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(54) Title: PROCESS FOR PERMANENT SHAPING OF THE HAIR USING ULTRASOUND

(57) Abstract: The invention relates to a process for permanent reshaping of keratin fibres, in particular of the hair, comprising: a) a step of applying, to the keratin fibres, a reducing composition containing one or more reducing agents chosen from non-sulphur-containing reducing agents, protective thiols, sulphites, bisulphites or derivatives of sulphinic acid, b) an optional step of rinsing said fibres, then c) an optional step of fixing by oxidation, characterized in that the process comprises a step d) of applying, to the keratin fibres, ultrasonic waves delivered by a generator supplying mechanical vibrations of which the frequency is between 20 kHz and 1000 kHz, step d) being carried out after or during step a), it being possible for the process to optionally comprise a step e) of placing the keratin fibres under mechanical tension by means of a device capable of imposing a shape on said fibres.

PROCESS FOR PERMANENT SHAPING OF THE HAIR USING ULTRASOUND

The subject of the invention is a process for permanent reshaping of the hair using a reducing composition and ultrasound. The invention also relates to a kit comprising a reducing composition and a device generating ultrasonic waves (ultrasound) at a predetermined frequency.

The most common technique for permanently reshaping the hair consists, in a first stage, in opening the -S-S- disulphide bonds of keratin (keratocystine) using a composition containing a suitable reducing agent (reduction step) and then, after having rinsed the head of hair thus treated, generally with water, in reforming said disulphide bonds, in a second stage, by applying to the hair, which has been placed under tension beforehand, for example with curlers, an oxidizing composition (oxidation step, also known as fixing step) so as to finally give the hair the desired shape. This technique thus makes it possible to make the hair wavy (permanent-wave process) and/or smooth out (straighten) the hair. The new shape imposed on the hair via a chemical treatment as above is evidently long-lasting and especially resistant to the action of washing with water or with shampoo, as opposed to simple standard techniques of temporary reshaping, such as hairsetting.

Permanent reshaping processes that are more efficient, more cosmetic and less harmful to keratin fibres and that lead to longer-lasting hair reshaping are constantly being sought.

In order to improve the performance levels of permanent reshaping processes, the compositions generally used contain large concentrations of reducing agent (s). With the same aim, a heating process during the reduction step or after the latter has also been developed, in order to increase the chemical action of the reducing agent(s). These techniques use hot air,

hot steam or infrared to heat the hair fixed on a roller or a curler, which may itself be heated.

It has been observed that these technologies do not lead to a significant improvement in terms of production and longevity of the hair reshaping, for instance curls, when compared with the standard techniques at ambient temperature. Furthermore, the treated hair shows substantial degradation, which hinders users from performing repeated hair treatments, such as successive permanent-waving operations or smoothing-out (straightening) operations or a combination of permanent-waving and dyeing, for example.

The problem addressed by the invention is that of finding a process for permanent reshaping of the hair which provides, compared with the prior art processes:

- curls of improved shape and liveliness in the case of permanent-waving,
- an improved reduction in volume in the case of hair straightening,
- less degradation of the fibre, in particular with successive applications and in combination with other chemical treatments such as oxidation dyeing,
- a longer lasting artificial shape in the face of various attacks (shampooing, blow drying, UV exposure, etc.),
- a satisfactory cosmetic aspect after treatment,
- results of hairsetting more readily predictable according to the nature and the state of degradation of the hair to be treated.

Thus, the invention relates to a process for permanent reshaping of keratin fibres, in particular of the hair, comprising:

a) a step of applying, to the keratin fibres, a reducing composition containing one or more reducing agents chosen from non-sulphur-containing reducing agents, protective thiols, sulphites, bisulphites or derivatives of sulphinic acid,

b) an optional step of rinsing said fibres, then

c) an optional step of fixing by oxidation,

characterized in that the process comprises a step d) of applying, to the keratin fibres, ultrasonic waves delivered by a generator supplying mechanical vibrations of which the frequency is between 20 kHz and 1000 kHz, step d) being carried out after or during step a), it being possible for the process to optionally comprise a step e) of placing the keratin fibres under mechanical tension by means of a device capable of imposing a shape on said fibres.

The expression "*process for permanent reshaping of keratin fibres*" is intended to mean processes for permanent-waving, smoothing or relaxing of keratin fibres.

The invention also relates to a kit.

Other characteristics, aspects, subjects and advantages of the present invention will be more clearly apparent on reading the description which follows.

During step e), the placing of the keratin fibres under mechanical tension can be done over the entire length of the hair or at mid-length on long hair. Depending on the shape of the hairstyle, the hair shaping can be carried out with more or less thick locks.

According to a first embodiment of the process according to the invention, the device of step e) which imposes the desired shape on the hair also emits the ultrasonic waves of step d). In this case, the device of step e) comprises a generator supplying mechanical vibrations of which the frequency is between 20 kHz and 1000 kHz, so as to produce the ultrasound. It also has one or more means capable of imposing a shape on the hair.

According to this first variant of the invention, mention may be made, as a device for placing under mechanical tension of step e) comprising a generator of ultrasonic waves, of ultrasound-emitting curlers,

ultrasound-emitting straightening tongs or ultrasound-emitting curling tongs.

According to a second embodiment of the process according to the invention, the device of step e) which imposes the desired shape on the hair and that of step d) which emits ultrasound are distinct devices.

In this case, the device for placing under mechanical tension of step e) may be a curler, straightening tongs or curling tongs. The generator of step d) can be a fixed or portable device which delivers ultrasound and which is, if possible, readily positionable on a head of hair or a curler.

If it is a fixed device delivering ultrasound, it can be a hood or a bonnet.

If it is a portable device delivering ultrasound, it can be a probe or a gun.

Step a) of applying, to the keratin fibres, a reducing composition so as to reduce the disulphide bonds of keratin can be followed by an optional leave-in time.

According to one variant of the process according to the invention, step a) of applying, to the keratin fibres, the reducing composition can precede step e) of placing the keratin fibres under mechanical tension, with or without a leave-in time. In this case, the reducing step is carried out with the fibres in the original form, i.e. on fibres not placed under tension.

Advantageously, the pH of the reducing composition according to the invention is between 2 and 13.

The pH of the reducing composition according to the invention is preferably between 7 and 11.

The reducing composition used in the process according to the invention comprises, in a cosmetically acceptable medium, one or more reducing agents, said reducing agent(s) being chosen from non-sulphur-containing reducing agents or protective thiols, sulphites, bisulphites or derivatives of sulphinic acid.

For the purpose of the present invention, the term

"protective thiol" is intended to mean any molecule capable of generating a thiol by chemical reaction or simple photochemistry (hydrolysis, for example).

Among the protective thiols that can be used according to the invention, mention may be made of thioesters, thiocarbonates, thiocarbamates and thioethers.

Said reducing agent(s) can also be chosen from sulphites, bisulphites or derivatives of sulphinic acid.

By way of sulphites and bisulphites that can be used in the composition according to the invention, mention may be made of alkali metal or alkaline-earth metal or ammonium sulphites or bisulphites, and in particular sodium sulphite or bisulphite, potassium sulphite or bisulphite or alkanolamine sulphites or bisulphites, such as monoethanolamine sulphite or bisulphite. Examples of derivatives of sulphinic acid are given in application FR2814948.

Preferably, the reducing agent(s) is (are) chosen from non-sulphur-containing reducing agents. For the purposes of the present invention, the term "non-sulphur-containing reducing agent" is intended to means a reducing agent which comprises no sulphur atom in its structure.

The non-sulphur-containing reducing agent(s) included in the composition according to the invention is (are) preferably chosen from phosphines, alkali metal or alkaline-earth metal borohydrides, reducing sugars and reductones.

By way of phosphines that can be used in the composition according to the invention, mention may be made of the monophosphines or diphosphines as described in application FR2870119.

By way of borohydrides that can be used in the composition according to the invention, mention may be made of sodium borohydride or potassium borohydride.

By way of reducing sugars, mention may be made, in a nonlimiting manner, of ribose, glucose, maltose,

galactose, lactose or xylose.

Among the reductones of the invention, ascorbic acid and erythorbic acid are preferred.

The reducing agent(s) generally represent(s) from 0.01% to 50%, preferably from 0.5% to 15%, by weight, relative to the total weight of the reducing composition.

For the purpose of improving the cosmetic properties of the hair or alternatively of reducing or avoiding degradation thereof, the reducing composition may also contain a treating agent or cationic, anionic, non-ionic, or amphoteric nature.

Among the treating agents which are particularly preferred, mention may in particular be made of those described in French Patent Application No. 2 598 613. Use may also be made, as treating agents, of linear or cyclic, volatile or non-volatile silicones or mixtures thereof, polydimethylsiloxanes, quaternized polyorganosiloxanes such as those described in French Patent Application No. 2 535 730, polyorganosiloxanes containing aminoalkyl groups modified with alkoxycarbonylalkyl groups, such as those described in US Patent No. 4 749 732, polyorganosiloxanes such as the polyoxyalkyl polydimethylsiloxane copolymer of the Dimethicone Copolyol type, a polydimethylsiloxane containing stearoxy end groups (stearoxy dimethicone), a dialkylammonium acetate polydimethylsiloxane copolymer or a polydimethylsiloxane polyalkylbetaine copolymer described in British Patent Application No. 2 197 352, and also silanes such as stearoxytrimethylsilane.

The reducing composition may in particular contain cationic polymers such as those used in the compositions of French Patents FR-A-2 472 382 and FR-A-2 495 931, or else cationic polymers of the ionene type, such as those used in the compositions of Luxembourg Patent No. 83703. It may also contain basic amino acids (such as lysine or arginine) or acidic amino acids (such as glutamic acid or aspartic acid), peptides and derivatives thereof, protein hydrolysates,

waxes, swelling agents and penetrating agents or agents for reinforcing the efficiency of the reducing agent, such as the SiO_2/PDMS (polydimethylsiloxane) mixture, dimethylisosorbitol, urea and its derivatives, solvents such as ethanol, isopropanol, pyrrolidone, N-alkyl-pyrrolidones, alkylene glycol alkyl ethers or dialkylene glycol alkyl ethers, for instance propylene glycol monomethyl ether, dipropylene glycol monomethyl ether, ethylene glycol monoethyl ether and diethylene glycol monoethyl ether, polyols, for instance glycerol, propane-1,2-diol and butane-1,2-diol, 2-imidazolidinone, and other compounds such as fatty alcohols, lanoline derivatives, active ingredients such as pantothenic acid, agents for preventing hair loss, antidandruff agents, thickeners, suspending agents, sequestering agents, opacifiers, dyes, sunscreens, and also fragrances and preservatives. Preferably, the reducing compositions of the invention contain one or more polyols.

The basifying agent preferably used in the compositions of use according to the invention is an agent for increasing the pH of the composition(s), in which it is present. The basifying agent is a Brönsted, Lowry or Lewis base. It may be inorganic or organic.

The basifying agent is particularly chosen from:

a) aqueous ammonia,

b) alkanolamines such as monoethanolamine, diethanolamine and triethanolamine, and derivatives thereof,

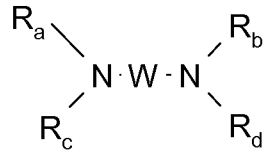
c) oxyethylenated and/or oxypropylenated ethylenediamines,

d) inorganic or organic hydroxides,

e) alkali metal silicates such as sodium metasilicates,

f) amino acids, preferably basic amino acids, such as arginine, lysine, ornithine, citrulline and histidine,

g) the compounds of formula (I) below:



(I)

formula (I)

in which W is a propylene residue optionally substituted with a hydroxyl group or a C1-C4 alkyl radical; Ra, Rb, Rc and Rd, which may be identical or different, represent a hydrogen atom or a C1-C4 alkyl or C1-C4 hydroxyalkyl radical.

The inorganic or organic hydroxides are preferably chosen from a) hydroxides of an alkali metal, b) hydroxides of an alkaline-earth metal, for instance sodium hydroxide or potassium hydroxide, c) hydroxides of a transition metal, such as hydroxides of metals from groups III, IV, V and VI, d) lanthanide or actinide hydroxides, quaternary ammonium hydroxides and guanidinium hydroxide.

The hydroxide may be formed *in situ*, for instance guanidine hydroxide by reacting calcium hydroxide and guanidine carbonate.

Aqueous ammonia, monoethanolamine, arginine and lysine are preferred.

The basifying agent(s) as defined previously preferably represent(s) from 0.001% to 10% by weight of the weight of the composition containing them, more particularly from 0.005% to 8% by weight of the composition. This concentration depends in particular on the desired pH of the reducing composition.

According to one preferred embodiment, the reducing agent is left to act for a time of from 1 to 50 minutes, preferably for 1 to 30 minutes. Preferably, the reducing composition is applied to clean, wet hair fibres.

The process then optionally comprises a step b) of rinsing the keratin fibres.

Preferably, the process according to the invention comprises a rinsing step b).

The process according to the invention optionally

comprises a step c) of fixing by oxidation, so as to reform the disulphide bonds, by application, to the keratin fibres, of an oxidizing composition containing one or more oxidizing agents, optionally followed by a leave-in time.

The oxidizing composition generally comprises one or more oxidizing agents chosen from hydrogen peroxide, urea peroxide, alkali metal bromates, polythionates, and persalts such as perborates, percarbonates and persulphates.

Preferably, the oxidizing agent is chosen from alkali metal bromates and hydrogen peroxide.

The oxidizing agent(s) generally represent(s) from 0.1% to 15%, preferably from 0.5% to 10%, by weight, relative to the total weight of the oxidizing composition.

Preferably, when the oxidizing agent is hydrogen peroxide in aqueous solution, the oxidizing composition used in the process according to the invention contains at least one agent for stabilizing aqueous hydrogen peroxide solution.

Mention may in particular be made of alkali metal or alkaline-earth metal pyrophosphates, such as tetrasodium pyrophosphate, alkali metal or alkaline-earth metal stannates, phenacetin or acid salts of oxyquinoline, such as oxyquinoline sulphate. Even more advantageously, at least one stannate optionally in combination with at least one pyrophosphate is used.

The agent(s) for stabilizing aqueous hydrogen peroxide solution generally represent(s) from 0.0001% to 5% by weight, and preferably from 0.01% to 2% by weight, relative to the total weight of the oxidizing composition.

Generally, the pH of the oxidizing composition ranges from 1.5 to 9, preferably from 2 to 8.

Preferably, the oxidizing composition as defined above is left to act for approximately 2 to 30 minutes, preferably from 2 to 15 minutes, more particularly from 2 to 7 minutes.

The process according to the invention comprises a step d) of applying, to the keratin fibres, ultrasonic waves delivered by a generator supplying mechanical vibrations of which the frequency is between 20 kHz and 1000 kHz.

Preferably, the frequency of the ultrasonic waves is between 25 kHz and 500 kHz, and more preferably between 30 kHz and 100 kHz.

The ultrasonic waves can be applied to the hair impregnated with the composition comprising one or more non-thiolated reducing agents. In one particular case of the invention, the ultrasonic waves and the reducing composition can be applied sequentially. For example, in a first stage, the reducing composition is applied to the head of hair and then rinsed out; the ultrasonic waves are then applied to the head of hair thus "pretreated".

The ultrasonic waves can also be delivered during the oxidation step or as an intra-treatment, i.e. between the reducing step and the oxidizing step. The action times for the ultrasonic waves are between 1 minutes and 1 hour, and preferably between 10 and 30 minutes.

Preferably, the process which is the subject of the invention comprises a step of applying a care composition containing one or more non-silicone cationic polymers or one or more silicones, preferably amino silicones.

Among all the non-silicone cationic polymers that can be used in the context of the present invention, cyclopolymers, in particular the dimethyldiallyl-ammonium chloride homopolymers sold under the name Merquat 100 by the company Nalco, and quaternary diammonium polymers, and in particular Mexomere PO from the company Chimex, are preferably used in the reducing composition.

The preferred silicone is the Wacker Belsil ADM LOG 1 silicone from the company Wacker.

A step of applying a care composition makes it

possible to limit or prevent sensitization of the hair which could result from the treatment of the hair with reducing agents and oxidizing agents during the permanent reshaping process which is the subject of the invention. The care composition as defined above also makes it possible to protect the artificial colour of the hair.

The carrier of the oxidizing and care compositions is preferably an aqueous medium constituted of water, and can advantageously contain cosmetically acceptable organic solvents, including, more particularly, alcohols such as ethyl alcohol, isopropyl alcohol, benzyl alcohol and phenylethyl alcohol, or polyols or polyol ethers, for instance ethylene glycol monomethyl, monoethyl and monobutyl ethers, propylene glycol and its ethers, for instance propylene glycol monomethyl ether, butylene glycol, glycerol, dipropylene glycol, and also diethylene glycol alkyl ethers, for instance diethylene glycol monoethyl ether or monobutyl ether. The organic solvents may then be present in concentrations of between approximately 0.1% and 20%, and preferably between approximately 1% and 10%, by weight, relative to the total weight of the composition.

The pHs of the oxidizing composition and of the care composition which are used in the process according to the invention can be obtained and/or adjusted conventionally by adding either one or more alkaline agents, such as those already mentioned in the reducing composition, or acidifying agents such as, for example, hydrochloric acid, acetic acid, lactic acid, boric acid, citric acid and phosphoric acid.

The reducing composition, the oxidizing composition and the care composition which are used in the process according to the invention can, independently of one another, be in the form of a thickened or non-thickened lotion, a cream, a gel or a foam.

A subject of the invention is also a kit combining at least:

- a device (A) comprising one or more means for

placing keratin fibres under tension, and

- a device (B) comprising one or more means for applying, to the keratin fibres, ultrasonic waves delivered by a generator supplying mechanical vibrations of which the frequency is between 20 kHz and 1000 kHz,

- a compartment containing a reducing composition containing one or more reducing agents chosen from non-sulphur-containing reducing agents, protective thiols, sulphites, bisulphites or derivatives of sulphinic acid,

the devices (A) and (B) being identical or different.

Optionally, the kit may contain a cosmetic composition containing at least one oxidizing agent.

In addition, the invention relates to a process for permanent reshaping of keratin fibres, in particular of the hair, comprising:

a) a step of applying, to the keratin fibres, a composition comprising, in a cosmetically acceptable medium, one or more inorganic or organic hydroxides, the pH of said composition ranging from 10 to 14,

b) an optional step of rinsing said fibres,

characterized in that the process comprises a step c) of applying, to the keratin fibres, ultrasonic waves delivered by a generator supplying mechanical vibrations of which the frequency is between 20 kHz and 1000 kHz, step c) being carried out during or after step a), it being possible for the process to optionally comprise a step d) of placing the keratin fibres under mechanical tension by means of a device capable of imposing a shape on said fibres.

The description which follows concerns this embodiment of the process.

The process according to the invention comprises a step a) of applying, to the keratin fibres, a composition comprising, in a cosmetically acceptable medium, one or more inorganic or organic hydroxides.

For the purpose of the present invention, the term

"hydroxide" is intended to mean a compound capable of releasing hydroxide ions.

The composition of step a) according to the invention comprises one or more inorganic or organic hydroxides, the pH of the composition ranging from 10 to 14.

More particularly, the inorganic or organic hydroxide is chosen from alkali metal hydroxides, alkaline-earth metal hydroxides, transition metal hydroxides, said transition metal being in particular from groups IIIB, IVB, VB and VIB, lanthanide or actinide hydroxides, ammonium hydroxides, guanidine hydroxide, or mixtures thereof.

By way of hydroxide compounds that can be used according to the invention in step a), mention may in particular be made of sodium hydroxide, potassium hydroxide, lithium hydroxide, caesium hydroxide, magnesium hydroxide, calcium hydroxide and guanidine hydroxide.

It should be noted that certain hydroxides, and more particularly guanidine hydroxide, can be in the form of precursors, i.e. of at least two compounds which, when brought into contact, result in guanidine hydroxide. Mention may be made of the combination of an alkaline-earth metal hydroxide, for instance calcium hydroxide, with guanidine carbonate.

The pH of the composition of step a) ranges from 10 to 14, and preferably from 12 to 14.

The composition of step a) used in the process according to the invention is generally in the form of an emulsion, preferably an oil-in-water or water-in-oil emulsion.

When the composition of step a) used according to the invention is in emulsion form, it generally contains at least one non-ionic, anionic, cationic or amphoteric emulsifier.

The emulsifiers are chosen appropriately according to the emulsion to be obtained: water-in-oil (W/O) or oil-in-water (O/W) emulsion.

For the oil-in-water (O/W) emulsions, mention may, for example, be made of the following emulsifiers:

*as amphoteric emulsifiers, N-acylamino acids such as N-alkylaminoacetates and disodium cocoamphodiacetate, and amine oxides such as stearamine oxide;

*as anionic emulsifiers, acylglutamates such as "disodium hydrogenated tallow glutamate" (Amisoft HS-21® sold by the company Ajinomoto); carboxylic acids and their salts, such as sodium stearate; phosphoric esters and their salts, such as "DEA oleth-10 phosphate"; sulphosuccinates such as "Disodium PEG-5 citrate lauryl sulphosuccinate" and "Disodium ricinoleamido MEA sulphosuccinate";

*as cationic emulsifiers, alkylimidazolidiniums such as isostearylethylimidonium ethosulphate; ammonium salts such as N,N,N-trimethyl-1-docosanaminium chloride (behentrimonium chloride);

*as non-ionic emulsifiers, esters and ethers of saccharides, such as sucrose stearate, sucrose cocoate, and the mixture of sorbitan stearate and sucrose cocoate sold by the company ICI under the name Arlatone 2121®; polyol esters, in particular glycerol esters or sorbitol esters, such as glyceryl stearate, polyglyceryl-2 stearate, sorbitan stearate; glycerol ethers; oxyethylenated and/or oxypropylenated ethers, such as the oxyethylenated, oxypropylenated ether of lauryl alcohol containing 25 oxyethylenated groups and 25 oxypropylenated groups (CTFA name "PPG-25 laureth-25") and the oxyethylenated ether of the mixture of C_{12}-C_{15} fatty alcohols comprising 7 oxyethylenated groups (CTFA name "C_{12}-C_{15} Pareth-7"); ethylene glycol polymers, such as PEG-100, and mixtures thereof.

One or more of these emulsifiers may be used.

For the water-in-oil (W/O) emulsions, mention may be made, as examples of emulsifiers, of polyol fatty esters, in particular fatty esters of glycerol or of sorbitol, and in particular isostearyl, oleyl and ricinoleyl esters of a polyol, such as the mixture of petrolatum, polyglyceryl-3 oleate, glyceryl isostea-

rate, hydrogenated castor oil and ozokerite, sold under the name Protegin W® by the company Goldschmidt, sorbitan isostearate, polyglyceryl diisostearate, polyglyceryl-2 sesquiisostearate; esters and ethers of saccharides such as "methyl glucose dioleate"; fatty esters such as magnesium lanolate; dimethicone copolyols and alkyl dimethicone copolyols, such as the lauryl methicone copolyol sold under the name Dow Corning 5200 Formulation Aid by the company Dow Corning; the cetyl dimethicone copolyol sold under the name Abil EM 90® by the company Goldschmidt, and the dimethicone copolyol sold under the name KF-6015 by the company Shin-Etsu; and mixtures thereof.

In one particular case of the invention, the composition of step a) may comprise the combination of an alkali metal or alkaline-earth metal hydroxide with an agent which activates the breaking of the disulphide bonds of the hair. The activating agent is in particular cysteine or a cysteine salt, a cysteine derivative or the corresponding salt, which is optionally substituted, or a cysteine homologue, which is optionally substituted. The activating agent may also be a sulphite or bisulphite salt.

The inorganic or organic hydroxide(s) is (are) advantageously present in the composition of step a) at a concentration ranging from 0.2% to 10% by weight, and preferably from 0.5% to 8% by weight, relative to the total weight of the composition.

When the composition of step a) is applied to the keratin fibres, its temperature is preferably between 20 and 40°C, better still between 25 and 35°C.

In general, the composition of step a) is left to act for 5 to 60 minutes, preferably from 10 to 20 minutes, in order for the desired reshaping to take place.

After step a) of applying the composition comprising one or more inorganic or organic hydroxides, and after the optional leave-in time, the keratin fibres are generally rinsed according to step b), preferably

with water.

Preferably, the process according to the invention comprises a step b) of rinsing the keratin fibres.

The process according to the invention comprises a step c) of applying, to the keratin fibres, ultrasonic waves delivered by a generator supplying mechanical vibrations of which the frequency is between 20 kHz and 1000 kHz.

Preferably, the frequency of the ultrasonic waves is between 25 kHz and 500 kHz, and more preferably between 30 kHz and 100 kHz.

The ultrasonic waves can be applied to the hair impregnated with the composition comprising one or more inorganic or organic hydroxides. In one particular case of the invention, the ultrasonic waves and the composition comprising one or more inorganic or organic hydroxides can be supplied sequentially. For example, in a first stage, the composition comprising one or more inorganic or organic hydroxides is applied to the head of hair and then rinsed out; the ultrasonic waves are then applied to the hair thus "pretreated".

The action times for the ultrasonic waves are between 1 minute and 1 hour, and preferably between 10 and 30 minutes.

Preferably, the process which is the subject of the invention comprises a step of applying a care composition containing one or more non-silicone cationic polymers or one or more silicones, preferably amino silicones.

Among the non-silicone cationic polymers which can be used in the context of the present invention, cyclo-polymers, in particular the dimethyldiallylammonium chloride homopolymers sold under the name Merquat 100 by the company Nalco, quaternary diammonium polymers, and in particular Mexomere PO from the company Chimex, are preferably used.

The preferred silicone is the Wacker Belsil ADM LOG 1 silicone from the company Wacker.

A step of applying a care composition makes it

possible to limit or prevent sensitization of the hair which could result from the treatment of the hair during the permanent reshaping process which is the subject of the invention. The care composition as defined above can also make it possible to protect the artificial colour of the hair.

The carrier of the care composition is preferably an aqueous solution constituted of water and can advantageously contain cosmetically acceptable organic solvents, including more particularly alcohols, such as ethyl alcohol, isopropyl alcohol, benzyl alcohol and phenylethyl alcohol, or polyols or polyol ethers, for instance ethylene glycol monomethyl, monoethyl and monobutyl ethers, propylene glycol or its ethers, for instance propylene glycol monomethyl ether, butylene glycol, glycerol, dipropylene glycol, and also diethylene glycol alkyl ethers, for instance diethylene glycol monoethyl ether or monobutyl ether. The organic solvents can then be present in concentrations of between approximately 0.1% and 20%, and preferably between approximately 1% and 10%, by weight, relative to the total weight of the composition.

The pH of the care composition optionally used in the process according to the invention can be obtained and/or adjusted conventionally by adding either one or more basifying agents, or acidifying agents such as, for example, hydrochloric acid, acetic acid, lactic acid, boric acid, citric acid and phosphoric acid.

The care composition optionally used in the process according to the invention may be in the form of a thickened or non-thickened lotion, a cream, a gel or a foam.

The subject of the invention is also a kit comprising at least:

- a device (A) comprising one or more means for placing keratin fibres under mechanical tension, and
- a device (B) comprising one or more means for applying, to the keratin fibres, ultrasonic waves

delivered by a generator supplying mechanical vibrations of which the frequency is between 20 kHz and 1000 kHz,

- a compartment containing a composition comprising, in a cosmetically acceptable medium, one or more inorganic or organic hydroxides, the pH of said composition ranging from 10 to 14,

the devices (A) and (B) being identical or different.

The following compositions were prepared (as percentage by mass of the total composition) in order to illustrate the process using one or more inorganic or organic hydroxides.

Composition 1 (guanidine carbonate)

	Composition 1
Guanidine carbonate	6.4
Demineralized water	93.6

Composition 2 (guanidine activator)

	Composition 2
Calcium hydroxide	45
Propylene glycol	55

Compositions 1 and 2 were mixed in a 5.5:1 ratio (final pH 13.35). The resulting preparation was applied, in a bath ratio of 2, to locks of 0.2 g of frizzy natural hair. The locks were then positioned flat in an ultrasonic bath delivering waves of 40 kHz (power 120W), for 5, 10 and 15 minutes. At the end of each leave-in time, the locks were rinsed thoroughly with water and then dried.

In a second series of treatments, the preparation obtained by mixing compositions 1 and 2 in the same ratio as previously was applied, in a bath ratio of 2, to locks of 0.2 g of frizzy natural hair. The locks were then positioned flat on a thermostatic plate, the

temperature of which was fixed at 32°C, for 5, 10 and 15 minutes. At the end of each leave-in time, the locks were washed thoroughly with water and then dried.

The smoothing performance levels were evaluated in terms of the ability of the treatments to relax the natural curliness of the frizzy hair (elongation).

The results are given in the following table:

	Conditions	Leave-in time (minutes)	Smoothing performance levels
Example 1	Ultrasound	15	+++
	No ultrasound	15	++
Example 2	Ultrasound	10	++
	No ultrasound	10	+
Example 3	Ultrasound	5	-
	No ultrasound	5	--

+++: *very substantial elongation*
++: *substantial elongation*
+: *medium elongation*
-: *mediocre elongation*

The use of ultrasound during the chemical treatment of Examples 1 to 3 therefore makes it possible both to increase the smoothing performance levels and to reduce the treatment times compared with a process with no ultrasound.

EXAMPLES 4 and 5

The following composition was prepared (as percentage by mass of the total composition):

	Composition 3
Sodium hydroxide	2.25
Demineralized water	97.75
pH measured	13.3

Composition 3 was applied, in a bath ratio of 2, to locks of 0.2 g of frizzy natural hair. The locks were then positioned flat in an ultrasonic bath delivering waves of 40 kHz (power 120W), for 10 and 15 minutes. At the end of each leave-in time, the locks were washed thoroughly with water and then dried.

In a second series of treatments, composition 3 was applied, in a bath ratio of 2, to locks of 0.2 g of frizzy natural hair. The locks were then positioned flat on a thermostatic plate, the temperature of which was fixed at 32°C, for 10 and 15 minutes. At the end of each leave-in time, the locks were rinsed thoroughly with water and then dried.

The smoothing performance levels were evaluated here again in terms of the ability of the treatments to relax the natural curliness of the frizzy hair.

The results are given in the following table:

	Conditions	Leave-in time (minutes)	Smoothing performance levels
Example 4	Ultrasound	15	+++
	No ultrasound	15	+++
Example 5	Ultrasound	10	+++
	No ultrasound	10	+

+++: *very substantial elongation*
++: *substantial elongation*
+: *medium elongation*
-: *mediocre elongation*

The use of ultrasound in combination with an alkaline smoothing formulation containing sodium hydroxide makes it possible to reduce the treatment times while retaining excellent elongation performance levels compared with a process with no ultrasound.

EXAMPLES ILLUSTRATING THE PROCESS WITH REDUCING AGENTS

The following compositions were prepared (as

percentage by mass of the total composition):

	Comp. 1	Comp. 2	Comp. 3	Comp. 4	Comp. 5
Tris(hydroxymethyl)-phosphine	6.2	-	-	-	-
Sodium sulphite		6.3			
Sodium hydrosulphite	-	-	8.7	-	-
Sodium metabisulphite	-	-	-	9.5	-
Formamidine sulphinic acid	-	-	-	-	6.9
Monoethanolamine	qs pH 9	qs pH 9	qs pH 9	qs pH 9	qs pH 9
Demineralized water	qs 100	qs 100	qs 100	qs 100	qs 100

Composition 6 (oxidizing lotion)

Hydrogen peroxide (at 35%)	5.15
Sodium salicylate	0.03
Tetrasodium pyrophosphate.10H_2O	0.04
Etidronic acid, tetrasodium salt (30%)	0.15
Phosphoric acid	0.3
Demineralized water	qs 100

Locks of 1 g of Japanese natural hair rolled on curlers 1 cm in diameter were immersed in glass containers containing the compositions noted 1 to 5. Each container was then placed, for 15 minutes, in an ultrasonic bath delivering waves of 40 kHz (power 120W, bath temperature at 32°C).

In a second series of treatments, locks of 1 g of Japanese natural hair rolled on curlers 1 cm in diameter were immersed in glass containers containing the compositions noted 1 to 5. Each container was then placed, for 15 minutes, in a waterbath of which the temperature was fixed at 32°C.

For the two series of treatments, at the end of

the leave-in time, the locks were rinsed with tap water, and wrung out, and then each was treated with composition 6, in a bath ratio of 2, for 5 minutes at ambient temperature. At the end of the leave-in time, the locks were rinsed, unrolled and then dried.

The performance levels in terms of curliness for each treatment are given in the following table:

	Conditions	Curliness results
Composition 1	Ultrasound	++
	No ultrasound	+
Composition 2	Ultrasound	+
	No ultrasound	--
Composition 3	Ultrasound	+
	No ultrasound	-
Composition 4	Ultrasound	+
	No ultrasound	--
Composition 5	Ultrasound	+
	No ultrasound 32°C	-

++: *very substantial curliness*
+: *medium curliness*
- *mediocre curliness*
--: *no curliness*

In each case, the use of ultrasound made it possible to significantly increase the hair shaping performance levels of the non-thiolated reducing agents, compared with a process with no ultrasound.

CLAIMS

1. Process for permanent reshaping of keratin fibres, in particular of the hair, comprising:

a) a step of applying, to the keratin fibres, a reducing composition containing one or more reducing agents chosen from non-sulphur-containing reducing agents, protective thiols, sulphites, bisulphites or derivatives of sulphinic acid,

b) an optional step of rinsing said fibres, then

c) an optional step of fixing by oxidation,

characterized in that the process comprises a step d) of applying, to the keratin fibres, ultrasonic waves delivered by a generator supplying mechanical vibrations of which the frequency is between 20 kHz and 1000 kHz, step d) being carried out after or during step a),

it being possible for the process to optionally comprise a step e) of placing the keratin fibres under mechanical tension by means of a device capable of imposing a shape on said fibres.

2. Process according to Claim 1, characterized in that, during step d), the frequency of the ultrasonic waves is between 25 kHz and 500 kHz, and more preferably between 30 kHz and 100 kHz.

3. Process according to Claim 1 or 2, characterized in that the device of step e) which imposes the desired shape on the hair emits the ultrasonic waves of step d).

4. Process according to any one of Claims 1 to 3, characterized in that the device is chosen from ultrasound-emitting curlers, ultrasound-emitting straightening tongs or ultrasound-emitting curling tongs.

5. Process according to either one of Claims 1 and 2, characterized in that the device of step e) which imposes the desired shape on the hair and that of step d) which emits ultrasound are distinct devices.

6. Process according to any one of Claims 1, 2

or 5, characterized in that the device is chosen from probes and guns.

7. Process according to any one of Claims 1 to 6, characterized in that it comprises a rinsing step b).

8. Process according to any one of Claims 1 to 7, characterized in that the non-sulphur-containing reducing agent(s) is (are) chosen from phosphines, alkali metal or alkaline-earth metal borohydrides, reducing sugars and reductones.

9. Process according to any one of Claims 1 to 7, characterized in that the reducing agent(s) is (are) chosen from sulphites, bisulphites and derivatives of sulphinic acid.

10. Process according to any one of Claims 1 to 7, characterized in that the protective thiols are chosen from thioesters, thiocarbonates, thiocarbamates and thioethers.

11. Process according to Claim 9, characterized in that the sulphites or bisulphites are chosen from alkali metal or alkaline-earth metal sulphites or bisulphites, or ammonium sulphites or bisulphites or alkanolamine sulphites or bisulphites.

12. Process according to any one of Claims 1 to 11, characterized in that the pH of the reducing composition is between 2 and 13, and preferably between 7 and 11.

13. Process according to any one of Claims 1 to 12, characterized in that the oxidizing agent used in step c) is chosen from alkali metal bromates and/or hydrogen peroxide.

14. Kit comprising at least:

- a device (A) comprising one or more means for placing keratin fibres under mechanical tension, and
- a device (B) comprising one or more means for applying, to the keratin fibres, ultrasonic waves delivered by a generator supplying mechanical vibrations of which the frequency is between

20 kHz and 1000 kHz,

- a compartment containing a reducing composition as defined in Claims 1 to 13, the devices (A) and (B) being identical or different.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/062398

A. CLASSIFICATION OF SUBJECT MATTER
INV. A45D7/06
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)
A45D

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, 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	EP 1 721 540 A1 (SAKAKIBARA ITSUO [JP]) 15 November 2006 (2006-11-15) paragraphs [0001], [0003], [0004], [0018] - [0020], [0055], [0063]; claims -----	1-14
X	US 2003/106564 A1 (OLSHAVSKY MICHAEL ANDREW [US] ET AL) 12 June 2003 (2003-06-12) paragraphs [0001], [0004], [0007], [0023], [0063]; claims -----	1-14
X	WO 2007/037143 A2 (MATSUSHITA ELECTRIC WORKS LTD [JP]; UCHINASHI SAKAE [JP]) 5 April 2007 (2007-04-05) page 1, line 1 - line 8 page 3, line 15 - line 21 page 9, line 3 - line 11; claims -----	1-14

☐ 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

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"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
19 January 2011	27/01/2011

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2010/062398

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