

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
16 September 2010 (16.09.2010)

PCT

(10) International Publication Number
WO 2010/102891 A2

(51) International Patent Classification:

A61K 8/891 (2006.01) *A61Q 5/12* (2006.01)
A61Q 5/02 (2006.01)

(21) International Application Number:

PCT/EP2010/052071

(22) International Filing Date:

18 February 2010 (18.02.2010)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

09154693.7 10 March 2009 (10.03.2009) EP

(71) Applicant (for AE, AG, AU, BB, BH, BW, BZ, CA, CY, EG, GB, GD, GH, GM, IE, IL, KE, KN, LC, LK, LS, MT, MW, MY, NA, NG, NZ, OM, PG, SC, SD, SG, SL, SZ, TT, TZ, UG, VC, ZA, ZM, ZW only): **UNILEVER PLC** [GB/GB]; a company registered in England and Wales under company no. 41424, Unilever House, 100 Victoria Embankment, London Greater London EC4Y 0DY (GB).

(71) Applicant (for all designated States except AE, AG, AU, BB, BH, BW, BZ, CA, CY, EG, GB, GD, GH, GM, IE, IL, IN, KE, KN, LC, LK, LS, MT, MW, MY, NA, NG, NZ, OM, PG, SC, SD, SG, SL, SZ, TT, TZ, UG, US, VC, ZA, ZM, ZW): **UNILEVER N.V.** [NL/NL]; Weena 455, NL-3013 AL Rotterdam (NL).

(71) Applicant (for IN only): **HINDUSTAN UNILEVER LIMITED** [IN/IN]; Hindustan Lever House, 165/166 Backbay Reclamation, Maharashtra, Mumbai 400 020 (IN).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **MURRAY, Andrew, Malcolm** [GB/GB]; Unilever R & D Port Sunlight, Quarry Road East, Bebington, Wirral Merseyside CH63

3JW (GB). **RED, Pamela, Eileen** [GB/GB]; Unilever R & D Port Sunlight, Quarry Road East, Bebington, Wirral Merseyside CH63 3JW (GB). **RICHARDS, Claire, Louise** [GB/GB]; Unilever R & D Port Sunlight, Quarry Road East, Bebington, Wirral Merseyside CH63 3JW (GB).

(74) Agent: **NEWBOULD, Frazer, Anthony**; Unilever PLC, Unilever Patent Group, Colworth House, Sharnbrook, Bedford Bedfordshire MK44 1LQ (GB).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) Title: COMPOSITION

(57) Abstract: Aqueous composition comprising 0.01 to 5% wt. of an alkyl-modified silicone and a dendritic macromolecule wherein the alkyl-modified silicone is characterised by the general formula (I): $(CH_3)_3Si-O-[Si(CH_3)(R)O]_m-[Si(CH_3)_2O]_n-Si(CH_3)_3$ (I) in which m has a value of 1 to 450, n has a value of 1 to 3000 and R is a monovalent alkyl radical of from 8 to 60 carbon atoms and is fluid under ambient conditions.



WO 2010/102891 A2

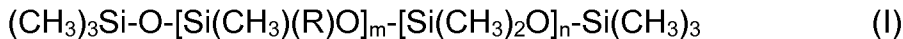
COMPOSITION

The present invention relates to an improved hair composition.

Despite the prior art there remains the need for compositions which are able to prevent hair from frizzing post wash and dry.

Accordingly, and in a first aspect, the present invention provides an aqueous composition comprising 0.01 to 5% wt. of an alkyl-modified silicone and a dendritic macromolecule.

The alkyl modified silicones for use in the hair care compositions of the invention may be chemically characterised by the general formula (I):



in which m has a value of 1 to 450, n has a value of 1 to 3000 and R is a monovalent alkyl radical of from 8 to 60 carbon atoms.

The alkyl modified silicones for use in the invention are fluids under ambient conditions.

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

Preferred alkyl modified silicones for use in the invention have a number average molecular weight (M_n) ranging from 10,000 to 450,000, more preferably from 60,000 to 110,000 dalton.

- 2 -

In general formula (I), the $-\text{[Si(CH}_3)_2\text{O]}-$ units are typically randomly interspersed with the $-\text{[Si(CH}_3)(\text{R})\text{O]}-$ units. m and n are typically average values due to the nature of the polymerisation process.

- 5 Preferred materials of general formula (I) for use in the invention have an m value ranging from 40 to 100, more preferably from 50 to 80.

Preferred materials of general formula (I) for use in the invention have an n value ranging from 500 to 1400, more preferably from 700 to 1200.

10

Preferred materials of general formula (I) for use in the invention have a ratio of $m:n$ ranging from 15:85 to 1:99, more preferably from 10:90 to 5:95.

15

In preferred materials of general formula (I) for use in the invention, R is a linear alkyl radical having from 8 to 22, more preferably from 8 to 14, most preferably from 10 to 12 carbon atoms.

Preferably, the alkyl-modified silicones of the invention are emulsified.

20

Methods for the preparation of alkyl modified silicones suitable for use in the invention are known in the art and described for example in EP 495 596 and WO91/09586.

25

Alkyl modified silicones suitable for use in the invention are also commercially available from suppliers of silicones such as Momentive Performance Materials, Inc. (of Wilton, Connecticut, USA) and Dow Corning Corporation (of Midland, Michigan, USA).

30

Emulsified particles of alkyl modified silicone may typically have a Sauter mean particle diameter ($D_{3,2}$) in the composition of the invention ranging from 0.1 to 10, preferably from 1 to 4 micrometers.

- 3 -

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.

Mixtures of any of the above described alkyl modified silicones may also be used.

5

Alkyl modified silicones for use in compositions of the invention are available as pre-formed silicone emulsions from suppliers of silicones such as those mentioned above. The use of such pre-formed silicone emulsions is preferred for ease of processing and control of silicone particle size. Such pre-formed silicone emulsions will typically additionally comprise a suitable emulsifier, such as an anionic or non-ionic surfactant, and may be prepared by a chemical emulsification process such as emulsion polymerisation, or by mechanical emulsification using a high shear mixer.

10

15 The total amount of alkyl modified silicone in hair care compositions of the invention generally ranges from 0.01 to 5%, preferably from 0.05 to 2%, more preferably from 0.1 to 1.5% by total weight alkyl modified silicone based on the total weight of the composition.

20 Dendritic macromolecules are macromolecules with densely branched structures having a large number of end groups. A dendritic polymer includes several layers or generations of repeating units which all contain one or more branch points. Dendritic polymers, including dendrimers and hyperbranched polymers, are prepared by condensation reactions of monomeric units having at least two different types of reactive groups. Dendrimers are highly symmetric, whereas macromolecules designated as hyperbranched may to a certain degree hold an asymmetry, yet maintaining the highly branched treelike structure.

25

Dendritic macromolecules normally consist of an initiator or nucleus having one or more reactive sites and a number of branching layers and optionally a layer of

30

- 4 -

chain terminating molecules. Continued replication of branching layers normally yields increased branch multiplicity and, where applicable or desired, increased number of terminal groups. The layers are usually called generations and the branches dendrons.

5

In a preferred embodiment the dendritic macromolecule is a hydroxyl-functionalised dendritic macromolecule and more preferably one which comprises polyester units.

10 Suitable materials are described in SE 468 771, which discloses a macromolecule which is composed of an initiator, having at least one hydroxyl group, to which initiator is added at least one branching generation comprising at least one chain extender, having at least one carboxyl group and at least two hydroxyl groups.

15

Further suitable materials are described in SE 503 342, in which the macromolecule is substantially composed of a nucleus, having at least one epoxide group, to which nucleus is added at least one branching generation comprising at least one chain extender, having at least three reactive functions of which at least one is a carboxyl or epoxide group and at least one is a hydroxyl group.

20

These materials are also referred to as polyhydric polyester alcohols or hyperbranched polyols. Preferably these materials have at least eight, more preferably at least sixteen, most preferably at least thirty-two terminal hydroxyl groupings per macromolecule. Their molecular weight is preferably at least 800, more preferably at least 1600, most preferably at least 2500 g/mole.

25

These materials are available commercially from Perstorp AB, SE-284 80 Perstorp, Sweden under the trademark of BOLTORN. Examples of such materials

30

- 5 -

are BOLTORN H10, BOLTORN H20, BOLTORN H30, BOLTORN H2004 and BOLTORN H40, of which BOLTORN H30, BOLTORN H40 and BOLTORN H2004 are preferred.

- 5 In a preferred embodiment the compositions of the invention comprise a hydrophobically functionalised dendritic macromolecule. Preferred hydrophobic groups are carbon based. C₄-C₂₄ alkyl or alkenyl groups are preferred hydrophobic groups, more preferred are C₆-C₂₂ alkyl or alkenyl groups, especially preferred are C₈-C₁₆ alkyl or alkenyl groups, most preferred are dendritic macromolecule having
- 10 C₁₀-C₁₄ alkyl or alkenyl groups. The hydrophobic groups may include linear and branched hydrophobes as well as arylalkyl groups, however it is preferred if the alkyl hydrophobic groups are linear. The hydrophobic groups may be unsaturated groups but are preferably saturated. The hydrophobic groups are sometimes linked to the dendritic macromolecule through linking groups, suitable linking
- 15 groups include ester or amide groups.

In some instances it is preferred if the dendritic macromolecule is fully or partially hydrophobically functionalised at the periphery and/or the terminal groups of the dendritic macromolecule. (In the context of the present invention the term

20 periphery means the outer layer or edge of the dendritic macromolecule.)

Where the dendritic macromolecule is hydrophobically functionalised at the periphery preferably 5 to 95% of the terminal groups are hydrophobically functionalised, more preferably from 10 to 85%, most preferably from 20 to 60%.

25

In a further embodiment the number of hydrophobic groups can be expressed as a percentage of the potential sites on the dendritic macromolecule available for hydrophobic modification both on the periphery of the molecule and internally within the molecule. Preferably 10 to 90 % of these available sites are

- 6 -

hydrophobically modified, more preferably 20 to 70% are hydrophobically modified.

It is preferred if the generation number of the polymer is 2 or greater. The
5 maximum generation number is preferably 9 or less, more preferably 7 or less.

Preferred hydrophobically functionalised dendritic macromolecules are built up from polyester units. Suitable macromolecules of this type are disclosed in
10 US 5 418 301 and can be sold under the tradename Perstop.

Other preferred dendritic macromolecules are built up from polyamide units. Suitable macromolecules of this type are disclosed in Macromolecules 2001, 34, 3559-3566 and are sold under the tradename Hybrane. Preferably the groups are selected from succinic anhydride units, dodecyl succinic anhydride units,
15 hexahydrophthalic anhydride units and phthalic anhydride units or mixtures thereof.

The level of hydrophobically functionalised dendritic macromolecule is preferably from 0.0001 to 30 wt% of the total composition, more preferably the level is from
20 0.05 to 8 wt%, most preferably from 0.1 to 5 wt%.

Preferably the number average molecular weight of the polymers are from 500 to 50,000, more preferably the number average molecular weight to from 500 to 10,000; most preferably the number average molecular weight is from 750 to
25 5,000.

Preferably, the dendritic macromolecule comprises polyester, polyether, polyamide, polyanhydride units or mixtures thereof.

- 7 -

In a particular embodiment the dendritic macromolecule comprises units selected from succinic anhydride units, dodecyl succinic anhydride units, hexahydrophthalic anhydride units and phthalic anhydride units or mixtures thereof.

5

Most preferably, the dendritic macromolecule is emulsified prior to incorporation into the composition.

Suitable emulsifiers include sodium lauryl ether sulphate, most preferably SLES
10 1EO or SLES 3EO; linear sulphonic acid and triethanolamine (Biosoft AS100).
Most preferably, the emulsified dendritic macromolecule comprises inulin lauryl carbamate.

The total amount of dendritic macromolecule in hair care compositions of the
15 invention generally ranges from 0.01 to 5%, preferably from 0.05 to 2%, more preferably from 0.1 to 1.5% by total weight alkyl modified silicone based on the total weight of the composition.

Preferably, the composition additionally comprises a further silicone component
20 comprising (i) from 50 to 95% by weight of the further silicone component of a second silicone which has a viscosity of at least 100,000 mm²/sec at 25°C, and (ii) from 5 to 50% by weight of the further silicone component of a functionalised silicone.

25 Preferably, the composition comprises from 0.1 to 20% wt. further silicone component.

Preferably, the further silicone component has an average particle size in the range from 0.004 to 100 µm, more preferably from 0.004 to 20µm and most
30 preferably from 0.004 to 10 µm.

- 8 -

Preferably, the further silicone component is in the form of a mechanical emulsion.

A suitable further silicone component is commercially available from Dow Corning as DC 7134.

5

Preferably, the second silicone is a gum and has a viscosity of at least 500,000 mm²/sec at 25°C. Preferably, the second silicone has a molecular weight of at least 200,000 Daltons.

10 Preferably, the second silicone is a polydimethylsiloxane.

Preferably, the functionalised silicone has a viscosity of less than 500,000 mm²/sec at 25°C. Preferably, the functionalised silicone has a molecular weight of less than 200,000 Daltons.

15

Preferably, the functionalised silicone is an amino-functionalised silicone. Preferably, the amino-functionalised silicone has a mole percent amino functionality in the range from 0.3 to 8, preferably from 0.5 to 4.

20 Preferably, the weight ratio of the second silicone to the functionalised silicone in the silicone component is in the range from 15:1 to 1:1, preferably from 5:1 to 1:5.

The composition according to the invention may be any hair care composition for example a shampoo, conditioner, mask or such composition used as part of the
25 hair cleansing regime. Preferably though the composition is a conditioning composition or a conditioning shampoo. More preferably, it is a dedicated conditioning composition for the treatment of hair (typically after shampooing) and subsequent rinsing.

- 9 -

Such a conditioner will comprise one or more conditioning surfactants which are cosmetically acceptable and suitable for topical application to the hair.

Suitable conditioning surfactants are selected from cationic surfactants, used singly
5 or in admixture. Examples include quaternary ammonium hydroxides or salts thereof, e.g. chlorides.

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

In conditioners of the invention, the level of cationic surfactant is preferably from 0.01 to 10%, more preferably 0.05 to 5%, most preferably 0.1 to 2% by weight of the
25 composition.

Conditioners of the invention advantageously incorporate a fatty alcohol material. The combined use of fatty alcohol materials and cationic surfactants in conditioning compositions is believed to be especially advantageous, because this leads to the
30 formation of a lamellar phase, in which the cationic surfactant is dispersed.

- 10 -

Representative fatty alcohols comprise from 8 to 22 carbon atoms, more preferably 16 to 20. Examples of suitable fatty alcohols include cetyl alcohol, stearyl alcohol and mixtures thereof. The use of these materials is also advantageous in that they contribute to the overall conditioning properties of compositions of the invention.

5

The level of fatty alcohol material in conditioners of the invention is conveniently from 0.01 to 10%, preferably from 0.1 to 5% by weight of the composition. The weight ratio of cationic surfactant to fatty alcohol is suitably from 10:1 to 1:10, preferably from 4:1 to 1:8, optimally from 1:1 to 1:4.

10

Silicone is a particularly preferred ingredient in hair treatment compositions of the invention. In particular, hair shampoos and conditioners of the invention will preferably also comprise emulsified particles of silicone, for enhancing conditioning performance. The silicone is insoluble in the aqueous matrix of the composition and so is present in an emulsified form, with the silicone present as dispersed particles.

15

Suitable silicones include polydiorganosiloxanes, in particular polydimethylsiloxanes which have the CTFA designation dimethicone. Also suitable for use compositions of the invention (particularly shampoos and conditioners) are polydimethyl siloxanes having hydroxyl end groups, which have the CTFA designation dimethiconol. Also suitable for use in compositions of the invention are silicone gums having a slight degree of cross-linking, as are described for example in WO 96/31188. These materials can impart body, volume and stylability to hair, as well as good wet and dry conditioning.

20

25

The viscosity of the emulsified silicone itself (not the emulsion or the final hair conditioning composition) is typically at least 10,000 cst. In general we have found that conditioning performance increases with increased viscosity.

30

Accordingly, the viscosity of the silicone itself is preferably at least 60,000 cst,

- 11 -

most preferably at least 500,000 cst, ideally at least 1,000,000 cst. Preferably the viscosity does not exceed 10^9 cst for ease of formulation.

Emulsified silicones for use in hair shampoos and conditioners of the invention will typically have an average silicone particle size in the composition of less than 30, preferably less than 20, more preferably less than 10 microns. We have found that reducing the particle size generally improves conditioning performance. Most preferably the average silicone particle size of the emulsified silicone in the composition is less than 2 microns, ideally it ranges from 0.01 to 1 micron.

10 Silicone emulsions having an average silicone particle size of ≤ 0.15 microns are generally termed microemulsions.

Particle size may be measured by means of a laser light scattering technique, using a 2600D Particle Sizer from Malvern Instruments.

15 Suitable silicone emulsions for use in the invention are also commercially available in a pre-emulsified form.

Examples of suitable pre-formed emulsions include emulsions DC2-1766, DC2-1784, and microemulsions DC2-1865 and DC2-1870, all available from Dow
20 Corning. These are all emulsions/microemulsions of dimethiconol. Cross-linked silicone gums are also available in a pre-emulsified form, which is advantageous for ease of formulation. A preferred example is the material available from Dow Corning as DC X2-1787, which is an emulsion of cross-linked dimethiconol gum. A further preferred example is the material available from Dow Corning as DC X2-
25 1391, which is a microemulsion of cross-linked dimethiconol gum.

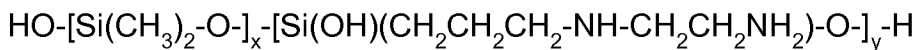
A further preferred class of silicones for inclusion in shampoos and conditioners of the invention are amino functional silicones. By "amino functional silicone" is meant a silicone containing at least one primary, secondary or tertiary amine
30 group, or a quaternary ammonium group.

- 12 -

Examples of suitable amino functional silicones include:

- (i) polysiloxanes having the CTFA designation "amodimethicone", and the general formula:

5



in which x and y are numbers depending on the molecular weight of the polymer, generally such that the molecular weight is between about 5,000 and 500,000.

10

- (ii) polysiloxanes having the general formula:



15

in which:

G is selected from H, phenyl, OH or C₁₋₈ alkyl, e.g. methyl;

a is 0 or an integer from 1 to 3, preferably 0;

20 b is 0 or 1, preferably 1;

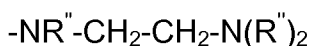
m and n are numbers such that (m + n) can range from 1 to 2000, preferably from 50 to 150;

m is a number from 1 to 2000, preferably from 1 to 10;

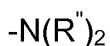
n is a number from 0 to 1999, preferably from 49 to 149, and

25

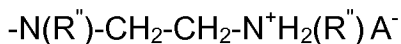
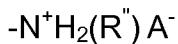
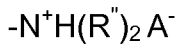
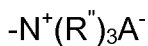
R' is a monovalent radical of formula -C_qH_{2q}L in which q is a number from 2 to 8 and L is an aminofunctional group selected from the following:



30



- 13 -



5

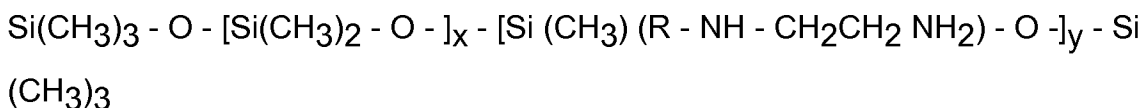
in which R'' is selected from H, phenyl, benzyl, or a saturated monovalent hydrocarbon radical, e.g. C₁₋₂₀ alkyl, and;

A is a halide ion, e.g. chloride or bromide.

10

Suitable amino functional silicones corresponding to the above formula include those polysiloxanes termed "trimethylsilylamodimethicone" as depicted below, and which are sufficiently water insoluble so as to be useful in compositions of the invention:

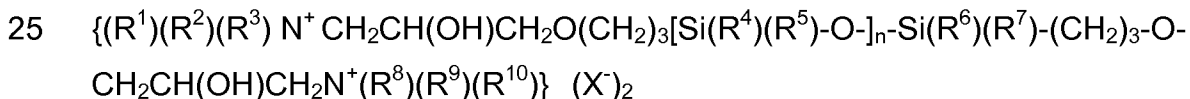
15



20

wherein x + y is a number from about 50 to about 500, and wherein R is an alkylene group having from 2 to 5 carbon atoms. Preferably, the number x + y is in the range of from about 100 to about 300.

(iii) quaternary silicone polymers having the general formula:



30

wherein R¹ and R¹⁰ may be the same or different and may be independently selected from H, saturated or unsaturated long or short chain alk(en)yl, branched chain alk(en)yl and C₅-C₈ cyclic ring systems;

- 14 -

R² thru' R⁹ may be the same or different and may be independently selected from H, straight or branched chain lower alk(en)yl, and C₅-C₈ cyclic ring systems; n is a number within the range of about 60 to about 120, preferably about 80, and

- 5 X⁻ is preferably acetate, but may instead be for example halide, organic carboxylate, organic sulphonate or the like.

Suitable quaternary silicone polymers of this class are described in EP-A-0 530 974.

10

Amino functional silicones suitable for use in shampoos and conditioners of the invention will typically have a mole % amine functionality in the range of from about 0.1 to about 8.0 mole %, preferably from about 0.1 to about 5.0 mole %, most preferably from about 0.1 to about 2.0 mole %. In general the amine
15 concentration should not exceed about 8.0 mole % since we have found that too high an amine concentration can be detrimental to total silicone deposition and therefore conditioning performance.

20

The viscosity of the amino functional silicone is not particularly critical and can suitably range from about 100 to about 500,000 cst.

Specific examples of amino functional silicones suitable for use in the invention are the aminosilicone oils DC2-8220, DC2-8166, DC2-8466, and DC2-8950-114 (all ex Dow Corning), and GE 1149-75, (ex General Electric Silicones).

25

Also suitable are emulsions of amino functional silicone oils with non ionic and/or cationic surfactant.

30

Suitably such pre-formed emulsions will have an average amino functional silicone particle size in the shampoo composition of less than 30, preferably less

- 15 -

than 20, more preferably less than 10 microns. Again, we have found that reducing the particle size generally improves conditioning performance. Most preferably the average amino functional silicone particle size in the composition is less than 2 microns, ideally it ranges from 0.01 to 1 micron. Silicone emulsions
5 having an average silicone particle size of ≤ 0.15 microns are generally termed microemulsions.

Pre-formed emulsions of amino functional silicone are also available from suppliers of silicone oils such as Dow Corning and General Electric. Specific
10 examples include DC929 Cationic Emulsion, DC939 Cationic Emulsion, and the non-ionic emulsions DC2-7224, DC2-8467, DC2-8177 and DC2-8154 (all ex Dow Corning).

An example of a quaternary silicone polymer useful in the present invention is the
15 material K3474, ex Goldschmidt.

The total amount of silicone incorporated into compositions of the invention depends on the level of conditioning desired and the material used. A preferred amount is from 0.01 to about 10% by weight of the total composition although
20 these limits are not absolute. The lower limit is determined by the minimum level to achieve conditioning and the upper limit by the maximum level to avoid making the hair and/or skin unacceptably greasy.

We have found that a total amount of silicone of from 0.3 to 5%, preferably 0.5 to
25 3%, by weight of the total composition is a suitable level.

Compositions of this invention may contain any other ingredient normally used in hair treatment formulations. These other ingredients may include viscosity modifiers, preservatives, colouring agents, polyols such as glycerine and
30 polypropylene glycol, chelating agents such as EDTA, antioxidants such as

- 16 -

vitamin E acetate, fragrances, antimicrobials and sunscreens. Each of these ingredients will be present in an amount effective to accomplish its purpose. Generally these optional ingredients are included individually at a level of up to about 5% by weight of the total composition.

5

Preferably, compositions of this invention also contain adjuvants suitable for hair care. Generally such ingredients are included individually at a level of up to 2%, preferably up to 1%, by weight of the total composition.

10 Among suitable hair care adjuvants, are:

(i) natural hair root nutrients, such as amino acids and sugars. Examples of suitable amino acids include arginine, cysteine, glutamine, glutamic acid, isoleucine, leucine, methionine, serine and valine, and/or precursors and derivatives thereof. The amino acids may be added singly, in mixtures, or
15 in the form of peptides, e.g. di- and tripeptides. The amino acids may also be added in the form of a protein hydrolysate, such as a keratin or collagen hydrolysate. Suitable sugars are glucose, dextrose and fructose. These may be added singly or in the form of, e.g. fruit extracts.

20 (ii) hair fibre benefit agents. Examples are:

- ceramides, for moisturising the fibre and maintaining cuticle integrity. Ceramides are available by extraction from natural sources, or as synthetic ceramides and pseudoceramides. A preferred ceramide is Ceramide II, ex Quest. Mixtures of ceramides may also be suitable, such as Ceramides
25 LS, ex Laboratoires Serobiologiques.

- free fatty acids, for cuticle repair and damage prevention. Examples are branched chain fatty acids such as 18-methyleicosanoic acid and other homologues of this series, straight chain fatty acids such as stearic,
30 myristic and palmitic acids, and unsaturated fatty acids such as oleic acid,

- 17 -

linoleic acid, linolenic acid and arachidonic acid. A preferred fatty acid is oleic acid. The fatty acids may be added singly, as mixtures, or in the form of blends derived from extracts of, e.g. lanolin.

- 5 Mixtures of any of the above active ingredients may also be used.

The invention is further illustrated by way of the following non-limitative examples, in which all percentages quoted are by weight based on total weight unless otherwise stated.

10

In a second aspect there is provided a method for preventing frizzing of hair by applying to the hair a composition according to the first aspect of the invention.

EXAMPLE 1

15

Table 1 shows a composition according an embodiment of the invention. It is made by standard processes.

Table 1

Ingredient	Wt%
Water	89.18
Lactic acid	0.38
Methyl parahydroxybenzoate	0.2
Stearyl alcohol	5
Behenyltrimmonium chloride	0.87
TAS	1.25
Silicone emulsion	2.5
Alkyl Modified Silicone*	0.5
Emulsified dendritic macromolecule**	0.5

20

- 18 -

* HUJ-7419 silicone emulsion (INCI name is alkylmethyl silicone) ex. Momentive.

** Boltorn H2004 Perstorp

5 **EXAMPLE 2**

Three formulations were tested for their effect on frizz (curly hair). In this test, HUJ and/or NLP (dendritic macromolecule) were applied to curly hair via a standard conditioner formulation then rinsed using the standard protocol. The formulations tested were:

1. 1% HUJ
2. 1% NLP
3. 1% HUJ/ NLP (50:50 mixture)

Surprisingly, despite being the same overall level of material, the HUJ/ NLP mixture shows a significant improvement in frizz reduction compared to either the HUJ or NLP on their own.

Table 2 shows the results of a panel study measuring frizz (low score = low frizz). Clearly the mixture is better than either the NLP or HUJ alone. A low value represents a low frizz.

Table 2

Sample	Score
1% NLP	5.8
1% HUJ	2.4
1% NLP/HUJ	1.9

CLAIMS

1. Aqueous composition comprising 0.01 to 5% wt. of an alkyl-modified
silicone and a dendritic macromolecule wherein the alkyl-modified silicone
5 is characterised by the general formula (I):



10 in which m has a value of 1 to 450, n has a value of 1 to 3000 and R is a
monovalent alkyl radical of from 8 to 60 carbon atoms and is fluid under
ambient conditions.

2. A composition according to any preceding claim wherein the dendritic
macromolecule is emulsified prior to incorporation into the remainder of the
15 composition.
3. A composition according to any preceding claim which is a hair conditioning
composition.
- 20 4. A composition according to any preceding claim which is a conditioning
shampoo.
5. Method for preventing or reducing hair frizz by applying to the hair a
composition according to any preceding claim and then shampooing and
25 rinsing.