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(54) METHOD FOR CURL REDUCTION OF KERATIN FIBERS

(57) The present invention is directed to a method for reducing curls on keratin fibers, preferably on human keratin fibers, more preferably on human hair, comprising the steps of i) selecting one or more curler(s) with a larger diameter than the curl diameter d_{curl} of the selected portion of the keratin fibers to be treated, ii) putting the selected portion of keratin fibers under mechanical tension on the selected one or more curler(s) of step i), iii) applying to the keratin fibers a chemical composition for semi-permanently or permanently reshaping of keratin fibers, iv) optionally covering keratin fibers with a moisture barrier, v) optionally heating the keratin fibers to a temperature in the range of 50°C to 230°C, vi) optionally applying an oxidative composition and optionally removing the moisture barrier from keratin fibers, vii) removing the one or more curler(s) from the keratin fibers, viii) rinsing-off the keratin fibers, wherein process steps ii), iii), and vii), viii) can be executed in either order.

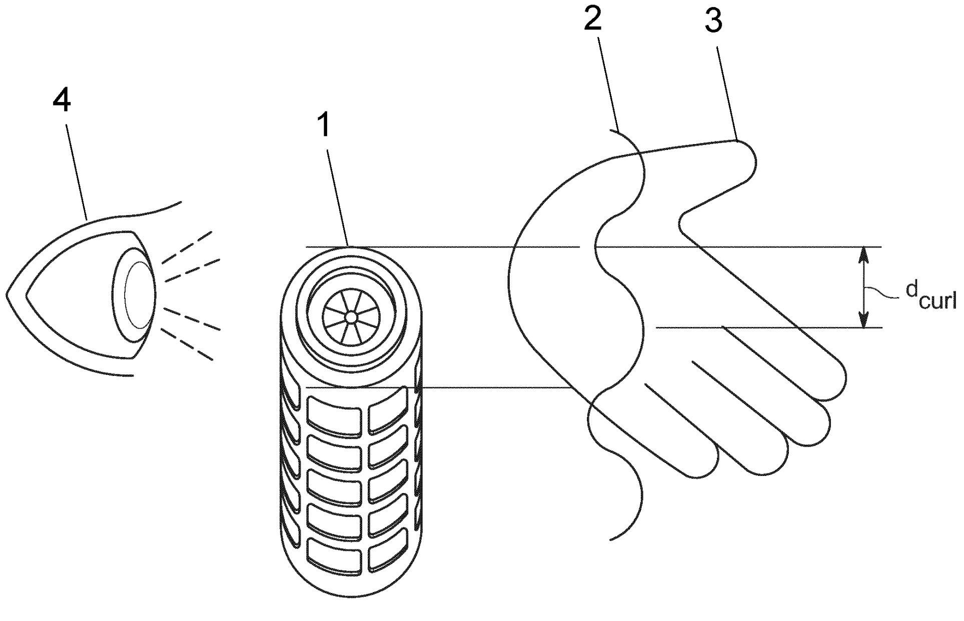


FIG. 1

Processed by Luminess, 75001 PARIS (FR)

Description

Field of the invention

[0001] The present application is directed to a method for curl reduction of keratin fibers.

Background of the invention

[0002] Current curl reduction processes usually involve certain types of straightening process, which typically involve the application of highly alkaline compositions comprising alkali hydroxides or acidic compositions comprising hydroxy carboxylic acids such as glyoxylic acid. Either way, the customer's hair is straight at the end of the treatment.

[0003] Alternatively, there are processes available that permanently or semi-permanently wave the hair. Such perming processes either require steps of reducing and later oxidizing the hair or applying moderately alkaline non-reducing, non-oxidizing compositions to hair in combination with a heating sequence as disclosed in WO2016/098870.

[0004] In summary, the customer has the choice between permanently straight hair and permanently waved hair. There is no process available that durably reduces the curling of hair while not completely straightening it.

[0005] Therefore, it is highly desirable to develop curl reducing processes that confer low damage to keratin fibers and permanently reduce curls while not completely straightening the hair.

Summary of the invention

[0006] Therefore, the object of the present invention is a method for reducing curls on keratin fibers, preferably on human keratin fibers, more preferably on human hair, comprising the steps of:

i) selecting one or more curler(s) with a larger diameter than the curl diameter d_{curl} of the selected portion of the keratin fibers to be treated,

ii) putting the selected portion of keratin fibers under mechanical tension on the selected one or more curler(s) of step i),

iii) applying to the keratin fibers a chemical composition for semi-permanently or permanently reshaping of keratin fibers,

iv) optionally covering keratin fibers with a moisture barrier,

v) optionally heating the keratin fibers to a temperature in the range of 50°C to 230°C,

vi) optionally applying an oxidative composition and optionally removing the moisture barrier from keratin fibers,

vii) removing the one or more curler(s) from the keratin fibers,

viii) rinsing-off the keratin fibers

wherein process steps ii), iii), and vii), viii) can be executed in either order.

Brief description of the figures

[0007]

Fig. 1 depicts the selection method of a larger curler size with respect to the size of the curls of the hair by the naked human eye.

Fig. 2 depicts the selection method of a larger curler size with respect to the size of the curls of the hair by measuring with a ruler.

Detailed description of the invention

[0008] The inventor of the present invention has unexpectedly and surprisingly found out that the process according to the claims delivered a curl reduction even though keratin fibers were treated with a perming process. The decisive factor was the selection of the curler size in relation to the curl size of the keratin fibers. Selecting a larger curler diameter with respect to the curl size delivered a curl reduction, which was durable, cosmetically appealing, and low damaging.

Curl reduction process

[0009] The present invention is directed to a method for reducing curls on keratin fibers, preferably on human keratin fibers, more preferably on human hair, comprising the steps of:

i) selecting one or more curler(s) (1) with a larger diameter than the curl diameter d_{curl} of the selected portion of the keratin fibers (2) to be treated,

ii) putting the selected portion of keratin fibers (2) under mechanical tension on the selected one or more curler(s) (1) of step i),

iii) applying to the keratin fibers (2) a chemical composition for semi-permanently or permanently reshaping of keratin fibers,

iv) optionally covering keratin fibers (2) with a moisture barrier,

v) optionally heating the keratin fibers (2) to a temperature in the range of 50°C to 230°C,

vi) optionally applying an oxidative composition and optionally removing the moisture barrier from keratin fibers (2),

vii) removing the one or more curler(s) (1) from the keratin fibers (2),

viii) rinsing-off the keratin fibers (2),

wherein process steps ii), iii), and vii), viii) can be executed in either order.

[0010] Fig. 1 illustrates the method to determine the mean curl diameter d_{curl} of the portion of keratin fibers to be treated by the naked human eye.

[0011] The operator of this method may be the customer, a stylist, or another user skilled in curling methods.

[0012] The operator follows the following steps to select one or more curler(s) (1) with a larger diameter than the curl diameter d_{curl} of the selected portion of the keratin fibers (2) to be treated:

x) holding the portion of keratin fibers (1) to be treated in the operator's hand (3) without applying force onto the keratin fibers,

xi) placing the curler (1) in an axial direction next to the portion of the keratin fibers (2) to be treated,

xii) comparing with the naked human eye (4) the diameter of the curler (1) with the distance d_{curl} between the infliction points I_1 and I_2 of two adjacent curls along the portion of keratin fibers (2) to be treated.

[0013] As an alternative to judging the diameter of the one or more curler(s) (1) by the naked human eye with respect to the curl diameter, measurements may be performed on the portion of keratin fibers to be treated. This aspect of the present invention is illustrated in Fig. 2.

[0014] Fig. 2 illustrates two options to ensure that the one or more curler(s) (1) have a larger diameter than d_{curl} of step i). Options a) and b) include the following steps:

xx) measuring on the portion of the keratin fiber to be treated (5) the distance $d_{1,2}$ between a first infliction point I_1 and the next adjacent infliction point I_2 corresponding to d_{curl} (option a)), or

xxi) measuring on the portion of keratin fibers (6) to be treated the distance $d_{1,n}$ between a number n of infliction points with respect to the first infliction point I_1 and dividing the received distance $d_{1,n}$ by the number n of infliction points to receive d_{curl} (option b)).

[0015] It is preferred from the viewpoint of curl reduction that the ratio of the diameter of the one or more curler(s) (1) in step i) to the curl diameter d_{curl} is 1.1 or higher, preferably 1.2 or higher, more preferably 1.5 or higher.

[0016] It is preferred from the viewpoint of accuracy of measurements that the curl diameter d_{curl} of step i) is/are measured with a ruler (7) by holding the portion of keratin fibers (5, 6) in the operator's hand (8) without applying mechanical force onto it.

[0017] By using any of the above-described methods, the first step of curl reduction is achieved by the selection of the appropriate diameter of the one or more curler(s) (1) which is close to the desired curl diameter upon completion of the entire process.

Permanent waving composition

[0018] It is preferred from the viewpoint of permanent reshaping performance that the chemical composition of step iii) is a permanent waving composition having a pH in the range of 3 to 12 and comprising one or more reducing agent(s).

[0019] The pH of the permanent waving composition may preferably be in the range of 4 to 11, more preferably in the range of 7.5 to 10.5. The pH may be adjusted with the known organic and/or inorganic acids and alkalizing agents (such as detailed below).

[0020] It is preferred from the viewpoint of reshaping performance that the permanent waving composition of step iii) may be left on the hair for a period of 1 to 60 min, preferably 2 to 45 min, more preferably 5 to 30 min, further more preferably 5 to 20 min at ambient temperature and without using any heat and/or heating device.

[0021] For this aspect of the present invention, the permanent waving composition comprises one or more reducing agent(s) selected from one or more sulfite salt(s) and/or hydrogen sulfite salt(s), thiogylcolic acid and/or its salts, cysteamine and/or its salts, thioglycerin and/or its salts, glycerol esters of thioglycolic acid and/or its salts, thiolactic acid and/or its salts, cysteine or homocysteine and/or its salts, and their mixtures.

[0022] It is preferred from the viewpoint of reshaping performance that the permanent waving composition of step iii) comprises one or more reducing agent(s) at a total concentration in the range of 0.1% to 30% by weight, still more preferably in the range of 0.25% to 25% by weight, still further more preferably 0.5% to 20% by weight, calculated to the total weight of the permanent waving composition.

[0023] It is preferred from the viewpoint of user convenience that the permanent waving composition is an aqueous composition, i.e., it preferably has a water content of 50% by weight or more, preferably of 70% by weight or more, calculated to the total weight of the permanent waving composition.

[0024] In case the method of the present invention is practiced with a permanent waving composition comprising one or more reducing agents, step vi) requires the application of an oxidative composition, preferably comprising hydrogen peroxide or a bromate salt. The oxidative composition is applied onto hair and left on the hair for 0.5 to 30 min, preferably 2 to 25 min, more preferably 3 to 20 min and further more preferably 5 to 15 min at ambient temperature without application of any heat and/or heating device.

[0025] The fibers are preferably rinsed off at the end of the above referred processing time. Optionally the oxidizing composition may also be left on the hair, i.e., not rinsed off from hair.

[0026] The total concentration of one or more oxidizing agents in the oxidizing composition, preferably hydrogen peroxide or bromate salt, is in the range of 0.1 to 15%, preferably 0.2 to 12.5%, more preferably 0.25 to 10% and most preferably 0.5 to 8% by weight, calculated to the total weight of the oxidizing composition.

[0027] In general, the pH of the oxidizing composition is in the range of 2 to 8. The pH of the composition is depending on the oxidizing agent of the composition. In case of hydrogen peroxide a pH in the range of 2 to 6 is suitable. In case of sodium bromate a pH of 5 to 8 is suitable. The pH of the composition may be adjusted using inorganic and/or organic acids and bases well known in the art.

Non-reducing, non-oxidative composition

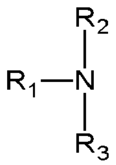
[0028] It is preferred from the viewpoint of damage reduction that the chemical composition for semi-permanently or permanently reshaping of keratin fibers of step iii) is a non-reducing, non-oxidative composition having a pH in the range of 7 to 12.

[0029] It is further preferred from the viewpoint of curl reduction that the non-reducing, non-oxidative composition of step iii) has a pH is in the range of 7.5 to 11, preferably in the range of 8.0 to 10.5, more preferably in the range of 8.25 to 10.

[0030] The term non-reducing denotes a composition comprising reducing agents at 1% by weight or less, preferably at 0.5% by weight or less, more preferably at 0.1% by weight or less, calculated to the total weight of the non-reducing, non-oxidative composition or permanent waving composition, further more preferably the non-reducing, non-oxidative composition is free of reducing agents.

[0031] The term non-oxidizing denotes a composition comprises oxidizing agents at 1% by weight or less, preferably at 0.5% by weight or less, more preferably at 0.1% by weight or less, calculated to the total weight of the non-reducing, non-oxidative composition, further more preferably the non-reducing, non-oxidative composition is free of oxidizing agents.

[0032] It is further preferred from the viewpoint of curl reduction that the non-reducing, non-oxidative composition or the permanent waving composition comprises one or more alkalizing agent(s), preferably ammonia and/or its salt(s), organic amine(s) and/or salt(s) of organic amines according to the following general structure:



wherein R_1, R_2, and R_3 are independently selected from H, linear C_1-C_6 alkyl which may be substituted with one hydroxyl group and/or sulfo group, or branched C_3-C_{12} alkyl or alkanol, wherein at least one of R_1, R_2, or R_3 is different from H, and/or their mixtures.

[0033] It is further preferred from the viewpoint of curl reduction that one or more alkalizing agent(s) of the non-reducing, non-oxidative composition or the permanent waving composition is/are ammonia and/or its salt(s), mono- and/or diethanolamine, butyl ethanolamine, butyl diethanolamine, dibutyl ethanolamine, methylethanolamine, triethanolamine, N-lauryl diethanolamine, diisopropanolamine, dimethyl isopropanolamine, isopropanolamine, triisopropanolamine, isobutanolamine, triethylamine, tris-(hydroxymethyl)-aminomethane, taurine, and/or aminomethyl propanol, and/or their salt(s), and/or their mixture(s).

[0034] The most preferred alkalizing agents of the non-reducing, non-oxidative composition is/are ammonia and/or its salt(s), monoethanolamine, triethanolamine, tris-(hydroxymethyl)-aminomethane, and/or aminomethyl propanol, and/or their salt(s), and/or their mixture(s).

[0035] It is preferred from the viewpoint of curl reduction that the total concentration of alkalizing agents in the non-reducing, non-oxidative composition or the permanent waving composition of step iii) is in the range of 0.1% to 25% by weight, preferably in the range of 0.5% to 20% by weight, more preferably in the range of 1% to 15% by weight, calculated to the total weight of the non-reducing, non-oxidative composition or the permanent waving composition.

[0036] It is further preferred from the viewpoint of cosmetic safety and curl reduction that the non-reducing, non-oxidative composition or the permanent waving composition comprises one or more thickening agent(s), preferably one or more thickening polymer(s), more preferably one or more anionic thickening polymer(s).

[0037] The preferred anionic thickening polymers from the viewpoint of cosmetic acceptance are carbohydrate-based thickening polymers and/or thickening polymer(s) comprising acrylate or methacrylate monomers, and/or their salt(s), and/or their mixtures.

[0038] Suitable anionic thickening polymers are copolymers and/or crosspolymers which comprise an acrylate and/or methacrylate monomer unit and optionally least one more hydrophobic unit such as alkyl chains. Examples are acrylates/c10-30 alkyl acrylate crosspolymer, acrylates/steareth-20 methacrylate copolymer, acrylates/stearyl acrylate/dimethicone methacrylate copolymer, acrylates/beheneth-25 methacrylate copolymer, acrylates/lauryl acrylate/stearyl acrylate/ ethylamine oxide methacrylate copolymer, Hydroxyethyl acrylate / sodium acryloyldimethyl taurate copolymer, carboxymethyl cellulose, alginic acids, sodium alginates, ammonium alginates, calcium alginates, gum arabic, guar gum or xanthan gum, dehydroxanthan gum or acrylic acid polymers known with the CTFA adopted name Carbomer and its derivatives.

[0039] The most preferred anionic thickening polymers are carbohydrate-based thickening polymers such as carboxymethyl cellulose, alginic acids, sodium alginates, ammonium alginates, calcium alginates, gum arabic, guar gum or xanthan gum, dehydroxanthan gum, and/or their salt(s), and/or their mixtures.

[0040] It is preferred from the viewpoint of cosmetic safety, user convenience, and composition stability that the total concentration of thickening agent(s), preferably the total concentration of thickening polymer(s), more preferably the total concentration of anionic thickening polymer(s) is in the range of 0.1% to 15% by weight, preferably in the range of 0.25% to 12.5% by weight, more preferably in the range of 0.5% to 10% by weight, calculated to the total weight of the non-reducing, non-oxidative composition or the permanent waving composition.

[0041] It is further preferred from the viewpoint of curl reduction that the non-reducing, non-oxidative composition or the permanent waving composition comprises one or more one or more lipophilic compound(s).

[0042] Preferably one or more lipophilic compound(s) is/are selected from C_{12}-C_{22} fatty alcohols, natural and/or vegetable oils, mineral oil, and fatty acid esters consisting of linear or branched, saturated or unsaturated fatty acids with C_{12} to C_{22} being esterified with linear or branched primary alcohols with C_3 to C_{12}, and/or silicones, and/or their mixtures.

[0043] The preferred lipophilic compound(s) is/are isopropyl palmitate, isopropyl laurate, octyl palmitate, isocetyl palmitate, octyl stearate, oleyl oleate, myristyl myristate, and/or their mixtures, the most referred ones are isopropyl palmitate and/or isopropyl laurate, and/or their mixtures.

[0044] It is preferred from the viewpoint of composition stability and curl reduction that the total concentration of lipophilic compound(s) in the non-reducing, non-oxidative composition or the permanent waving composition is in the range of 5% to 75% by weight, preferably 10% to 70% by weight, more preferably 15% to 60% by weight, further more preferably 20% to 50% by weight, still further more preferably 25% to 40% by weight, calculated to the total weight of the non-reducing, non-oxidative composition or the permanent waving composition.

[0045] The non-reducing, non-oxidative composition or the permanent waving composition may comprise one or more surfactant(s).

[0046] Suitably, such surfactants are anionic, non-ionic, amphoteric and/or zwitterionic, and/or cationic surfactants, and/or their mixtures.

[0047] Suitable anionic surfactants are selected from ethoxylated or non-ethoxylated alkyl ether sulfate surfactants, alkyl sulfates, ethoxylated and/or non-ethoxylated alkyl carboxylates, ethoxylated or non-ethoxylated amino acid surfactants, and/or their mixtures.

[0048] Suitable alkyl sulfate or preferably ethoxylated alkyl ether sulfate surfactant or mixtures thereof have an alkyl chain length of C_{10} to C_{22}.

[0049] Suitable example anionic surfactants are laureth sulfates, coceth sulfate, pareth sulfate, capryleth sulphate, myreth sulfate, oleth sulfate, deceth sulfate, trideceth sulfate, coco sulphate, C_{10}-C_{16} alkyl sulphate, C_{11}-C_{15} alkyl sulphate, C_{12}-C_{18} alkyl sulphate, C_{12}-C_{15} alkyl sulphate, C_{12}-C_{16} alkyl sulphate, C_{12}-C_{13} alkyl sulfate, lauryl sulphate, myrystyl sulphate, palm kernel sulphate, cetearyl sulfate, cetyl sulphate, decyl sulphate, oleyl sulphate, behenyl sulphate and/or their salts. All of the aforementioned anionic surfactants may or may not be ethoxylated at various degrees.

[0050] Cations for the surfactants may be selected from sodium, potassium, magnesium and/or ammonium.

[0051] Suitable non-ionic surfactants are alkyl polyglycosides, ethoxylated triglycerides, ethoxylated fatty alcohols, ethoxylated fatty acid esters, and/or their mixtures.

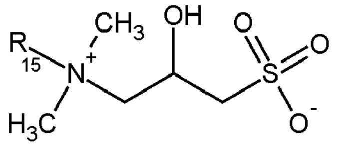
[0052] Preferred non-ionic surfactants are alkyl (poly)glycosides according to the general structure:

$$R_{23}O(R_{24}O)_tZ_x$$

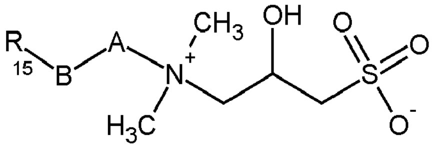
[0053] Wherein Z denotes a carbohydrate with C_5 to C_6, R_{23} is an alkyl group with C_8 to C_{18}, R_{24} is methyl, ethyl or propyl, t ranges from 0 to 10, and x ranges from 1 to 5. Suitable compounds according to this structure are C_9-C_{11} alkylpolyglycoside, the structures disclosed in EP-A 70 074, and JP 2015-123019A.

[0054] The most preferred compounds according to the structure of above are decyl glucoside, lauryl glucoside, and coco glucoside.

[0055] Suitable amphoteric/zwitterionic surfactants are compounds according to the general structure(s)



and/or



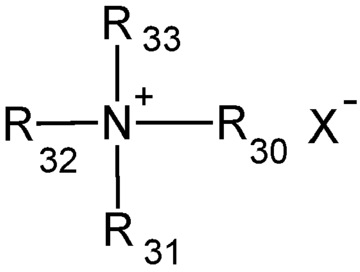
wherein R_{15} is a straight or branched, saturated or unsaturated, substituted or unsubstituted alkyl chain with a carbon number of C_{10} to C_{22}, preferably R_{15} is a straight alkyl chain with a carbon number of C_{10} to C_{16}, A is a straight alkyl chain with a carbon number of C_1 to C_6 or a branched alkyl chain with a carbon number of C_3 to C_6, preferably A is a linear alkyl chain with a carbon number of C_3, and B is an amide or an ester group.

[0056] Suitable compounds are known as hydroxysultaine surfactants, such as cocoamidopropyl hydroxysultaine, laurylamidopropyl hydroxysultaine, erucamidopropyl hydroxysultaine, lauryl hydroxysultaine, and cocoyl hydroxysultaine, and/or their salt(s).

[0057] Further suitable amphoteric/zwitterionic surfactants are of betaine type. Suitable compounds may be selected from alkyl betaines and/or alkylamido betaines. A preferred compound selected from alkyl betaines is lauryl betaine. A preferred compound selected from alkylamido betaines is cocamidopropyl betaine. The disclosure also relates to the salts of the compounds.

[0058] The preferred amphoteric/zwitterionic surfactant(s) is/are selected from alkylamido betaines and/or alkylamidoalkyl betaine surfactants.

[0059] Suitable cationic surfactants are of quaternary ammonium structure according to the following general structure



where R_{30} is a saturated or unsaturated, branched or linear alkyl chain with C_8-C_{22} or

R_{34} CO NH $(CH_2)_n$

where R_{34} is saturated or unsaturated, branched or linear alkyl chain with C_7-C_{21} atoms and n has typical value of 1-4 or

R_{35} CO O $(CH_2)_n$

where R_{35} is saturated or unsaturated, branched or linear alkyl chain with C_7-C_{21} atoms and n has typical value of 1-4, and

R_{31} is unsaturated or saturated, branched or linear alkyl chain with C_1-C_{22} atoms or

R_5 CO NH $(CH_2)_n$

or

R_6 CO O $(CH_2)_n$

where R_{34}, R_{35} and n are same as above.

[0060] R_{32} and R_{33} have an alkyl chain with C_1 to C_4, and X^- typically is chloride, bromide, or methosulfate.

[0061] Typical examples of those ingredients are cetyl trimethyl ammonium chloride, stearyl trimonium chloride, dipalmitoyl dimonium chloride, distearyl dimethyl ammonium chloride, stearamidopropyl trimethyl ammonium chloride, dioleoylethyl dimethyl ammonium methosulfate, dioleoylethyl hydroxyethylmonium methosulfate, behenyl trimethyl ammonium chloride, and/or their mixtures.

[0062] It is preferred from the viewpoint of composition stability that the total concentration of surfactants is 0.1% by weight or more, preferably 0.5% by weight or more, further more preferably 0.75% by weight or more, calculated to the total weight of the non-reducing, non-oxidative composition or the permanent waving composition.

[0063] It is preferred from the viewpoint of composition stability and cost of goods that the that the total concentration surfactants is 10% by weight or less, further more preferably 7% by weight or less, still further more preferably 5% by weight or less, calculated to the total weight of the non-reducing, non-oxidative composition or the permanent waving composition.

[0064] For attaining the above-mentioned effects, it is preferred that the total concentration of surfactants is in the range of 0.1% to 10% by weight, preferably 0.5% to 7% by weight, more preferably in the range of 0.75% to 5% by weight, calculated to the total weight of the non-reducing, non-oxidative composition or the permanent waving composition.

[0065] It is further preferred from the viewpoint of curl reduction that the keratin fibers are heated in step v) to a temperature in the range of 70°C to 210°C, preferably to a temperature in the range of 80°C to 180°C, more preferably to a temperature in the range of 90°C to 150°C.

[0066] It is further preferred from the viewpoint of curl reduction and user convenience that the keratin fibers in step v) are heated for a time period in the range of 1 min to 90 min, preferably for a time period in the range of 5 min to 60 min, more preferably for a time period in the range of 10 min to 45 min.

[0067] The following examples are to illustrate the present invention and not to limit it.

EXAMPLES

[0068] Curly hair was purchased from International Hair Importers & Products Inc., Glendale, New York, USA. Mean curl diameter d_{curl} of Indian frizzy hair (15 cm, 2 g per bundle) was determined with a ruler according to method b) with n=3. Curler diameters were selected as listed in table 1. The hair streaks were shampooed with a commercially available shampoo under the brand name Goldwell Deep Cleansing Shampoo. Then the streaks were towel dried. 1 g of the non-reducing, non-oxidizing composition detailed below was applied to each of the hair streaks with a brush. The streaks were then wound on curlers possessing an electrical heating system and the selected diameter. The rods were then heated to a temperature in the range of 90°C for 20 min with a digital perming machine. Then the rods were allowed to cool down, and the hair was shampooed with the same shampoo from above. The streaks were then blow-dried.

[0069] Assessment of curling efficiency was investigated by measuring and calculating the curl reduction efficiency S_E according to the formula:

$$S_E = (L_t - L_0)/(L_{max} - L_0) \times 100\%$$

wherein Lo is the length of the hair streak prior to curl reduction, Lt is the length of the hair streak after the curl reduction experiment, and L_{max} is the theoretically possible length of the hair streak determined by mechanically straightening the keratin fibers and measuring their length in elongated state. The number S_E is reported as percentage and a higher percentage corresponds to higher curl reduction degree. In addition, the curl reduction degree was qualitatively evaluated by the naked human eye.

Non-reducing, non-oxidizing composition

[0070]

	% by weight
Tris(hydroxymethyl)am inomethane	5.0
Isopropyl myristate	25.0
Decyl glucoside	5.0
Sodium lauryl sulfate	1.0
Acrylates copolymer	1.5
Styrene-ethylene-propylene-block copolymer	1.0
NaOH/HCl	ad pH 9.4
Water	ad 100.0

Table 1

Parameters/results	Comp. ex. 1	Inv. ex. 1	Inv. ex. 2
Mean curl diameter d_{curl} [mm]	26	26	26
Selected rod diameter [mm]	24	30	40
Rod diameter / d_{curl}	0.92	1.2	1.5
Curl reduction efficiency S_E [%]	61	72	83
Tress appearance	Wavy	Slightly wavy	Essentially Straight

[0071] Selecting a curler with a diameter below d_{curl} (comp. ex. 1) did not have a visual influence on the curly appearance of the hair streak. Selecting a curler diameter larger than d_{curl} (inv. ex. 1 and 2) reduced the curling of the hair. Inv. ex. 2 was essentially curl reduction with the inventive process.

Permanent waving composition

[0072]

	% by weight
Ammonium thioglycolate	10
Ammonium hydroxide	2
Water	to 100

[0073] The pH of the above composition was adjusted to pH 8.5.

Oxidizing composition

[0074]

Hydrogen peroxide	3
Phosphoric acid	q.s. to pH 3
Water	to 100

[0075] The curler selection was carried out as described above and the same type of curly hair was used. A hair streak weighing approximately 5 g and having a length of 20 cm was treated using the above compositions. Firstly, the streak was washed with a commercially available shampoo composition and towel dried. Afterwards, the streak was dipped into the aqueous reducing composition and left in the solution for 15 min and taken out and rinsed off with water. Afterwards, the streak was put on curlers. After 10 min, the streak was taken out and rinsed off and dipped into the oxidizing composition for 15 min and the curlers were taken off. It was observed that the streak had less curls in comparison to its state prior to the curl reduction treatment.

Claims

1. A method for reducing curls on keratin fibers, preferably on human keratin fibers, more preferably on human hair, comprising the steps of:

i) selecting one or more curler(s) (1) with a larger diameter than the curl diameter d_{curl} of the selected portion of the keratin fibers (2) to be treated,
ii) putting the selected portion of keratin fibers (2) under mechanical tension on the selected one or more curler(s) (1) of step i),
iii) applying to the keratin fibers (2) a chemical composition for semi-permanently or permanently reshaping of keratin fibers,
iv) optionally covering keratin fibers (2) with a moisture barrier,
v) optionally heating the keratin fibers (2) to a temperature in the range of 50°C to 230°C,
vi) optionally applying an oxidative composition and optionally removing the moisture barrier from keratin fibers (2),
vii) removing the one or more curler(s) (1) from the keratin fibers (2),
viii) rinsing-off the keratin fibers (2),

wherein process steps ii), iii), and vii), viii) can be executed in either order.

2. The method according to claim 1 **characterized in that** the one or more curler(s) (1) having a larger diameter than d_{curl} of step i) is/are selected by the following steps:

x) holding the portion of keratin fibers (1) to be treated in the operator's hand (3) without applying force onto the keratin fibers,
xi) placing the curler (1) in an axial direction next to the portion of the keratin fibers (2) to be treated,
xii) comparing with the naked human eye (4) the diameter of the curler (1) with the distance d_{curl} between the infliction points I_1 and I_2 of two adjacent curls along the portion of keratin fibers (2) to be treated.

3. The method according to claim 1 **characterized in that** the one or more curler(s) (1) having a larger diameter than d_{curl} of step i) is/are selected by the following steps:

xx) measuring on the portion of the keratin fiber to be treated (5) the distance $d_{1,2}$ between a first infliction point I_1 and the next adjacent infliction point I_2 corresponding to d_{curl}, or

xxi) measuring on the portion of keratin fibers (6) to be treated the distance $d_{1,n}$ between a number n of infliction points with respect to the first infliction point I_1 and dividing the received distance $d_{1,n}$ by the number n of infliction points to receive d_{curl}.

4. The method according to claim 3 **characterized in that** the ratio of the diameter of the one or more curler(s) (1) in step i) to the curl diameter d_{curl} is 1.1 or higher, preferably 1.2 or higher, more preferably 1.5 or higher.

5. The method according to any of claims 3 or 4 **characterized in that** the curl diameter d_{curl} of step i) is/are measured with a ruler (7) by holding the portion of keratin fibers (5, 6) in the operator's hand (8) without applying mechanical force onto it.

6. The method according to any of the preceding claims **characterized in that** the chemical composition of step iii) is a permanent waving composition having a pH in the range of 3 to 12 and comprising one or more reducing agent(s).

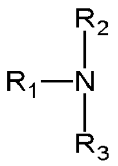
7. The method according to claim 6 **characterized in that** the permanent waving composition comprises one or more reducing agent(s) selected from one or more sulfite salt(s) and/or hydrogen sulfite salt(s), thiogylcolic acid and/or its salts, cysteamine and/or its salts, thioglycerin and/or its salts, glycerol esters of thioglycolic acid and/or its salts, thiolactic acid and/or its salts, cysteine or homocysteine and/or its salts, and their mixtures, more preferably the permanent waving composition comprises one or more reducing agent(s) at a total concentration in the range of 0.1% to 30% by weight, still more preferably in the range of 0.25% to 25% by weight, still further more preferably 0.5% to 20% by weight, calculated to the total weight of the permanent waving composition.

8. The method according to any of the claims 1 to 5 **characterized in that** the semi-permanent or permanent waving composition of step ii) is a non-reducing, non-oxidative composition having a pH in the range of 7 to 12.

9. The method according to any of the preceding claims **characterized in that** the non-reducing, non-oxidative composition comprises reducing agents at 1% by weight or less, preferably at 0.5% by weight or less, more preferably at 0.1% by weight or less, calculated to the total weight of the non-reducing, non-oxidative composition, further more preferably the non-reducing, non-oxidative composition is free of reducing agents.

10. The method according to any of the claims 8 to 9 **characterized in that** the semi-permanent or permanent waving composition of step iii) has a pH is in the range of 7.5 to 11, preferably in the range of 8.0 to 10.5, more preferably in the range of 8.25 to 10.

11. The method according to any of the preceding claims **characterized in that** the semi-permanent or permanent waving composition comprises one or more alkalizing agent(s), preferably the one or more alkalizing agent(s) is/are ammonia and/or its salt(s), organic amine(s) and/or salt(s) of organic amines according to the following general structure:



$$R_1-\overset{\displaystyle R_2}{\underset{\displaystyle R_3}{N}}$$

wherein R_1, R_2, and R_3 are independently selected from H, linear C_1-C_6 alkyl which may be substituted with one hydroxyl group and/or sulfo group, or branched C_3-C_{12} alkyl or alkanol, wherein at least one of R_1, R_2, or R_3 is different from H, and/or their mixtures, preferably one or more alkalizing agent(s) of the non-reducing, non-oxidative composition or permanent waving composition is/are ammonia and/or its salt(s), mono- and/or diethanolamine, butyl ethanolamine, butyl diethanolamine, dibutyl ethanolamine, methylethanolamine, triethanolamine, N-lauryl diethanolamine, diisopropanolamine, dimethyl isopropanolamine, isopropanolamine, triisopropanolamine, isobutanolamine, triethylamine, tris-(hydroxymethyl)-aminomethane, taurine, and/or aminomethyl propanol, and/or their salt(s), and/or their mixture(s), more preferably one or more alkalizing agent(s) of the non-reducing, non-oxidative composition or permanent waving composition is/are ammonia and/or its salt(s), monoethanolamine, triethanolamine, tris-(hydroxymethyl)-aminomethane, and/or aminomethyl propanol, and/or their salt(s), and/or their mixture(s).

12. The method according to any of the preceding claims **characterized in that** the total concentration of alkalizing agents in the semi-permanent or permanent waving composition of step ii) is in the range of 0.1% to 25% by weight, preferably in the range of 0.5% to 20% by weight, more preferably in the range of 1%to 15% by weight, calculated to the total weight of the semi-permanent or permanent waving composition.

13. The method according to any of the preceding claims **characterized in that** the semi-permanent or permanent waving composition of step ii) comprises one or more thickening agent(s), preferably one or more thickening polymer(s), more preferably one or more anionic thickening polymer(s), still more preferably carbohydrate-based thickening polymers and/or thickening polymer(s) comprising acrylate or methacrylate monomers, and/or their salt(s), and/or their mixtures, still further more preferably the total concentration of thickening agent(s), preferably the total concentration of thickening polymer(s), more preferably the total concentration of anionic thickening polymer(s) is in the range of 0.1% to 15% by weight, preferably in the range of 0.25% to 12.5% by weight, more preferably in the range of 0.5% to 10% by weight, calculated to the total weight of the semi-permanent or permanent waving composition of step ii).

14. The method according to any of the preceding claims **characterized in that** keratin fibers are heated in step v) to a temperature in the range of 70°C to 210°C, preferably to a temperature in the range of 80°C to 180°C, more preferably to a temperature in the range of 90°C to 150°C.

15. The method according to any of the preceding claims **characterized in that** the keratin fibers in step v) are heated for a time period in the range of 1 min to 90 min, preferably for a time period in the range of 5 min to 60 min, more preferably for a time period in the range of 10 min to 45 min.

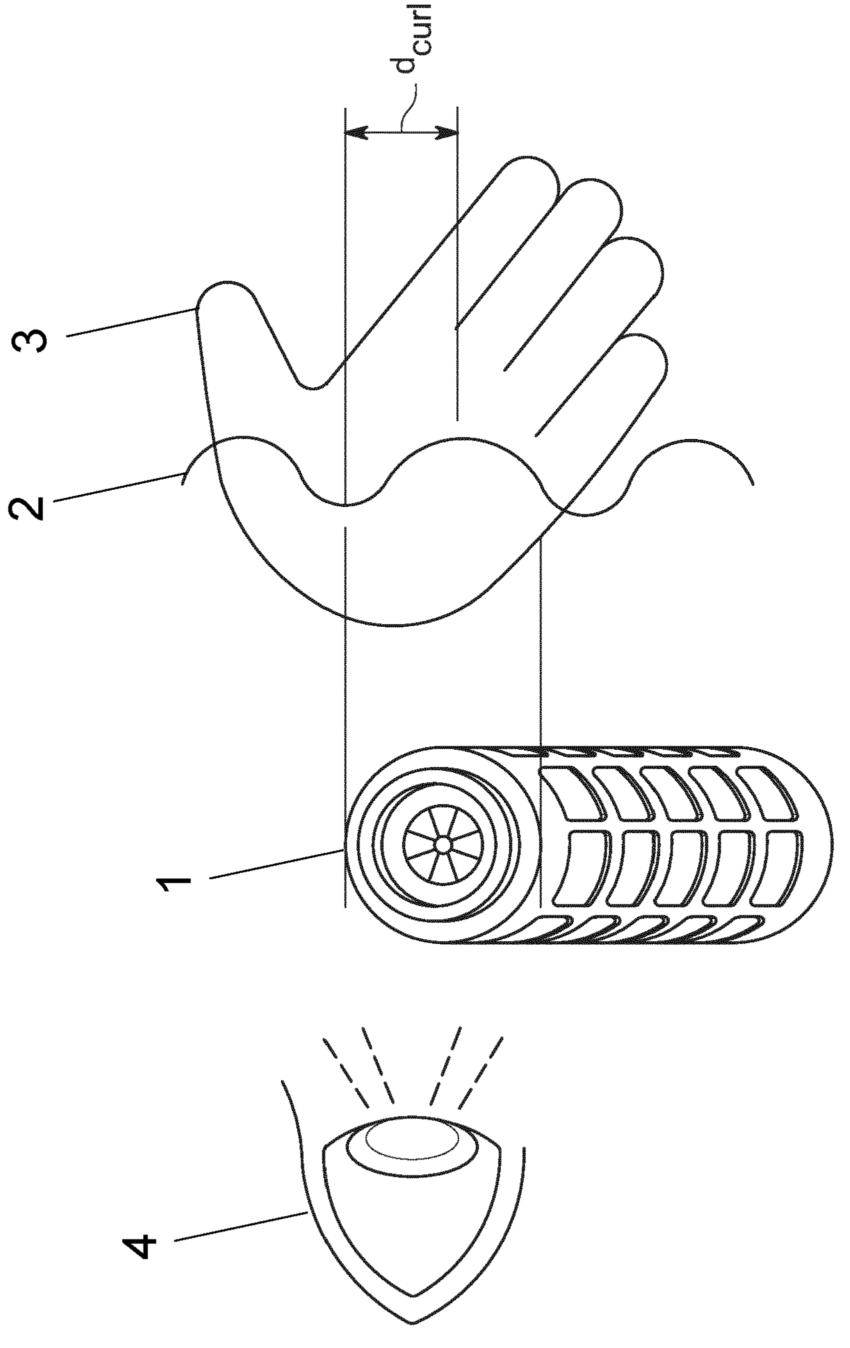


FIG. 1

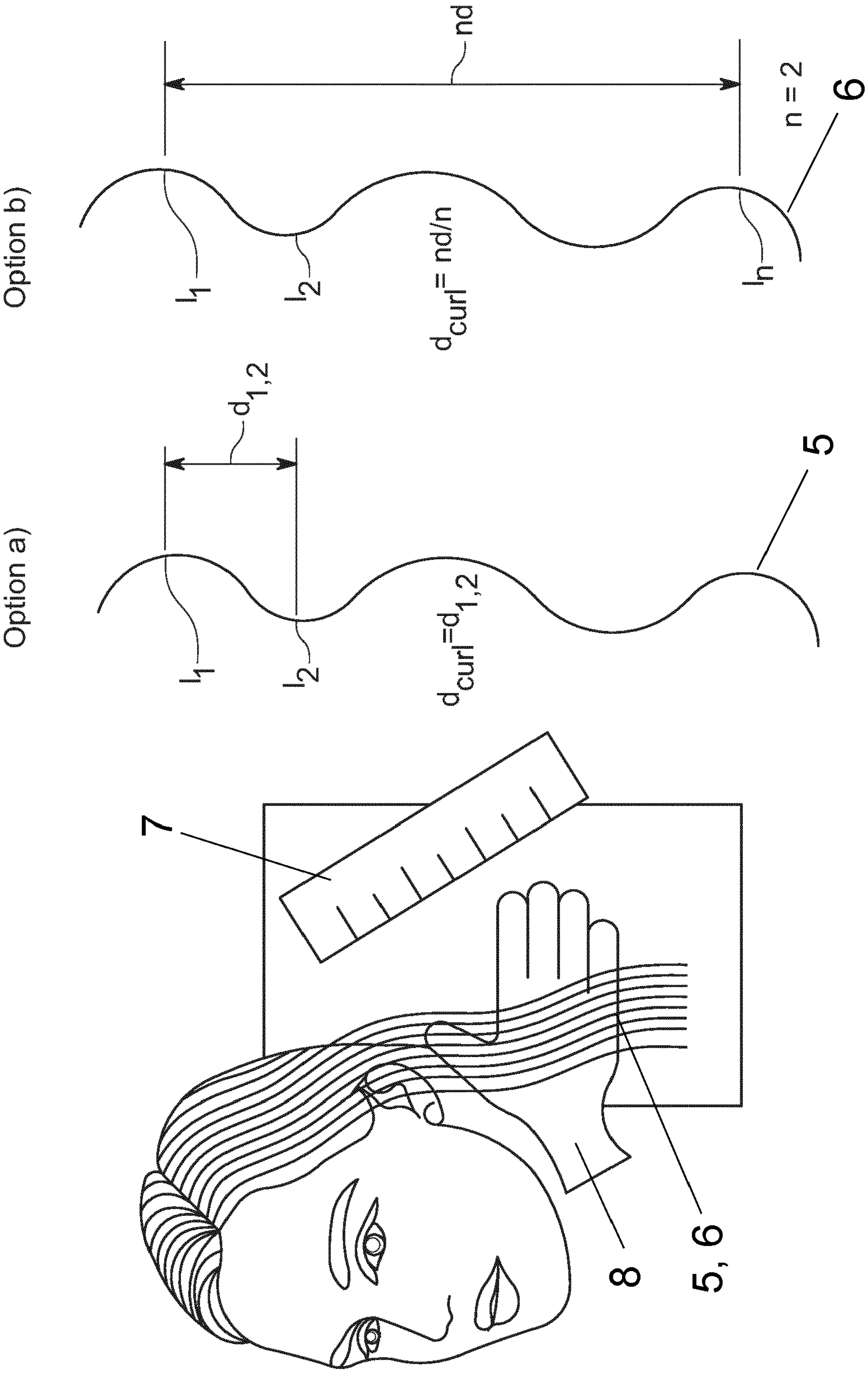

Option a)
Option b)
l_1
l_2
$d_{1,2}$
$d_{curl}=d_{1,2}$
5
l_1
l_2
l_n
nd
n = 2
6
$d_{curl}= nd/n$
7
8
5, 6

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 22 20 0645

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	Joy Arthur: "Naturally Curly Hair to Soft Curls using Velcro Rollers", , 1 September 2018 (2018-09-01), XP93035412, Retrieved from the Internet: URL:https://www.youtube.com/watch?v=WYcaJXIUyqw [retrieved on 2023-03-28] * video * -----	1-15	INV. A45D7/04 ADD. A45D7/06
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			TECHNICAL FIELDS SEARCHED (IPC)
X	Perkins Sabrina - ET AL: "The Right Rollers for Every Style, Length and Hair Type ¦ NaturallyCurly.com", -, 9 December 2014 (2014-12-09), pages 1-16, XP93035425, - Retrieved from the Internet: URL:https://www.naturallycurly.com/curlreading/home/the-right-rollers-for-every-hairstyle-curl-pattern * page 1 * ----- -/--	1-15	A45D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 March 2023	Zetzsche, Brigitta

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EUROPEAN SEARCH REPORT

Application Number
EP 22 20 0645

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	Hairstyles By Eden: "BEAUTIFUL NATURAL HAIR / ROLLER SET!!", , 18 March 2019 (2019-03-18), XP93035535, Retrieved from the Internet: URL:https://www.youtube.com/watch?v=xbUcPURGBrc [retrieved on 2023-03-28] * video * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 March 2023	Zetzsche, Brigitta

2

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D : document cited in the application
L : document cited for other reasons
&: member of the same patent family, corresponding document

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

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- EP 70074 A **[0053]**
- JP 2015123019 A **[0053]**