 2023232894 A1	08-12-2023 07-12-2023