PRESSURIZED HAIR COMPOSITION
COMPRISING AT LEAST ONE
ELASTOMERIC FILM-FORMING POLYMER

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The present disclosure relates to a pressurized hair composition comprising at least one elastomeric film-forming polymer and at least one propellant, and also the use of these compositions for styling the hair.
PRESSURIZED HAIR COMPOSITION
COMPRISING AT LEAST ONE ELASTOMERIC FILM-FORMING POLYMER

[0001] This application claims benefit of U.S. Provisional Application No. 60/620,429, filed Oct. 21, 2004, the contents of which are incorporated herein by reference. This application also claims benefit of priority under 35 U.S.C. § 119 to French Patent Application No. 04 51397, filed Jul. 1, 2004, the contents of which are also incorporated by reference.

[0002] In one embodiment, the present disclosure relates to a pressurized hair composition comprising at least one elastomeric film-forming polymer and at least one propellant, and the use of the composition for styling the hair.

[0003] Styling compositions, such as lacquers and sprays, packaged in the form of an aerosol spray, are generally composed of a liquid phase comprising, in a cosmetically acceptable alcoholic or aqueous-alcoholic medium, at least one film-forming polymer, and a propellant that is a liquefied gas under reduced pressure or dissolved in the liquid phase.

[0004] In the hair products field, it may be desirable to produce aerosol lacquers that contain no volatile organic compound such as ethanol or dimethyl ether, for essentially ecological reasons, while at the same time conserving good properties with respect to shaping and holding the hair style.

[0005] The difficulty is to obtain good spraying conditions and a lacquer that has shaping and holding properties entirely equivalent to those of the commonly used lacquers and contains no volatile organic compound.

[0006] The present inventors have found that the use, in pressurized hair compositions, of certain elastomeric film-forming polymers results in formulations that may be readily sprayable, such as when they contain a high proportion of water. These compositions may be readily applied to the hair and, surprisingly, may give the appearance of dry hair much more rapidly than the known polymers that were tested. The elastomeric film-forming polymers may exhibit a satisfactory styling capacity and may be easily removed by simple shampooing. Brushing the treated hair may not result in a powdering effect, but may leave the hair soft and shiny.

[0007] Disclosed herein is a hair composition, packaged in an aerosol device, comprising, in a cosmetically acceptable medium, at least one elastomeric film-forming polymer chosen from non-ionic, anionic, amphoteric and cationic elastomeric film-forming polymers comprising at least one fluoro group, wherein the at least one elastomeric film-forming polymer is chosen such that the material obtained by drying this polymer, at ambient temperature and at a relative humidity of 55%±5%, has a mechanical profile defined by at least:

[0008] a) an elongation at break (ε) of greater than or equal to 800%;

[0009] b) an instantaneous recovery (R,) of greater than or equal to 75%, after an elongation of 150%; and

[0010] c) a recovery (R,00) at 300 seconds of greater than 80%, and at least one propellant.

[0011] Further disclosed herein is the use of such a hair composition for styling the hair.

[0012] As used herein, the term “film obtained by drying at ambient temperature (22° C±2° C) and at a relative humidity of 55%±5%” means the film obtained, under these conditions, from a mixture containing 6% of active material (AM) of the elastomeric film-forming polymer in a mixture of 30% by weight of ethanol and 70% by weight of water, relative to the total weight of alcohol-water, the amount of mixture being adjusted so as to obtain, in a Teflon matrix, a film 500 μm±50 μm thick. The drying is continued until the weight of the film no longer changes, which lasts approximately 12 days. The film-forming polymers that are soluble or partially soluble in ethanol are tested in ethanol alone. The other polymers are tested in water alone, in soluble or dispersed form. The relative humidity can readily be determined by one of ordinary skill in the art using the known techniques.

[0013] As used herein, the elongation at break and the recovery rate are evaluated by the tests described below.

[0014] To carry out the tensile tests, the film is cut into rectangle-shaped test pieces, 80 mm long and 15 mm wide.

[0015] The tests are carried out on a device sold under the name Lloyd or sold under the name Zwick, under the same temperature and humidity conditions as for the drying, i.e., a temperature of 22° C±2° C and a relative humidity of 55%±5%.

[0016] The test pieces are drawn at a rate of 20 mm/min and the distance between the jaws is 50±1 mm.

[0017] To determine the instantaneous recovery (R,), the following procedure is carried out:

[0018] the test piece is drawn by 150% (εmax), i.e., 1.5 times its initial length (l0),

[0019] the stress is released by applying a return speed equal to the tensile speed, i.e., 20 mm/min, and the elongation of the test piece is measured as a percentage, after returning to zero constraint (ε0).

[0020] The % instantaneous recovery (R,) is given by the formula below:

\[ R, = \left( \frac{\varepsilon_{\text{max}} - \varepsilon_0}{\varepsilon_{\text{max}}} \right) \times 100 \]

[0021] To determine the recovery at 300 seconds, the test piece, having undergone the above operations, is maintained at zero constraint for a further 300 seconds, and its percentage elongation (ε300) is measured.

[0022] The % recovery at 300 seconds (R,300) is given by the formula below:

\[ R_{300} = \left( \frac{\varepsilon_{\text{max}} - \varepsilon_{300}}{\varepsilon_{\text{max}}} \right) \times 100 \]

[0023] For example, the at least one elastomeric film-forming polymer of the composition disclosed herein, optionally combined with at least one agent chosen from plasticizers and film-forming agents, is such that it forms under the conditions of the above tests, a film having an elongation at break ranging from 800% to 3000%; an instantaneous recovery ranging from 75% to 100%; and a recovery at 300 seconds ranging from 85% to 100%.

[0024] In one embodiment, the at least one elastomeric film-forming polymer of the composition disclosed herein is such that it forms at ambient temperature and at a relative humidity ranging from 30% to 80%, a film having an
elongation at break ranging from 400% to 1200% and/or an instantaneous recovery ranging from 57% to 93%.

[0025] For example, in some of the compositions disclosed herein, the at least one elastomeric film-forming polymer is present in an amount ranging, for example, from 0.05% to 20% by weight, such as from 0.1% to 15% by weight, and further such as from 0.25% to 10% by weight, relative to the total weight of the composition.

[0026] In one embodiment, the at least one elastomeric film-forming polymer is chosen from polyurethanes, polyvinyl alcohols, and polymers comprising at least one (meth-)acrylic unit. It may be in the form of a homopolymer or a copolymer. For example, it is in a non-crosslinked form in the composition.

[0027] The composition may also comprise at least one auxiliary film-forming agent chosen from plasticizers and agents for facilitating the formation of a film of the at least one elastomeric polymer on keratin materials, the function of which is to modify the properties of the at least one elastomeric polymer. Such an auxiliary film-forming agent can be chosen from any of the compounds known to those skilled in the art to be capable of performing the desired function, and can, for example, be chosen from plasticizers and coalescence agents. The at least one elastomeric film-forming polymer, optionally combined with at least one auxiliary film-forming agent chosen from plasticizers and agents for facilitating film formation, are capable of forming a film, after evaporation of the cosmetic medium. This evaporation can be carried out in the open air or by supplying heat, for example, by a dryer.

[0028] As an example of the plasticizers and the agents for facilitating film formation on keratin materials, use may be made of those described in document FR-A-2 782 917. For example, the at least one auxiliary film-forming agent is chosen from the common plasticizers and coalescence agents, such as:

- glycols and their derivatives, such as diethylene glycol ethyl ether, diethylene glycol methyl ether, diethylene glycol butyl ether or alternatively diethylene glycol hexyl ether, ethylene glycol ethyl ether, ethylene glycol butyl ether, ethylene glycol hexyl ether or pentylene glycol,
- glyceryl esters,
- derivatives of propylene glycol, such as propylene glycol phenyl ether, propylene glycol diacetate, dipropylene glycol butyl ether, tripropylene glycol butyl ether, propylene glycol methyl ether, dipropylene glycol ethyl ether, diethylene glycol methyl ether, triethylene glycol methyl ether and propylene glycol butyl ether,
- acid esters, for example, carboxylic acid esters such as citrates, phthalates, adipates, carbonates, tartrates, phosphates or sebacates, and
- mixtures thereof.

[0030] The amount of the at least one auxiliary film-forming agent can be chosen by those skilled in the art based on their general knowledge, so as to obtain a polymeric system (elastomeric polymers + at least one auxiliary film-forming agent) that produces a film having the desired mechanical properties, while at the same time allowing the composition to keep the desired cosmetic properties. In practice, this amount ranges, for example, from 0.01% to 25% by weight, such as from 0.01% to 15% by weight, relative to the total weight of the composition.

[0035] In one embodiment, in the compositions disclosed herein, the at least one elastomeric film-forming polymer is soluble in an aqueous-alcoholic medium.

[0036] As used herein, the term "compounds soluble" in a given medium means compounds (such as monomers or polymers) which, when introduced into the medium at 25°C, at a concentration by weight equal to 10%, if need be neutralized, make it possible to obtain a solution that is macroscopically homogeneous and transparent, i.e., that has a light transmission value, at a wavelength equal to 500 nm, through a sample 1 cm thick, of at least 70%, such as at least 80%.

[0037] The term "compounds dispersible" in a medium means compounds (such as monomers or polymers) which, when introduced into the medium at 25°C, at a concentration by weight of greater than or equal to 1%, make it possible to obtain a non-transparent homogeneous dispersion.

[0038] For example, the material obtained by drying the polymer disclosed herein, at ambient temperature and at a relative humidity of 55±5%, is water-soluble and/or water-dispersible.

[0039] In one embodiment, an aqueous-alcoholic solution of 5% by weight of the at least one elastomeric film-forming polymer disclosed herein, comprising 30% by weight of water made up to 100% by weight with alcohol, has a viscosity of greater than 20 cps and less than 200 cps at 25°C.

[0040] The viscosity is measured with a Rheomat 180 viscometer.

[0041] The elastomeric film-forming polymers that are useful in the composition disclosed herein are chosen from those known in the art. They may, for example, be synthesized according to the method described in French patent application FR 2 815 350.

[0042] Aerosol Device

[0043] The term "cosmetically acceptable medium" as used herein means a medium consisting of water or one or more cosmetically acceptable organic solvents, for instance C1-C6 lower alcohols, such as ethanol, isopropanol, tert-butanol and n-butanol, and alkylene glycols such as propylene glycol, or alternatively a mixture of water and at least one cosmetically acceptable organic solvent.

[0044] The composition of the cosmetically acceptable medium and its proportion in the final hair composition are such that the overall content, in the hair composition, of volatile organic compounds (VOCs) is, for example, at most 55% by weight.
Dimethyl ether and C3-C8 alkanes, such as propane, n-butane and isobutane, are, for example, used as the propellant.

The liquid phase/propellant weight ratio in the pressurized hair compositions disclosed herein ranges, for example, from 0.05:1 to 50:1, such as from 1.5:1 to 25:1.

The hair compositions disclosed herein can also comprise at least one ingredient chosen from cosmetic and formulation ingredients, normally used in the cosmetics field.

By way of examples of such ingredients, mention may be made of anionic, cationic, non-ionic or amphoteric film-forming polymers other than the at least one elastomeric film-forming polymer described above, volatile or non-volatile silicones, anionic, cationic, amphoteric or non-ionic surfactants, thickeners, pearlescent agents, UV-screening agents, free-radical scavengers, fragrances, preserving agents, pigments and dyes, pH modifiers, solubilizing agents, plasticizers, anti-foaming agents, waxes and oils, vitamins, conditioning agents, and organic or mineral particles that are synthetic or of natural origin.

If the aerosol device that is used to package the compositions disclosed herein is a two-compartment device, it may comprise an outer aerosol can comprising an inner pocket hermetically welded to a valve. The composition is introduced into the inner pocket and a compressed gas is introduced between the pocket and the can at a pressure that is sufficient to eject the product in the form of a spray through the orifice of a nozzle. Such a device is sold under the name EP Spray by the company EP-Spray System SA. The compressed gas is, for example, used at a pressure ranging from 1 to 12 bar, such as from 9 to 11 bar.

Of course, those skilled in the art will take care to choose this or these optional additional additive(s) and/or the amount(s) thereof in such a way that the intrinsic advantageous properties of the compositions disclosed herein are not impaired by the addition(s) envisaged.

The hair compositions are, for example, hair lacquers or mousses.

Other than in the operating examples, or where otherwise indicated, all numbers expressing quantities of ingredients, reaction conditions, and so forth used in the specification and claims are to be understood as being modified in all instances by the term "about." Accordingly, unless indicated to the contrary, the numerical parameters set forth in this specification and attached claims are approximations that may vary depending upon the desired properties sought to be obtained by the present disclosure. At the very least, and not as an attempt to limit the application of the doctrine of equivalents to the scope of the claims, each numerical parameter should be construed in light of the number of significant digits and ordinary rounding approaches.

Notwithstanding that the numerical ranges and parameters set forth in the broad scope of the disclosure are approximations, the numerical values set forth in the specific examples are reported as precisely as possible. Any numerical value, however, inherently contains certain errors necessarily resulting from the standard deviation found in their respective testing measurements.

The present disclosure is illustrated by the following non-limiting examples.

**EXAMPLE 1**

**Mono-Compartmentalized Lacquer Propelled by a Liquefied Gas in a Conventional Aerosol Device**

<table>
<thead>
<tr>
<th>Polyurethane (NMDEA&lt;sup&gt;1&lt;/sup&gt;/PTMO 2900&lt;sup&gt;2&lt;/sup&gt;/IPD&lt;sup&gt;3&lt;/sup&gt;)</th>
<th>3 g/%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fomblin diol 100&lt;sup&gt;4&lt;/sup&gt;</td>
<td>-2,0,5(30,5) AM</td>
</tr>
</tbody>
</table>

| Ethanol | 10 g |
| Water | 52 g |
| DME | 35 g |

<sup>1</sup>N-Methyl-diethanolamine
<sup>2</sup>Poly(tetramethylene oxide) having a weight-average mass of 2900
<sup>3</sup>Isophorone diisocyanate
<sup>4</sup>Perfluoroether

**EXAMPLE 2**

**Bi-Compartmentalized Lacquer Propelled with Compressed Air**

<table>
<thead>
<tr>
<th>Polyurethane (NMDEA&lt;sup&gt;1&lt;/sup&gt;/PTMO 2900&lt;sup&gt;2&lt;/sup&gt;/IPD&lt;sup&gt;3&lt;/sup&gt;)</th>
<th>3 g/%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fomblin diol 100&lt;sup&gt;4&lt;/sup&gt;</td>
<td>-2,0,5(30,5) AM</td>
</tr>
</tbody>
</table>

| Water | 97 g |

<sup>1</sup>N-Methyl-diethanolamine
<sup>2</sup>Poly(tetramethylene oxide) having a weight-average mass of 2900
<sup>3</sup>Isophorone diisocyanate
<sup>4</sup>Perfluoroether

This formulation was packaged in an aerosol device comprising a pocket, sold under the name EP spray. This aerosol distribution device comprises an assembly consisting of a pocket hermetically welded to a valve and a vortex-nozzle diffuser. The valve is attached to a conventional aerosol can.

The pocket was filled with the formulation, and compressed air was introduced between the pocket and the can at a pressure sufficient to eject the product in the form of a spray.

Pressure of the compressed gas ranges from 1 to 12 bar, such as from 9 to 11 bar.

1. A hair composition, packaged in an aerosol device, comprising, in a cosmetically acceptable medium, at least one elastomeric film-forming polymer chosen from non-ionic, anionic, amphoteric and cationic elastomeric film-forming polymers comprising at least one fluoro group, wherein the at least one elastomeric film-forming polymer is chosen such that the material obtained by drying the at least
one elastomeric film-forming polymer, at ambient temperature and at a relative humidity of 55\%±5\%, has a mechanical profile defined by at least:

a) an elongation at break (e) of greater than or equal to 800\%;

b) an instantaneous recovery (R_t) of greater than or equal to 75\%, after an elongation of 150\%; and

c) a recovery (R_{300s}) at 300 seconds of greater than 80\%, and

at least one propellant.

2. The composition according to claim 1, wherein the at least one elastomeric film-forming polymer is soluble in an aqueous or aqueous-alcoholic medium.

3. The composition according to claim 1, wherein, at a relative humidity ranging from 30\% to 80\%, the elongation at break of the film obtained ranges from 400\% to 1200\% and/or its instantaneous recovery ranges from 57\% to 93\%.

4. The composition according to claim 2, wherein the at least one elastomeric film-forming polymer is soluble in an aqueous-alcoholic medium.

5. The composition according to claim 1, wherein the material obtained by drying the at least one elastomeric film-forming polymer, at ambient temperature and at a relative humidity of 55\%±5\%, is water-soluble and/or water-dispersible.

6. The composition according to claim 4, wherein an aqueous-alcoholic solution of 5\% by weight of the at least one elastomeric film-forming polymer, comprising 30\% by weight of water made up to 100\% by weight with alcohol, has a viscosity of greater than 20 cps and less than 200 cps at 25\°C.

7. The composition according to claim 1, wherein the at least one elastomeric film-forming polymer is present in an amount ranging from 0.05\% to 20\% by weight, relative to the total weight of the composition.

8. The composition according to claim 7, wherein the at least one elastomeric film-forming polymer is present in an amount ranging from 0.1\% to 15\% by weight, relative to the total weight of the composition.

9. The composition according to claim 1, wherein the at least one elastomeric film-forming polymer is chosen from polyurethanes, polyvinyl alcohols, and polymers comprising at least one (meth)acrylic unit.

10. The composition according to claim 1, wherein the at least one propellant is chosen from dimethyl ether, C_{3-5} alkanes, 1,1-difluoroethane, mixtures of dimethyl ether and C_{3-5} alkanes, and mixtures of 1,1-difluoroethane and at least one compound chosen from dimethyl ether and C_{3-5} alkanes.

11. The composition according to claim 1, further comprising at least one auxiliary film-forming agent chosen from plasticizers and agents for facilitating the formation of the film of the at least one elastomeric polymer on a keratin material.

12. The composition according to claim 1, further comprising at least one compound chosen from cosmetic additives and formulation adjuvants.

13. The composition according to claim 12, wherein the cosmetic additives and formulation adjuvants are chosen from anionic, cationic, non-ionic and amphoteric film-forming polymers that are soluble or dispersible in an aqueous or aqueous-alcoholic medium, volatile and non-volatile silicones, anionic, cationic, amphoteric and non-ionic surfactants, thickeners, pearlescent agents, UV-screening agents, free-radical scavengers, fragrances, preserving agents, pigments and dyes, pH modifiers, solubilizing agents, plasticizers, anti-foaming agents, waxes and oils, vitamins, conditioners, and organic and mineral particles that are synthetic or of natural origin.

14. The composition according to claim 1, comprising at most 55\% by weight of volatile organic compounds, relative to the total weight of the composition.

15. A method for styling hair, comprising applying to the hair a composition, packaged in an aerosol device, comprising, in a cosmetically acceptable medium, at least one elastomeric film-forming polymer chosen from non-ionic, anionic, amphoteric and cationic elastomeric film-forming polymers comprising at least one fluorour group, wherein the at least one elastomeric film-forming polymer is chosen such that the material obtained by drying the at least one elastomeric film-forming polymer, at ambient temperature and at a relative humidity of 55\%±5\%, has a mechanical profile defined by at least:

a) an elongation at break (e) of greater than or equal to 800\%;

b) an instantaneous recovery (R_t) of greater than or equal to 75\%, after an elongation of 150\%; and

c) a recovery (R_{300s}) at 300 seconds of greater than 80\%, and

at least one propellant.