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(54) Title: METHODS FOR TREATING KERATIN FIBERS WITH OSMOLYTES, CARBOXYLIC ACID AND AMINO ACIDS

(57) Abstract: The disclosure relates to compositions and methods for treating curly hair, for example for enhancing or reshaping curls or waves. The compositions comprise (a) at least one amino acid, (b) at least one osmolyte, (c) at least one carboxylic acid, and (d) at least one solvent. The methods comprise applying the compositions to the hair.



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TECHNICAL FIELD

The present disclosure relates to compositions and methods for treating curly hair, for example for enhancing curls, reshaping curls, or preventing, reducing, and/or repairing damage to curly hair.

BACKGROUND

Consumers desire to have healthy, strong hair. However, various hair treatments, such as those for changing or enhancing the appearance of hair, e.g., by changing the color, style, and/or shape of the hair, are known to damage hair. Additionally, repeated styling can lead to damaged hair, for example due to repeated use of heat and styling tools. All of these processes can break bonds within the hair fibers, which if not reformed results in damaged hair.

Further, 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.

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 or relaxing 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, 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 curly or wavy, such damage also tends to manifest as loss of curl shape and/or curl definition. As such, consumers seek compositions and processes for preventing or minimizing such damage and/or for repairing hair that has been damaged by these treatments and processes. In addition, consumers with curly or wavy hair desire compositions and processes that restore and/or enhance curl shape and/or definition.

However, formulating compositions that satisfactorily address these issues has proven to be challenging. For example, some compositions that attempt to address the problem of damage 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 compositions attempt to address the damage within the hair fiber, but to date have not been satisfactory.

The present inventors have now discovered a synergistic combination of components that is surprisingly effective for preventing or minimizing hair damage and treating damaged hair and restoring or enhancing curl shape. Hair treated with compositions according to the disclosure exhibit surprisingly reduced signs of damage including greater strength and/or decreased elasticity, and more visible curl shape and definition.

SUMMARY

The present disclosure relates to compositions and methods for treating curly or wavy 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 compositions comprise a synergistic combination of one or more amino acids, preferably one or more basic amino acids, one or more osmolytes, and one or more carboxylic acids, and the methods comprise applying a composition according to the disclosure to the hair. The compositions are preferably free or substantially free of silicone compounds.

In various embodiments, the disclosure relates to compositions for treating curly hair, the compositions comprising (a) at least one amino acid, (b) at least one osmolyte, (c) at least one carboxylic acid, and (d) at least one solvent. The compositions optionally further include (e) at least one film former. The pH of the 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.

In some embodiments the 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 composition. In further embodiments the 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 composition. In still further embodiments, the compositions comprise a mixture of basic, acidic, and/or neutral amino acids, for example the compositions may comprise arginine and serine. In various embodiments, the total amount of amino acids and salts thereof present in the 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 composition.

In some preferred embodiments, 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 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 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 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 various embodiments, the 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, relative to the total weight of the composition. In various embodiments, the 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 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 12% by weight, relative to the total weight of the composition.

In some embodiments, the 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%, more preferably from about 0.75% to about 8%, more preferably from about 1% to about 6%, and most preferably from about 1.5% to about 5% by weight, relative to the total weight of the composition.

The compositions may optionally also include at least one additional component chosen from fatty compounds, surfactants, thickening agents, or combinations thereof.

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 solvent, preferably comprising at least one polyol, and (e) optionally at least one additional component chosen from film formers, fatty compounds, surfactants, thickening agents, or combinations thereof. For example, in at least some embodiments, the 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 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 composition. The pH of the 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 composition. In some embodiments, the 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 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 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 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, and (e) optionally at least one film former, wherein the total amount of carboxylic acids and salts thereof ranges from about 2% to about 8%, and wherein all amounts are by weight, relative to the total weight of the composition. The pH of the 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 composition. In some embodiments, the 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 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 compositions include at least one additional component chosen from fatty compounds, surfactants, thickening agents, or combinations thereof. If present, the 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 composition. When the compositions comprise serine, the 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 compositions comprise serine, the 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.

The disclosure further relates to methods of treating hair, preferably curly or wavy hair, comprising applying a composition according to the disclosure to the hair. 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 show the structures of certain exemplary osmolytes that can be included in compositions according to the disclosure.

FIGS. 2A-2C show images of curly hair before and after treatment with a composition according to the disclosure.

FIGS. 3A-3B show images of previously bleached curly hair before and after treatment with a composition according to the disclosure.

FIG. 4 shows RUMBA 2D images of curly hair swatches that were treated with a composition according to the disclosure (2A) or a comparative composition (C1) after a bleaching process.

DETAILED DESCRIPTION

The disclosure relates to compositions and methods for treating hair, particularly curly or wavy hair, for example for reshaping curly hair and/or enhancing curl or wave recovery, and/or for repairing damaged hair, providing strength to the hair, and/or reducing elasticity of the hair fibers. Hair that has been treated with compositions and methods described herein surprisingly demonstrates recovery of curls that were noticeably diminished due to various hair treatments and processes.

I. COMPOSITIONS

The compositions that can be used for treating curly or wavy hair according to the present disclosure comprise (a) at least one amino acid, (b) at least one osmolyte, (c) at least one carboxylic acid, and (d) at least one solvent. The compositions may optionally comprise one or more additional components, such as film formers, fatty compounds, surfactants, thickening agents, or combinations thereof.

Amino Acids

Compositions according to the disclosure comprise at least one amino acid. Optionally, in various embodiments, compositions according to the disclosure 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, compositions include at least one basic amino acid.

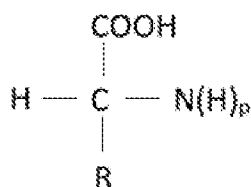
As used herein, the term “amino acid” includes amino carboxylic acids and salts thereof as well as amino sulfonic acids and salts thereof. As used herein, amino acids are understood to refer to organic compounds containing a carboxylic acid group (—COOH) (amino carboxylic acids) and/or sulfonic acid 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. 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 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 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 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 compositions according to the disclosure comprise one or more amino acids of formula (I):



(I)

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 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 (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.

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 (C1-C4)alkyl group, optionally substituted by one or more groups chosen from hydroxyl (–OH), amino (–NH₂), –CONH₂, –NH–C(NH)–NH₂, or an imidazole ring. In some embodiments p is preferably 2.

In some embodiments, the compositions comprise one or more amino acids chosen from arginine, glycine, proline, methionine, serine, 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 composition consist essentially of or consist of amino acids chosen from arginine, glycine, proline, methionine, serine, 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 compositions may comprise, consist essentially of, or consist of glycine and/or salts thereof. In other embodiments, the amino acid(s) useful in the compositions may comprise, consist essentially of, or consist of arginine and/or salts thereof. In other embodiments, the amino acid(s) useful in the 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 compositions may comprise, consist essentially of, or consist of

methionine and/or salts thereof. In other embodiments, the amino acid(s) useful in the 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 compositions may comprise, consist essentially of, or consist of arginine and/or salts thereof. In other
5 embodiments, the amino acid(s) useful in the 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 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 compositions may comprise, consist essentially of, or consist of basic
10 amino acids and/or salts thereof.

In various embodiments, the total amount of amino acids may range from 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
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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%, or about 4.5% to about 5% by weight, relative to the total weight of the 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 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 composition, including all ranges and subranges using any of the foregoing as upper and lower limits. In some preferred embodiments, the compositions comprise a total amount of basic amino acids in any of the foregoing ranges and amounts.

In one preferred embodiment, the 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 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 composition. In a further preferred embodiment, arginine is the only the basic amino acid in the composition.

In various preferred embodiments, the 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 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 composition, including all ranges and subranges using any of the foregoing as upper and lower limits.

In another preferred embodiment, compositions according to the disclosure 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 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 composition. For example, in some preferred embodiments, the compositions may comprise serine in an amount 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 composition, including all ranges and subranges using any of the foregoing as upper and lower limits.

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 compositions according to the

disclosure, and to choose total amounts of basic amino acids and serine such that the 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 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 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 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.

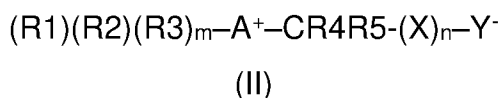
Osmolytes

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 sugars and sugar alcohols (polyols), polyamines, betaines, methylsulfonium compounds (e.g., dimethylsulfonopropionate), and urea. For purposes of this disclosure, "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.

Compositions according to the disclosure comprise one or more osmolytes, preferably one or more organic osmolytes. In some embodiments, the compositions comprise more than one osmolyte. Without intending to be bound by

theory, it is believed that the use of osmolytes according to the disclosure 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.

5 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:



10 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;
- 15 - 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[–];

20 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 ($-NH_2$), $-SH$, $-COOH$, or $-CONH_2$.

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. 1A-1B. As shown in FIG. 1A, in some embodiments the compounds of formula (II) are in zwitterionic form, and as shown in FIG. 1B, 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. 1A-1B, 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).

5 In some preferred embodiments, compositions according to the disclosure comprise at least one compound of formula (II). In additional preferred embodiments, compositions according to the disclosure 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
10 as from 2 to 10 carbon atoms, or from 3 to 8 carbon atoms.

 In some preferred embodiments, compositions according to the disclosure comprise at least one compound of formula (II) wherein R1 = R2 = methyl; A is N; and/or Y is COO⁻. In some other preferred embodiments, compositions according to the disclosure comprise at least one compound of formula (II) wherein R3
15 is methyl. In other preferred embodiments, compositions according to the disclosure 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, compositions according to the disclosure
20 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, compositions according to the disclosure comprise at least one compound of formula (II) wherein R4 and R5, which
25 may be the same or different, are chosen from a hydrogen atom, a saturated, linear or branched (C1-C10) alkyl group, preferably (C1-C6)alkyl, more preferably (C1-C4) 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
30 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, -CONH₂; more preferably where R4 is hydrogen and/or where R5 is a hydrogen atom or a saturated, linear or branched (C1-C6)alkyl, more preferably (C1-C4) alkyl; optionally substituted by one group chosen from hydroxyl (-OH), amino

($-\text{NH}_2$), $-\text{COOH}$, or $-\text{CONH}_2$. In some preferred embodiments, when A is N and $m = 0$, 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 further preferred embodiments, $\text{R}_1 = \text{R}_2 = \text{methyl}$, A is N, Y is $\text{COO}-$, 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 composition comprises at least one compound of formula (II) wherein $\text{R}_1 = \text{R}_2 = \text{R}_3 = \text{methyl}$; A is N; Y is $\text{COO}-$; 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 composition comprises, consists essentially of, or consists of one or more of the compounds shown in FIGS. 1A-1B. In more preferred embodiments, compositions according to the disclosure 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 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 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%, 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 composition. For example, the total amount of osmolytes present in the 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 composition, including all ranges and subranges using any of the foregoing as upper and lower limits.

In preferred embodiments the compositions comprise at least one betaine, and the total amount of betaines ranges from about 0.5% to about 5%, for 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 composition, including all ranges and subranges using any of the foregoing as upper and lower limits.

In a particularly preferred embodiment, the composition comprises 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 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 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 amino acids and osmolytes to provide a weight ratio of the total amount of amino acid(s) and salts thereof in the composition to the total amount of osmolytes in the 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, 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 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 composition to the total amount of osmolytes in the composition may be 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, or about 2.5, including all ranges and subranges using any of the foregoing as upper and lower limits.

In some embodiments, the compositions comprise a total amount of amino acids chosen from compounds of formula (I) and a total amount of osmolytes
5 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 composition may
10 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 composition may be about
15 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, or about 2.5, including all ranges and subranges using any of the foregoing as upper and lower limits.

In a particularly preferred embodiment, the composition comprises arginine and glycine betaine and has a weight ratio of arginine to glycine betaine of
20 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. In another particularly preferred embodiment, the composition comprises arginine, serine, and glycine betaine and has
25 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.

Carboxylic Acids

30 Compositions according to the disclosure include at least one carboxylic acid. Optionally, the compositions may comprise at least two carboxylic acids, at least three carboxylic acids, etc. According to various embodiments of the disclosure, 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 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 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 monocarboxylic 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

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 dicarboxylic 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 more thereof. In some embodiments, the 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 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 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 alkaline earth metal salts, such as sodium citrate and/or sodium tartrate; and 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 composition. For example, in some embodiments, the total amount of carboxylic acids ranges from about 1% to about 15%, such as 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%,
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
20 of the composition.
25
30

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 composition. For example, in some preferred embodiments, the 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 composition.

It may be advantageous in some embodiments to choose amounts of amino acids and carboxylic acids such that the 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 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 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 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

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

In preferred embodiments, the solvent includes water. In certain embodiments, the composition comprises from about 50% to about 98% of water, by weight, relative to the total weight of the composition. In certain embodiments, the composition comprises water in an amount ranging from about 50% to about 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 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 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 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.

Preferably, the 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 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 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-

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 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 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, 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 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 composition. In some preferred embodiments, the solvent comprises water and at least one non-aqueous solvent, preferably chosen from polyols. In some embodiments, the 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 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.

Film Formers

Optionally, compositions according to the disclosure may comprise at least one film former. In a preferred embodiment, compositions according to the disclosure include at least one film former. As used herein, the terms “film former,”
5 “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
10 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,
15 starches, gums, or combinations of two or more of the foregoing.

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, or phosphoric acid and have a number-average molecular weight of ranging from about
20 500 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 monoethylenic monomer such as ethylene, styrene, vinyl esters, acrylic or methacrylic
25 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, or copolymers of methacrylic acid and of methyl methacrylate; (B) crotonic acid
30 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 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 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 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 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 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 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 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
5 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
10 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*-
15 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
20 such as N,N-dimethylaminopropylamine or by semiesterification with an N,N-dialkylaminoalkanol.

In preferred embodiments, the 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
25 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
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);
5 vinylactam copolymers, such as a poly(vinylpyrrolidone/vinylactam) 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
10 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).

Non-limiting examples of polysaccharides that can be chosen include oxidized inulins, celluloses, starches, guar gums, xanthan gums, pullulan gums,
15 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,
20 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.

25 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
30 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.

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 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 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 composition.

Surfactants

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

Although the compositions may optionally include one or more anionic surfactants and/or nonionic surfactants, in at least some embodiments, the compositions are free or substantially free of anionic surfactants and/or nonionic surfactants. For example, in some embodiments the 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 compositions comprise at least one cationic surfactant. 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 composition according to the disclosure.

Non-limiting examples of useful cationic surfactants include alkylamidoamines and esterquats, such as, for example, brassicamidopropyl dimethylamine, lauramidopropyl dimethylamine, myristamidopropyl dimethylamine, stearamidopropyl dimethylamine, cocamidopropyl dimethylamine, ricinamidopropyl dimethylamine, isostearamidopropyl dimethylamine, oleamidopropyl dimethylamine, behenamidopropyl dimethylamine, palmamidopropyl dimethylamine, behentrimonium chloride, cetrimonium chloride, 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, 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 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.

If present, the total amount of cationic surfactants may range up to 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 composition. For example, the total amount of cationic surfactants may range from about 0.001% to about 10%, from about 0.01% to about 8%, from about 0.1% to about 6%, or from about 0.5% to about 4% by weight, relative to the total weight of the composition. In at least some preferred embodiments, the 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 composition.

In at least some embodiments, the 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 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, sodium lauroamphohydroxypropylsulfonate, sodium

lauroamphopropionate, sodium cornamphopropionate, sodium lauriminodipropionate, ammonium cocaminopropionate, ammonium cocaminodipropionate, ammonium cocoamphoacetate, ammonium cocoamphohydroxypropylsulfonate, ammonium cocoamphopropionate, ammonium cornamphopropionate, ammonium lauraminopropionate, ammonium lauroamphoacetate, ammonium lauroamphohydroxypropylsulfonate, ammonium lauroamphopropionate, ammonium cornamphopropionate, ammonium lauriminodipropionate, triethanolamine cocaminopropionate, triethanolamine cocaminodipropionate, triethanolamine cocoamphoacetate, triethanolamine cocoamphohydroxypropylsulfonate, triethanolamine cocoamphopropionate, triethanolamine cornamphopropionate, triethanolamine lauraminopropionate, triethanolamine lauroamphoacetate, triethanolamine lauroamphohydroxypropylsulfonate, triethanolamine lauroamphopropionate, triethanolamine cornamphopropionate, triethanolamine lauriminodipropionate, cocoamphodipropionic acid, disodium caproamphodiacetate, 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.

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, 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 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 composition. For example, the total amount of amphoteric surfactants may range from about 0.001% to about 6%, from about 0.01% 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 composition. In at least some embodiments, the compositions are free or substantially free of amphoteric surfactants.

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.

Fatty Compounds

Optionally, 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.

In some embodiments, compositions according to the disclosure 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 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 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.

5 In some embodiments, compositions according to the disclosure 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 alkoxyated or non-
10 alkoxyated, 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
15 alcohol, or combinations of two or more thereof. In some preferred embodiments, the 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
20 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
25 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
30 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,

5 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-octyldodecyl palmitate, alkyl myristates such as isopropyl, butyl, cetyl, 2-octyldodecyl, myristyl or
10 stearyl myristate, hexyl stearate, butyl stearate, isobutyl stearate, dioctyl malate, hexyl laurate, 2-hexyldodecyl 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
15 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
composition comprises at least one fatty acid ester and/or fatty alcohol ester, for example pentaerythrityl tetraisostearate.

In some embodiments, compositions according to the disclosure comprise at least one wax. Non-limiting examples of waxes that can be used include
20 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
25 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 compositions comprise a wax component that
30 comprises, consists essentially of, or consists of cetyl esters.

In some embodiments, the 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, ucuuba butter, 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.

In some preferred embodiments, the fatty compound does not include silicones. In some preferred embodiments, the compositions comprise at least one fatty alcohol, at least one fatty acid, at least one natural wax, at least one vegetable oil/butter, at least one fatty acid ester, and/or at least one fatty alcohol ester. In some preferred embodiments, the fatty compound comprises, consists essentially of, or consists of ucuuba butter, pentaerythrityl tetraisoostearate, lauric acid, cetearyl alcohol, and/or cetyl esters.

If present, the total amount of fatty compounds in the 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 composition. In some preferred embodiments, the 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 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 composition.

Thickening Agents

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 associate colloids, such as bentonite, colloidal silicon dioxide, and microcrystalline cellulose, celluloses such as hydroxyethylcellulose and hydroxypropylcellulose, and guar gums such as hydroxypropyl guar.

In some embodiments, the thickening agent may be chosen from 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.

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 composition.

Auxiliary Components

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 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 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 compositions may be in any suitable form. For example, the compositions may be a liquid, a gel, a gel cream, a high-, medium- or low-density cream, a serum, a lotion, etc.

II. METHODS

The disclosure further relates to methods of treating hair, particularly curly or wavy hair. The methods of treating hair may be methods of restoring or enhancing curl shape and/or definition. Surprisingly, the curl shape and/or definition obtained with compositions according to the disclosure may be long-lasting. 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 methods of treating hair may be methods for reducing or preventing hair damage, protecting hair from damage, restoring hair fiber moisture equilibrium, providing hair fiber strength, improving hair fiber elasticity, 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 composition according to the disclosure (a "curl-enhancing composition") onto the hair, optionally leaving the composition on the hair for a period of time ("processing time," "resting period," or "leave-in period"), and optionally rinsing the 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 to treat the hair.

The leave-in period may last for a period of time deemed appropriate to allow the active agents to provide benefits to the hair, such as about 30 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
5 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 8 hours, from about 8 hours to about 24 hours, from about 8 hours to about 12 hours, etc. For example, a leave-in time may be overnight,
10 or may be until the hair is next rinsed or shampooed in the user's ordinary course of hygiene.

Although not required, methods of using compositions according to the disclosure may also include a step of heating the hair to which the composition has been applied, for example during the resting period while the composition is on the
15 hair. For example, a blow dryer, hood dryer, etc., may be used.

At least in some embodiments, hair that can be treated according to the methods described may be hair that has been previously bleached, dyed, straightened, relaxed, etc. It will be understood that hair which is treated according to various methods described herein can be hair that was previously subjected to such chemical
20 treatments and is therefore in need of repair, curl reshaping, curl enhancing, or the like. Thus, the methods may occur within any period of time after such chemical treatment that the repair, curl reshaping, curl enhancing, etc., benefits are desired. For example, the methods may occur within six months of a chemical treatment such as a bleaching, dyeing, straightening, relaxing, etc., treatment, such as within five months,
25 within four months, within three months, within two months, within one month, within three weeks, within two weeks, within one week, within five days, within four days, within three days, within two days, within one day, within 12 hours, within 8 hours, within 6 hours, within 4 hours, within 2 hours, or within 1 hour after such treatment. The time period within which the methods according to the disclosure are contemplated to
30 be implemented is not limited.

In one exemplary embodiment, a 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

composition to wet, damp, or dry hair, leaving the composition on 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.

5 In further exemplary embodiments, a 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 composition according to the disclosure to wet, damp, or dry hair, leaving the 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), preferably with
10 intermediate rinsing of the hair, applying a chemical treatment such as a bleaching, dyeing, straightening, relaxing, or permanent waving composition 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),
15 preferably with intermediate rinsing of the hair, applying a composition according to the disclosure to the hair. Thus, it is contemplated that compositions according to the disclosure 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
20 compositions into chemical treatment processes, the curl or wave shape or definition can be preserved.

Surprisingly, hair treated with compositions and methods according to the disclosure has less damage than hair not treated with compositions and methods according to the disclosure, and correspondingly greater curl retention or recovery.
25 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 compositions and methods according to the disclosure may have lower elasticity and/or greater tensile strength than hair similarly
30 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.

5 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
10 “a salt thereof” also relates to “salts thereof.” Thus, where the disclosure 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
15 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.

20 As used herein, the term “salts” referred to throughout the disclosure 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
25 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
30 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 disclosure, 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 composition, i.e. is present in an amount greater than 0%.

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 compositions of the present disclosure, 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 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.

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

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.

5 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 compositions of the disclosure, in any manner. It may also mean contacting the hair in an effective amount.

10 The term “treating hair” (and its grammatical variations) as used herein refers to the application of the 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 compositions of the present disclosure.

15 As used herein, the terms “enhancing curls,” “enhancing curl recovery,” “reshaping curls,” “reshaping curly hair,” or the like, are intended to mean that the 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 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 compositions and methods according to the disclosure is due to the 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.

20 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.

30 For purposes of the present disclosure, 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.

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 disclosure 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 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-1B according to the disclosure were prepared as shown in Table 1.

TABLE 1

	1A	1B
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

Compositions 1A and 1B include a combination of amino acids (arginine), osmolytes (trimethyl glycine), carboxylic acids (citric acid), esters (pentaerythrityl tetraisostearate), surfactants, and fatty compounds.

Example 2 – Evaluation of Curl Recovery and Cosmetic Benefits

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

Example 2A – Leave-on Treatment

Equal amounts of either composition 1A or 1B 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. 2C shows the swatches prior to treatment, and FIGS. 2A-2B show the swatches after treatment with compositions 1A and 1B, respectively. As FIGS. 2A-2C demonstrate, the degree of curl and curl definition restored to the hair with treatment according to the disclosure is significant. In addition, the swatches have significant reduction in frizziness and volume, and increased shine and smoothness.

Example 2B – Rinse-off Treatment

Equal amounts of composition 1B 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. 3A shows images of three swatches bleached according to a standard bleaching protocol at room temperature (27°C) before and after treatment with composition 1B, and FIG. 3B shows images of three swatches bleached according to an accelerated bleaching protocol at increased temperature (37°C) before and after treatment with composition 1B. As FIGS. 3A-3B 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.

Example 2 demonstrates that compositions according to the disclosure surprisingly and unexpectedly restore curls and curl definition to damaged hair and provide cosmetic benefits to treated hair.

Example 3 – Compositions and Evaluation of Curl Recovery

Composition 2A according to the disclosure, and comparative composition C1, were prepared as shown in Table 2.

TABLE 2

	2A	C1
Glycine betaine	1.88	
Basic amino acids	3.75	
Citric acid	5.46	0.18
Cationic surfactants	2.85	2.85
Esters	2.00	2.00
Fatty compounds (waxes, vegetable oils/butters, fatty alcohols)	7.00	7.00

	2A	C1
Thickeners	0.98	0.98
Nonionic surfactants	0.004	0.004
Additives (preservatives, fragrance)	≤ 2	≤ 2
Water and non-aqueous solvents	QS to 100	QS to 100

Compositions 2A and C1 are identical other than the presence of amino acids (arginine), osmolytes (trimethyl glycine), carboxylic acids (citric acid) in composition 2A. The compositions of Table 2 were used to conduct a study of the curl recovery benefits of compositions according to the disclosure.

5 Two swatches of curly hair were (T0) analyzed using a polarization imaging system that takes successive images of a hair sample illuminated with infrared LED and under several polarization states, using a rotating polarizer (RUMBA, Bossa Nova Technologies, LLC). The images give a modulated intensity on each pixel. The modulation is caused by the birefringence of the hair fiber and contains the angle
10 signature that can be extracted with the system's software to build an orientation image of the sample. The orientation data can be mapped onto a 2D image to visualize the whole sample. From this orientation data, a coefficient that relates to straightness of the hair can be defined – the straighter the hair fibers in the swatch, the closer to a single angle value the distribution of the orientation will be. The standard deviation of
15 such a distribution is therefore inversely proportional to the perception of straightness. The same process is done for the alignment, where the alignment of a hair swatch is defined as the hair fibers being “locally straight.” Thus, a straightness coefficient is defined on a small scale of the 2D mapping of the orientation, which allows for a straightness coefficient to be obtained on every pixel of the image.

20 Next, the swatches were shampooed with a commercially available shampoo, rinsed, and dried. The swatches were then 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 27°C for 50 minutes. The swatches
25 were rinsed, shampooed again, rinsed, and dried. The swatches were then subjected to a second bleaching treatment with the same mixture but processed at 27°C for 30 minutes, rinsed, shampooed, rinsed again, and dried. Once dry, the swatches were again analyzed with the RUMBA system (T1).

The swatches were then treated with equal amounts of either composition 2A or C1 which was left to rest on the hair and then rinsed. This process was repeated four times, for a total of five treatments, after which the swatches were again analyzed with the RUMBA system (T2). Finally, the swatches were shampooed and rinsed three times, and once more analyzed with the RUMBA system (T3).

FIG. 4 show images generated from the RUMBA system at each time point. As FIG. 4 clearly shows, the hair treated with composition 2A had significant curl recovery, whereas the composition treated with composition C1 had no curl recovery.

Example 3 therefore demonstrates that compositions according to the disclosure are surprisingly beneficial for restoring hair curls that may be lost as a result of damage to hair caused by harsh processes such as bleaching, dyeing, straightening, or the like.

Example 4 – Additional Compositions

The following compositions according to the disclosure can be prepared and are expected to similarly provide curl enhancing/reshaping benefits to curly hair.

TABLE 3

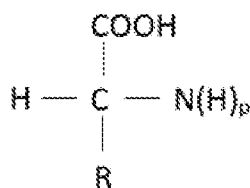
	3A	3B	3C	3D	3E
Arginine	2.0	9.8	2.5		
Lysine			2.5	2.0	10
Valine betaine	2.0	4.5	2.0	1.0	4.0
Citric acid			3	2.0	9.8
Lactic acid	2.0	10	2		
Serine	0.05	0.5		0.05	0.5
Fatty compound(s)	10	8.0		9.0	15
Cationic and/or amphoteric surfactant(s)	3.0		0.5	2.5	5.0
Additional component(s) (e.g. pH adjusters, vitamins, preservatives, extracts, thickeners)	< 5	< 5	< 5	< 5	< 5
Solvent(s) (water and/or non-aqueous solvents)	QS	QS	QS	QS	QS

The above examples demonstrate that the compositions and methods according to the disclosure surprisingly and unexpectedly restore curls to hair and repair hair that has been damaged.

SET OF CLAIMS

1. A method for enhancing curls, comprising:
- (i) applying a curl-enhancing composition to hair, comprising:
- a) at least one compound chosen from amino acids or salts thereof;
- b) at least one osmolyte;
- c) at least one compound chosen from carboxylic acids or salts thereof; and
- d) water, and
- (ii) optionally rinsing the hair.

2. The method of claim 1, wherein the curl-enhancing composition comprises a) at least one amino acid chosen from compounds of formula (I) or salts thereof:



(I)

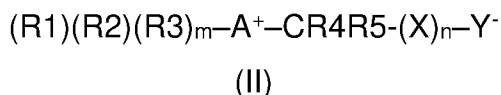
wherein:

- 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, 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, 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. The method of claim 1 or claim 2, wherein the curl-enhancing composition comprises 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. The method of any one of claims 1 to 3, wherein the curl-enhancing composition comprises 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:



5 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;

10 - 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:

15 ○ 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;

20 ○ 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

25 ○ 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.

30 5. The method of any one of claims 1 to 4, wherein the curl-enhancing composition comprises a) at least one basic amino carboxylic acid and b) at least one betaine.

6. The method of any one of claims 1 to 5, wherein the curl-enhancing composition comprises 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.

5 7. The method of any one of claims 1 to 6, wherein the curl-enhancing composition comprises b) at least one polyamine chosen from diamines, triamines, tetramines, pentamines, or combinations of two or more thereof.

8. The method of any one of claims 1 to 7, wherein the curl-enhancing composition comprises b) at least one compound of formula (II) chosen
10 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.

9. The method of any one of claims 1 to 8, wherein the curl-enhancing composition comprises b) at least one compound of formula (II) chosen
15 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
20 comprising glycine betaine.

10. The method of any one of claims 1 to 9, wherein the curl-enhancing composition comprises b) at least one compound of formula (II), wherein:

R1 and R2 are methyl;

A is N; and/or

25 Y is COO—.

11. The method of any one of claims 1 to 10, wherein the curl-enhancing composition comprises 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
30 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 method of any one of claims 1 to 11, wherein the total amount of amino acids and salts thereof in the curl-enhancing composition ranges from about

2% to about 15%, preferably from about 2.5% to about 12%, more preferably from about 3% to about 10%, and most preferably from about 3.5% to about 8% by weight, relative to the total weight of the composition.

13. The method of any one of claims 1 to 12, wherein the total amount
5 of osmolytes in the curl-enhancing composition ranges from about 0.5% to about 10%, preferably from about 1% to about 8%, more preferably from about 1% to about 5%, and most preferably from about 1.5% to about 3.5% by weight, relative to the total weight of the composition.

14. The method of any one of claims 1 to 13, wherein the total amount
10 of carboxylic acids and salts thereof in the curl-enhancing composition ranges from about 3% to about 15%, preferably from about 3% to about 12%, more preferably from about 3.5% to about 10%, and most preferably from about 4% to about 8% by weight, relative to the total weight of the composition.

15. The method of any one of claims 1 to 14, wherein the pH of the
15 curl-enhancing composition ranges from about 2 to about 6, preferably from about 2.5 to about 5, more preferably from about 2.5 to about 4.5, and most preferably from about 3 to about 4.

16. The method of any one of claims 1 to 15, wherein the curl-enhancing composition further comprises at least one film former.

20 17. The method of any one of claims 1 to 16, wherein the curl-enhancing composition comprises:

- 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
25 salts thereof;
- c) at least one compound chosen from citric acid, lactic acid, or salts thereof; and
- d) water and at least one polyol.

30 18. The method of any one of claims 1 to 17, wherein the curl-enhancing composition comprises:

- 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 or salts thereof;
- d) water and at least one polyol; and

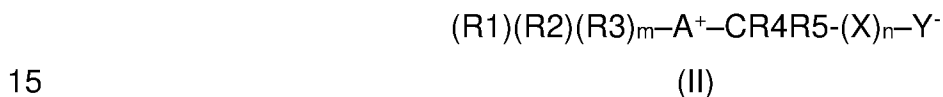
e) optionally at least one compound chosen from serine or salts thereof.

19. The method of any one of claims 1 to 18, wherein the curl-enhancing composition is rinsed from the hair after a leave-in period of time ranging from about 1 minute to about 24 hours.

20. The method of any one of claims 1 to 19, wherein the hair to which the curl-enhancing composition is applied is hair that has been bleached and/or dyed.

21. A method for enhancing curls, comprising:

- (i) applying a curl-enhancing composition to hair, comprising:
- 10 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;
- 20 - 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[–];

25 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
- 30

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;

c) at least one compound chosen from carboxylic acids or salts

10 thereof; and

d) water; and

(ii) optionally rinsing the hair.

22. The method of claim 21, wherein the curl-enhancing composition comprises b) at least one compound of formula (II) wherein:

15 R1, R2, and R3 are 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 methylene or ethylene;

20 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.

23. The method of claim 21 or claim 22, wherein the curl-enhancing composition comprises 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.

30

24. The method of any one of claims 21 to 23, wherein the curl-enhancing composition further comprises at least one film former.

25. The method of any one of claims 21 to 24, wherein the curl-enhancing composition further comprises at least one additional component chosen

from fatty compounds, surfactants, thickening agents, or combinations of two or more thereof.

26. The method of any one of claims 21 to 25, wherein the pH of the curl-enhancing composition ranges from about 2.5 to about 5, preferably from about 2.5 to about 4.5, more preferably from about 3 to about 4.

27. The method of any one of claims 21 to 26, wherein the total amount of amino acids and salts thereof ranges from about 2% to about 15%, preferably from about 2.5% to about 12%, more preferably from about 3% to about 10%, and most preferably from about 3.5% to about 8% by weight, relative to the total weight of the composition.

28. The method of any one of claims 21 to 27, wherein the total amount of osmolytes ranges from about 0.5% to about 10%, preferably from about 1% to about 8%, more preferably from about 1% to about 5%, and most preferably from about 1.5% to about 3.5% by weight, relative to the total weight of the composition.

29. The method of any one of claims 21 to 28, wherein the total amount of carboxylic acids and salts thereof ranges from about 3% to about 15%, preferably from about 3% to about 12%, more preferably from about 3.5% to about 10%, and most preferably from about 4% to about 8% by weight, relative to the total weight of the composition.

30. The method of any one of claims 21 to 29, wherein the curl-enhancing composition comprises:

- a) at least one compound chosen from basic amino acids or salts thereof;
- b) glycine betaine;
- c) at least one compound chosen from carboxylic acids having from 3 to 14 carbon atoms or salts thereof; and
- d) water and optionally at least one polyol.

31. The method of any one of claims 21 to 29, wherein the curl-enhancing composition comprises:

- a) at least one compound chosen from arginine or salts thereof;
- b) at least one osmolyte chosen from compounds of formula (II);
- c) at least one compound chosen from carboxylic acids having from 3 to 14 carbon atoms or salts thereof; and
- d) water and optionally at least one polyol.

32. The method of any one of claims 21 to 29, wherein the curl-enhancing composition comprises:

- a) at least one compound chosen from arginine or salts thereof;
- b) glycine betaine;
- 5 c) at least one compound chosen from carboxylic acids having from 3 to 14 carbon atoms or salts thereof, preferably chosen from citric acid, lactic acid, salts thereof, or combinations thereof;
- d) water and optionally at least one polyol; and
- e) optionally at least one film former.

10 33. The method of any one of claims 21 to 32, wherein the curl-enhancing composition is rinsed from the hair after a leave-in period of time ranging from about 1 minute to about 24 hours.

15 34. The method of any one of claims 21 to 33, wherein the hair to which the curl-enhancing composition is applied is hair that has been bleached and/or dyed.

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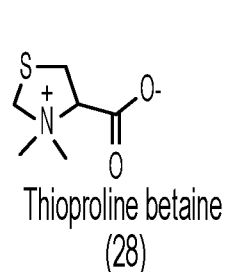
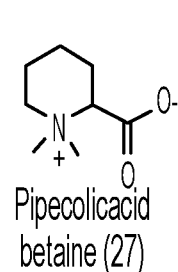
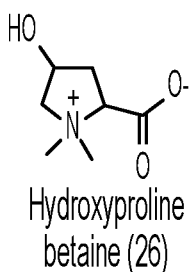
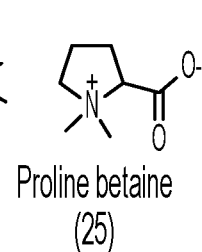
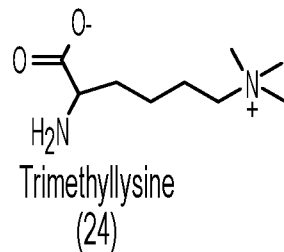
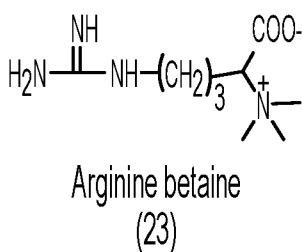
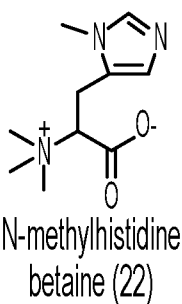
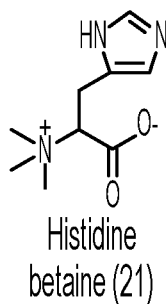
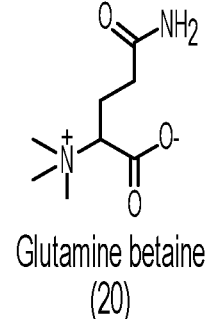
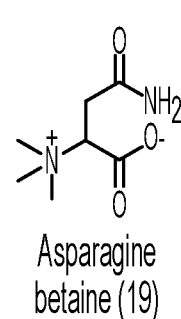
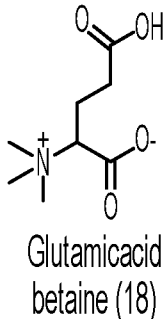
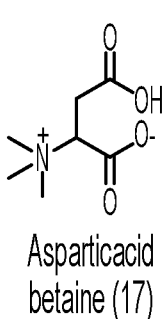
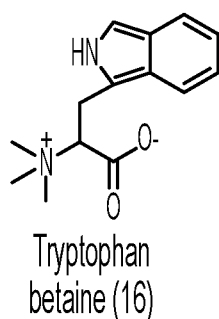
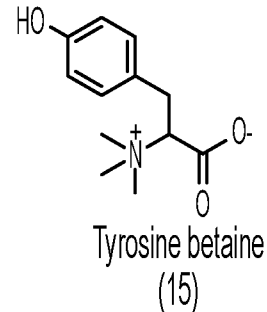
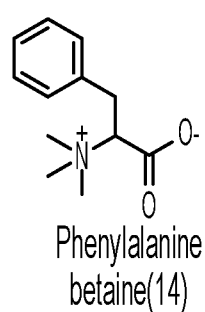
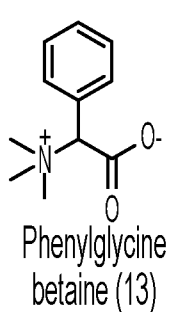
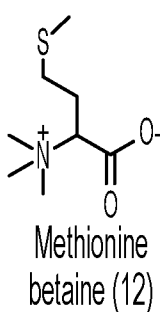
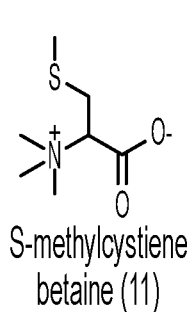
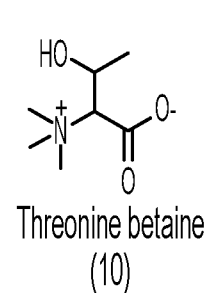
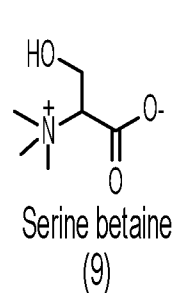
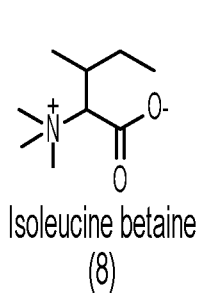
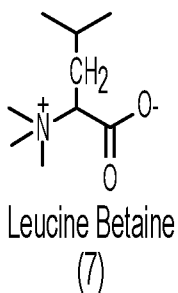
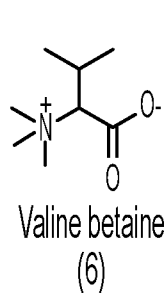
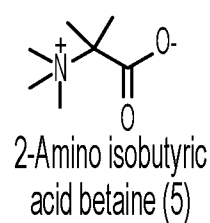
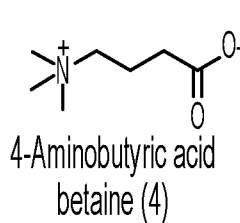
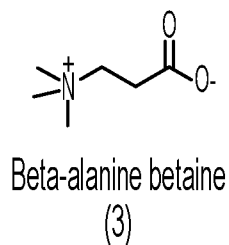
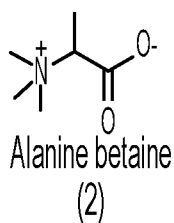
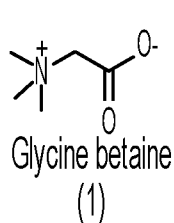


FIG. 1A

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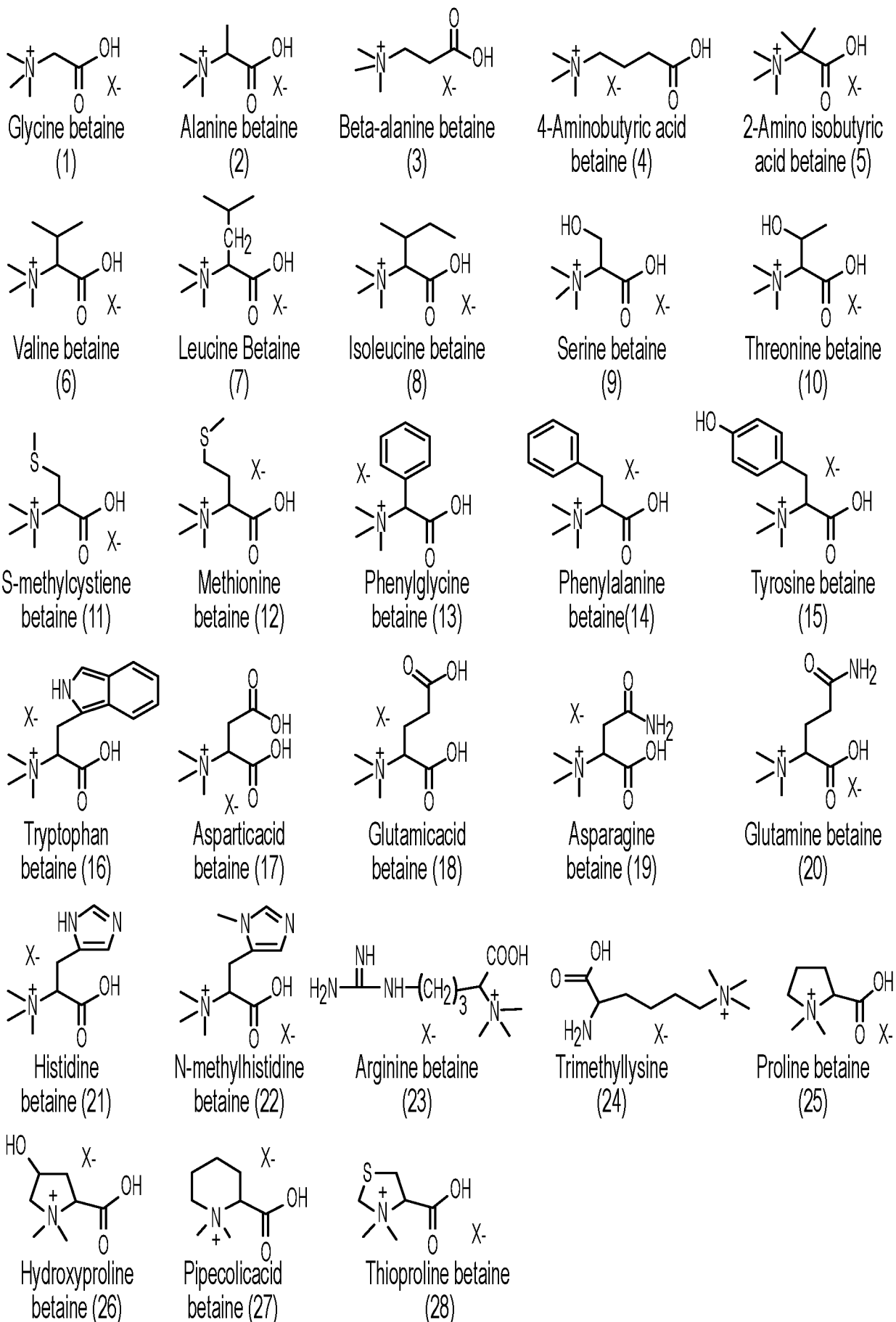


FIG. 1B



FIG. 2A

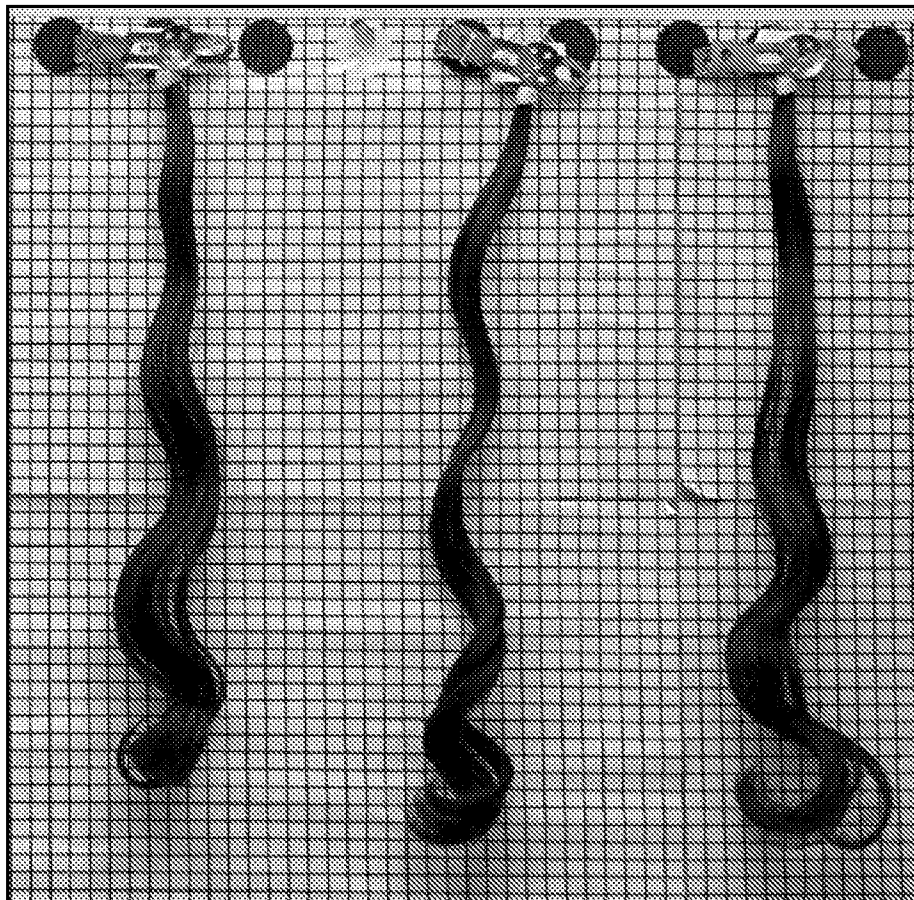
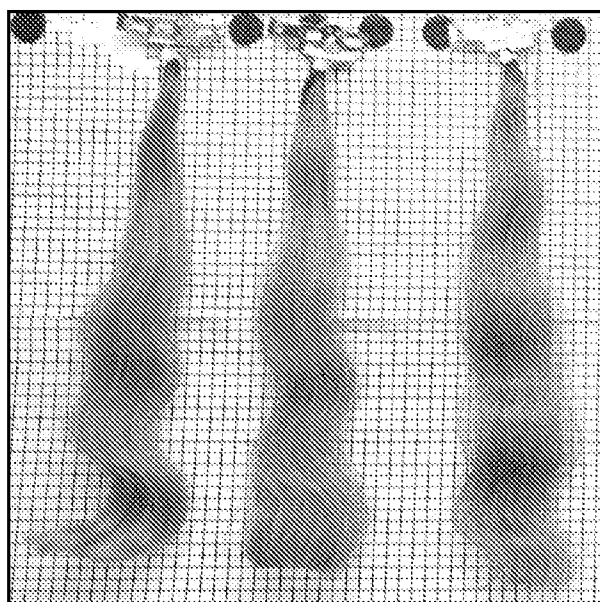


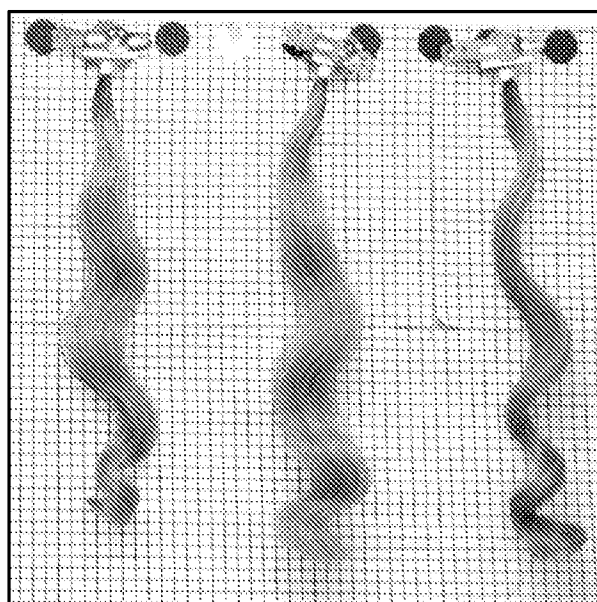
FIG. 2B



FIG. 2C

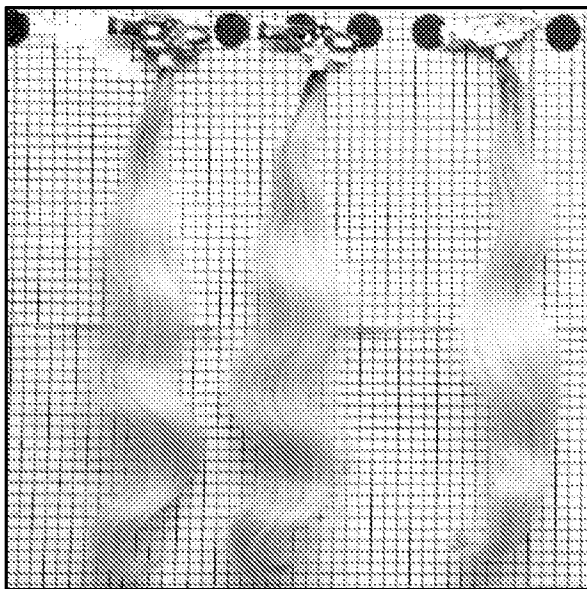


BEFORE TREATMENT

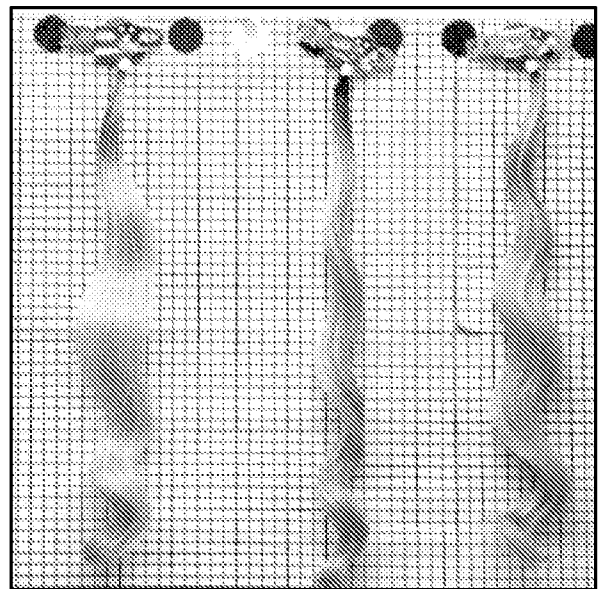


AFTER TREATMENT

FIG. 3A



BEFORE TREATMENT



AFTER TREATMENT

FIG. 3B

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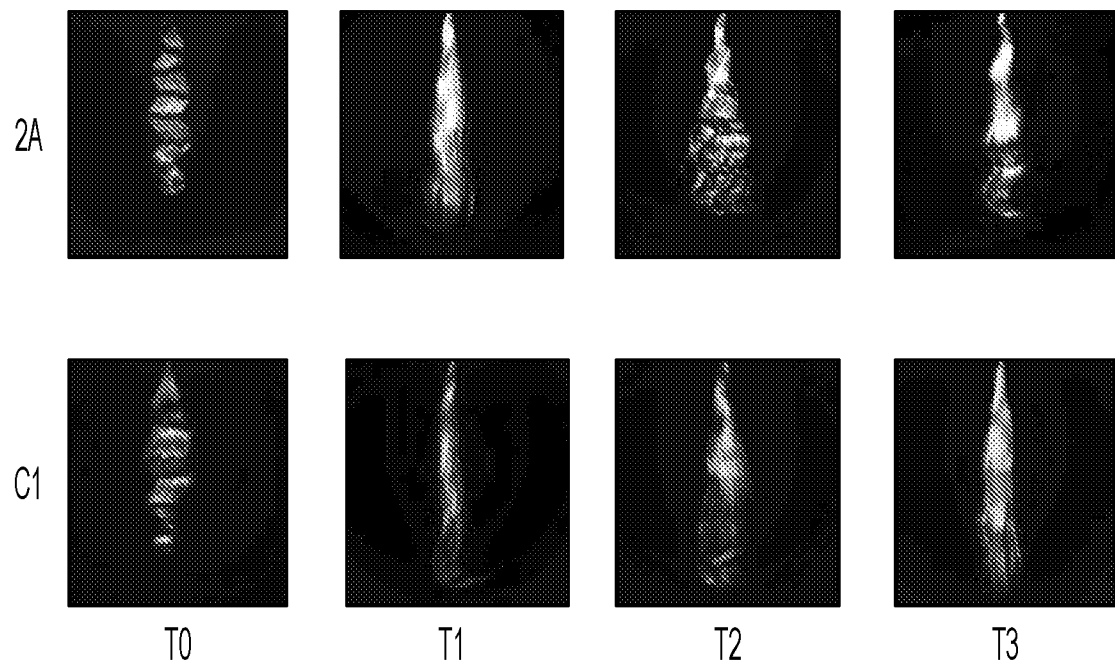


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/BR2023/050485

A. CLASSIFICATION OF SUBJECT MATTER		
INV.	A61K8/365	A61K8/41
	A61K8/60	A61Q5/00
		A61Q5/04
		A61Q5/06
		A61Q5/12
		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, CHEM ABS Data, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2023/232840 A1 (OREAL [FR]) 7 December 2023 (2023-12-07)	1 - 34
Y	page 45; claim 1; example 1B -----	1 - 34
X	WO 2023/164280 A1 (RUGHANI RONAK [US]; KHINE CHO CHO [US] ET AL.) 31 August 2023 (2023-08-31)	1 - 34
Y	claim 1; examples 5A, 5B, 6E, 6F -----	1 - 34
X	WO 2023/232894 A1 (OREAL [FR]) 7 December 2023 (2023-12-07)	1 - 34
Y	the whole document -----	1 - 34
	- / - -	
☒ 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		Date of mailing of the international search report
13 June 2024		05/07/2024
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/BR2023/050485

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE GNPD [Online] MINTEL; 21 November 2023 (2023-11-21), anonymous: "Conditioner", XP093171949, Database accession no. 11283226	1 - 34
Y	abstract -----	1 - 34
X	DATABASE GNPD [Online] MINTEL; 21 November 2023 (2023-11-21), anonymous: "Shampoo", XP093171945, Database accession no. 11283224	1 - 34
Y	abstract -----	1 - 34

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/BR2023/050485

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	US 2023285256 A1 WO 2023164280 A1	14-09-2023 31-08-2023
WO 2023232894 A1	07-12-2023	FR 3136163 A1 WO 2023232894 A1	08-12-2023 07-12-2023