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(54) METHOD FOR ANALYSING TREATMENTS ON HAIR

VERFAHREN ZUR ANALYSE VON BEHANDLUNGEN AN HAAREN

MÉTHODE D'ANALYSE DES TRAITEMENTS SUR LES CHEVEUX

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(73) Proprietors:
- **Unilever PLC**
  London, Greater London EC4Y 0DY (GB)
  Designated Contracting States:
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- **Unilever N.V.**
  3013 AL Rotterdam (NL)
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(72) Inventors:
- **IFTIKHAR, Abid**
  Bebington
  Wirral Merseyside CH63 3JW (GB)
- **MCKEOWN, Robert**
  Bebington
  Wirral Merseyside CH63 3JW (GB)

(74) Representative: **Mathai, Neenu Grace**
Unilever PLC
Unilever Patent Group
Colworth House Sharnbrook
Bedford Bedfordshire MK44 1LQ (GB)

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- **VALÉRIA FERNANDES MONTEIRO ET AL: "Morphological analysis of polymers on hair fibers by SEM and AFM", MATERIALS RESEARCH, vol. 6, no. 4, 1 December 2003 (2003-12-01), pages 501-506, XP055270758, BR ISSN: 1516-1439, DOI: 10.1590/S1516-14392003000400013**
- **JACALYN G GOULD ET AL: "Electron microscopy-image analysis: Quantification of ultrastructural changes in hair fiber cross sections as a result of cosmetic treatment Presented at the Society of Cosmetic Chemists Annual Meeting", J. SOC. COSMET. CHEM, vol. 36, 1 January 1985 (1985-01-01), pages 53-59, XP055270759,**
- **HYUNG JIN AHN ET AL: "An ultrastuctural study of hair fiber damage and restoration following treatment with permanent hair dye", INTERNATIONAL JOURNAL OF DERMATOLOGY, vol. 41, no. 2, 1 February 2002 (2002-02-01), pages 88-92, XP055270760, UK ISSN: 0011-9059, DOI: 10.1046/j.1365-4362.2002.01375.x**
- **GIERAD LAPUT ET AL: "3D Printed Hair: Fused Deposition Modeling of Soft Strands, Fibers and Bristles", USER INTERFACE SOFTWARE AND TECHNOLOGY, 1 January 2015 (2015-01-01), pages 593-597, XP055270761, 2 Penn Plaza, Suite 701 New York NY 10121-0701 USA ISBN: 978-1-4503-3069-5**

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Description

Field of the Invention

[0001] The present invention relates to a method of analysing the effect of benefit agents on hair, delivered from hair treatment compositions, the deposition behaviour thereof, and of recommending a suitable hair treatment.

Background and Prior Art

[0002] VALERIA FERNANDES MONTEIRO ET AL: "Morphological analysis of polymers on hair fibers by SEM and AFM", MATERIALS RESEARCH, vol. 6, no. 4, 1 December 2003 (2003-12-01), pages 501-506, XP055270758, BR; and JACALYN G GOULD ET AL: "Electron microscopy-image analysis: Quantification of ultrastructural changes in hair fiber cross sections as a result of cosmetic treatment; Presented at the Society of Cosmetic Chemists Annual Meeting", J. SOC. COSMET. CHEM, vol. 36, 1 January 1985 (1985-01-01), pages 53-59, XP055270759 disclose imaging and microscope-based approaches for analysing the effect of treatments on hair fibres.

[0003] HYUNG JIN AHN ET AL: "An ultrastuctural study of hair fiber damage and restoration following treatment with permanent hair dye",INTERNATIONAL JOURNAL OF DERMATOLOGY, vol. 41, no. 2, 1 February 2002 (2002-02-01), pages 88-92, XP055270760, UK; discloses an ultra-structural study of hair fibre damage and restoration using electron microscopy.

[0004] GIERAD LAPUT ET AL: "3D Printed Hair: Fused Deposition Modelling of Soft Strands, Fibers and Bristles", USER INTERFACE SOFTWARE AND TECHNOLOGY, 1 January 2015, (2015-01-01), pages 593-597, XP055270761, discloses the production of hair fibres by 3D printing.

[0005] WO14041186A1 describes a system or component such as software for 3D modelling of bodies.

[0006] Assaults such as treatments, protocols and hair care regimes are known to cause damage to the surface and structure of hair. Remedial and beneficial treatments are available to mitigate these detrimental effects but the concept can be difficult for the consumer to grasp and the full effects of the remedial treatments difficult to fully comprehend.

[0007] The method of the invention can be used to assess properties of hair fibres, which have been exposed to various remedial and beneficial treatments. In this way it is possible to demonstrate any surface improvement, such as "smoothing", arising from the application of the treatment to the hair. It also becomes possible to recommend a suitable product according to an individual's need.

Definition of the Invention

[0008] In a first aspect, the present invention provides a method of analysing the effect and deposition of remedial and beneficial treatments on hair, comprising the steps of:

(i) collecting imaging data for at least one hair surface,
(ii) applying at least one treatment, comprising at least one benefit agent, to the hair surface, to deposit the benefit agent onto the hair surface,
(iii) collecting imaging data for the hair surface arising from step (ii),
(iv) converting the imaging data collected at steps (i) and (iii) into a format to create magnified images from a 3D printer,
(v) producing magnified 3D models of the hair surface from a 3D printer using the data from step iv,
(vi) comparing the 3D model arising from step (iii) to the 3D model arising from step (i),
(vii) analyzing the deposition behavior of the benefit agent,
(viii) analyzing any consumer perceivable effect resulting from step (ii), and
(ix) correlating the analysis of step (vii) to the analysis of step (viii).

[0009] Preferably, steps (ii) to (vi) are repeated. Steps (ii) to (vi) may be repeated multiple times in order to enable assessment of the impact of repeated or long term exposure to the benefit agent. For example, from 2 to 20 times, preferably from 2 to 8 times.

[0010] This method allows the properties shown in the magnified image/3D model at step (v) of the method of the invention to be compared to the initial image/3D model from step (i).

[0011] Properties that may be seen in the magnified image obtained at the initial stage (i) are external topographical aspects of the hair fibre, for example, cuticle lift, cuticle damage (for example, chipping, splitting, change in shape and breaking), cuticle erosion, split ends, kinks, blobs, cracks, holes and knots. The extent to which these are present at the initial imaging stage (i) depends on the age and condition of the hair at the beginning of the method.

[0012] Different benefit agents are deposited onto hair surfaces in different ways and the nature of the deposition can affect the benefit perceived by the consumer. For example, deposition may occur in layers or as discrete particles, and

at different locations on the hair surface. These aspects are conferred at step (ii) of the method, and are apparent from step (v).

[0013] Examples of benefit agents that may be deposited onto hair surfaces include hair conditioning agents such as silicones, lipids and oils; styling polymers; waxes, sunscreens, bodyfying agents and mixtures thereof.

[0014] A preferred silicone is DC5-7134 (ex Dow Corning). A preferred styling polymer is PSA Acudyne MD5800 (ex Dow Corning).

[0015] Consumer perceivable effects are any changes, perceived by the consumer, as a result of the treatment with the benefit agent, including for example, changes to the perception of damage, the perception of protection or the perception of repairing. These can be perceived by properties such as rough feel, smoothness, softness, harshness, dryness, moisturisation, ease of combing and friction.

[0016] It is possible to recommend a suitable product according to an individual's need, that targets the properties of the hair.

[0017] The method of the invention may be used in an educational tool, in communication with press, media or trade, at point of sale, in professional environments such as salons, and in commercial material, advertisement material and promotional material.

General Description of the Invention

The image

[0018] Preferably, the image is a topographic surface image; more preferably, the topographic surface image is produced using a 3D optical profiler, such as a Sensofar S neox, or laser profilometer.

[0019] The topographic surface is converted into a format suitable for a 3D printer, preferably it is exported in a digital file as spatial coordinates (X, Y, Z) of each point which describes the topographic (3D) surface. Preferably, this is completed using a profilometer. An example of a suitable profilometer is the Sensofar S neox profilometer that can produce a 3d image of the surface to be studied. The profilometer software, for example sensoSCAN v5, can export a file ".dat" that is a list of all the X, Y, Z coordinates of each point.

[0020] Preferably, the magnified 3D image has a magnification of from 100 to 50,000, preferably 30,000 times.

[0021] If desired the conversion of the imaging data iv) comprises a magnification process. The magnification is preferably achieved by change of resolution, units and/or rescale of coordinate axis, producing a new digital file with the new spatial coordinates. A preferred way of magnifying the data points is using Matlab. In this preferred method the ".dat" file is imported in Matlab as a matrix and a set of Matlab scripts are used to manipulate the matrix and change the resolution/scale. It is highly preferred if the matrix is exported into a new ASCII file ".XYZ" as a list of all the X, Y, Z coordinates of each point.

[0022] The imaging data is converted into an image suitable for a 3D printer. Preferably, the file is imported in a 3D-CAD software and the 3D surface is applied onto a face of a parallelogram to obtain a 3D object. The resulting 3D image is exported to a digital file compatible with the 3D-printer device software. The XYZ file is preferably imported into a software conversion package, for example the "Rhino" software package, which can convert it into a 3d file and export as a .STL file.

[0023] The 3D image is printed to form a 3D object. This can be achieved by using any of the modern 3D printers available, an example is EOS (Electro Optical Systems) EOSINT P380 Selective Laser Sintering printer and a 3D replica of the magnified surface produced.

[0024] Preferably, a colour rinse is applied to the 3D model to highlight the areas of interest. The colours can be varied according to the surface height. This is useful in showing up extent of cuticle lift and depth of holes, etc.

The Hair

[0025] The method of the invention can be carried out on a single hair fibre, or a bundle of hair fibres.

[0026] The hair is preferably human hair.

Beneficial and Remedial Treatments

[0027] A preferred type of treatments are those that reduce or alleviate the effects of damage to the hair. A further preferred type of treatment are styling treatments.

[0028] Preferred treatments for hair are rinse off and leave on products. Leave on products include conditioning products and styling products such as mousses, waxes, creams and gels.

[0029] Preferred hair treatment compositions are selected from a shampoo, a rinse-off hair conditioner, a hair mask, a leave-on conditioner composition, and a pre-treatment composition, more preferably selected from a rinse-off hair

conditioner, a hair mask, a leave-on conditioner composition, and a pre-treatment composition and most preferably selected from a rinse-off hair conditioner, a hair mask and a leave-on conditioner composition. An example of a suitable pre-treatment composition is an oil treatment.

[0030] Rinse off conditioners for use in the invention are conditioners that are typically left on wet hair for 1 to 2 minutes before being rinsed off.

[0031] Hair masks for use in the present invention are treatments that are typically left on the hair for 3 to 10 minutes, preferably from 3 to 5 minutes, more preferably 4 to 5 minutes, before being rinsed off.

[0032] Leave-on conditioners for use in the invention are typically applied to the hair and left on the hair for more than 10 minutes, and preferably are applied to the hair after washing and not rinsed out until the next wash.

[0033] Treatments compositions for use in the method of the current invention preferably comprise conditioning agents. Conditioning agents are preferably selected from cationic surfactants, used singly or in admixture.

[0034] Cationic surfactants useful in compositions for use in the method of the invention contain amino or quaternary ammonium hydrophilic moieties which are positively charged when dissolved in aqueous composition.

[0035] Examples of suitable cationic surfactants are those corresponding to the formula

$$[N(R_1)(R_2)(R_3)(R_4)]^+ (X)^-$$

in which R_1, R_2, R_3 and R_4 are independently selected from (a) an aliphatic group of from 1 to 22 carbon atoms, or (b) an aromatic, alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alklaryl group having up to 22 carbon atoms; and X is a salt-forming anion such as those selected from halogen, (e.g. chloride, bromide), acetate, citrate, lactate, glycolate, phosphate nitrate, sulphate, and alkylsulphate radicals.

[0036] The aliphatic groups can contain, in addition to carbon and hydrogen atoms, ether linkages, and other groups such as amino groups. The longer chain aliphatic groups, e.g., those of about 12 carbons, or higher, can be saturated or unsaturated.

[0037] The most preferred cationic surfactants for compositions for use in the method of the present invention are monoalkyl quarternary ammonium compounds in which the akyl chain lengthy is C_8 to C_{14}.

[0038] Suitable examples of such materials correspond to the formula

$$[N(R_5)(R_6)(R_7)(R_8]^+ (X)^-$$

in which R_5 is a hydrocarbon chain having 8 to 14 carbon atoms or a functionalised hydrocarbyl chain with 8 to 14 carbon atoms and containing ether, ester, amido or amino moieties present as substituents or as linkages in the radical chain, and R_6, R_7 and R_8 are independently selected from (a) hydrocarbyl cahins of from 1 to about 4 carbon atoms, or (b) functionalised hydrocarbyl chains having from 1 to about 4 carbon atoms and containing one or more aromatic, ether, ester, amido or amino moieties present as substituents or as linkages in the radical chain, and X is a salt-forming anion such as those selected from halogen, (e.g. chloride, bromide), acetate, citrate, lactate, glycolate, phosphate nitrate, sulphate and alkylsulphate radicals.

[0039] The functionalised hydrocarbyl cahins (b) may suitably contain one or more hydrophilic moieties selected from alkoxy (preferably C_1-C_3 alkoxy), polyoxyalkylene, alkylester, and combinations thereof.

[0040] Preferably the hydrocarbon chains R_1 have 12 to 14 carbon atoms, most preferably 12 carbon atoms. They may be derived from source oils which contain substantial amounts of fatty acids having the desired hydrocarbyl chain length. For example, the fatty acids from palm kernel oil or coconut oil can be used as a source of C_8 to C_{12} hydrocarbyl chains.

[0041] Typical monoalkyl quarternary ammonium compounds of the above general formula for use in compositions for use in the method of the invention include:

(i) Lauryl trimethylammonium chloride (available commercially as Arquad C35 ex Akzo); cocodimethyl benzyl ammonium chloride (available commercially as Arquad DMCB-80 ex-Akzo)

(ii) Compounds of the formula:

$$[N(R_1)(R_2)((CH_2CH_2O)_xH)((CH_2CH_2O)_yH]^+ (X)^-$$

wherein:

x + y is an integer from 2 to 20;

R_1 is a hydrocarbyl chain having 8 to 14, preferably 12 to 14, most preferably 12 carbon atoms and containing ether, ester, amido or amino moieties present as substituent's or as linkages in the radical chain;

R_2 is a C_1-C_3 alkyl group or benzyl group, preferably methyl, and

X is a salt-forming anion such as those selected from halogen, (e.g. chloride, bromide), acetate, citrate, lactate, glycolate, phosphate nitrate, sulphate, methosulphate and alkylsulphate radicals.

Suitable examples are PEG-n lauryl ammonium chlorides (where n is the PEG chain length), such as PEG-2 cocomonium chloride (available commercially as Ethoquad C12 ex-Akzo Nobel); PEG-2 cocobenzyl ammonium chloride (available commercially as Ethoquad CB12 ex-Akzo Nobel); PEG-5 cocomonium methosulphate (available commercially as Rewoquat CPEM ex Rewo); PEG-15 cocomonium chloride (available commercially as Ethoquad C/25 ex-Akzo).

(iii) Compounds of the formula:

$$[N(R_1)(R_2)(R_3)((CH_2)_nOH)]^+ (X)^-$$

wherein:

n is an integer from 1 to 4, preferably 2;
R_1 is a hydrocarbyl chain having 8 to 14, preferably 12 to 14, most preferably 12 carbon atoms;
R_2 and R_3 are independently selected from C_1 - C_3 alkyl groups, and are preferably methyl, and
X- is a salt-forming anion such as those selected from halogen, (e.g. chloride, bromide), acetate, citrate, lactate, glycolate, phosphate nitrate, sulphate, alkylsulphate radicals. Suitable examples are lauryldimethylhydroxyethylammonium chloride (available commercially as Prapagen HY ex-Clariant).

[0042] Mixtures of any of the foregoing cationic surfactants compounds may also be suitable.

[0043] Examples of suitable cationic surfactants for use in hair compositions for use in the method of the invention include cetyltrimethylammonium chloride, behenyltrimethylammonium chloride, cetylpyridinium chloride, tetramethylammonium chloride, tetraethylammonium chloride, octyltrimethylammonium chloride, dodecyltrimethylammonium chloride, hexadecyltrimethylammonium chloride, octyldimethylbenzylammonium chloride, decyldimethylbenzylammonium chloride, stearyldimethylbenzylammonium chloride, didodecyldimethylammonium chloride, dioctadecyldimethylammonium chloride, tallowtrimethylammonium chloride, cocotrimethylammonium chloride, and the corresponding hydroxides thereof. Further suitable cationic surfactants include those materials having the CTFA designations Quaternium-5, Quaternium-31 and Quaternium-18. Mixtures of any of the foregoing materials may also be suitable. A particularly useful cationic surfactant is cetyltrimethylammonium chloride, available commercially, for example as DEHYQUART, ex Henkel.

[0044] The level of cationic surfactant is preferably from 0.01 to 10, more preferably 0.05 to 5, most preferably 0.1 to 2 w.t. % of the total composition.

[0045] A preferred conditioner comprises a conditioning gel phase. Such conditioners and methods for making them are described in WO2014/016354, WO2014/016353, WO2012/016352 and WO2014/016351.

[0046] The conditioning compositions may also comprise other optional ingredients. Such ingredients include, but are not limited to; fatty material, deposition polymers and further conditioning agents.

[0047] Conditioner compositions preferably additionally comprise fatty materials. The combined use of fatty materials and cationic surfactants in conditioning compositions is believed to be especially advantageous, because this leads to the formation of a structured lamellar or liquid crystal phase, in which the cationic surfactant is dispersed.

[0048] By "fatty material" is meant a fatty alcohol, an alkoxylated fatty alcohol, a fatty acid or a mixture thereof. Preferably, the alkyl chain of the fatty material is fully saturated.

[0049] Representative fatty materials comprise from 8 to 22 carbon atoms, more preferably 16 to 22. Examples of suitable fatty alcohols include cetyl alcohol, stearyl alcohol and mixtures thereof. The use of these materials is also advantageous in that they contribute to the overall conditioning properties of compositions.

[0050] Alkoxylated, (e.g. ethoxylated or propoxylated) fatty alcohols having from about 12 to about 18 carbon atoms in the alkyl chain can be used in place of, or in addition to, the fatty alcohols themselves. Suitable examples include ethylene glycol cetyl ether, polyoxyethylene (2) stearyl ether, polyoxyethylene (4) cetyl ether, and mixtures thereof. The level of fatty material in conditioners is suitably from 0.01 to 15, preferably from 0.1 to 10, and more preferably from 0.1 to 5 percent by weight of the total composition. The weight ratio of cationic surfactant to fatty alcohol is suitably from 10:1 to 1:10, preferably from 4:1 to 1:8, optimally from 1:1 to 1:7, for example 1:3.

[0051] Further conditioning ingredients include esters of fatty alcohol and fatty acids, such as cetyl palmitate.

[0052] A conditioning composition for use in the present invention may preferably comprise a miscellar structured liquid.

[0053] The pH of a conditioner comprising the present composition is preferably 3-5. More preferably the pH of the composition is 4.5-5.5.

[0054] Where the composition has a pH of less than 3.10 it is preferred that it is in the form of a conditioning mask for intense treatment.

[0055] Further conditioning ingredients include conditioning oils, preferably selected from coconut oil and olive oil.
[0056] The invention will now be illustrated by the following non-limiting Examples:

Examples

[0057] Specimen hair fibres were sampled from a human head and an untreated specimen was imaged according to the method below. The fibres were then treated with silicone or a styling polymer, and imaged as before.
[0058] The silicone was DC5-7134 (ex Dow Corning).
[0059] The styling polymer was a pressure sensitive adhesive (PSA) available as Acudyne MD5800 (ex Dow Corning).
[0060] The silicone was incorporated into a conditioner base, whilst the PSA was prepared in a shampoo base.
[0061] The shampoo composition, comprising PSA styling polymer is shown in Table 2.

Table 2: Composition of shampoo comprising PSA

Material	**Weight % in composition**
Acudyne MD 5800[1] (55 % active)	3.64 %
Carbopol® 980[2] (4 % active)	10 %
Sodium hydroxide (50 % active)	0.43 %
Sodium Laureth Sulphate (70 % active)	17.14 %
Cocoamidopropyl betaine[3] (30 % active)	5.33 %
Jaguar C14 S[4]	0.2 %
Water and minors	To 100 %
1 - Acudyne MD5800 is an acrylic PSA available from Dow Corning 2 - Carbopol® 980 is a crosslinked polyacrylate polymer available from Lubrizol 3 - supplied by Galaxy 4 - Jaguar C14 S is Guar Hydroxypropyl Trimonium Chloride polymer available from Rhodia	

[0062] The shampoo composition was prepared using the following method;
Heating the water to 30°C and stirring using an overhead stirrer and paddle (e.g. Heidolph). Adding the PSA emulsion and stirring until thoroughly mixed. Adding each of the remaining ingredients individually and allowing the composition to thoroughly mix between each addition. Adjusting the pH and viscosity as required using NaCl and NaOH.
[0063] Hair was treated with the shampoo using the following method:-
The hair fibres were held under running water for 30 seconds, shampoo applied using a non-hypodermic syringe in a dose of 0.1 ml of shampoo per 1g of hair and rubbed into the hair for 30 seconds. Excess lather was removed by holding under running water for 30 seconds and the shampoo stage repeated. The hair was rinsed under running water for 1 minute and excess water removed using a wipe.
[0064] The conditioner composition, comprising silicone is shown in Table 3 and may be prepared by the following method;
Heating the water to 81 °C and stirring using an overhead stirrer and paddle (e.g. Heidolph). Mixing in the fatty materials and the surfactant. Maintaining heat and stirring for 30 minutes. Cooling the mixture and mixing in the remaining ingredients. Mixing at high shear for 5 minutes (e.g. using a Silverson mixer).

Table 3: Composition of conditioner comprising DC5-7134

Material	**Weight % in composition**
Lactic acid (85 % active)	0.38 %
Stearamidopropyl Dimethylamine	1.25 %
Cetearyl Alcohol	5.00 %
Behentrimonium Chloride & Dipropylene Glycol[2] (68.5 % active)	1.25 %
Sodium chloride	0.10 %
Silicone DC 5-7134[3] (70 % active)	1.45 %

(continued)

Material	Weight % in composition
Water and minors	To 100 %
1 - DC5-7134 available from Dow Corning 2 - trade name Genamin BTLF supplied by Aako 3 - Silicone DC 5-71334 supplied by Dow Corning	

[0065] Hair was treated with the conditioner using the following method:-
The hair fibres were held under running water for 30 seconds. Conditioner was then applied to the hair by a non-hypodermic syringe in a dose of 0.2 ml of conditioner per 1g of hair and massaged into the hair for 1 minute. The hair was rinsed under running water for 1 minute and excess water removed using a wipe.

Imaging Method

[0066] The topographic surface of the hair fibres was converted into a format suitable for a 3D printer, by exporting in a digital file as spatial coordinates (X, Y, Z) of each point which describes the topographic (3D) surface using a sensoSCAN v5 with a Sensofar S neox profilometer.

[0067] The resulting digital file data was magnified by importing to Matlab as a matrix and using Matlab scripts to manipulate the matrix and change the resolution/scale. The matrix was then exported into a new ASCII file ".XYZ" as a list of all the X,Y,Z coordinates of each point. The magnification was 30,000 times.

[0068] The imaging data was converted into an image suitable for a 3D printer using 3D-CAD software and the 3D surface was applied onto a face of a parallelogram to obtain a 3D object. The resulting 3D image was exported to a digital file compatible with the 3D-printer device software by use of the "Rhino" software package, which converted it into a 3D file and exported it as a .STL file.

[0069] The 3D image was then printed to form a 3D object. This was achieved by using an EOS (Electro Optical Systems) EOSINT P380 Selective Laser Sintering printer and a 3D replica of the magnified surface produced.

[0070] Comparing the resulting 3D images demonstrated the effect of the treatments on the hair.

[0071] The results are shown in Figures 1, 2 and 3, where:-

Fig 1 is a 3D printable image of an untreated hair fibre.
Fig 2 is a 3D printable image of hair that has been treated with shampoo comprising PSA styling polymer.
Fig 3 is a 3D printable image of a hair fibre that has been treated with conditioner comprising silicone.

[0072] It can be seen that the treatments clearly had an impact on the surface of the hair. Silicone was deposited as a layer along the length of the fibre, thus having a beneficial smoothing effect to raised or chipped cuticles. Particles of styling polymer (i.e. pressure sensitive adhesive) were deposited in discrete blobs on the cuticles. This caused increased friction and conferred a styling benefit and shape benefit and longevity of hold. Thus it is possible to recommend highly suitable treatments to suit individual hair needs.

Claims

1. A method of analysing the effect and deposition of remedial and beneficial treatments on hair, comprising the steps of:

(i) collecting imaging data for at least one hair surface,
(ii) applying at least one treatment, comprising at least one benefit agent, to the hair surface, to deposit the benefit agent onto the hair surface,
(iii) collecting imaging data for the hair surface arising from step (ii),
(iv) converting the imaging data collected at steps (i) and (iii) into a format to create magnified images from a 3D printer,
(v) producing magnified 3D models of the hair surface from a 3D printer using the data from step iv,
(vi) comparing the 3D model arising from step (iii) to the 3D model arising from step (i),
(vii) analyzing the deposition behavior of the benefit agent,
(viii) analyzing any consumer perceivable effect resulting from step (ii), and
(ix) correlating the analysis of step (vii) to the analysis of step (viii).

2. A method as claimed in claim 1, which further comprises a step of repeating steps (ii) to (vi).

3. A method as claimed in claim 1 or claim 2, wherein the hair composition is selected from a shampoo, a rinse-off hair conditioner, a hair mask, a leave-on treatment composition, and a pre-treatment composition.

4. A method as claimed in any preceding claim, wherein the benefit agent is selected from hair conditioning agents such as silicones, lipids and oils; styling polymers; waxes, sunscreens, bodyfying agents and mixtures thereof.

5. A method as claimed in any preceding claim, wherein the benefit agent is deposited onto hair surfaces in layers or as discrete particles.

6. A method as claimed in any preceding claim, which further comprises a step of applying a colour rinse to the 3D model to highlight the areas of interest.

7. A method as claimed in any preceding claim, wherein the magnified 3D has a magnification of from 100 to 50,000, preferably 30,000 times.

Patentansprüche

1. Verfahren zur Analyse des Effekts und der Ablagerung von Heil- und vorteilhaften Behandlungen auf Haar, umfassend die Schritte:

(i) Sammeln von Bildgebungsdaten für mindestens eine Haaroberfläche,
(ii) Auftragen mindestens einer Behandlung, umfassend mindestens ein Vorteilsmittel, auf die Haaroberfläche, um das Vorteilsmittel auf der Haaroberfläche abzulagern,
(iii) Sammeln der Bildgebungsdaten für die Haaroberfläche, die sich aus dem Schritt (ii) ergeben,
(iv) Umwandeln der in den Schritten (i) und (iii) gesammelten Bildgebungsdaten in ein Format, um vergrößerte Bilder von einem 3D-Drucker zu erzeugen,
(v) Erzeugen vergrößerter 3D-Modelle der Haaroberfläche von einem 3D-Drucker unter Verwendung der Daten aus Schritt iv,
(vi) Vergleichen des sich aus Schritt (iii) ergebenden 3D-Modells mit dem sich aus Schritt (i) ergebenden 3D-Modell,
(vii) Analysieren des Ablagerungsverhaltens des Vorteilsmittels,
(viii) Analysieren aller vom Verbraucher wahrzunehmenden Effekte, die aus dem Schritt (ii) resultieren, und
(ix) Korrelieren der Analyse des Schritts (vii) mit der Analyse des Schritts (viii).

2. Verfahren, wie im Anspruch 1 beansprucht, das ferner einen Schritt von Wiederholungsschritten (ii) bis (vi) umfasst.

3. Verfahren, wie im Anspruch 1 oder Anspruch 2 beansprucht, wobei die Haarzusammensetzung unter einem Shampoo, einem abspülbaren Haarkonditionierer, einer Haarmaske, einer Leave-on-Behandlungszusammensetzung und einer Vorbehandlungszusammensetzung ausgewählt ist.

4. Verfahren, wie in irgendeinem vorhergehenden Anspruch beansprucht, wobei das Vorteilsmittel unter Haarkonditioniermitteln, wie Siliconen, Lipiden und Ölen; Styling-Polymeren; Wachsen, Sonnenschutzmitteln, Körperpflegemitteln und Mischungen davon ausgewählt ist.

5. Verfahren, wie in irgendeinem vorhergehenden Anspruch beansprucht, wobei das Vorteilsmittel auf dem Haar in Schichten oder als diskrete Partikel auf den Haaroberflächen abgelagert wird.

6. Verfahren, wie in irgendeinem vorhergehenden Anspruch beansprucht, welches ferner einen Schritt der Anwendung einer Farbspülung auf das 3D-Modell umfasst, um die interessierenden Bereiche hervorzuheben.

7. Verfahren, wie in irgendeinem vorhergehenden Anspruch beansprucht, wobei das vergrößerte 3D eine 100- bis 50.000-, vorzugsweise 30.000-fache, Vergrößerung aufweist.

Revendications

1. Procédé d'analyse des effet et dépôt de traitements réparateurs et bénéfiques sur des cheveux, comprenant les étapes de :

   (i) recueil de données d'imagerie pour au moins une surface des cheveux,
   (ii) application d'au moins un traitement, comprenant au moins un agent bénéfique, à la surface des cheveux, pour déposer l'agent bénéfique sur la surface des cheveux,
   (iii) recueil de données d'imagerie pour la surface des cheveux provenant de l'étape (ii),
   (iv) conversion des données d'imagerie recueillies dans les étapes (i) et (iii) dans un format pour créer des images agrandies à partir d'une imprimante 3D,
   (v) production de modèles 3D agrandis de la surface des cheveux à partir d'une imprimante 3D en utilisant les données de l'étape (iv),
   (vi) comparaison du modèle 3D provenant de l'étape (iii) au modèle 3D provenant de l'étape (i),
   (vii) analyse du comportement au dépôt de l'agent bénéfique,
   (viii) analyse de tout effet perceptible par le consommateur résultant de l'étape (ii), et
   (ix) corrélation de l'analyse de l'étape (vii) par rapport à l'analyse de l'étape (viii).

2. Procédé selon la revendication 1, qui comprend de plus une étape répétant les étapes (ii) à (vi).

3. Procédé selon la revendication 1 ou la revendication 2, dans lequel la composition des cheveux est choisie parmi un shampoing, un agent de conditionnement à rincer, un masque pour cheveux, une composition de traitement sans rinçage, et une composition de pré-traitement.

4. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'agent bénéfique est choisi parmi des agents de conditionnement des cheveux, tels que des silicones, des lipides et des huiles ; des polymères de coiffage ; des cires, des écrans solaires, des agents épaississeurs et des mélanges de ceux-ci.

5. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'agent bénéfique est déposé sur des surfaces des cheveux en couches ou comme particules discrètes.

6. Procédé selon l'une quelconque des revendications précédentes, qui comprend de plus une étape d'application d'un rinçage de couleur par rapport au modèle 3D pour accentuer les zones d'intérêt.

7. Procédé selon l'une quelconque des revendications précédentes, dans lequel la 3D agrandie présente un agrandissement de 100 à 50 000, de préférence 30 000 fois.

Fig. 1

Untreated fibre

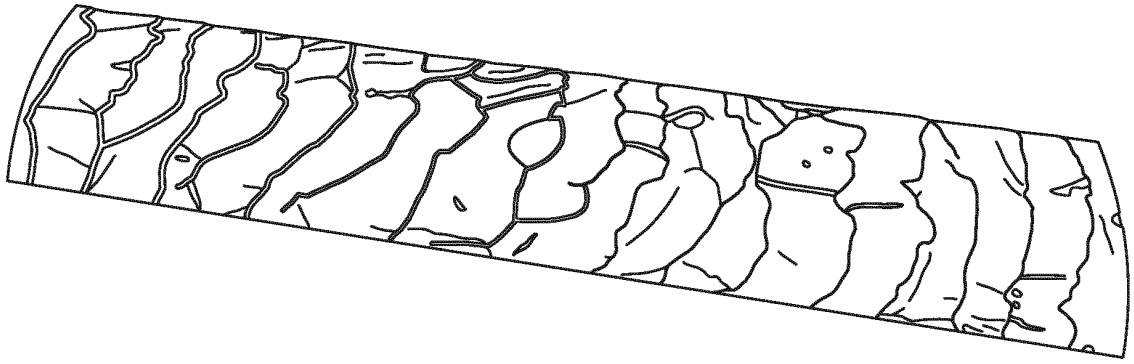


Fig. 2

Showing PSA deposition on hair from a 2% shampoo

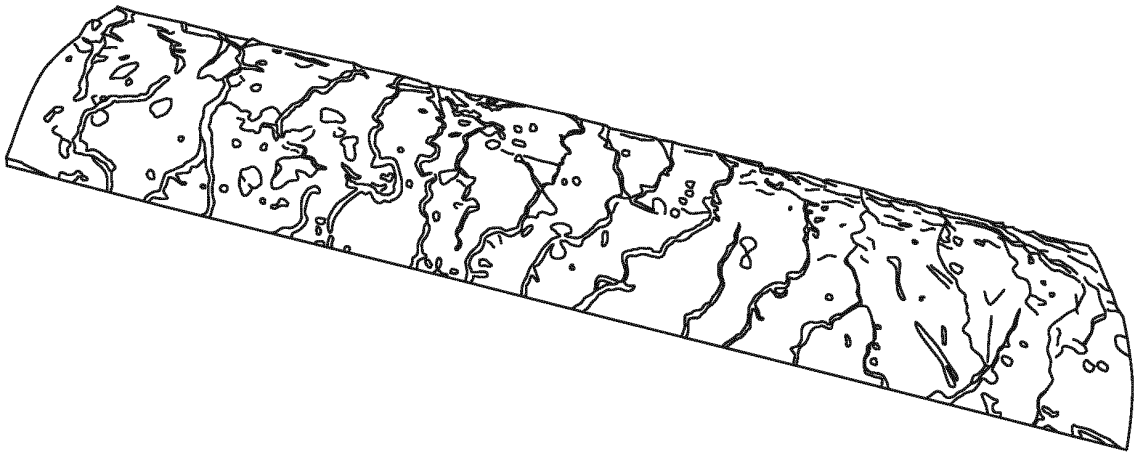
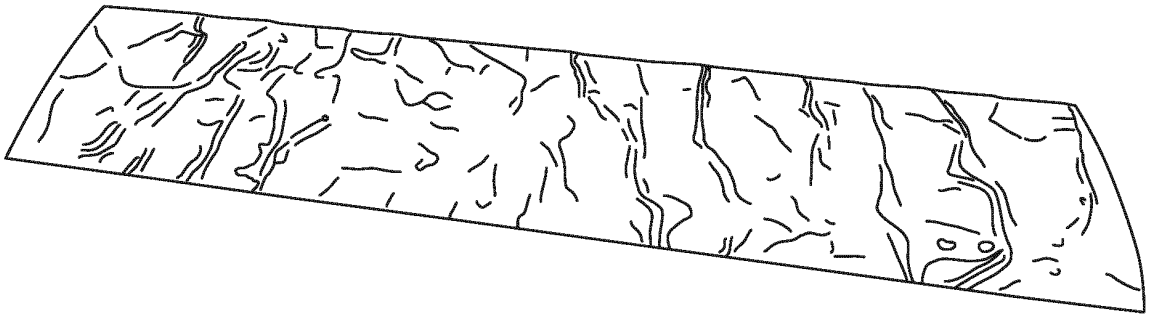


Fig. 3

Showing PSA silicone deposition on hair from a conditioner



REFERENCES CITED IN THE DESCRIPTION

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专利名称(译)	建模系统		
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当前申请(专利权)人(译)	联合利华 UNILEVER N.V.		
[标]发明人	IFTIKHAR ABID MCKEOWN ROBERT		
发明人	IFTIKHAR, ABID MCKEOWN, ROBERT		
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摘要(译)

一种使用3D打印机分析至少一个头发表面的方法，包括收集至少一个头发表面的第一成像数据。 将至少一种处理剂施加到所述至少一个毛发表面，所述至少一种处理剂包括至少一种有益剂； 在进行至少一种处理之后，收集至少一个头发表面的第二成像数据； 将第一成像数据转换为第一格式化数据，该第一格式化数据与3D打印机相关联； 将第二成像数据转换为第二格式化数据，该第二格式化数据与3D打印机相关联； 使用第一格式化数据从3D打印机产生至少一个头发表面的第一3D模型； 并使用第二格式化数据从3D打印机生成至少一个头发表面的第二3D模型。