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(54) Title: SHAMPOO COMPOSITIONS

(57) Abstract: The invention provides an aqueous shampoo composition comprising one or more anionic cleansing surfactants and incorporating a blend of silicones, the blend comprising: (i) a volatile silicone, and (ii) a non-volatile silicone in the form of discrete emulsified droplets having a Sauter mean droplet diameter ($D_{3,2}$) of 2 micrometers or less; in which the weight ratio of (i) : (ii) ranges from 1:1 to 1:10. The stability of the volatile silicone in the shampoo composition is significantly increased by combining it with small particle size non-volatile silicone.

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SHAMPOO COMPOSITIONS

FIELD OF THE INVENTION

This invention relates to shampoo compositions, and more particularly to shampoo compositions which incorporate a blend of non-volatile and volatile silicones.

BACKGROUND AND PRIOR ART

US 4,337,166 describes that the use of emulsified cyclic siloxanes in aqueous shampoo compositions results in reduced drying time of the washed fibres.

EP 074 264 describes the inclusion of dimethyl cyclic silicones in aqueous liquid conditioning shampoo compositions since they provide lubricity and other desirable qualities to the hair, and then evaporate.

A problem is that volatile silicones such as those described in US 4,337,166 and EP 074 264 are prone to phase separation when incorporated into shampoo compositions, leading to an unstable product.

The present inventors have found that shampoo compositions can be formulated with a combination of volatile silicone and small particle size non-volatile silicones, to give superior conditioning benefits. In particular, shampoo compositions of the invention give improved wet conditioning

benefits, such as soft feel, smooth feel and combability when wet. Shampoo compositions of the invention also impart an improved and long lasting clean feel and light feel to the hair. Shampoo compositions of the invention also show improved performance with respect to negatives such as scalp regreasing and scalp irritation which are commonly associated with prior art conditioning shampoos.

SUMMARY OF THE INVENTION

The present invention provides an aqueous shampoo composition comprising one or more anionic cleansing surfactants and incorporating a blend of silicones, the blend comprising:

(i) a volatile silicone, and

(ii) a non-volatile silicone in the form of discrete emulsified droplets having a Sauter mean droplet diameter ($D_{3,2}$) of 2 micrometers or less;

in which the weight ratio of (i) : (ii) ranges from 1:1 to 1:10.

DETAILED DESCRIPTION

Aqueous Shampoo Composition

By aqueous shampoo composition is meant a composition which has water or an aqueous solution or a lyotropic liquid crystalline phase as its major component. Suitably, the composition will comprise from 50% to 98% by weight based on total weight of water, preferably from 60% to 90%.

Anionic Cleansing Surfactant

Shampoo compositions according to the invention comprise one or more anionic cleansing surfactants which are cosmetically acceptable and suitable for topical application to the hair.

Examples of suitable anionic cleansing surfactants are the alkyl sulphates, alkyl ether sulphates, alkaryl sulphonates, alkanoyl isethionates, alkyl succinates, alkyl sulphosuccinates, N-alkyl sarcosinates, alkyl phosphates, alkyl ether phosphates, and alkyl ether carboxylic acids and salts thereof, especially their sodium, magnesium, ammonium and mono-, di- and triethanolamine salts. The alkyl and acyl groups generally contain from 8 to 18, preferably from 10 to 16 carbon atoms and may be unsaturated. The alkyl ether sulphates, alkyl ether phosphates and alkyl ether carboxylic acids and salts thereof may contain from 1 to 20 ethylene oxide or propylene oxide units per molecule.

Typical anionic cleansing surfactants for use in shampoo compositions of the invention include sodium oleyl succinate,

ammonium lauryl sulphosuccinate, sodium lauryl sulphate, sodium lauryl ether sulphate, ammonium lauryl sulphate, ammonium lauryl ether sulphate, sodium dodecylbenzene sulphonate, triethanolamine dodecylbenzene sulphonate, sodium cocoyl isethionate, sodium lauryl isethionate, lauryl ether carboxylic acid and sodium N-lauryl sarcosinate.

Preferred anionic cleansing surfactants are sodium lauryl sulphate, sodium lauryl ether sulphate(n)EO, (where n is from 1 to 3), ammonium lauryl sulphate, ammonium lauryl ether sulphate(n)EO, (where n is from 1 to 3), sodium cocoyl isethionate and lauryl ether carboxylic acid (n) EO (where n is from 10 to 20).

A particularly preferred anionic cleansing surfactant is sodium lauryl ether sulphate(n)EO (where n is from 1 to 3).

Mixtures of any of the foregoing anionic cleansing surfactants may also be suitable. Preferred mixtures are those of sodium lauryl ether sulphate(n)EO (where n is from 1 to 3) with further anionic cleansing surfactants as described above. Preferred further anionic cleansing surfactants are sodium cocoyl isethionate, and more preferably lauryl ether carboxylic acid (n) EO (where n is from 10 to 20).

The total amount of anionic cleansing surfactant in shampoo compositions of the invention generally ranges from 0.5 to 45%, preferably from 1.5 to 35%, more preferably from 5 to 20% by weight of the composition.

Volatile Silicone (i)

The term "volatile" as used herein means that the material in question has a vapour pressure under ambient conditions equal to or above that of ethanol.

The term "ambient conditions" as used herein, unless otherwise specified, refers to surrounding conditions at one atmosphere of pressure, 50% relative humidity, and 25°C.

The boiling point of the volatile silicone (i) under one atmosphere of pressure will preferably be less than about 250°C, more typically less than about 235°C, and most preferably ranges from 99°C to 235°C.

Volatile silicones (i) suitable for use herein include both linear and cyclic silicones. The linear volatile silicones will generally have viscosities of 5 mm^2sec^{-1} (centistokes) or less at 25°C, while the cyclic volatile silicones will generally have viscosities of 10 mm^2sec^{-1} or less at 25°C.

All silicone viscosities mentioned herein are kinematic viscosities unless otherwise specified, and are generally provided by suppliers of silicones, either as measured at 25°C using calibrated capillary glass viscometers under gravity flow conditions, or as deduced from the molecular weight of the material in question.

Suitable cyclic volatile silicones include cyclopolysiloxanes such as cycloalkylsiloxanes and

cycloalkylalkoxysiloxanes, wherein alkyl and alkoxy groups contain C_1-C_8 alkyl groups.

A general formula for suitable cyclic volatile silicones is:

$[(R_1)(R_2)Si-O-]_n$

in which n is 3 to 7 and R_1 and R_2 are independently selected from C_1-C_8 alkyl, aryl (especially phenyl), and alkaryl (e.g. C_1-C_8 substituted aryl).

Preferably R_1 and R_2 are C_1-C_2 alkyl. Most preferably R_1 and R_2 are C_1 alkyl(such materials have the CTFA designation cyclomethicone).

Preferably n is 4 to 6, most preferably 4 or 5.

Specific examples of most preferred cyclic volatile silicones are octamethyl cyclotetrasiloxane, decamethyl cyclopentasiloxane, and mixtures thereof.

Linear volatile silicones include polyorganosiloxanes such as polydialkylsiloxanes and polyalkylarylsiloxanes.

A general formula for suitable linear volatile silicones is:

$(R_1)(R_2)(R_3)Si-O-[Si(R_4)(R_5)O]_n\ Si(R_6)(R_7)(R_8)$

in which n is 1 to 7 and R_1, R_2, R_3, R_4, R_5, R_6, R_7, and R_8 are independently selected from C_1-C_8 alkyl, aryl (especially phenyl), and alkaryl (e.g. C_1-C_8 substituted aryl).

Preferably R_1, R_2, R_3, R_4, R_5, R_6, R_7, and R_8 are C_1-C_2 alkyl. Most preferably R_1, R_2, R_3, R_4, R_5, R_6, R_7, and R_8 are C_1 alkyl (such materials have the CTFA designation dimethicone).

Silicones of the above described types are commercially available, for example from Dow Corning as DC 244, 245, 344, 345 and 200 fluids. DC 245 (decamethyl cyclopentasiloxane) is a preferred volatile silicone.

The amount of the volatile silicone (i) may range from 0.01 to 5%, preferably 0.05 to 2%, more preferably from 0.1 to 1% by total weight of volatile silicone based on the total weight of the aqueous shampoo composition.

Non-volatile Silicone (ii)

The term "non-volatile" as used herein means that the material in question has a vapour pressure under ambient conditions of 0.2mm Hg or less, preferably about 0.1mm Hg or less.

The boiling point of the non-volatile silicone (ii) under one atmosphere of pressure will preferably be at least about 260° C, more preferably at least about 275, most preferably at least about 300°C.

Suitable non-volatile silicones (ii) for use in the shampoo compositions of the invention include polydiorganosiloxanes, in particular polydimethylsiloxanes which have the CTFA designation dimethicone, and polydimethyl siloxanes having

hydroxyl end groups, which have the CTFA designation dimethiconol.

Dimethiconol is particularly preferred.

The viscosity of the non-volatile silicone (ii) itself typically ranges from 350 to 200,000,000 mm^2sec^{-1} at 25°C. Preferably the viscosity is at least 5,000 mm^2sec^{-1} at 25 °C, more preferably at least 10,000 mm^2sec^{-1}. Preferably the viscosity does not exceed 20,000,000 mm^2sec^{-1}, more preferably 10,000,000 mm^2sec^{-1}, most preferably 5,000,000 mm^2sec^{-1}.

Non-volatile silicones (ii) for use in the shampoo compositions of the invention are in the form of discrete emulsified droplets having a Sauter mean droplet diameter ($D_{3,2}$) of 2 micrometers or less. Preferably the droplet diameter ranges from 0.01 to 1 micrometer, more preferably from 0.01 to 0.5 micrometer.

A suitable method for measuring the Sauter mean droplet diameter ($D_{3,2}$) is by laser light scattering using an instrument such as a Malvern Mastersizer.

In order for such a non-volatile silicone to exist in discrete emulsified droplets in the aqueous shampoo compositions according to the invention, it must be water-insoluble.

The term "water-insoluble" as used herein means that the material is not soluble in water (distilled or equivalent) at a concentration of 0.1% (w/w), at 25°C.

Non-volatile silicones (ii) of the requisite silicone particle size are available in the form of pre-formed emulsions from suppliers of silicones such as Dow Corning and GE Silicones. The use of such pre-formed emulsions is preferred for ease of processing and control of silicone particle size. Such pre-formed emulsions will typically additionally comprise a suitable emulsifier such as an anionic or nonionic emulsifier, or mixture thereof, and may be prepared by a chemical emulsification process such as emulsion polymerisation, or by mechanical emulsification using a high shear mixer. Pre-formed silicone emulsions having a Sauter mean droplet diameter ($D_{3,2}$) of less than 0.15 micrometers are generally termed microemulsions.

Examples of suitable pre-formed emulsions include emulsions DC2-1766, DC2-1784, DC-1785, DC-1786, DC-1788 and microemulsions DC2-1865 and DC2-1870, all available from Dow Corning. These are all emulsions/microemulsions of dimethiconol.

The amount of the non-volatile silicone (ii) may range from 0.05 to 10%, preferably 0.05 to 5%, more preferably from 0.5 to 2% by total weight of non-volatile silicone based on the total weight of the aqueous shampoo composition.

The weight ratio of silicones (i) : (ii) in the composition of the invention ranges from 1:1 to 1:10, preferably from 1:2 to 1:8, most preferably from 1:3 to 1:5.

Optional Ingredients

Optionally, the aqueous shampoo composition of the invention may contain further ingredients as described below to enhance performance and/or consumer acceptability.

Co-surfactant

The composition can include co-surfactants, to help impart aesthetic, physical or cleansing properties to the composition.

An example of a co-surfactant is a nonionic surfactant, which can be included in an amount ranging from 0.5 to 8%, preferably from 2 to 5% by weight based on the total weight of the composition.

For example, representative nonionic surfactants that can be included in shampoo compositions of the invention include condensation products of aliphatic (C_8 - C_{18}) primary or secondary linear or branched chain alcohols or phenols with alkylene oxides, usually ethylene oxide and generally having from 6 to 30 ethylene oxide groups.

Other representative nonionic surfactants include mono- or di-alkyl alkanolamides. Examples include coco mono- or di-ethanolamide and coco mono-isopropanolamide.

Further nonionic surfactants which can be included in shampoo compositions of the invention are the alkyl polyglycosides (APGs). Typically, the APG is one which comprises an alkyl

group connected (optionally via a bridging group) to a block of one or more glycosyl groups. Preferred APGs are defined by the following formula:

$$RO - (G)_n$$

wherein R is a branched or straight chain alkyl group which may be saturated or unsaturated and G is a saccharide group.

R may represent a mean alkyl chain length of from about C_5 to about C_{20}. Preferably R represents a mean alkyl chain length of from about C_8 to about C_{12}. Most preferably the value of R lies between about 9.5 and about 10.5. G may be selected from C_5 or C_6 monosaccharide residues, and is preferably a glucoside. G may be selected from the group comprising glucose, xylose, lactose, fructose, mannose and derivatives thereof. Preferably G is glucose.

The degree of polymerisation, n, may have a value of from about 1 to about 10 or more. Preferably, the value of n lies from about 1.1 to about 2. Most preferably the value of n lies from about 1.3 to about 1.5.

Suitable alkyl polyglycosides for use in the invention are commercially available and include for example those materials identified as: Oramix NS10 ex Seppic; Plantaren 1200 and Plantaren 2000 ex Henkel.

Other sugar-derived nonionic surfactants which can be included in compositions of the invention include the C_{10}-C_{18} N-alkyl (C_1-C_6) polyhydroxy fatty acid amides, such as the

C_{12}-C_{18} N-methyl glucamides, as described for example in WO 92 06154 and US 5 194 639, and the N-alkoxy polyhydroxy fatty acid amides, such as C_{10}-C_{18} N-(3-methoxypropyl) glucamide.

A preferred example of a co-surfactant is an amphoteric or zwitterionic surfactant, which can be included in an amount ranging from 0.5 to about 8%, preferably from 1 to 4% by weight based on the total weight of the composition.

Examples of amphoteric or zwitterionic surfactants include alkyl amine oxides, alkyl betaines, alkyl amidopropyl betaines, alkyl sulphobetaines (sultaines), alkyl glycinates, alkyl carboxyglycinates, alkyl amphoacetates, alkyl amphopropionates, alkylamphoglycinates, alkyl amidopropyl hydroxysultaines, acyl taurates and acyl glutamates, wherein the alkyl and acyl groups have from 8 to 19 carbon atoms. Typical amphoteric and zwitterionic surfactants for use in shampoos of the invention include lauryl amine oxide, cocodimethyl sulphopropyl betaine, lauryl betaine, cocamidopropyl betaine and sodium cocoamphoacetate.

A particularly preferred amphoteric or zwitterionic surfactant is cocamidopropyl betaine.

Mixtures of any of the foregoing amphoteric or zwitterionic surfactants may also be suitable. Preferred mixtures are those of cocamidopropyl betaine with further amphoteric or zwitterionic surfactants as described above. A preferred further amphoteric or zwitterionic surfactant is sodium cocoamphoacetate.

The total amount of surfactant (including any co-surfactant, and/or any emulsifier) in compositions of the invention is generally from 1 to 50%, preferably from 2 to 40%, more preferably from 10 to 25% by weight based on the total weight of the composition.

Cationic Polymers

Cationic polymers are preferred ingredients in shampoo compositions of the invention for enhancing conditioning performance.

Suitable cationic polymers may be homopolymers which are cationically substituted or may be formed from two or more types of monomers. The weight average (M_w) molecular weight of the polymers will generally be between 100 000 and 2 000 000 Dalton. The polymers will have cationic nitrogen containing groups such as quaternary ammonium or protonated amino groups, or a mixture thereof. If the molecular weight of the polymer is too low, then the conditioning effect is poor. If too high, then there may be problems of high extensional viscosity leading to stringiness of the composition when it is poured.

The cationic nitrogen-containing group will generally be present as a substituent on a fraction of the total monomer units of the cationic polymer. Thus when the polymer is not a homopolymer it can contain spacer non-cationic monomer units. Such polymers are described in the CTFA Cosmetic Ingredient Directory, 3rd edition. The ratio of the cationic

to non-cationic monomer units is selected to give polymers having a cationic charge density in the required range for each of the first and second cationic polymers.

Suitable cationic polymers include, for example, copolymers of vinyl monomers having cationic amine or quaternary ammonium functionalities with water soluble spacer monomers such as (meth)acrylamide, alkyl and dialkyl (meth)acrylamides, alkyl (meth)acrylate, vinyl caprolactone and vinyl pyrrolidine. The alkyl and dialkyl substituted monomers preferably have C1-C7 alkyl groups, more preferably C1-3 alkyl groups. Other suitable spacers include vinyl esters, vinyl alcohol, maleic anhydride, propylene glycol and ethylene glycol.

The cationic amines can be primary, secondary or tertiary amines, depending upon the particular species and the pH of the composition. In general secondary and tertiary amines, especially tertiary, are preferred.

Amine substituted vinyl monomers and amines can be polymerized in the amine form and then converted to ammonium by quaternization.

The cationic polymers can comprise mixtures of monomer units derived from amine- and/or quaternary ammonium-substituted monomer and/or compatible spacer monomers.

Suitable cationic polymers include, for example:

- cationic diallyl quaternary ammonium-containing polymers including, for example, dimethyldiallylammonium chloride homopolymer and copolymers of acrylamide and dimethyldiallylammonium chloride, referred to in the industry (CTFA) as Polyquaternium 6 and Polyquaternium 7, respectively;

- mineral acid salts of amino-alkyl esters of homo- and co-polymers of unsaturated carboxylic acids having from 3 to 5 carbon atoms, (as described in U.S. Patent 4,009,256);

- cationic polyacrylamides(as described in WO95/22311).

Other cationic polymers that can be used include cationic polysaccharide polymers, such as cationic cellulose derivatives, cationic starch derivatives, and cationic guar gum derivatives.

Cationic polysaccharide polymers suitable for use in compositions of the invention include monomers of the formula:

$$A\text{-}O\text{-}[R\text{-}N^{+}(R^{1})(R^{2})(R^{3})X^{-}],$$

wherein: A is an anhydroglucose residual group, such as a starch or cellulose anhydroglucose residual. R is an

alkylene, oxyalkylene, polyoxyalkylene, or hydroxyalkylene group, or combination thereof. R^1, R^2 and R^3 independently represent alkyl, aryl, alkylaryl, arylalkyl, alkoxyalkyl, or alkoxyaryl groups, each group containing up to about 18 carbon atoms. The total number of carbon atoms for each cationic moiety (i.e., the sum of carbon atoms in R^1, R^2 and R^3) is preferably about 20 or less, and X is an anionic counterion.

Another type of cationic cellulose includes the polymeric quaternary ammonium salts of hydroxyethyl cellulose reacted with lauryl dimethyl ammonium-substituted epoxide, referred to in the industry (CTFA) as Polyquaternium 24. These materials are available from Amerchol Corp. (Edison, NJ, USA) for instance under the tradename Polymer LM-200.

Other suitable cationic polysaccharide polymers include quaternary nitrogen-containing cellulose ethers (e.g. as described in U.S. Patent 3,962,418), and copolymers of etherified cellulose and starch (e.g. as described in U.S. Patent 3,958,581).

A particularly suitable type of cationic polysaccharide polymer that can be used is a cationic guar gum derivative, such as guar hydroxypropyltrimethylammonium chloride (commercially available from Rhodia in their JAGUAR trademark series). Examples of such materials are JAGUAR C13S, JAGUAR C14, JAGUAR C15, JAGUAR C17 and JAGUAR C16 Jaguar CHT and JAGUAR C162.

Mixtures of any of the above cationic polymers may be used. Preferred is a mixture of first and second cationic polymers selected from the above described materials in which the first cationic polymer has a mean charge density from 0.2 to 1.0 meq/gm, preferably from 0.3 to 0.9 meq/gm, and the second cationic polymer has a mean charge density from 1.3 to 3 meq/gm, preferably from 1.4 to 2.5, more preferably from 1.5 to 1.8.

The cationic charge density of the polymer is suitably determined via the Kjeldahl method as described in the US Pharmacopoeia under chemical tests for nitrogen determination.

More preferably the first and cationic polymers are both cationically substituted guar gums, both cationically substituted hydroxyethylcelluloses or both cationic polyacrylamides, because of the relative ease of manufacture and wide availability of these polymers.

Most preferably the first and second cationic polymers are guar hydroxypropyltrimethylammonium chlorides.

Cationic polymer will generally be present in compositions of the invention at levels of from 0.01 to 5%, preferably from 0.05 to 1%, more preferably from 0.08 to 0.5% by total weight of cationic polymer based on the total weight of the composition.

Suspending Agent

Preferably the aqueous shampoo composition of the invention further comprises a suspending agent. Suitable suspending agents are selected from polyacrylic acids, cross-linked polymers of acrylic acid, copolymers of acrylic acid with a hydrophobic monomer, copolymers of carboxylic acid-containing monomers and acrylic esters, cross-linked copolymers of acrylic acid and acrylate esters, heteropolysaccharide gums and crystalline long chain acyl derivatives. The long chain acyl derivative is desirably selected from ethylene glycol stearate, alkanolamides of fatty acids having from 16 to 22 carbon atoms and mixtures thereof. Ethylene glycol distearate and polyethylene glycol 3 distearate are preferred long chain acyl derivatives, since these impart pearlescence to the composition. Polyacrylic acid is available commercially as Carbopol 420, Carbopol 488 or Carbopol 493. Polymers of acrylic acid cross-linked with a polyfunctional agent may also be used; they are available commercially as Carbopol 910, Carbopol 934, Carbopol 941 and Carbopol 980. An example of a suitable copolymer of a carboxylic acid containing monomer and acrylic acid esters is Carbopol 1342. All Carbopol (trademark) materials are available from Goodrich.

Suitable cross-linked polymers of acrylic acid and acrylate esters are Pemulen TR1 or Pemulen TR2. A suitable heteropolysaccharide gum is xanthan gum, for example that available as Kelzan mu.

Mixtures of any of the above suspending agents may be used. Preferred is a mixture of cross-linked polymer of acrylic acid and crystalline long chain acyl derivative.

Suspending agent will generally be present in compositions of the invention at levels of from 0.1 to 10%, preferably from 0.5 to 6%, more preferably from 0.9 to 4% by total weight of suspending agent based on the total weight of the composition.

Further Conditioning Agents

Shampoo compositions of the invention may comprise further conditioning agents to optimise wet and dry conditioning benefits.

Aqueous shampoo compositions of the invention preferably include, as further conditioning agents, one, more preferably two, and most preferably all of the following further conditioning agents: (a) water-soluble, nonionic cellulose polymer; (b) fatty alcohol; and (c) additional silicone material selected from:

(I) non-volatile silicones in the form of discrete emulsified droplets having a Sauter mean droplet diameter ($D_{3,2}$) of 2 micrometers or more, preferably 5 micrometers or more, and more preferably 8 micrometers or more; and
(II) amino functional silicones.

A preferred further conditioning agent is a water-soluble, nonionic cellulose polymer (a). Such materials provide a smooth wet feel to the hair.

As used herein, "water-soluble" refers to any material that is sufficiently soluble in water to form a substantially clear solution to the naked eye at a concentration of 1.0% or more by weight of the material in water at 25°C.

Suitable water-soluble nonionic cellulose polymers include methylcellulose and hydroxypropyl methylcellulose. These materials are manufactured by heating cellulose fibres with caustic solution which in turn is treated with methyl chloride, yielding the methyl ether of cellulose. Methylcellulose is made using only methyl chloride. For hydroxypropyl methylcellulose, propylene oxide is used in addition to methyl chloride to obtain hydroxypropyl substitution on the anhydroglucose units.

Methyl cellulose and hydroxypropyl methylcellulose are commercially available in a number of viscosity grades from Dow Chemical as their METHOCEL trademark series. Hydroxypropyl methyl cellulose is preferred. Generally the viscosity of the hydroxypropyl methyl cellulose is at least 2,000, preferably at least 10,000, more preferably at least 70,000 mPa.s for a 2% aqueous solution at 20°C, measured by Ubbelohde tube viscometer. Examples of preferred materials are METHOCEL 40-101 and METHOCEL 40-202 from Dow Chemical.

Water-soluble nonionic cellulose polymer will generally be present in compositions of the invention at levels of from

0.001 to 1%, preferably from 0.002 to 0.5%, more preferably from 0.02 to 0.1% by total weight of cationic polymer based on the total weight of the composition.

Another preferred further conditioning agent is a fatty alcohol (b). Representative fatty alcohols comprise from 8 to 22, more preferably 16 to 22 carbon atoms.

Preferably the fatty alcohol has a melting point higher than 30°C. Examples of suitable fatty alcohols include stearyl-, cetyl-, myristyl-, behenyl-, lauryl- and oleyl alcohols and mixtures thereof. Preferred are cetyl and stearyl alcohol and most preferred is a mixture of cetyl and stearyl alcohol. The weight ratio of such a mixture of cetyl and stearyl alcohol suitably ranges from 4:1 to 1:4, preferably from 2:1 to 1:2, and is most preferably about 1:1.

Fatty alcohol will generally be present in compositions of the invention at levels of from 0.01 to 5%, preferably from 0.1 to 3%, more preferably from 0.2 to 2.0% by total weight of fatty alcohol based on the total weight of the composition.

Another preferred further conditioning agent is an additional silicone material (c) selected from:

(I) non-volatile silicones in the form of discrete emulsified droplets having a Sauter mean droplet diameter ($D_{3,2}$) of 2 micrometers or more, preferably 5 micrometers or more, and more preferably 8 micrometers or more; and
(II) amino functional silicones.

Suitable non-volatile silicones (I) for use in the shampoo compositions of the invention include polydiorganosiloxanes, in particular polydimethylsiloxanes which have the CTFA designation dimethicone, and polydimethyl siloxanes having hydroxyl end groups, which have the CTFA designation dimethiconol. Dimethicone is particularly preferred.

The viscosity of the non-volatile silicone (I) itself typically ranges from 50 to 1000 mm^2sec^{-1} at 25°C. Preferably the viscosity ranges from 100 to 300 mm^2sec^{-1} at 25 °C.

Non-volatile silicones (I) of the requisite silicone particle size are available in the form of pre-formed emulsions from suppliers of silicones. Such pre-formed emulsions will typically additionally comprise a suitable emulsifier such as an anionic or nonionic emulsifier, or mixture thereof, and may be prepared by a chemical emulsification process such as emulsion polymerisation, or by mechanical emulsification using a high shear mixer. A suitable example is DC2-1310 dimethicone emulsion(from Dow Corning).

By "amino functional silicone" is meant a silicone containing at least one primary, secondary or tertiary amine group, or a quaternary ammonium group.

Suitable amino functional silicones (II) include trimethylsilylamodimethicone as depicted below:

$Si(CH_3)_3 - O - [Si(CH_3)_2 - O -]_x - [Si (CH_3) (R - NH - CH_2CH_2 NH_2) - O -]_y - Si (CH_3)_3$

wherein x + y is a number from about 50 to about 500, and the mole percent amine functionality is from 0.3% to 8%, and wherein R is an alkylene group having from 2 to 5 carbon atoms. Preferably, the number x + y is from 100 to 300, and the mole percent amine functionality is from 0.3% to 8%, preferably from 0.5% to 4%.

As expressed here, the weight percent amine functionality is measured by titrating a sample of the amino functional silicone against alcoholic hydrochloric acid to the bromocresol green end point. The mole percent amine is calculated using a molecular weight of 45 (corresponding to $CH_3- CH_2-NH_2$). Suitably, the mole percent amine functionality measured and calculated in this way is from 0.3% to 8%.

Suitable amino functional silicones (II) are available from suppliers of silicones in the form of pre-formed emulsions with non-ionic and/or cationic surfactant. Specific examples include DC929 Cationic Emulsion, DC939 Cationic Emulsion (from Dow Corning) and SME253 (from GE Silicones).

Additional silicone material (c) as described above will generally be present in compositions of the invention at levels of from 0.01 to 2%, preferably from 0.02 to 1.5%, more preferably from 0.05 to 1% by total weight of additional silicone material based on the total weight of the composition.

Other Optional Ingredients

Aqueous shampoo compositions of the invention may contain other ingredients for enhancing performance and/or consumer acceptability. Such ingredients include fragrance, dyes and pigments, pH adjusting agents, pearlescers or opacifiers, viscosity modifiers, preservatives, and natural hair nutrients such as botanicals, fruit extracts, sugar derivatives and amino acids.

Process

The invention also provides a process for preparing an aqueous shampoo composition as described above, comprising the steps of preparing a blend of (i) a volatile silicone, and (ii) a non-volatile silicone in the form of discrete emulsified droplets having a Sauter mean droplet diameter ($D_{3,2}$) of 2 micrometers or less, in which the weight ratio of (i) : (ii) ranges from 1:1 to 1:10, and then combining the blend so obtained with water, anionic cleansing surfactant, and further optional shampoo ingredients to form the final aqueous shampoo composition.

Preferably the volatile silicone (i) is blended with the non-volatile silicone (ii) by mixing it with a pre-formed emulsion of the non-volatile silicone and incorporating the blend into the shampoo composition of the invention.

Mode of Use

The compositions of the invention are primarily intended for topical application to the hair and/or scalp of a human subject in rinse-off compositions, in order to provide cleansing while improving hair fibre surface properties such as smoothness, softness, manageability, cuticle integrity, and shine. The compositions provided by the invention are aqueous compositions, used by massaging them into the hair followed by rinsing with clean water prior to drying the hair. Optionally, a separate conditioning formulation may be applied after rinsing and before drying, but this may not be necessary as the compositions of the invention are intended to provide both cleansing and conditioning to the hair.

The invention is further illustrated with reference to the following, non-limiting examples:

EXAMPLES

Examples 1 to 4

The compositions illustrated in Examples 1 to 4 represent embodiments of the present invention.

INGREDIENT	% weight			
	Example 1	Example 2	Example 3	Example 4
Sodium lauryl ether sulphate (70% active)	17.14	17.14	17.14	17.14
Cocamidopropyl betaine (30% active)	5.33	5.33	5.33	5.33
Sodium cocoamphoacetate (32% active)	3.13	-	-	-
Laureth-11-carboxylic acid (86% active)	-	-	1.16	-
Sodium cocoyl isethionate (78% active)	-	2.56	-	2.56
Cetyl alcohol	0.25	1.00	0.25	1.00
Stearyl alcohol	0.25	-	0.25	-
Hydroxypropyl methyl cellulose (1)	0.05	0.05	0.05	0.05
Guar hydroxypropyltrimonium chloride (2)	0.098	0.11	0.098	0.11
Guar hydroxypropyltrimonium chloride (3)	0.033	0.04	0.033	0.04
Silicone (4)	3.41	3.41	3.41	3.41
Silicone (5)	-	1.00	-	-
Silicone (6)	0.68	-	0.68	0.68
Pearliser	1.05	2.05	1.05	2.05
Perfume	0.50	0.50	0.50	0.50
Carbomer 980 (7)	0.40	0.40	0.40	0.40
Preservative	0.15	0.15	0.15	0.15
Sodium hydroxide	0.20	0.20	0.30	0.20
Sodium chloride	0.70	1.00	1.70	1.00
Water, minors	to 100	to 100	to 100	to 100

(1) METHOCEL 40-101, from Dow Chemical

(2) JAGUAR C13S, from Rhodia

(3) JAGUAR C17, from Rhodia

(4) An emulsion of dimethiconol and decamethyl cyclopentasiloxane with anionic emulsifier, from GE Silicones. Weight ratio of dimethiconol:decamethyl cyclopentasiloxane in the emulsion is 80:20. Viscosity of the dimethiconol is 1 million mPas at 25°C, and Sauter mean droplet diameter ($D_{3,2}$) of the dimethiconol is 0.23 micrometer. Silicone content of the emulsion is 50% by weight based on total weight of the emulsion.

(5) DC2-1310 (an emulsion of dimethicone with nonionic emulsifier from Dow Corning). Sauter mean droplet diameter ($D_{3,2}$) of the dimethicone is 10 micrometer. Silicone content of the emulsion is 60% by weight based on total weight of the emulsion.

(6) SME253 (a microemulsion of amodimethicone with nonionic emulsifier from GE Silicones). Sauter mean droplet diameter ($D_{3,2}$) of the amodimethicone is 0.02 micrometer. Silicone content of the emulsion is 20% by weight based on total weight of the emulsion.

(7) CARBOPOL 980, from Goodrich.

Performance evaluation of the compositions of Examples 1 to 4 showed that they give excellent cleansing and wet and dry conditioning benefits from a single product.

Stability evaluation of the compositions of Examples 1 to 4 showed that they remain physically and chemically stable after 3 months of stability testing.

Example 5 and Comparative Example A

Shampoo compositions were prepared having ingredients as shown in the following Table:

INGREDIENT	Example 5	Comparative Example A
Sodium lauryl ether sulphate (70% active)	20.00	20.00
Cocamidopropyl betaine (30% active)	10.00	10.00
Sodium cocoyl isethionate (78% active)	1.28	1.28
Cetyl alcohol	2.00	2.00
Guar hydroxypropyltrimonium chloride[2]	0.075	0.075
Guar hydroxypropyltrimonium chloride[3]	0.025	0.025
Silicone[4]	1.56	-
Silicone [6]	0.25	0.25
Silicone [8]	-	1.25
Perfume	0.60	0.60
Carbomer 980[7]	0.40	0.40
Pearliser	4.00	4.00
Preservative	0.15	0.15
Sodium hydroxide	0.20	0.20
Sodium chloride	1.00	1.00
Water, minors	to 100	to 100

(8) An emulsion of dimethiconol with anionic emulsifier, from Dow Corning. Viscosity of the dimethiconol is 1.3 million mPas at 25°C, and Sauter mean droplet diameter ($D_{3,2}$) of the dimethiconol is 0.23 micrometer. Silicone content of the emulsion is 50% by weight based on total weight of the emulsion.

The formulations of Example 5 and Comparative Example A were compared in a half head assessment, which was performed in salon by both hairdressers and panellists. The total number of panellists was 36.

Hairdresser assessment showed significant wins for Example 5 over Comparative Example A across a variety of wet and dry conditioning attributes including soft feel when dry, slippery feel when wet, ease of combing (both when wet and dry), clean feel on scalp (both when wet and dry), and good hair alignment.

CLAIMS

1. An aqueous shampoo composition comprising one or more anionic cleansing surfactants and incorporating a blend of silicones, the blend comprising:

(i) a volatile silicone, and

(ii) a non-volatile silicone in the form of discrete emulsified droplets having a Sauter mean droplet diameter ($D_{3,2}$) of 2 micrometers or less;

in which the weight ratio of (i) : (ii) ranges from 1:1 to 1:10.

2. A composition according to claim 1, which comprises from 50% to 98% by weight based on total weight of water, preferably from 60% to 90%.

3. A composition according to claim 1 or claim 2, in which the anionic cleansing surfactant is a mixture of sodium lauryl ether sulphate(n)EO, (where n is from 1 to 3), and sodium cocoyl isethionate or lauryl ether carboxylic acid (n) EO (where n is from 10 to 20).

4. A composition according to any one of claims 1 to 3, in which the volatile silicone (i) is decamethyl cyclopentasiloxane.

5. A composition according to any one of claims 1 to 4, in which the non-volatile silicone (ii) is dimethiconol having a Sauter mean droplet diameter ($D_{3,2}$) diameter ranging from 0.01 to 1 micrometer, more preferably from 0.01 to 0.5 micrometer.

6. A composition according to any one of claims 1 to 5, in which the weight ratio of silicones (i) : (ii) ranges from 1:2 to 1:8, most preferably from 1:3 to 1:5.

7. A composition according to any one of claims 1 to 6, which includes, as further conditioning agents, one, more preferably two, and most preferably all of the following further conditioning agents: (a) water-soluble, nonionic cellulose polymer; (b) fatty alcohol; and (c) additional silicone material selected from:
(I) non-volatile silicones in the form of discrete emulsified droplets having a Sauter mean droplet diameter ($D_{3,2}$) of 2 micrometers or more, preferably 5 micrometers or more, and more preferably 8 micrometers or more; and
(II) amino functional silicones.

8. A process for preparing an aqueous shampoo composition according to any one of claims 1 to 7, comprising the steps of preparing a blend of (i) a volatile silicone, and (ii) a non-volatile silicone in the form of discrete emulsified droplets having a Sauter mean droplet diameter ($D_{3,2}$) of 2 micrometers or less, in which the weight ratio of (i) : (ii) ranges from 1:1 to 1:10, and then combining the blend so obtained with

water, anionic cleansing surfactant, and further optional shampoo ingredients to form the final aqueous shampoo composition.

9. A process according to claim 8, in which the volatile silicone (i) is blended with the non-volatile silicone (ii) by mixing it with a pre-formed emulsion of the non-volatile silicone and incorporating the blend into the shampoo composition of the invention.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2005/003913

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61K7/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61K

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 468 721 A (UNILEVER PLC ; UNILEVER NV (NL)) 29 January 1992 (1992-01-29) examples	1-9
X	US 6 706 258 B1 (GALLAGHER PETER ET AL) 16 March 2004 (2004-03-16) examples	1-9
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A	EP 0 560 516 A (UNILEVER PLC ; UNILEVER NV (NL)) 15 September 1993 (1993-09-15) table 1	1-9

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 June 2005	01/07/2005

Name and mailing address of the ISA	Authorized officer
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Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2005/003913

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 01/08654 A (UNILEVER PLC ; LEVER HINDUSTAN LTD (IN); UNILEVER NV (NL)) 8 February 2001 (2001-02-08) the whole document	1-9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
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INTERNATIONAL SEARCH REPORT

rnational application No.
PCT/EP2005/003913

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: -

Present claims 1, 5, 7 and 8 relate to a composition defined by reference to the following parameter:

Sauter mean droplet diameter (D3,2)

The use of this parameter in the present context is considered to lead to a lack of clarity within the meaning of Article 84 EPC. It is impossible to compare the parameters the applicant has chosen to employ with what is set out in the prior art. The lack of clarity is such as to render a meaningful complete search impossible.

The subject-matter of claims 1 and 3-9, excluding the above mentioned parameter, in conjunction with the examples, were searched.

Present claim 2 is unclear and was interpreted for search purposes in light of page 2, line 28- page 3, line 2 of the description.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.