

COMPOSITION COMPRISING OXIDISED POLYSACCHARIDE

Field of the Invention

- 5 The present invention relates to a hair care composition comprising an oxidised polysaccharide, to the use of an oxidised polysaccharide as a hair fixative agent and to a method of treating hair with the hair care composition.

Background

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Hair care compositions that can be used to fix hair into position are known and typically comprise a polymer as a hair fixative agent. One such hair fixative agent is Amphomer®, which is an amphoteric acrylic polymer. Amphomer® is an effective hair fixative agent and has other desirable properties, such as being clear, non-tacky, giving a good feel on the hair and is readily removed by washing or combing out. Amphomer® is however non-biodegradable.

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There is a desire to provide hair care compositions that provide improvements from an environmental perspective whilst still being able to be formulated into existing formulations, especially aqueous and water-ethanol based formulations, and maintaining the performance of the current compositions. For example, environmental legislation and consumer opinion has made it desirable to provide components for hair care compositions, and hair care compositions, that are derived from naturally available compounds, have improved sustainability and suitably are biodegradable.

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25 There is therefore a need to provide hair fixative agents and/or hair care compositions that are derived from naturally available compounds, have improved sustainability and/or suitably are biodegradable and considered to meet the changing environmental requirements.

Summary

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According to a first aspect of the present invention there is provided a hair care composition comprising an oxidised polysaccharide, wherein the oxidised polysaccharide is derived from a polysaccharide that comprises two or more monosaccharide units and wherein each oxidised monosaccharide unit in the oxidised polysaccharide comprises at least 2 aldehyde groups.

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According to a second aspect of the present invention, there is provided the use of an oxidised polysaccharide, wherein the oxidised polysaccharide is derived from a polysaccharide that comprises two or more monosaccharide units and wherein each oxidised monosaccharide unit in the oxidised polysaccharide comprises at least 2 aldehyde groups, as a hair fixative agent.

According to a third aspect of the present invention there is provided a method of treating hair with a hair care composition, the method comprising applying the hair care composition according to the first aspect of the present invention to hair.

- 5 According to a fourth aspect of the invention, there is provided a hair product comprising a hair care composition according to the first aspect of the invention and suitable packaging.

Detailed description

- 10 Unless otherwise stated, the following terms used in the specification and claims have the meanings set out below.

As used in the specification and the appended claims, the singular forms "a", "an," and "the" include both singular and plural referents unless the context clearly dictates otherwise.

- 15 Throughout this specification, the term "comprising" or "comprises" means including the component(s) specified but not to the exclusion of the presence of other components. The term "consisting essentially of" or "consists essentially of" means including the components specified but excluding other components except for components added for a purpose other than
20 achieving the technical effect of the invention. The term "consisting of" or "consists of" means including the components specified but excluding other components.

- Whenever appropriate, depending upon the context, the use of the term "comprises" or "comprising" may also be taken to include the meaning "consists essentially of" or "consisting essentially of", and also may also be taken to include the meaning "consists of" or "consisting of".
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- As used herein, unless otherwise expressly specified, all numbers such as those expressing values, ranges, amounts of percentages may be read as if prefaced by the word "about", even
30 if the term does not expressly appear.

- The recitation of numerical ranges by endpoints includes all integer numbers and, where appropriate, fractions subsumed within that range (e.g. 1 to 5 can include 1, 2, 3, 4 when referring to, for example, a number of elements, and can also include 1.5, 2, 2.75 and 3.80, when referring to, for example, measurements). The recitation of end points also includes the end point values themselves (e.g. from 1.0 to 5.0 includes both 1.0 and 5.0). Any numerical range recited herein
35 is intended to include all sub-ranges subsumed therein.

The optional features set out herein may be used either individually or in combination with each other where appropriate and particularly in the combinations as set out in the accompanying claims. The optional features for each exemplary aspect of the invention, as set out herein are also applicable to any other aspects or exemplary aspects of the invention, where appropriate.

- 5 In other words, the skilled person reading this specification should consider the optional features for each aspect or embodiment of the invention as interchangeable and combinable between different aspects of the invention.

- 10 As used herein, the term "and/or," when used in a list of two or more items, means that any one of the listed items can be employed by itself or any combination of two or more of the listed items can be employed. For example, if a list is described as comprising group A, B, and/or C, the list can comprise A alone; B alone; C alone; A and B in combination; A and C in combination, B and C in combination; or A, B, and C in combination.

- 15 According to a first aspect of the present invention there is provided a hair care composition comprising an oxidised polysaccharide, wherein the oxidised polysaccharide is derived from a polysaccharide that comprises two or more monosaccharide units and wherein each oxidised monosaccharide unit in the oxidised polysaccharide comprises at least 2 aldehyde groups.

- 20 For the avoidance of doubt in the oxidised polysaccharide at least one of the monosaccharide units present in polysaccharide is oxidised.

- The oxidised polysaccharide is derived from a polysaccharide that comprises two or more monosaccharide units. For example, the polysaccharide from which the oxidised polysaccharide is derived may comprise from 2 to 12000, preferably from 2 to 150 monosaccharide units. For example, the polysaccharide from which the oxidised polysaccharide is derived may comprise from 3 to 12000, preferably from 3 to 150 monosaccharide units. For example, the polysaccharide from which the oxidised polysaccharide is derived may comprise from 4 to 12000, preferably from 4 to 150 monosaccharide units.

- 30 References herein to "hair" are intended to refer to any type of hair, including human and animal hair. Preferably the hair is human hair growing on the head.

- 35 By the term "polysaccharide" we mean a saccharide compound comprising two or more monosaccharide units. For example the term "polysaccharide" as used herein is intended to include disaccharides and oligosaccharides as well as compounds comprising higher numbers of monosaccharide units.

By the term "oxidised polysaccharide" we mean a polysaccharide that has undergone an oxidation reaction, i.e. in which hydroxy group(s) on the polysaccharide have been converted to aldehyde groups.

- 5 As the skilled person would appreciate, the oxidised polysaccharide may cross-link *in situ* for example by reaction of the aldehyde group(s) with free hydroxy groups. The amount of cross-linking that occurs will depend on factors such as the degree of oxidation, concentration and other components present. Definitions of the oxidised polysaccharides provided herein are to the oxidised polysaccharide as prepared by oxidation of the polysaccharide (i.e. before any
10 cross-linking may occur).

The oxidised polysaccharide may be biodegradable.

- The oxidised polysaccharide may be substantially linear or linear, by which we mean that the
15 linkages between the monosaccharide units are substantially or wholly the same throughout the polysaccharide.

- For example, when the monosaccharide units are D-glucose units, those units may have glycosidic linkages substantially or wholly at the carbon-1 and carbon-4 positions. For example,
20 the polysaccharide comprising the D-glucose units may have 80% or more, such as 90% or more, or 100%, of $\alpha(1\rightarrow4)$ glycosidic bonds. When the polysaccharide comprising D-glucose units has 100% of $\alpha(1\rightarrow4)$ glycosidic bonds then the polysaccharide is considered linear. When the polysaccharide comprising D-glucose units has 80% or more, or 90% or more, of $\alpha(1\rightarrow4)$ glycosidic bonds then the polysaccharide is considered to be substantially linear.

- 25 For example, when the monosaccharide units are D-glucose units, those units may have glycosidic linkages substantially or wholly at the carbon-1 and carbon-6 positions. For example, the polysaccharide comprising the D-glucose units may have 80% or more, such as 90% or more, or 100%, $\alpha(1\rightarrow6)$ glycosidic bonds. When the polysaccharide comprising D-glucose units
30 has 100% $\alpha(1\rightarrow6)$ glycosidic bonds then the polysaccharide is considered linear. When the polysaccharide comprising D-glucose units has 80% or more, or 90% or more, $\alpha(1\rightarrow6)$ glycosidic bonds then the polysaccharide is considered to be substantially linear.

- The oxidised polysaccharide may be non-ionic.
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The oxidised polysaccharide may be soluble in water at typical room temperature and pressure.

The oxidised polysaccharide is derived from a polysaccharide that comprises two or more monosaccharide units. The oxidised polysaccharide comprises one or more monosaccharide

unit that has undergone an oxidation reaction in which at least 2 hydroxy groups have been converted to an aldehyde group. Suitably 2 hydroxy groups that undergo the oxidation reaction and are converted to aldehyde groups are positioned on adjacent carbon atoms in the monosaccharide unit and the adjoining C-C bond is broken in the oxidation reaction.

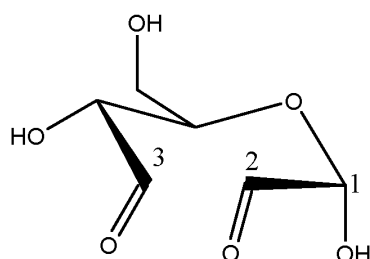
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Each oxidised monosaccharide unit in the oxidised polysaccharide comprises at least 2 aldehyde groups. For example, each oxidised monosaccharide unit in the oxidised polysaccharide may comprise or have 2 aldehyde groups. Suitably, the 2 aldehyde groups are positioned on adjacent carbon atoms in the oxidised monosaccharide unit. The oxidation typically causes ring opening, and breakage of adjoining C-C bonds, upon the formation of the aldehyde groups.

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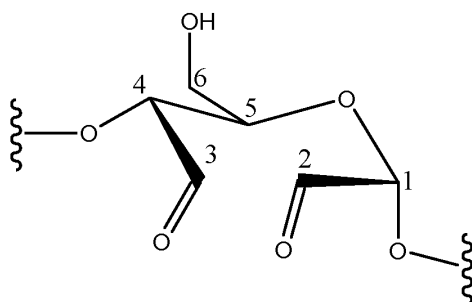
Suitably, the two aldehyde groups are positioned at the carbon-2 and carbon-3 locations of each oxidised monosaccharide unit in the oxidised polysaccharide. For example, when the monosaccharide unit is a D-glucose unit the aldehyde groups at the carbon-2 and carbon-3 locations of the oxidised monosaccharide unit are as shown:

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If the oxidised monosaccharide (D-glucose) unit shown above was a component of an oxidised polysaccharide it may be linked to other monosaccharide units (which may be oxidised or not) via the carbon-1 and carbon-4 positions as shown below:

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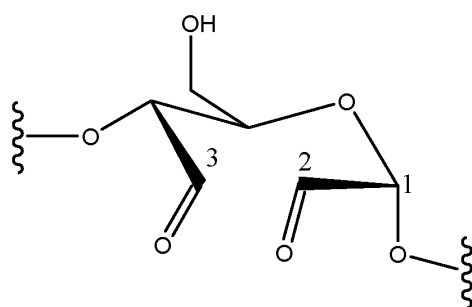
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When the monosaccharide unit is a D-glucose unit it may be oligomerised or polymerised to form a polysaccharide, such as maltodextrin or dextran, preferably maltodextrin. Maltodextrin may alternatively be formed by hydrolysis of starch, such as corn starch.

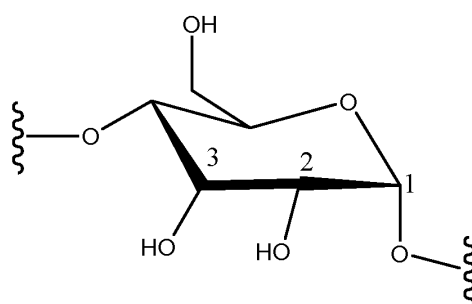
- 5 Additional groups in the monosaccharide units may be oxidised, i.e. in addition to the hydroxy groups at the carbon-2 and carbon-3 locations of the monosaccharide unit. For example, the hydroxy group at the carbon-6 location may be oxidised by any suitable oxidation reaction as would be well known to persons skilled in the art. Suitable such oxidation reactions include the Dess Martin periodinane and Swern oxidation reactions.

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An oxidised polysaccharide comprising oxidised D-glucose units may have a structure comprising the oxidised units (i) and the unoxidised units (ii) as follows:



(i)



(ii)

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The ratio of units (i) : units (ii) will depend on the degree of oxidation of the oxidised polysaccharide.

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Although units (i) and (ii) above show the D-glucose units having glycosidic linkages at the carbon-1 and carbon-4 positions, the skilled person would appreciate that glycosidic linkages at other locations could be provided. The location of the glycosidic linkages will depend on the particular polysaccharide used. For example, glycosidic linkages may be provided at the carbon-1 and carbon-6 positions and/or at the carbon-1 and carbon-3 positions.

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The oxidised polysaccharide is terminated with end units that may or may not include oxidised groups.

- 5 The oxidised polysaccharide may have a degree of oxidation of 5 to 100%, such as from 20 to 100% or from 30 to 100%, for example from 50 to 90 or from 50 to 70 %.

By the term "degree of oxidation" we mean the percentage of monosaccharide units within the oxidised polysaccharide that has been ring opened (i.e. due to oxidation). A person skilled in the art would readily know how to determine the degree of oxidation of an oxidised polysaccharide. For example, the degree of oxidation may be determined by chemical means such as the Cannizzaro reaction (which uses a base to convert the dialdehyde into alcohol and carboxylic acid via disproportionation) followed by titration to determine the number of carboxylic acid groups. The "degree of oxidation" may alternatively be referred to as the "oxidation level".

15 The oxidised polysaccharide may be formed from a polysaccharide by reaction with a suitable oxidizing agent, such as a hypochlorite, perchlorate or periodate compound, periodic acid or iodic acid and salts and mixtures thereof. Suitable periodate reagents would be well known to persons skilled in the art and include sodium periodate. Suitably the oxidised polysaccharide is used without any further treatment or chemical modification, i.e. following the preparation of the oxidised polysaccharide by reaction of a polysaccharide with a suitable oxidizing agent.

The monosaccharide units may be selected from one or more of glucose, dextrose, fructose, levulose, galactose, deoxyribose, glyceraldehyde, erythrose, threose, ribose, arabinose, xylose, lyxose, allose, altrose, mannose, idose, galactose, talose, erythrulose, ribulose, xylulose, psciose, robose, tagatose and isomers thereof.

Suitably, the monosaccharide units are selected from one or more of glucose and isomers thereof (such as D-glucose).

30 Suitably, the monosaccharide units are glucose units or isomers thereof (such as D-glucose).

Suitably, the monosaccharide units are glucose units.

35 Suitably, the monosaccharide units are D-glucose units.

The oxidised polysaccharide may be derived from one or more of cellulose, guar, diutan, starch, chitin, chitosan, glycogen, xanthan, dextran, dextrin, welan, gellan, pullulan, pectin, scleroglucan, schizophyllan, levan, locust bean gum, peptidoglycan, tara, konjak, tamarind,

starch, karaya, tragacanth, carrageenan, glycan, succinoglycan, glucan, scleroglucan, maltodextrin, cyclodextrin, inulin, alginates, amylose and amylopectin.

5 Preferably the polysaccharide (i.e. from which the oxidised polysaccharide is derived) is fully or partially water soluble.

10 The oxidised polysaccharide may have any suitable molecular mass. For example, the oxidised polysaccharide may have a relative molecular mass (Mr) of above 100,000 or above 400,000, such as from 100,000 to 1,000,000 or from 100,000 to 700,000, for example from 400,000 to 700,000 or from 400,000 to 600,000.

15 Suitably, the oxidised polysaccharide may be derived from maltodextrin. A suitable maltodextrin may have a dextrose equivalent of from 2 to 20, for example from 4 to 7, or from 13 to 17, or from 16.5 to 19.

Suitably, the oxidised polysaccharide may be derived from dextran. A suitable dextran may have a relative molecular mass (Mr) of above 100,000 or above 400,000, such as from 100,000 to 1,000,000 or from 100,000 to 700,000, for example from 400,000 to 700,000 or from 400,000 to 600,000.

20 Suitably, the oxidised polysaccharide is derived from a maltodextrin having a dextrose equivalent of from 2 to 20 (for example from 4 to 7, or from 13 to 17, or from 16.5 to 19) and/or from a dextran having a relative molecular mass (Mr) of from 100,000 to 1,000,000 (for example from 100,000 to 700,000, from 400,000 to 700,000 or from 400,000 to 600,000).

25 The hair care composition may comprise up to 25 wt%, for example up to 20 wt%, of the oxidised polysaccharide. The hair care composition may comprise at least 0.1 wt%, for example at least 0.5 wt%, of the oxidised polysaccharide.

30 The hair care composition may comprise from 0.1 to 7 wt%, for example from 0.5 to 7 wt% or from 2 to 5 wt%, of the oxidised polysaccharide.

The hair care composition may comprise further additional components.

35 For example, the hair care composition may further comprise a carrier or solvent. Any suitable carrier or solvent may be included in the hair care composition. A suitable carrier or solvent may be selected from water, ethanol, propanol, isopropanol, isobutanol, tertiary-butanol and mixtures thereof. Suitably, the carrier or solvent may comprise an ethanol-water mixture, such as an

ethanol-water mixture in a 1:1 volume ratio. The use of water as a carrier offers environmental advantages.

When the carrier or solvent is water, the hair care composition may be in the form of an emulsion.

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For example, the hair care composition may further comprise a propellant. Any suitable propellant may be included in the hair care composition. A suitable propellant may be selected from a chlorofluorocarbon, a hydrofluorocarbon (such as hydrofluorocarbon 152A), n-propane, isopropane, n-butane, isobutane, dimethyl ether, dimethoxymethane, dimethoxyethane, compressed air, compressed nitrogen, and compressed carbon dioxide. A suitable propellant may be selected from n-propane, isopropane, n-butane, isobutane, dimethyl ether, dimethoxymethane, dimethoxyethane, compressed air and compressed carbon dioxide.

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Suitable further additional components may include: anti-corrosion agents; anti-dandruff agents; anti-static agents; anti-oxidants; chelating agents; conditioning agents; co-styling agents; emulsifiers; foaming agents; fragrances; fragrance solubilisers; hair colouring agents; moisturising agents; neutralising agents for styling polymers, rheology modifier and pH adjusters; other active ingredients; plasticisers; preservatives; product colouring agents; shine agents; slip agents; styling agents; texturising agents; thermal protection agents; UV absorbers; viscosifying agents; and wetting agents.

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Suitably, anti-corrosion agents are present when the hair care composition is an aqueous composition to be packaged in a metal container. A suitable anti-corrosion agent may be cyclohexylamine.

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A suitable anti-dandruff agent may be piroctone olamine.

Suitable anti-static agents may include behentrimonium chloride; behentrimonium methosulfate; cetrimonium bromide; cetrimonium chloride; laurrimonium chloride and olealkonium chloride.

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Suitable anti-oxidants may include BHT (butylated hydroxytoluene); BHA (butylated hydroxyanisole, tocopherol; vitamin E and tocopheryl acetate.

Suitable chelating agents may include EDTA, EDDS, IDS, GLDA, HEDP, DTPMP, and salts thereof, for example disodium EDTA and tetrasodium EDTA.

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Suitable conditioning agents may include polyquaternium crosspolymer-3; stearamidopropyl dimethylamine; behentrimonium chloride; behentrimonium methosulfate; bisamino PEG/PPG-41/3 aminoethyl PG-propyl dimethicone; cetrimonium bromide; cetrimonium chloride;

cyclopentasiloxane; laurtrimonium chloride; olealkonium chloride; phenyl trimethicone; polydimethylsiloxane; polyquaternium-11; polyquaternium-37; polyquaternium-46; polyquaternium-55; polysilicone-15 and vinyl dimethicone/methicone silsesquioxane crosspolymers.

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Suitable co-styling agents may include acrylates crosspolymer-3; acrylates/octylacrylamide copolymer; acrylates/t-butylacrylamide copolymer; butyl ester of PVM/MA copolymer; crotonic acid/vinyl C8-12 isoalkyl esters/VA/bis-vinyldimethicone copolymer; methacryloyl ethyl betaine/acrylates copolymer; octylacrylamide/acrylates/butylaminoethyl methacrylate copolymer; PEG-150/decyl alcohol/SMDi copolymer; polyamide-1; polyurethane-14; AMP-acrylates copolymer; polyvinylcaprolactam; PVP; sodium polyacrylate; VA/crotonates/vinyl neodecanoate copolymer; vinyl caprolactam/VP/dimethylaminoethyl methacrylate copolymer; VP/dimethylaminoethylmethacrylate copolymer; VP/DMAPA acrylates copolymer; VP/VA copolymer; polyquaternium-11; polyquaternium-37; polyquaternium-46 and polyquaternium-55.

15 The suitable co-styling agent may comprise an additional hair fixative agent.

Suitable emulsifiers may include cetareth-2; cetareth-20; cetareth-25; ceteath-10 phosphate; alkyl glucosides (such as decyl glucoside), coco glucoside; lauryl glucoside; dicetyl phosphate; glycerol stearate; laureth-3; laureth-7; oleth-20; oleth-5; palmitic acid; PEG-100 stearate; 20 polyglyceryl-3 stearate; potassium cetyl phosphate; PPG-15 stearyl ether; PPG-5-ceteth-20; rhamnolipids; sodium laureth sulfate; sophorolipids; steareth-2; steareth-21; stearic acid and trilaureth-4 phosphate.

Foaming agents may be present when the hair care composition is in the form of a mousse. 25 Suitable foaming agents may include behentrimonium chloride; behentrimonium methosulfate; behenyl alcohol; C14-16 olefin sulfonate; cetareth-2; cetareth-20; cetareth-25; cetearyl alcohol; cetrimonium bromide; cetrimonium chloride; cetyl alcohol; cocamidopropyl betaine; alkyl glucosides (such as decyl glucoside, coco glucoside and lauryl glucoside); glycerol stearate; laureth-3; laureth-7; laurtrimonium chloride; lauryl alcohol; myristyl alcohol; olealkonium chloride; 30 oleth-20; oleth-5; palmitic acid; PEG-100 stearate; polyglyceryl-3 stearate; polysorbate-20; PPG-15 stearyl ether; rhamnolipids; sophorolipids; steareth-2; steareth-21; stearic acid and stearyl alcohol.

A suitable fragrance may be Parfum.

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Suitable fragrance solubilisers may include PEG-40 hydrogenated castor oil; polysorbate-20 and polysorbate-80.

Suitable hair colouring agents may include acid violet 43; basic red 76; basic blue 99; basic brown 16; basic yellow 87; HC yellow no. 4; disperse red 11 and henna.

5 Suitable moisturising agents may include glycerin; panthenol and derivatives thereof; propanediol and propylene glycol.

10 Suitable neutralising agents for styling polymers, rheology modifiers and pH adjusters may include aminomethyl propanol; potassium hydroxide; sodium hydroxide; tetrahydroxypropyl ethylenediamine; triethanolamine; triisopropanolamine and tromethane.

Other suitable active ingredients may include plant extracts, keratin hydrolysate, wheat amino acids, silk amino acids and niacinimide. Such suitable active ingredients may act to protect, strengthen and/or smooth hair.

15 Suitable plasticisers may include bis-diglyceryl polyacyladipate-2; cetearyl octanoate; dibutyl phthalate; dicaprylyl maleate; diethyl phthalate; diethylhexyl adipate; diisopropyl adipate; diisopropyl dimer dilinoleate; ethylhexyl palmitate; glycerin; isopropyl myristate; lauryl pyrrolidone; octyl pyrrolidone; panthenol and derivatives; PEG-12 dimethicone; PPG-12 dimethicone; propanediol; propylene glycol; stearyl stearate and triethyl citrate.

20 Suitable preservatives may include ethylhexyl glycerin; caprylyl glycol; DMDM hydantoin (1,3-bis(hydroxymethyl)-5,5-dimethylimidazolidine-2,4-dione); phenoxyethanol; sodium benzoate; potassium sorbate, methyl paraben and caprylhydroxamic acid.

25 Suitable product colouring agents may include charcoal powder; CI 42090 and CI 14700.

Suitable shine agents may include amodimethicone ; bisamino PEG/PPG-41/3-aminoethyl PG-propyl dimethicone; cyclopentasiloxane; phenyl trimethicone; polydimethylsiloxane; polysilicone-15 and vinyl dimethicone/methicone silsesquioxane crosspolymers.

30 Suitable slip agents may include PEG-12; PEG-14M and PEG-45M.

35 Suitable styling agents may include beeswax; candellis wax; candellis wax esters; ceresin; copernicia cerifera wax; hydrogenated palm oil; kaolin; microcrystalline wax; ozokerite; petrolatum; paraffin; mineral oil; polyethylene; pumice; rice bran wax; shea butter; silica silylate and synthetic beeswax.

Suitable texturising agents include beeswax; behenyl alcohol; bis-diglyceryl polyacyladipate-2; C13-14 isoalkane; candellis wax; candellis wax esters; caprylic/capric triglyceride; ceresin; cetearyl alcohol; cetearyl octanoate; cetyl alcohol; copernicia cerifera wax; dibutyl phthalate;

dicaprylyl maleate; diethyl phthalate; diethylhexyl adipate; diisopropyl adipate; diisopropyl dimer dilinoleate; ethylhexyl palmitate; glycerin; hydrogenated palm oil; isohexadecane; isopropyl myristate; kaolin; lauryl alcohol; microcrystalline wax; myristyl alcohol; ozokerite PEG-12 dimethicone; petrolatum; paraffin; mineral oil; PEG-12, PEG-14M, PEG-45M, polyethylene; 5 polyquaternium crosspolymer-3; polysorbate-20; PPG-12 dimethicone; pumice; rice bran wax; shea butter; silica; silica silylate; stearamidopropyl dimethylamine; stearyl alcohol; stearyl stearate; synthetic beeswax and triethyl citrate.

Suitable thermal protection agents may include bisamino PEG/PPG-41/3 aminoethyl PG-propyl 10 dimethicone.

UV absorbers may act to protect the hair and/or the hair care composition. Suitable UV absorbers may include benzophenone-4; ethylhexyl dimethyl; PABA (4-amino parabenzoic acid); PABA derivates (such as PEG-25 ester derivates of PABA) and ethylhexyl 15 methoxycinnamate.

Suitable viscosifying agents may include behenyl alcohol; cetearyl alcohol; cetyl alcohol; lauryl alcohol; myristyl alcohol and stearyl alcohol.

20 Suitable wetting agents may include ceteath-10 phosphate; dicetyl phosphate; lauryl pyrrolidone; octyl pyrrolidone; potassium cetyl phosphate; PPG-5-ceteth-20; sodium laureth sulfate and trilaureth-4 phosphate.

Suitably the oxidised polysaccharide as described herein acts as a hair fixative agent in the hair 25 care composition. The term "hair fixative agent" has its ordinary meaning in the art and would be well understood by persons skilled in the art. The oxidised polysaccharide suitably acts as a hair fixative agent without the need for reaction with another chemical compound. For example, the oxidised polysaccharide suitably acts as a hair fixative agent without reaction with a chemical compound such as a hydroxyaromatic compound (for example a hydroxyaromatic compound in 30 which two meta groups are meta to each other) or a pyridinecarboxylic acid compound.

The hair care composition of the present invention may be a hairstyling composition, for example a hairspray composition.

35 Suitable hairstyling compositions may include hairsprays (aerosol and non-aerosol); gels (such as colouring gel and spray gels); lotions (such as colouring lotions); spritz creams; putty; pastes; clays; waxes; pomadee; mousses (such as pump mousses, aerosol mousses and hair colouring aerosol mousses); gel-to-mousses and powders

The hair care composition may be provided in any form suitable for application to the hair. For example, the hair care composition may be in the form of an aerosol, gel, wax, mousse or spray composition.

- 5 The hair care composition may be in the form of an aerosol composition.

When the hair care composition is in the form of an aerosol composition, the composition may comprise a propellant as described herein. An aerosol composition may, for example, comprise further additional components selected from anti-corrosion agents; conditioning agents; shine agents; thermal protection agents; co-styling polymers; fragrances; neutralisers for styling polymers; rheology modifiers; pH adjustment agents; plasticisers; moisturising agents; carriers/solvents; slip agents; texturising agents; UV absorbers; wetting agents; emulsifiers; and other active ingredients. The carrier/solvent may comprise water, such as a water and ethanol mixture (for example a water and ethanol mixture in a 1:1 volume ratio).

15 The hair care composition may be in the form of a gel composition. A gel composition may, for example, comprise further additional components selected from anti-corrosion agents; anti-dandruff agents; chelating agents; texturising agents; conditioning agents; anti-static agents; shine agents; thermal protection agents; texture modifying agents; co-styling polymers; other active ingredients; fragrance; fragrance solubilising agents; hair colouring agents; neutralising agents for styling polymers, rheology modifiers; pH adjusters; plasticisers; moisturising agents; wetting agents; preservatives; product colouring agents; slip agents; carriers/solvents; UV absorbing agents; rheology modifiers; and viscosifiers.

- 25 The hair care composition may be in the form of a spray composition. A spray composition may, for example, comprise further additional components selected from solvents and fragrance.

According to a second aspect of the present invention there is provided the use of an oxidised polysaccharide, wherein the oxidised polysaccharide is derived from a polysaccharide that comprises two or more monosaccharide units and wherein each oxidised monosaccharide unit in the oxidised polysaccharide comprises at least 2 aldehyde groups, as a hair fixative agent.

The oxidised polysaccharide acts as a hair fixative agent, i.e. to hold the hair in place when applied. Suitably, the oxidised polysaccharide when applied to the hair has a good feel and is non tacky. Suitably the oxidised polysaccharide is easily removed from the hair after use, for example by washing or combing the hair.

According to a third aspect of the present invention there is provided a method of treating hair with a hair care composition comprising applying the hair care composition according to the first aspect of the invention to hair.

- 5 The method of treating hair is suitably a method of fixing the hair in place.

The method of treating hair may comprise a step of drying the hair following application of the hair care composition, for example by heating the hair, typically heating the hair once the oxidised polysaccharide has been applied thereto. For example, the hair may be heated to a
10 temperature above ambient temperature but below 100°C. Suitably the hair may be heated for example by drying the hair with a hair dryer.

According to a fourth aspect of the invention, there is provided a hair product comprising a hair care composition according to the first aspect of the invention and suitable packaging.

- 15 Preferred aspects of the second, third and fourth aspects of the present invention are as described in relation to the first aspect.

Brief Description of the Figures

20 For a better understanding of the invention, and to show how exemplary embodiments of the same may be carried into effect reference will be made, by way of example only, to the accompanying Figures, in which:

- 25 Figure 1 shows results of Example 4, in which hair was treated with an oxidised polysaccharide according to the present invention (maltodextrin dialdehyde solution prepared from maltodextrin 4-7 Dextrose Equivalents) and with a non-oxidised polysaccharide for comparison.

Figure 2 shows the results of Example 4 in which hair was treated with oxidised polysaccharides according to the present invention, which are maltodextrin 13-17 Dextrose Equivalents and
30 maltodextrin 16.5-19.5 Dextrose Equivalents.

Figure 3 shows the results of Example 4 in which hair was treated with an oxidised polysaccharide according to the present invention, which is dextran (Mr = 450,000-650,000).

- 35 The invention will now be further described with reference to the following non-limiting examples.

Examples

Example 1

Preparation of the Oxidised Polysaccharide - maltodextrin dialdehyde

- In a round bottom flask, water (30ml) was added to maltodextrin (4-7 Dextrose Equivalents, 5g).
- 5 The resulting mixture was stirred until the maltodextrin had dissolved and sodium periodate (6g) was added. The resulting reaction mixture was placed in the dark and stirred for 24 hours. Residual iodine salts were removed by dialysis or precipitation and the reaction mixture was then dried to 15% by weight.
- 10 The preparation was repeated using maltodextrin of differing molecular weight (13-17 Dextrose Equivalents and 16.5-19.5 Dextrose Equivalents).

Example 2

Preparation of the Oxidised Polysaccharide - dextran dialdehyde

- 15 In a round bottom flask, water (30ml) was added to dextran (Mr = 450,000-650,000, 5g). The resulting mixture was stirred until the maltodextrin had dissolved and sodium periodate (6g) was added. The resulting reaction mixture was placed in the dark and stirred for 24 hours. Residual iodine salts were removed by dialysis or precipitation and the reaction mixture was then dried to
- 20 15% by weight.

Example 3

Oxidation Level (Degree of oxidation) Measurement

- 25 The oxidation level of the materials obtained in Examples 1 and 2 was measured as follows:
- 0.1-0.2g of each of the products of Examples 1 and 2 was dissolved in 10ml 0.25M NaOH. The solution was placed in a heating block at 80°C for 7.5 minutes, after which it was rapidly cooled using ice water. To the solution 15ml 0.25M H₂SO₄ was added with 2-3 drops of phenolphthalein
- 30 solution. The mixture was then titrated with 0.25M NaOH in order to determine the carboxyl content which equates to the dialdehyde content.

The oxidation level results are shown in Table 1 below.

35

Table 1

Example	Starting material	Oxidation level (%)
1	Maltodextrin (4-7 Dextrose equivalents)	70
1	Maltodextrin (13 -17 Dextrose equivalents)	63

1	Maltodextrin (16.5-19.5 Dextrose equivalents)	65
2	Dextran (Mr=450,000-600,000)	68

Example 4
Hair Curl evaluation

5 A swatch of human hair was taken and twirled tightly round a 5mm diameter rod and both ends of the hair were fixed using tape. A 15wt% dialdehyde solution as prepared in each of Examples 1 and 2 above was taken and 2ml added over the hair with a pipette. Any runoff solution from the hair was collected and reapplied until the hair was wet. The rod and hair were then dried in
10 an oven at 45°C for 30 minutes or until dry. The rod was removed the curled hair evaluated visually.

The results are shown in Figures 1, 2 and 3.

15 Figure 1 shows on the left (marked A) hair treated with the 15wt% maltodextrin dialdehyde solution prepared from maltodextrin 4-7 Dextrose Equivalents as set out in Example 1 and on the right (marked B) hair treated with a non-oxidised polysaccharide (which was anon-oxidised maltodextrin) for comparison. The maltodextrin dialdehyde prepared from maltodextrin 4-7 Dextrose Equivalents acted as a hair fixative agent and gave excellent hold, good feel and was
20 non tacky.

Figure 2 shows on the left (marked A) hair treated with the 15wt% maltodextrin dialdehyde solution prepared from maltodextrin 13-17 Dextrose Equivalents and on the right (marked B) hair treated with the 15wt% maltodextrin dialdehyde solution prepared from maltodextrin 16.5-
25 19.5 Dextrose Equivalents as set out in Example 1. The maltodextrin dialdehyde prepared from maltodextrin 13-17 and 16.5-19.5 Dextrose Equivalents acted as a hair fixative agent and gave excellent hold, good feel and was non tacky.

The maltodextrin dialdehyde prepared from maltodextrin 4-7 Dextrose Equivalents, 3-17
30 Dextrose Equivalents and 16.5-19.5 Dextrose Equivalents was able to be washed out of the hair with water.

Figure 3 shows hair treated with the 15wt% dextran dialdehyde solution prepared from dextran (Mr = 450,000-650,000) as set out in Example 2. The dextran dialdehyde prepared from dextran
35 (Mr = 450,000-650,000) acted as a hair fixative agent and gave excellent hold, good feel and was non tacky.

The present invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. A hair care composition comprising an oxidised polysaccharide, wherein the oxidised polysaccharide is derived from a polysaccharide that comprises two or more monosaccharide units and wherein each oxidised monosaccharide unit in the oxidised polysaccharide comprises at least 2 aldehyde groups.
2. A hair care composition according to claim 1, wherein each oxidised monosaccharide unit in the oxidised polysaccharide comprises 2 aldehyde groups.
3. A hair care composition according to claim 2, wherein the aldehyde groups are positioned at the carbon-2 and carbon-3 locations of each oxidised monosaccharide unit in the oxidised polysaccharide.
4. A hair care composition according to any preceding claim, wherein the oxidised polysaccharide has a degree of oxidation of 5 to 100%.
5. A hair care composition according to any preceding claim, wherein the monosaccharide units are selected from one or more of glucose, dextrose, fructose, levulose, galactose, deoxyribose, glyceraldehyde, erythrose, threose, ribose, arabinose, xylose, lyxose, allose, altrose, mannose, idose, galactose, talose, glycerine, erythrulose, ribulose, xylulose, psciose, fructose, robose, tagatose and isomers thereof (preferably glucose, such as D-glucose).
6. A hair care composition according to claim 5, wherein the monosaccharide units are selected from one or more of glucose and isomers thereof.
7. A hair care composition according to any preceding claim, wherein the oxidised polysaccharide is derived from one or more of cellulose, guar, diutan, starch, chitin, chitosan, glycogen, xanthan, dextran, dextrin, welan, gellan, pullulan, pectin, scleroglucan, schizophyllan, levan, locust bean gum, peptidoglycan, tara, konjak, tamarind, starch, karaya, tragacanth, carrageenan, glycan, succinoglycan, glucan, scleroglucan, maltodextrin and cyclodextrin.
8. A hair care composition according to claim 7, wherein the oxidised polysaccharide is derived from maltodextrin.
9. A hair care composition according to any proceeding claim wherein the oxidised polysaccharide is derived from a polysaccharide which is partially or fully water soluble.

10. A hair care composition according to any preceding claim, which further comprises a propellant.
11. A hair care composition according to claim 10, wherein the propellant is selected from n-propane, isopropane, n-butane, isobutane, dimethyl ether, dimethoxymethane, dimethoxyethane, air and carbon dioxide.
12. A hair care composition according to any preceding claim, wherein the oxidised polysaccharide is a hair fixative agent.
13. A hair care composition according to any preceding claim, which is a hairstyling composition, for example a hairspray composition.
14. A hair care composition according to any preceding claim, which is an aerosol, gel, wax, mousse or spray composition.
15. Use of an oxidised polysaccharide, wherein the oxidised polysaccharide is derived from a polysaccharide that comprises two or more monosaccharide units and wherein each oxidised monosaccharide unit in the oxidised polysaccharide comprises at least 2 aldehyde groups, as a hair fixative agent.
16. A method of treating hair with a hair care composition comprising applying the hair care composition according to any of claims 1 to 14 to hair.
17. A hair product comprising a hair care composition according to any of claims 1 to 14 and suitable packaging.