



(51) International Patent Classification:

C09J 183/04 (2006.01) A61K 8/892 (2006.01)
C08L 83/12 (2006.01) A61K 8/90 (2006.01)
A61Q 5/00 (2006.01) A61K 8/06 (2006.01)
A61Q 19/00 (2006.01) C09J 183/06 (2006.01)
A61K 8/891 (2006.01) C08L 83/06 (2006.01)

(21) International Application Number:

PCT/US2014/027856

(22) International Filing Date:

14 March 2014 (14.03.2014)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/789,635 15 March 2013 (15.03.2013) US

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(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, BN, 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, IR, IS, JP, KE, KG, 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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, 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, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, 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, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))
- of inventorship (Rule 4.17(iv))

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) Title: COSMETIC COMPOSITIONS CONTAINING SILICONE RESIN EMULSIONS

(57) Abstract: The present invention describes personal care compositions useful for preparing hair care and skin care compositions. The personal care compositions comprise: i) a silicone resin emulsion comprising: A) 0.5 wt % to 95 wt % of a silicone resin or pressure sensitive adhesive (PSA), B) 0.1 to 90 wt % of a ethylene oxide/propylene oxide block copolymer, and sufficient amount of water to sum to 100 weight percent, ii) at least one personal care ingredient (C), iii) optionally in a cosmetically acceptable medium.



COSMETIC COMPOSITIONS CONTAINING SILICONE RESIN EMULSIONS**CROSS-REFERENCE TO RELATED APPLICATIONS**

[001] This application claims the benefit of United States Provisional Patent
5 Application No. 61/789,635 filed March 15, 2013.

TECHNICAL FIELD OF THE INVENTION

[002] This invention relates to the field of personal care compositions. In particular,
the invention relates to hair care and skin care compositions comprising a silicone
10 resin emulsion comprising a silicone resin or pressure sensitive adhesive and an
ethylene oxide/propylene oxide block copolymer, water and at least one cosmetic
ingredient.

BACKGROUND OF THE INVENTION

15 [003] Silicones can be used in hair care and skin care compositions. For example,
in U.S. Pat. No. 4,788,006 discloses shampoo compositions which comprise a
synthetic, anionic surfactant, a dispersed, insoluble, non-volatile silicone, a xanthan
gum suspending agent and water. Hair treating compositions containing
aminofunctional polysiloxanes have also been described, for example, in U.S. Pat. No.
20 4,563,347 that discloses aminoalkyl substituted polydimethylsiloxane. Other hair
treating compositions are described in U.S. Pat. Nos. 4,586,518, 4,601,902, and
4,618,689.

[004] Preparation of aqueous mechanical emulsions of silicone resins or PSAs is
difficult due to the handling of such highly molecular weight and/or solid materials.
25 Often, the silicone resin or PSA is dissolved in an organic aromatic solvent, or require
specialized surfactants containing aromatic solvents. The presence of such solvents
presents manufacturing challenges and also precludes their use in many personal,
cosmetic, or healthcare applications. Silicone resins or PSAs can be emulsified using
specialized equipment such as a twin screw extruder (TSE). However, the costs for
30 such equipment are relatively high, both from a capital and an operational standpoint.
PCT/US13/24761 discloses preparation of mechanical emulsions of silicone resins or
PSAs using a specific class of certain nonionic surfactants, namely poly(oxyethylene)-
poly(oxypropylene)-poly(oxyethylene) block copolymers.

[005] There is a continuous need to provide compositions for hair care and skin care
35 that provide lower environmental impact, lower transportation cost or reduced water
usage. There is a continuous need for emulsions useful in hair care and skin care

compositions which are not detrimental to the health of consumers, provide superior foaming, are clear and easy usable products or provide increased substantive conditioning properties.

5

SUMMARY OF THE INVENTION

[006] The present invention provides personal care compositions comprising silicone resin emulsions useful in hair care and skin care products.. Thus, the present invention provides personal care compositions comprising:

- i) a silicone resin emulsion comprising:
 - 10 A) 0.5 wt % to 95 wt % of a silicone resin or pressure sensitive adhesive (PSA),
 - B) 0.1 to 90 wt % of a ethylene oxide/propylene oxide block copolymer, and sufficient amount of water to sum to 100 weight percent;
- ii) at least one personal care ingredient (C); and
- 15 iii) optionally in a cosmetically acceptable medium.

[007] The personal care compositions of the present invention may be used as a hair care composition or as a skin care composition. The personal care compositions of the present invention may be used in a variety of personal care products or formulations to prepare optically clear compositions.

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DETAILED DESCRIPTION OF THE INVENTION

[008] The personal care compositions of the present invention are useful for preparing personal care products. Personal care compositions include hair care and skin care compositions. The personal care compositions can be used in shampoo, 25 hair and skin conditioners, hair fixative, hair styling aid, hair colorant, hair relaxer, shower gel, skin moisturizer, or body conditioner. The personal care compositions of the present invention can provide conditioning properties for imparting an ease of detangling, combing, pliability, smoothness, slipperiness, or styling benefits.

[009] In one embodiment, the present invention provides hair care compositions, 30 wherein the compositions comprise:

- i) a silicone resin emulsion comprising:
 - A) 0.5 wt % to 95 wt % of a silicone resin or pressure sensitive adhesive (PSA);
 - B) 0.1 to 90 wt % of a ethylene oxide/propylene oxide block copolymer; 35 and sufficient amount of water to sum to 100 weight percent;
- ii) at least one personal care ingredient (C); and

iii) optionally in a cosmetically acceptable medium.

[0010] In another embodiment, the present invention provides skin care compositions, wherein the compositions comprise:

i) a silicone resin emulsion comprising:

A) 0.5 wt % to 95 wt % of a silicone resin or pressure sensitive adhesive (PSA);

B) 0.1 to 90 wt % of a ethylene oxide/propylene oxide block copolymer; and sufficient amount of water to sum to 100 weight percent;

ii) at least one personal care ingredient (C); and

iii) optionally in a cosmetically acceptable medium.

[0011] The silicone resin emulsions of the present invention useful for personal care compositions comprise:

A) 0.5 wt % to 95 wt % of a silicone resin or pressure sensitive adhesive (PSA),

B) 0.1 to 90 wt % of a ethylene oxide/propylene oxide block copolymer, and sufficient amount of water to sum to 100 weight percent.

A) The Silicone Resin or Pressure Sensitive Adhesive (PSA)

[0012] Component A) may be either a silicone resin or PSA. As used herein, "silicone resin" refers to any organopolysiloxane containing at least one (RSiO_{3/2}), or (SiO_{4/2}) siloxy unit. As used herein in its broadest sense, a silicone PSA refers to the reaction products resulting from reacting a hydroxyl endblocked "linear" organopolysiloxane with a "resin" organopolysiloxane, wherein the resin organopolysiloxane contains at least one (RSiO_{3/2}), or (SiO_{4/2}) siloxy unit.

[0013] Organopolysiloxanes are polymers containing siloxy units independently selected from (R₃SiO_{1/2}), (R₂SiO_{2/2}), (RSiO_{3/2}), or (SiO_{4/2}) siloxy units, where R may be any organic group. These siloxy units are commonly referred to as M, D, T, and Q units respectively. These siloxy units can be combined in various manners to form cyclic, linear, or branched structures. The chemical and physical properties of the resulting polymeric structures vary depending on the number and type of siloxy units in the organopolysiloxane. "Linear" organopolysiloxanes typically contain mostly D or (R₂SiO_{2/2}) siloxy units, which results in polydiorganosiloxanes that are fluids of varying viscosity, depending on the "degree of polymerization" or DP as indicated by the number of D units in the polydiorganosiloxane. "Linear" organopolysiloxanes typically have glass transition temperatures (T_g) that are lower than 25 °C. "Resin" organopolysiloxanes result when a majority of the siloxy units are selected from T or Q siloxy units. When T siloxy

units are predominately used to prepare an organopolysiloxane, the resulting organosiloxane is often referred to as a “silsesquioxane resin”. When M and Q siloxy units are predominately used to prepare an organopolysiloxane, the resulting organosiloxane is often referred to as a “MQ resin”. Alternatively, the formula for an organopolysiloxane may be designated by the average of the siloxy units in the organopolysiloxane as follows; $R_n\text{SiO}_{(4-n)/2}$, where the R is independently any organic group, alternatively a hydrocarbon, or alternatively an alkyl group, or alternatively methyl. The value of n in the average formula may be used to characterize the organopolysiloxane. For example, an average value of $n = 1$ would indicate a predominate concentration of the $(\text{RSiO}_{3/2})$ siloxy unit in the organopolysiloxane, while $n = 2$ would indicate a predominance of $(\text{R}_2\text{SiO}_{2/2})$ siloxy units. As used herein, “organopolysiloxane resin” refers to those organopolysiloxanes having a value of n less than 1.8 in the average formula $R_n\text{SiO}_{(4-n)/2}$, indicating a resin.

[0014] The silicone resin useful as component A) may independently comprise (i) $(\text{R}^1_3\text{SiO}_{1/2})_a$, (ii) $(\text{R}^2_2\text{SiO}_{2/2})_b$, (iii) $(\text{R}^3\text{SiO}_{3/2})_c$, and (iv) $(\text{SiO}_{4/2})_d$ siloxy units, providing there is at least one T or Q siloxy unit in the silicone resin molecule. The amount of each unit present in the silicone resin is expressed as a mole fraction (i.e., a, b, c, or d) of the total number of moles of all M, D, T, and Q units present in the silicone resin. Any such formula used herein to represent the silicone resin does not indicate structural ordering of the various siloxy units. Rather, such formulae are meant to provide a convenient notation to describe the relative amounts of the siloxy units in the silicone resin, as per the mole fractions described above via the subscripts a, b, c, and d. The mole fractions of the various siloxy units in the present organosiloxane block copolymers, as well as the silanol content, may be readily determined by ^{29}Si NMR techniques.

[0015] The silicone resin may also contain silanol groups ($\equiv\text{SiOH}$). The amount of silanol groups present on the silicone resin may vary from 0.1 to 35 mole percent silanol groups [$\equiv\text{SiOH}$], alternatively from 2 to 30 mole percent silanol groups [$\equiv\text{SiOH}$], alternatively from 5 to 20 mole percent silanol groups [$\equiv\text{SiOH}$]. The silanol groups may be present on any siloxy units within the silicone resin.

[0016] The molecular weight of the silicone resin is not limiting. The silicone resin may have an average molecular weight (M_w) of at least 1,000 g/mole, alternatively an average molecular weight of at least 2,000 g/mole alternatively an average molecular weight of at least 5,000 g/mole. The average molecular weight may be readily determined using Gel Permeation Chromatography (GPC) techniques.

[0017] In one embodiment, the silicone resin is a MQ silicone. The silicone resin may be a MQ resin comprising at least 80 mole% of siloxy units selected from

($R^1_3SiO_{1/2}$)_a and ($SiO_{4/2}$)_d units (that is $a + d \geq 0.8$), where R^1 is an alkyl group having from 1 to 8 carbon atoms, an aryl group, a carbinol group, or an amino group, with the proviso that at least 95 mole % of the R^1 groups are alkyl groups, a and d each have a value greater than zero, and the ratio of a/d is 0.5 to 1.5.

[0018] The R^1 units of the MQ resin are independently an alkyl group having from 1 to 8 carbon atoms, an aryl group, a carbinol group, or an amino group. The alkyl groups are illustrated by methyl, ethyl, propyl, butyl, pentyl, hexyl, and octyl. The aryl groups are illustrated by phenyl, naphthyl, benzyl, tolyl, xylyl, xenyl, methylphenyl, 2-phenylethyl, 2-phenyl-2-methylethyl, chlorophenyl, bromophenyl and fluorophenyl with the aryl group typically being phenyl.

[0019] MQ resins suitable for use as component (A), and methods for their preparation, are known in the art. For example, U.S. Patent No. 2,814,601 to Currie et al., November 26, 1957, which is hereby incorporated by reference, discloses that MQ resins can be prepared by converting a water-soluble silicate into a silicic acid monomer or silicic acid oligomer using an acid. When adequate polymerization has been achieved, the resin is end-capped with trimethylchlorosilane to yield the MQ resin. Another method for preparing MQ resins is disclosed in U.S. Patent No. 2,857,356 to Goodwin, October 21, 1958, which is hereby incorporated by reference. Goodwin discloses a method for the preparation of an MQ resin by the cohydrolysis of a mixture of an alkyl silicate and a hydrolyzable trialkylsilane organopolysiloxane with water.

[0020] The MQ resins suitable as component A) in the present invention may contain D and T units. The MQ resins may also contain hydroxy groups. Typically, the MQ resins have a total weight % hydroxy content of 2-10 weight %, alternatively 2-5 weight %. The MQ resins can also be further "capped" wherein residual hydroxy groups are reacted with additional M groups.

[0021] In one embodiment, the silicone resin is a silsesquioxane resin. The silsesquioxane resin may be a silsesquioxane resin comprising at least 80 mole % of $R^3SiO_{3/2}$ units, where R^3 in the above trisiloxy unit formula is independently a C_1 to C_{20} hydrocarbyl, a carbinol group, or an amino group. As used herein, hydrocarbyl also includes halogen substituted hydrocarbyls. R^3 may be an aryl group, such as phenyl, naphthyl, anthryl group. Alternatively, R^3 may be an alkyl group, such as methyl, ethyl, propyl, or butyl. Alternatively, R^3 may be any combination of the aforementioned alkyl or aryl groups. Alternatively, R^3 is phenyl, propyl, or methyl. In

one embodiment, at least 40 mole % of the R^3 groups are propyl, referred herein as T-propyl resins, since the majority of the siloxane units are T units of the general formula $R^3SiO_{3/2}$ where at least 40 mole %, alternatively 50 mole %, or alternatively 90 mole % of the R^3 groups are propyl. In another embodiment, at least 40 mole % of the R^3 groups are phenyl, referred herein as T-phenyl resins, since the majority of the siloxane units are T units of the general formula $R^3SiO_{3/2}$ where at least 40 mole %, alternatively 50 mole %, or alternatively 90 mole % of the R^3 groups are phenyl. In yet another embodiment, R^3 may be a mixture of propyl and phenyl. When R^3 is a mixture of propyl and phenyl, the amounts of each in the resin may vary, but typically the R^3 groups in the silsesquioxane resin may contain 60 – 80 mole percent phenyl and 20- 40 mole percent propyl.

[0022] Silsesquioxane resins are known in the art and are typically prepared by hydrolyzing an organosilane having three hydrolyzable groups on the silicon atom, such as a halogen or alkoxy group. Thus, silsesquioxane resins can be obtained by hydrolyzing propyltrimethoxysilane, propyltriethoxysilane, propyltripropoxysilane, or by co-hydrolyzing the aforementioned propylalkoxysilanes with various alkoxy silanes. Examples of these alkoxy silanes include methyltrimethoxysilane, methyltriethoxysilane, methyltriisopropoxysilane, dimethyldimethoxysilane, and phenyltrimethoxysilane. Propyltrichlorosilane can also be hydrolyzed alone, or in the presence of alcohol. In this case, co-hydrolyzation can be carried out by adding methyltrichlorosilane, dimethyldichlorosilane, phenyltrichlorosilane, or similar chlorosilanes and methyltrimethoxysilane, methyltriethoxysilane, methyltriisopropoxysilane, or similar methylalkoxysilane. Alcohols suitable for these purposes include methanol, ethanol, n-propyl alcohol, isopropyl alcohol, butanol, methoxy ethanol, ethoxy ethanol, or similar alcohols. Examples of hydrocarbon-type solvents which can also be concurrently used include toluene, xylene, or similar aromatic hydrocarbons; hexane, heptane, isooctane, or similar linear or partially branched saturated hydrocarbons; and cyclohexane, or similar aliphatic hydrocarbons.

[0023] The silsesquioxane resins suitable in the present disclosure may contain M, D, and Q units, but typically at least 80 mole %, alternatively 90 mole % of the total siloxane units are T units. The silsesquioxane resins may also contain hydroxy and/or alkoxy groups. Typically, the silsesquioxane resins have a total weight % hydroxy content of 2-10 weight % and a total weight % alkoxy content of up to 20 weight %, alternatively 6-8 weight% hydroxy content and up to 10 weight % alkoxy content.

[0024] Representative, non-limiting examples of commercial silicone resins suitable as component A) include; silicone resins sold under the trademarks DOW CORNING[®] 840 Resin, DOW CORNING[®] 2-7466 Resin, DOW CORNING[®] 2-9138 Resin, DOW CORNING[®] 2-9148 Resin, DOW CORNING[®] 2104 Resin, DOW CORNING[®] 2106 Resin, DOW CORNING[®] 217 Flake Resin, DOW CORNING[®] 220 Flake Resin, DOW CORNING[®] 233 Flake Resin, DOW CORNING[®] 4-2136 Resin, Xiameter[®] RSN-6018 Resin, Xiameter[®] RSN-0217 Resin, Silres[®] MK methyl silicone resin, Dow Corning[®] MQ 1600 Resin.

[0025] As used herein, "silicone resin" also encompasses silicone-organic resins. Thus, silicone-organic resins includes silicone-organic copolymers, where the silicone portion contains at least one (RSiO_{3/2}), or (SiO_{4/2}) siloxy unit. The silicone portion of the silicone-organic resin may be any of the silsesquioxane or MQ resins as described above. The organic portion may be any organic polymer, such as those derived by free radical polymerization of one or more ethylenically unsaturated organic monomers.

Various types of ethylenically unsaturated and/or vinyl containing organic monomers can be used to prepare the organic portion including; acrylates, methacrylates, substituted acrylates, substituted methacrylates, vinyl halides, fluorinated acrylates, and fluorinated methacrylates, for example. Some representative compositions include acrylate esters and methacrylate esters such as methyl acrylate, ethyl acrylate, butyl acrylate, 2-ethylhexyl acrylate, methyl methacrylate, decyl acrylate, lauryl acrylate, isodecyl methacrylate, lauryl methacrylate, and butyl methacrylate; substituted acrylates and methacrylates such as hydroxyethyl acrylate, perfluorooctyl acrylate, hydroxypropyl acrylate, hydroxypropyl methacrylate, and hydroxyethyl methacrylate; vinyl halides such as vinyl chloride, vinylidene chloride, and chloroprene; vinyl esters such as vinyl acetate and vinyl butyrate; vinyl pyrrolidone; conjugated dienes such as butadiene and isoprene; vinyl aromatic compounds such as styrene and divinyl benzene; vinyl monomers such as ethylene; acrylonitrile and methacrylonitrile; acrylamide, methacrylamide, and N-methylol acrylamide; and vinyl esters of monocarboxylic acids.

[0026] The silicone resin selected as component A) may also be a combination(s) of any of the aforementioned silicone resins.

[0027] When component A) is a silicone PSA, it may be the reaction product of a hydroxy endblocked polydimethylsiloxane polymer and a hydroxy functional silicate or silicone resin. Typically, the hydroxy functional silicate resin is a trimethylsiloxy and hydroxy endblocked silicate resin, such as the silicone resins described above. The

polydimethylsiloxane polymer and hydroxy functional silicate resin are reacted in a condensation reaction to form the silicone PSA.

[0028] PSAs are disclosed in U.S. Patent Nos.: 4,584,355; 4,585,836; 4,591,622; 5,726,256; 5,776,614; 5,861,472; 5,869,556; 6,337,086, all of which are hereby

5 incorporated by reference for the purpose of disclosing the chemical compositions of PSAs useful as component A) in the present disclosure.

[0029] The silicone PSA may also be a silicone acrylate hybrid composition, as disclosed in WO2007/145996, which is incorporated herein by reference for its teaching of suitable PSA compositions as component A).

10 **[0030]** Representative, non-limiting examples of commercially available PSA's suitable as component A) include; Dow Corning® Q2-7406 Adhesive, Dow Corning® Q2-7735 Adhesive, Dow Corning® 7355 Adhesive, Dow Corning® 7358 Adhesive, Dow Corning® Q2-7566 Adhesive, Dow Corning® BIO-PSA 7-4102 Adhesive, Dow Corning® BIO-PSA 7-4202 Adhesive, Dow Corning® BIO-PSA 7-4302 Adhesive, Dow Corning® BIO-PSA 7-4402 Adhesive, Dow Corning® BIO-PSA 7-4502 Adhesive, Dow Corning® BIO-PSA 7-4602 Adhesive, Dow Corning® 7-4560, Shin-Etsu KR-100, Shin-Etsu KR-101-10, Shin-Etsu SR-130 Momentive PSA518, Momentive SPUR+ PSA 3.0, Momentive SILGRIP PSA529, Momentive SILGRIP PSA915, Momentive SILGRIP PSA610, Momentive SILGRIP PSA595, Momentive SILGRIP PSA6374, and Momentive SILGRIP
15
20 PSA6574.

[0031] The silicone resin and PSA may be, for example, the silicone resin and PSA disclosed in PCT/US13/24761, which is incorporated by reference in its entirety.

B) The Ethylene oxide/propylene oxide Block Copolymer

[0032] Component B) is an ethylene oxide/propylene oxide block copolymer.

25 Component B) may be selected from those ethylene oxide/propylene oxide block copolymers known to have surfactant behavior. Typically, the ethylene oxide/propylene oxide block copolymers useful as component B) are surfactants having an HLB of at least 12, alternatively, at least 15, or alternatively at least 18.

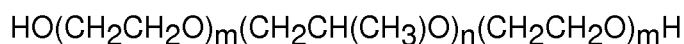
[0033] The molecular weight of the ethylene oxide/propylene oxide block copolymer
30 may vary, but typically is at least 4,000 g/mol, alternatively at least 8,000 g/mol, or at least 12,000 g/mol.

[0034] The amounts of ethylene oxide (EO) and propylene oxide (PO) present in the ethylene oxide/propylene oxide block copolymer may vary, but typically, the amount of EO may vary from 50 percent to 80 percent, or alternatively from 60 percent to about
35 85 percent, or alternatively from 70 percent to 90 percent.

[0035] In one embodiment, component B) is a poly(oxyethylene)-poly(oxypropylene)-poly(oxyethylene) tri-block copolymer. Poly(oxyethylene)-poly(oxypropylene)-poly(oxyethylene) tri-block copolymers are also commonly known as *Poloxamers*. They are nonionic triblock copolymers composed of a central hydrophobic chain of polyoxypropylene (poly(propylene oxide)) flanked by two hydrophilic chains of polyoxyethylene (poly(ethylene oxide)).

[0036] Poly(oxyethylene)-poly(oxypropylene)-poly(oxyethylene) tri-block copolymers are commercially available from BASF (Florham Park, NJ) and are sold under the tradename PLURONIC®. Representative, non-limiting examples suitable as component (B) include; PLURONIC® F127, PLURONIC® F98, PLURONIC® F88, PLURONIC® F87, PLURONIC® F77 and PLURONIC® F68, and PLURONIC® F-108.

[0037] In a further embodiment, the poly(oxyethylene)-poly(oxypropylene)-poly(oxyethylene) tri-block copolymer has the formula;



where the subscript "m" may vary from 50 to 400, or alternatively from 100 to 300, and the subscript "n" may vary from 20 to 100, or alternatively from 25 to 100.

[0038] In one embodiment, component B) is a tetrafunctional poly(oxyethylene)-poly(oxypropylene) block copolymer derived from the sequential addition of propylene oxide and ethylene oxide to ethylene diamine. These tetra-functional block copolymers are also commonly known as *Poloxamines*. The tetrafunctional poly(oxyethylene)-poly(oxypropylene) block copolymer may have the average formula; $[\text{HO}(\text{CH}_2\text{CH}_2\text{O})_q(\text{CH}_2\text{CH}(\text{CH}_3)\text{O})_r]_2\text{NCH}_2\text{CH}_2\text{N}[(\text{CH}_2\text{CH}(\text{CH}_3)\text{O})_r(\text{CH}_2\text{CH}_2\text{O})_q\text{H}]_2$ where the subscript "q" may vary from 50 to 400, or alternatively from 100 to 300, and the subscript "r" may vary from 15 to 75, or alternatively from 20 to 50.

[0039] Tetrafunctional poly(oxyethylene)-poly(oxypropylene) block copolymers are commercially available from BASF (Florham Park, NJ) and are sold under the tradename TETRONIC®. Representative, non-limiting examples suitable as component (B) include; TETRONIC® 908, TETRONIC® 1107, TETRONIC® 1307, TETRONIC® 1508 and TETRONIC® 1504.

[0040] The amounts of components A) and B) may vary in the emulsion. Typically the silicone resin emulsions comprise, alternatively consists essentially of, or alternatively consists of:

0.5 to 95 wt. % of A) the silicone resin;

alternatively 5 to 90 wt. % of A) silicone resin,

alternatively 10 to 80 wt. % of A) silicone resin,

alternatively 20 to 70 wt. % of A) silicone resin,

alternatively 30 to 60 wt. % of A) silicone resin,
to 90 wt. % of B) the ethylene oxide/propylene oxide block copolymer;
alternatively 0.1 to 50 wt. % of B) the block copolymer,
alternatively 0.5 to 40 wt. % of B) the block copolymer,
alternatively 1 to 30 wt. % of B) the block copolymer,
alternatively 1 to 20 wt. % of B) the block copolymer,
alternatively 1 to 10 wt. % of B) the block copolymer,
and sufficient amounts of water, or optional components, to sum to 100 wt%.

[0041] The silicone resin emulsion compositions of the present invention may be an oil/water emulsion, a water/oil emulsion, a multiple phase or triple emulsion.

[0042] In one embodiment, the emulsions of the present invention are "oil/water emulsions", that is, emulsions having an aqueous continuous phase and a dispersed phase comprising the silicone resin. The oil/water emulsions may be characterized by average volume particle of the dispersed silicone resin (oil) phase in a continuous aqueous phase. The particle size may be determined by laser diffraction of the emulsion. Suitable laser diffraction techniques are well known in the art. The particle size is obtained from a particle size distribution (PSD). The PSD can be determined on a volume, surface, length basis. The volume particle size is equal to the diameter of the sphere that has the same volume as a given particle. The term D_v represents the average volume particle size of the dispersed particles. $D_v 50$ is the particle size measured in volume corresponding to 50% of the cumulative particle population. In other words if $D_v 50 = 10 \mu\text{m}$, 50% of the particle have an average volume particle size below $10 \mu\text{m}$ and 50% of the particle have a volume average particle size above $10 \mu\text{m}$. $D_v 90$ is the particle size measured in volume corresponding to 90% of the cumulative particle population.

[0043] The average volume particle size of the dispersed silicone particles in the oil/water emulsions can be between $0.1 \mu\text{m}$ and $150 \mu\text{m}$; or between $0.1 \mu\text{m}$ and $30 \mu\text{m}$; or between $0.3 \mu\text{m}$ and $5.0 \mu\text{m}$.

[0044] The present emulsions may be prepared by any known methods, or alternatively prepared by the methods as discussed below.

[0045] The present invention further provides processes for making silicone resin emulsions comprising:

I) forming a dispersion of:

A) 100 parts of a silicone resin or PSA; and

B) 5 to 100 parts of a ethylene oxide/propylene oxide block copolymer;

II) admixing a sufficient amount of water to the dispersion from step I) to form an emulsion; and

III) optionally, further shear mixing the emulsion.

[0046] The amount of components A) and B) combined in step I) are as follows: A)

5 100 parts of a silicone resin or PSA, and B) 5 to 100 parts, alternatively 10 to 40 parts, or alternatively 10 to 25 of the ethylene oxide/propylene oxide block copolymer.

Components A) and B) are the same as described above.

[0047] As used herein, "parts" refers to parts by weight.

[0048] In one embodiment, the dispersion formed in step I) consists essentially of

10 components A) and B) as described above. In this embodiment, no additional surfactants or emulsifiers are added in step I). Furthermore, no solvents are added for the purpose of enhancing formation of an emulsion. As used herein, the phrase "essentially free of "solvents" means that solvents are not added to components A) and B) in order to create a mixture of suitable viscosity that can be processed on typical
15 emulsification devices. More specifically, "solvents" as used herein is meant to include any water immiscible low molecular weight organic or silicone material added to the non-aqueous phase of an emulsion for the purpose of enhancing the formation of the emulsion, and is subsequently removed after the formation of the emulsion, such as evaporation during a drying or film formation step. Thus, the phrase "essentially free
20 of solvent" is not meant to exclude the presence of solvent in minor quantities in process or emulsions of the present invention. For example, there may be instances where the components A) and B) may contain minor amounts of solvent as supplied commercially. Small amounts of solvent may also be present from residual cleaning operations in an industrial process. Preferably, the amount of solvent present in the
25 premix should be less than 2% by weight of the mixture, and most preferably the amount of solvent should be less than 1% by weight of the mixture.

[0049] The dispersion of step I) may be prepared by combining components A) and B) and further mixing the components to form a dispersion. The resulting dispersion may be considered as a homogenous mixture of the two components. The present

30 inventors have unexpectedly found that certain ethylene oxide/propylene oxide block copolymers readily disperse with silicone resin compositions, and hence enhance the subsequent formation of emulsion compositions thereof. The present inventors believe other nonionic and/or anionic surfactants, typically known for preparing silicone emulsions, do not necessarily form such dispersions or homogeneous mixtures upon
35 mixing with a silicone resin (at least not in the absence of a solvent or other substance to act as a dispersing medium). While not wishing to be limited to any theory, the

inventors believe the discovery of the present ethylene oxide/propylene oxide block copolymers to form such dispersions with silicone resins, provides emulsion compositions of silicone resins without the presence of undesirable solvents, or requiring elaborate handling/mixing techniques.

5 **[0050]** Mixing can be accomplished by any method known in the art to effect mixing of high viscosity materials. The mixing may occur either as a batch, semi-continuous, or continuous process. Mixing may occur, for example using, batch mixing equipments with medium / low shear include change-can mixers, double-planetary mixers, conical-screw mixers, ribbon blenders, double-arm or sigma-blade mixers; batch equipments
10 with high-shear and high-speed dispersers include those made by Charles Ross & Sons (NY), Hockmeyer Equipment Corp. (NJ); batch mixing equipment such as those sold under the tradename Speedmixer®; batch equipments with high shear actions include Banbury-type (CW Brabender Instruments Inc., NJ) and Henschel type (Henschel mixers America, TX). Illustrative examples of continuous mixers /
15 compounders include extruders single-screw, twin-screw, and multi-screw extruders, co-rotating extruders, such as those manufactured by Krupp Werner & Pfleiderer Corp (Ramsey, NJ), and Leistritz (NJ); twin-screw counter-rotating extruders, two-stage extruders, twin-rotor continuous mixers, dynamic or static mixers or combinations of these equipments.

20 **[0051]** Combining and mixing components A) and B) may occur in a single step or multiple step process. Thus, components A) and B) may be combined in total, and subsequently mixed via any of the techniques described above. Alternatively, a portion(s) of components A) and B) may first be combined, mixed, and followed by combining additional quantities of either or both components and further mixing. One
25 skilled in the art would be able to select optimal portions of components A) and B) for combining and mixing, depending on the selection of the quantity used and the specific mixing techniques utilized to perform step I) to provide a dispersion of components A) and B).

[0052] Step II) of the process involves admixing sufficient water to the mixture of step I
30 to form an emulsion. The emulsion may be a water continuous emulsion. Typically 5 to 700 parts water are mixed for every 100 parts of the step I mixture to form an emulsion. In one embodiment the emulsion formed is a water continuous emulsion. Typically, the water continuous emulsion has dispersed particles of the silicone resin from step I, and having an average particle size less than 150 μm .

35 **[0053]** The amount of water added in step II) can vary from 5 to 700 parts per 100 parts by weight of the mixture from step I. The water is added to the mixture from step

I at such a rate so as to form an emulsion of the mixture of step I. While this amount of water can vary depending on the selection of the amount of silicone resin present and the specific ethylene oxide/propylene oxide block copolymer used, generally the amount of water is from 5 to 700 parts per 100 parts by weight of the step I mixture, alternatively from 5 to 100 parts per 100 parts by weight of the step I mixture, or alternatively from 5 to 70 parts per 100 parts by weight of the step I mixture.

[0054] Typically the water is added to the dispersion from step I) in incremental portions, whereby each incremental portion comprises less than 30 weight % of the dispersion from step I) and each incremental portion of water is added successively to the previous after the dispersion of the previous incremental portion of water, wherein sufficient incremental portions of water are added to form an emulsion.

[0055] Alternatively, a portion or all the water used in step II) may be substituted with various hydrophilic solvents suitable for personal care compositions that are soluble with water such as low molecular weight alcohols, ethers, esters or glycols.

Representative non-limiting examples include low molecular weight alcohols such as methanol, ethanol, propanol, isopropanol and the like; low molecular weight ethers such as di(propyleneglycol) mono methyl ether, di(ethyleneglycol) butyl ether, di(ethyleneglycol) methyl ether, di(propyleneglycol) butyl ether, di(propyleneglycol) methyl ether acetate, di(propyleneglycol) propyl ether, ethylene glycol phenyl ether, propylene glycol butyl ether, 1-methoxy-2-propanol, 1-methoxy-2-propyl acetate, propylene glycol propyl ether, 1-phenoxy-2-propanol, tri(propyleneglycol) methyl ether and tri(propyleneglycol) butyl ether, and other like glycols.

[0056] Admixing in step II) can be accomplished by any method known in the art to affect mixing of high viscosity materials. The mixing may occur either as a batch, semi-continuous, or continuous process. Any of the mixing methods as described for step I), may be used to affect admixing in step II). Typically, the same equipment is used to effect mixing in steps I) and II).

[0057] Optionally, the emulsion formed in step II) may be further sheared according to step III) to reduce particle size and/or improve long term storage stability. The shearing may occur by any of the mixing techniques discussed above.

[0058] The silicone resin emulsions of the present disclosure may be further characterized by the properties of the resulting films or coatings produced after allowing a film of the silicone resin emulsions to dry. Typically, such coatings are obtained by forming a film of the emulsions on a surface, and allowing the film to stand for a sufficient period of time to evaporate the water present in the emulsions, which allows the silicone resin to cure. This process may be accelerated by increasing the

ambient temperature of the film or coating. In one embodiment, the resulting cured film is transparent and/or tack free.

[0059] The silicone resin emulsions containing a silicone resin or PSA as described above can be present in personal care compositions in conjunction with a personal care ingredient (C), optionally in a cosmetically acceptable medium. Additives can also be incorporated in the silicone resin emulsions of the present invention, such as, preservatives, surface active materials (surfactants or detergents or emulsifiers), foam booster, deposition agents, thickeners, water phase stabilizing agents, fillers, preservatives, suspending agents, biocides, freeze/thaw additives, anti-freeze agents, various thickeners, viscosity modifiers, and foam control agents. The personal care compositions may comprise one or more additives.

[0060] The additives can be present in an amount of up to 5 parts by weight per 100 parts by weight of a personal care product, or alternatively from 0.1 to 1 part by weight per 100 parts by weight of a personal care product.

[0061] For example, the compositions may contain at least one surfactant, such as, anionic, cationic, nonionic, or amphoteric surfactants, organomodified silicones such as dimethicone copolyol, oxyethylenated and/or oxypropylenated ethers of glycerol, oxyethylenated and/or oxypropylenated ethers of fatty alcohols such as cetareth-30, C12-15 pareth-7, fatty acid esters of polyethylene glycol such as PEG-50 stearate, PEG-40 monostearate, saccharide esters and ethers such as sucrose stearate, sucrose cocoate and sorbitan stearate, and mixtures thereof, phosphoric esters and salts thereof such as DEA oleth-10 phosphate, sulphosuccinates such as disodium PEG-5 citrate lauryl sulphosuccinate and disodium ricinoleamido MEA sulphosuccinate, alkyl ether sulphates such as sodium lauryl ether sulphate, isethionates, betaine derivatives, and mixtures thereof. The surfactant can be used at concentration range from about 0.1% to about 10%, alternatively, from about 0.3% to about 5.0%, by weight of the personal care composition.

[0062] Anionic surfactants include, for example, carboxylates (sodium 2-(2-hydroxyalkyloxy)acetate)), amino acid derivatives (N-acylglutamates, N-acylglycines or acylsarcosinates), alkyl sulfates, alkyl ether sulfates and oxyethylenated derivatives thereof, sulfonates, isethionates and N-acylisethionates, taurates and N-acyl N-methyltaurates, sulfosuccinates, alkylsulfoacetates, phosphates and alkyl phosphates, polypeptides, anionic derivatives of alkyl polyglycoside (acyl-D-galactoside uronate), and fatty acid soaps, alkali metal sulfonates, sulfonated glyceryl esters of fatty acids such as sulfonated monoglycerides of coconut oil acids, salts of sulfonated monovalent alcohol esters such as sodium oleylisethianate, amides of amino sulfonic

acids such as the sodium salt of oleyl methyl tauride, sulfonated products of fatty acids nitriles such as palmitonitrile sulfonate, sulfonated aromatic hydrocarbons such as sodium alpha-naphthalene monosulfonate, condensation products of naphthalene sulfonic acids with formaldehyde, sodium octahydroanthracene sulfonate, alkali metal alkyl sulfates such as sodium lauryl sulfate, ammonium lauryl sulfate or triethanol amine lauryl sulfate, ether sulfates having alkyl groups of 8 or more carbon atoms such as sodium lauryl ether sulfate, ammonium lauryl ether sulfate, sodium alkyl aryl ether sulfates, and ammonium alkyl aryl ether sulfates, alkylarylsulfonates having 1 or more alkyl groups of 8 or more carbon atoms, alkylbenzenesulfonic acid alkali metal salts exemplified by hexylbenzenesulfonic acid sodium salt, octylbenzenesulfonic acid sodium salt, decylbenzenesulfonic acid sodium salt, dodecylbenzenesulfonic acid sodium salt, cetylbenzenesulfonic acid sodium salt, and myristylbenzenesulfonic acid sodium salt, sulfuric esters of polyoxyethylene alkyl ether including $\text{CH}_3(\text{CH}_2)_6\text{CH}_2\text{O}(\text{C}_2\text{H}_4\text{O})_2\text{SO}_3\text{H}$, $\text{CH}_3(\text{CH}_2)_7\text{CH}_2\text{O}(\text{C}_2\text{H}_4\text{O})_{3.5}\text{SO}_3\text{H}$, $\text{CH}_3(\text{CH}_2)_8\text{CH}_2\text{O}(\text{C}_2\text{H}_4\text{O})_8\text{SO}_3\text{H}$, $\text{CH}_3(\text{CH}_2)_{19}\text{CH}_2\text{O}(\text{C}_2\text{H}_4\text{O})_4\text{SO}_3\text{H}$, and $\text{CH}_3(\text{CH}_2)_{10}\text{CH}_2\text{O}(\text{C}_2\text{H}_4\text{O})_6\text{SO}_3\text{H}$, sodium salts, potassium salts, amine salts of alkylnaphthylsulfonic acid, and mixtures thereof.

[0063] Cationic surfactants include, for example, various fatty acid amines and amides and their derivatives, and the salts of the fatty acid amines and amides. Examples of aliphatic fatty acid amines include dodecylamine acetate, octadecylamine acetate, and acetates of the amines of tallow fatty acids, homologues of aromatic amines having fatty acids such as dodecylanalin, fatty amides derived from aliphatic diamines such as undecylimidazoline, fatty amides derived from aliphatic diamines such as undecylimidazoline, fatty amides derived from disubstituted amines such as oleylaminodiethylamine, derivatives of ethylene diamine, quaternary ammonium compounds and their salts which are exemplified by tallow trimethyl ammonium chloride, dioctadecyldimethyl ammonium chloride, didodecyldimethyl ammonium chloride, dihexadecyl ammonium chloride, alkyltrimethylammonium hydroxides such as octyltrimethylammonium hydroxide, dodecyltrimethylammonium hydroxide, or hexadecyltrimethylammonium hydroxide, dialkyldimethylammonium hydroxides such as octyldimethylammonium hydroxide, decyldimethylammonium hydroxide, didodecyldimethylammonium hydroxide, dioctadecyldimethylammonium hydroxide, tallow trimethylammonium hydroxide, coconut oil, trimethylammonium hydroxide, methylpolyoxyethylene cocoammonium chloride, and dipalmityl hydroxyethylammonium methosulfate, amide derivatives of amino alcohols such as

beta-hydroxyethylstearylamine, amine salts of long chain fatty acids, and mixtures thereof.

[0064] Nonionic surfactants include, for example, polyoxyethylene alkyl ethers (such as, lauryl, cetyl, stearyl or octyl), polyoxyethylene alkylphenol ethers, polyoxyethylene lauryl ethers, polyoxyethylene sorbitan monooleates, polyoxyethylene alkyl esters, polyoxyethylene sorbitan alkyl esters, polyethylene glycol, polypropylene glycol, diethylene glycol, ethoxylated trimethylnonanols, polyoxyalkylene glycol modified polysiloxane surfactants, polyoxyalkylene-substituted silicones (rake or ABn types), silicone alkanolamides, silicone esters, silicone glycosides, dimethicone copolyols, fatty acid esters of polyols, for instance sorbitol or glyceryl mono-, di-, tri- or sesqui-oleates or stearates, glyceryl or polyethylene glycol laurates; fatty acid esters of polyethylene glycol (polyethylene glycol monostearate or monolaurate); polyoxyethylenated fatty acid esters (stearate or oleate) of sorbitol, and mixtures thereof.

[0065] Amphoteric surfactants, include, for example, amino acid surfactants, betaine acid surfactants, trimethylnonyl polyethylene glycol ethers and polyethylene glycol ether alcohols containing linear alkyl groups having from 11 to 15 such as 2,6,8-trimethyl-4-nonyloxypolyethylene oxyethanol (6 EO) (sold as Tergitol®TMN-6 by OSi Specialties, A Witco Company, Endicott, NY), 2,6,8-trimethyl-4-nonyloxypolyethylene oxyethanol (10 EO) (sold as Tergitol®TMN-10 by OSi Specialties, A Witco Company, Endicott, NY), alkylene-oxypolyethylene oxyethanol (C₁₁₋₁₅ secondary alkyl, 9 EO) (sold as Tergitol®15-S-9 by OSi Specialties, A Witco Company, Endicott, NY), alkylene-oxypolyethylene oxyethanol (C₁₁₋₁₅ secondary alkyl, 15 EO) (sold as Tergitol®15-S-15 by OSi Specialties, A Witco Company, Endicott, NY), octylphenoxy polyethoxy ethanol having varying amounts of ethylene oxide units such as octylphenoxy polyethoxy ethanol (40 EO) (sold as Triton® X405 by Rohm and Haas Company, Philadelphia, Pa.), nonionic ethoxylated tridecyl ethers available from Emery Industries, Mauldin, S.C. under the general tradename Trycol, alkali metal salts of dialkyl sulfosuccinates available from American Cyanamid Company, Wayne, N.J. under the general tradename Aerosol, polyethoxylated quaternary ammonium salts and ethylene oxide condensation products of the primary fatty amines (available from Armac Company, Chicago, Illinois under the tradenames Ethoquad, Ethomeen, or Arquad), polyoxyalkylene glycol modified polysiloxanes, N-alkylamidobetaines and derivatives thereof, proteins and derivatives thereof, glycine derivatives, sultaines, alkyl polyaminocarboxylates and alkylamphoacetates, and mixtures thereof. These surfactants may also be obtained from other suppliers under different tradenames.

[0066] Suspending agent can be used at concentrations effective for suspending silicone resin, or other water-insoluble material, in dispersed form in a personal care products. Such concentrations range from about 0.1% to about 10%, alternatively from about 0.3% to about 5.0%, by weight of the personal care compositions.

- 5 Suspending agents include, for example, crystalline suspending agents which can be categorized as acyl derivatives, long chain amine oxides, and mixtures thereof, concentrations of which range from about 0.1% to about 5.0%, alternatively from about 0.5% to about 3.0%, by weight of the personal care compositions. Other alternative suspending agents include ethylene glycol esters of fatty acids having from about 16 to
- 10 about 22 carbon atoms, ethylene glycol stearates, both mono and distearate containing less than about 7% of the mono stearate, alkanol amides of fatty acids having from about 16 to about 22 carbon atoms, stearic monoethanolamide, stearic diethanolamide, stearic monoisopropanolamide, stearic monoethanolamide stearate, long chain acyl derivatives such as long chain esters of long chain fatty acids (e.g.,
- 15 stearyl stearate, cetyl palmitate, etc.); glyceryl esters (e.g., glyceryl distearate) and long chain esters of long chain alkanol amides (e.g., stearamide diethanolamide distearate, stearamide monoethanolamide stearate), ethylene glycol esters of long chain carboxylic acids, long chain amine oxides, alkanol amides of long chain carboxylic acids, long chain hydrocarbyls having C8-C22 chains, N,N-dihydrocarbyl
- 20 amido benzoic acid and soluble salts thereof (e.g., Na, K), N,N-di(hydrogenated) C16, C18 and tallow amido benzoic acid species (which are commercially available from Stepan Company (Northfield, Illinois, USA), alkyl (C16-C22) dimethyl amine oxides (e.g., stearyl dimethyl amine oxide), xanthan gum (about 0.3% to about 3%, or from about 0.4% to about 1.2%, by weight of the personal care compositions), combinations
- 25 of long chain acyl derivatives and xanthan gum, carboxyvinyl polymers, copolymers of acrylic acid crosslinked with polyallylsucrose (e.g., Carbopol 934, 940, 941, and 956 available from B. F. Goodrich Company), primary amines having a fatty alkyl moiety having at least about 16 carbon atoms, palmitamine or stearamine, secondary amines having two fatty alkyl moieties each having at least about 12 carbon atoms,
- 30 dipalmitoylamine or di(hydrogenated tallow)amine, di(hydrogenated tallow)phthalic acid amide, crosslinked maleic anhydride-methyl vinyl ether copolymer, and mixtures thereof. Alternative suspending agents may be used in the personal care compositions which impart a gel-like viscosity to the composition, such as water soluble or colloiddally water soluble polymers like cellulose ethers (e.g., methylcellulose,
- 35 hydroxybutyl methylcellulose, hydroxypropylcellulose, hydroxypropyl methylcellulose, hydroxyethyl ethylcellulose and hydroxyethylcellulose), guar gum, polyvinyl alcohol,

polyvinyl pyrrolidone, hydroxypropyl guar gum, starch and starch derivatives, viscosity modifiers, gelling agents, and mixtures thereof.

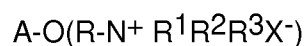
[0067] Thickening agent provide a convenient viscosity. For example, viscosities within the range of 500 to 25,000 mm²/s at 25 °C or in the range of 3,000 to 7,000

5 mm²/s are useful. Thickening agents include, for example, sodium alginate, gum arabic, polyoxyethylene, guar gum, hydroxypropyl guar gum, ethoxylated alcohols, such as laureth-4 or polyethylene glycol 400, cellulose derivatives exemplified by methylcellulose, methylhydroxypropylcellulose, hydroxypropylcellulose, polypropylhydroxyethylcellulose, starch, and starch derivatives exemplified by
10 hydroxyethylamylose and starch amylose, locust bean gum, electrolytes exemplified by sodium chloride and ammonium chloride, saccharides such as fructose and glucose, derivatives of saccharides such as PEG-120 methyl glucose diolateor, acrylamide copolymers, acrylate copolymers and salts thereof (such as sodium polyacrylate), xanthan gum and derivatives, cellulose gum, carbomer, cassia gum,
15 guar gum derivatives, cocamide derivatives, alkyl alchols, gelatin, PEG- derivatives, and combinations of two or more of the above thickening agents, for example, a combination of a cellulose derivative and any electrolyte, and a starch derivative and any electrolyte. The thickening agent is used is in an amount sufficient to provide a viscosity of from 500 to 25,000 mm²/s, from about 0.05 to 10 wt% or from about 0.05
20 to about 5 wt% based on the total weight of the personal care composition.

[0068] Deposition agents include, for example, cationic deposition aid, such as, a cationic deposition polymer. The cationic deposition aid will generally be present at levels of from 0.001 to 5%, preferably from about 0.01 to 1%, more preferably from about 0.02% to about 0.5% by weight of the personal care composition. The polymer
25 may be a homopolymer or be formed from two or more types of monomers. The molecular weight of the polymer will generally be between 5 000 and 10 000 000, typically at least 10 000 and preferably in the range 100 000 to about 2 000 000. The polymers will have cationic nitrogen containing groups such as quaternary ammonium or protonated amino groups, or a mixture thereof. The cationic charge density has
30 been found to need to be at least 0.1 meq/g, preferably above 0.8 or higher. The cationic charge density should not exceed 4 meq/g, it is preferably less than 3 and more preferably less than 2 meq/g. The charge density can be measured using the Kjeldahl method and should be within the above limits at the desired pH of use, which will in general be from about 3 to 9 and preferably between 4 and 8. The cationic
35 nitrogen-containing group will generally be present as a substituent on a fraction of the total monomer units of the cationic deposition polymer. Thus when the polymer is not

a homopolymer it can contain spacer noncationic monomer units. Such polymers are described in the CTFA Cosmetic Ingredient Directory, 3rd edition. Suitable cationic deposition aids 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. Suitable cationic amino and quaternary ammonium monomers include, for example, vinyl compounds substituted with dialkyl aminoalkyl acrylate, dialkylamino alkylmethacrylate, monoalkylaminoalkyl acrylate, monoalkylaminoalkyl methacrylate, trialkyl methacryloxyalkyl ammonium salt, trialkyl acryloxyalkyl ammonium salt, diallyl quaternary ammonium salts, and vinyl quaternary ammonium monomers having cyclic cationic nitrogen-containing rings such as pyridinium, imidazolium, and quaternized pyrrolidine, e.g., alkyl vinyl imidazolium, and quaternized pyrrolidine, e.g., alkyl vinyl imidazolium, alkyl vinyl pyridinium, alkyl vinyl pyrrolidine salts. The alkyl portions of these monomers are preferably lower alkyls such as the C₁-C₃, alkyls, more preferably C₁, and C₂ alkyls. Suitable amine-substituted vinyl monomers for use herein include dialkylaminoalkyl acrylate, dialkylaminoalkyl methacrylate, dialkylaminoalkyl acrylamide, and dialkylaminoalkyl methacrylamide, wherein the alkyl groups are preferably C₁-C₃ hydrocarbyls, more preferably C₁-C₂, alkyls. The cationic deposition aids can comprise mixtures of monomer units derived from amine- and/or quaternary ammonium-substituted monomer and/or compatible spacer monomers. Suitable cationic deposition aids include, for example: copolymers of 1-vinyl-2-pyrrolidine and 1-vinyl-3-methylimidazolium salt (e.g., Chloride salt) (referred to in the industry by the Cosmetic, Toiletry, and Fragrance Association, "CTFA" as Polyquaternium-16) such as those commercially available from BASF Wyandotte Corp. (Parsippany, NJ, USA) under the LUVIQUAT tradename (e.g., LUVIQUAT FC 370); copolymers of 1-vinyl-2-pyrrolidine and dimethylaminoethyl methacrylate (referred to in the industry by CTFA as Polyquaternium-11) such as those commercially from Gar Corporation (Wayne, NJ, USA) under the GAFQUAT tradename (e.g., GAFQUAT 755N); cationic diallyl

quaternary ammonium-containing polymer including, for example, dimethyldiallylammonium chloride homopolymer and copolymers of acrylamide and dimethylallylammonium chloride, referred to in the industry (CTFA) as Polyquaternium 6 and Polyquaternium 7, respectively; mineral acid salts of aminoalkyl 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; and cationic polyacrylamides as described in our copending UK Application No. 9403156.4 (W095/22311). Other cationic deposition aids that can be used include polysaccharide polymers, such as cationic cellulose derivatives and cationic starch derivatives. Cationic polysaccharide polymer materials suitable for use in compositions of the invention include those of the formula:



wherein A is an anhydroglucose residual group, such as starch or cellulose anhydroglucose residual, R is an alkylene oxyalkylene, polyoxyalkylene, or hydroxyalkylene group, or combination thereof, R¹, R² and R³ independently are alkyl, aryl, alkylaryl, arylalkyl, alkoxyalkyl, or alkoxyaryl groups, each group containing up to about 18 carbon atoms, and the total number of carbon atoms for each cationic moiety (i.e., the sum of carbon atoms in R¹, R² and R³) preferably being about 20 or less, and X is an anionic counterion, as previously described. Cationic cellulose is available from Amerchol Corp. (Edison, NJ, USA) in their Polymer iR (trademark) and LR (trade mark) series of polymers, as salts of hydroxyethyl cellulose reacted with trimethyl ammonium substituted epoxide, referred to in the industry (CTFA) as Polyquaternium 10. 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) under the tradename Polymer LM-200. Other cationic deposition aids that can be used include cationic guar gum derivatives, such as guar hydroxypropyltrimonium chloride (Commercially available from Celanese Corp. in their Jaguar trademark series). Other materials include quaternary nitrogen-containing cellulose ethers (e.g., as described in U.S. Patent 3,962,418, incorporated by reference herein), and copolymers of etherified cellulose and starch (e.g., as described in U.S. Patent 3,958,581, incorporated by reference herein).

[0069] A foam booster is an agent which increases the amount of foam available from a system at a constant molar concentration of surfactant, in contrast to a foam stabilizer which delays the collapse of a foam. Foam building is provided by adding to

the aqueous media, a foam boosting effective amount of a foam boosting. The foam boosting agent is preferably selected from the group consisting of fatty acid alkanolamides and amine oxides. The fatty acid alkanolamides are exemplified by isostearic acid diethanolamide, lauric acid diethanolamide, capric acid diethanolamide, coconut fatty acid diethanolamide, linoleic acid diethanolamide, myristic acid diethanolamide, oleic acid diethanolamide, stearic acid diethanolamide, coconut fatty acid monoethanolamide, oleic acid monoisopropanolamide, and lauric acid monoisopropanolamide. The amine oxides are exemplified by N-cocodimethylamine oxide, N-lauryl dimethylamine oxide, N-myristyl dimethylamine oxide, N-stearyl dimethylamine oxide, N-cocamidopropyl dimethylamine oxide, N-tallowamidopropyl dimethylamine oxide, bis(2-hydroxyethyl) C12-15 alkoxypropylamine oxide. Preferably a foam booster is selected from the group consisting of lauric acid diethanolamide, N-lauryl dimethylamine oxide, coconut acid diethanolamide, myristic acid diethanolamide, and oleic acid diethanolamide. The foam boosting agent is preferably present in the shampoo compositions of this invention in an amount from about 1 to 15 wt% and more preferably about 2 to 10 wt% based on the total weight of the composition. The composition may further comprise a polyalkylene glycol to improve lather performance. Concentration of the polyalkylene glycol in the shampoo composition may range from about 0.01% to about 5%, preferably from about 0.05% to about 3%, and more preferably from about 0.1% to about 2%, by weight of the composition. The optional polyalkylene glycols are characterized by the general formula:



wherein R is selected from the group consisting of H, methyl, and mixtures thereof. When R is H, these materials are polymers of ethylene oxide, which are also known as polyethylene oxides, polyoxyethylenes, and polyethylene glycols. When R is methyl, these materials are polymers of propylene oxide, which are also known as polypropylene oxides, polyoxypropylenes, and polypropylene glycols. When R is methyl, it is also understood that various positional isomers of the resulting polymers can exist. In the above structure, n has an average value of from about 1500 to about 25,000, preferably from about 2500 to about 20,000, and more preferably from about 3500 to about 15,000. Polyethylene glycol polymers useful herein are PEG-2M wherein R equals H and n has an average value of about 2,000 (PEG-2M is also known as Polyox WSR9 N-10, which is available from Union Carbide and as PEG-2,000); PEG-5M wherein R equals H and n has an average value of about 5,000 (PEG-5M is also known as Polyox WSRO N-35 and Polyox WSRS N-80, both available from Union Carbide and as PEG-5,000 and Polyethylene Glycol 300,000);

PEG-7M wherein R equals H and n has an average value of about 7,000 (PEG-7M is also known as Polyox WSRO N-750 available from Union Carbide); PEG-9M wherein R equals H and n has an average value of about 9,000 (PEG 9-M is also known as Polyox WSRS N-3333 available from Union Carbide); and PEG14 M wherein R equals H and n has an average value of about 14,000 (PEG-14M is also known as Polyox WSRO N-3000 available from Union Carbide). Other useful polymers include the polypropylene glycols and mixed polyethylene/polypropylene glycols.

[0070] Preservative may be added at about 0.01-5% by weight of the personal care composition.

[0071] Other additives include aerosol ingredients (e.g., propellant gases, such as carbon dioxide, nitrogen, nitrous oxide, volatile hydrocarbons such as butane, isobutane, or propane and chlorinated or fluorinated hydrocarbons such as dichlorodifluoromethane and dichlorotetrafluoroethane or dimethylether).

[0072] The personal care compositions of the present invention include those compositions which are intended to be placed in contact with the external parts of the human body, such as, skin (epidermis), hair system (in the skin, head, ear and nose), nails, mucosa, and any other "keratinous substrates", or with the teeth and the mucous membranes of the oral cavity and nasal cavity with a view exclusively or mainly for cleaning them, perfuming them, changing their appearance, protecting them, keeping them in good condition or correcting body odors. In some instances, personal care compositions may also include health care compositions. Accordingly, the personal care compositions of the present invention may be used health care, skin care, hair care, and/or nail care applications.

[0073] Personal care ingredients are those ingredients known to be used in personal care applications. A review of such ingredients may be found in the CTFA cosmetic ingredient handbook.

[0074] Personal care ingredients include, for example, emollients, waxes, moisturizers, pH controlling agents, preservatives and cosmetic biocides, sebum absorbants or sebum control agents, vegetable or botanical extracts, vitamins, proteins or amino-acids and their derivatives, pigments, colorants, fillers, silicone conditioning agents, cationic conditioning agents, hydrophobic conditioning agents, UV absorbers, sunscreen agents, antidandruff agents, antiperspirant agents, deodorant agents, skin protectants, hair dyes, nail care ingredients, fragrances or perfume, antioxidants, oxidizing agents, reducing agents, propellant gases, anti-acne agents, styling agents, oils, pediculicides, electrolytes, ceramides, liposomes, polyols, glycerine and propylene glycol and botanicals (plant extracts), additional conditioning agents such as

quaternary polymers or silicone materials, glycols, vitamins A and E in their various forms, humectants, parabens, occlusive agents, esters, agents for artificially tanning and/or browning the skin (for example, dihydroxyacetone (DHA)), and mixtures thereof.

5 **[0075]** The personal care ingredients can be present up in an amount of up to 5 parts by weight per 100 parts by weight of a personal care product, or alternatively from 0.1 to 1 part by weight per 100 parts by weight of a personal care product.

10 **[0076]** Cosmetically acceptable medium includes any medium that when placed in contact with the human body does not result in any short term or long term injury to the external or internal parts of the human body. Cosmetically acceptable medium include, for example, water, solvents, diluents, or mixtures and emulsions thereof.

15 **[0077]** The personal care compositions of the present invention may contain sufficient water to form a transparent mixture. Generally water is present at a level of from about 10 to 900 parts by weight, preferably from about 80 to about 900 parts by weight per 100 parts by weight of the other ingredients.

20 **[0078]** Anti-dandruff agents include, for example, pyridinethione salts, selenium compounds such as selenium disulfide, and soluble antidandruff agents.

25 **[0079]** Additional conditioning agents include, for example, quaternary nitrogen derivatives of cellulose ethers; homopolymers of dimethyldiallyl ammonium chloride; copolymers of acrylamide and dimethyldiallyl ammonium chloride; homopolymers or copolymers derived from acrylic acid or methacrylic acid which contain cationic nitrogen functional groups attached to the polymer by ester or amide linkages; polycondensation products of N,N'-bis-(2,3-epoxypropyl)-piperazine or piperazine-bis-acrylamide and piperazine; and copolymers of vinylpyrrolidone and acrylic acid esters with quaternary nitrogen functionality. Specific materials include the various polyquats Polyquaternium-7, Polyquaternium-8, Polyquaternium-10, Polyquaternium-11, and Polyquaternium-23, cationic surfactants such as cetyl trimethylammonium chloride, cetyl trimethylammonium bromide, and stearyltrimethylammonium chloride); cleansing agent (e.g., at least one anionic detergent surfactant, alkali metal sulforicinate, 30 sulfonated glyceryl esters of fatty acids such as sulfonated monoglycerides of coconut oil acids, salts of sulfonated monovalent alcohol esters such as sodium oleylisethianate, amides of amino sulfonic acids such as the sodium salt of oleyl methyl tauride, sulfonated products of fatty acids nitriles such as palmitonitrile sulfonate, sulfonated aromatic hydrocarbons such as sodium alpha-naphthalene 35 monosulfonate, condensation products of naphthalene sulfonic acids with formaldehyde, sodium octahydroanthracene sulfonate, alkali metal alkyl sulfates such

as sodium lauryl sulfate, ammonium lauryl sulfate or triethanol amine lauryl sulfate, ether sulfates having alkyl groups of 8 or more carbon atoms such as sodium lauryl ether sulfate, ammonium lauryl ether sulfate, sodium alkyl aryl ether sulfates, and ammonium alkyl aryl ether sulfates, alkylarylsulfonates having 1 or more alkyl groups of 8 or more carbon atoms, alkylbenzenesulfonic acid alkali metal salts exemplified by hexylbenzenesulfonic acid sodium salt, octylbenzenesulfonic acid sodium salt, decylbenzenesulfonic acid sodium salt, dodecylbenzenesulfonic acid sodium salt, cetylbenzenesulfonic acid sodium salt, and myristylbenzenesulfonic acid sodium salt, sulfuric esters of polyoxyethylene alkyl ether including

$\text{CH}_3(\text{CH}_2)_6\text{CH}_2\text{O}(\text{C}_2\text{H}_4\text{O})_2\text{SO}_3\text{H}$, $\text{CH}_3(\text{CH}_2)_7\text{CH}_2\text{O}(\text{C}_2\text{H}_4\text{O})_{3.5}\text{SO}_3\text{H}$, $\text{CH}_3(\text{CH}_2)_8\text{CH}_2\text{O}(\text{C}_2\text{H}_4\text{O})_8\text{SO}_3\text{H}$, $\text{CH}_3(\text{CH}_2)_{19}\text{CH}_2\text{O}(\text{C}_2\text{H}_4\text{O})_4\text{SO}_3\text{H}$, and $\text{CH}_3(\text{CH}_2)_{10}\text{CH}_2\text{O}(\text{C}_2\text{H}_4\text{O})_6\text{SO}_3\text{H}$, sodium salts, potassium salts, and amine salts of alkylnaphthylsulfonic acid, sodium lauryl sulfate, ammonium lauryl sulfate, triethanolamine lauryl sulfate, sodium lauryl ether sulfate, ammonium lauryl ether sulfate, and mixtures thereof.

[0080] Pediculicides are agents that control lice infestations. Suitable pediculicides are well known in the art and include, for example, pyrethrins such as those described in U.S. Patent 4,668,666, which is incorporated herein by reference in its entirety.

[0081] A pH adjusting agent adjusts the pH within the range of 4 to 9 or within the range of 5 to 6. Any water soluble acid such as a carboxylic acid or a mineral acid is suitable as a pH adjusting agent. For example, mineral acids such as hydrochloric acid, sulfuric acid, and phosphoric acid, monocarboxylic acid such as acetic acid and lactic acid, polycarboxylic acids such as succinic acid, adipic acid, and citric acid are suitable as a pH adjusting agent. The pH adjusting agent can be present in an amount from about 0.01 to 3 % by weight or about 0.1 to 0.5 % by weight based on the total weight of the personal care composition.

[0082] Pigments include, for example, iron oxides and titanium dioxide which can be present in the composition in the amount of about 0.1 to about 30 % by weight or about 5 to about 20 % by weight or about 8 to about 14 % by weight of the personal care composition.

[0083] Sunscreens include, for example, compounds that absorb ultraviolet light between about 290 to about 320 nanometers (the UV-B region) such as, but not exclusively, para-aminobenzoic acid derivatives and cinnamates such as octyl methoxycinnamate and those which absorb ultraviolet light in the range of 320-400 nanometers (the UV-A region) such as benzophenones and butyl methoxy dibenzoylmethane. Some additional examples of sunscreen chemicals which may be

employed in accordance with the present invention are 2-ethoxyethyl p-methoxycinnamate; menthyl anthranilate; homomenthyl salicylate; glyceryl p-aminobenzoate; isobutyl p-aminobenzoate; isoamyl p-dimethylaminobenzoate; 2-hydroxy-4-methoxybenzophenones sulfonic acid; 2,2'-dihydroxy-4-methoxybenzophenone; 2-hydroxy-4-methoxybenzophenone; 4-mono and 4-bis(3-hydroxy-propyl)amino isomers of ethyl benzoate; and 2-ethylhexyl p-dimethylaminobenzoate.

[0084] Additional personal care ingredients that may be used in the personal care compositions include fatty alcohols, colour care additives, anticellulites, pearlising agents, chelating agents, and film formers.

[0085] Personal care ingredients include health care ingredients. Examples include antiacne agents, antibacterial agents, antifungal agents, therapeutic active agents, external analgesics, skin bleaching agents, anti-cancer agents, diuretics, agents for treating gastric and duodenal ulcers, proteolytic enzymes, antihistamine, H1 histamine blockers, sedatives, bronchodilators, and diluents.

[0086] Personal care ingredients may also include antibiotic, antiseptic, antibacterial, antiinflammatory, astringents, hormones, smoking cessation compositions, cardiovascular, antiarrhythmic, alpha-1 blocker, beta blocker, ACE inhibitor, antiaggregant, non-steroidal anti-inflammatory agents such as diclofenac, antipsoriasis agents such as clobetasol propionate, antidermatitis agents, tranquillizer, anticonvulsant, anticoagulant agents, healing factors, cell growth nutrients, peptides, corticosteroidal drugs, antipruritic agents and others.

[0087] Examples of emollients include volatile or non-volatile silicone oils; silicone resins such as polypropylsilsesquioxane and phenyl trimethicone; silicone elastomers such as dimethicone crosspolymer; alkylmethylsiloxanes such as C30-45 Alkyl Methicone; volatile or non-volatile hydrocarbon compounds, such as squalene, paraffin oils, petrolatum oils and naphthalene oils; hydrogenated or partially hydrogenated polyisobutene; isoeicosane; squalane; isoparaffin; isododecane; isodecane or isohexadecane; branched C8-C16 esters; isohexyl neopentanoate; ester oils such as isononyl isononanoate, cetostearyl octanoate, isopropyl myristate, palmitate derivatives, stearates derivatives, isostearyl isostearate and the heptanoates, octanoates, decanoates or ricinoleates of alcohols or of polyalcohols, or mixtures thereof; hydrocarbon oils of plant origin, such as wheatgerm, sunflower, grapeseed, castor, shea, avocado, olive, soybean, sweet almond, palm, rapeseed, cotton seed, hazelnut, macadamia, jojoba, blackcurrant, evening primrose; or triglycerides of caprylic/capric

acids; higher fatty acids, such as oleic acid, linoleic acid or linolenic acid, and mixtures thereof.

[0088] Example of waxes include hydrocarbon waxes such as beeswax, lanolin wax, rice wax, carnauba wax, candelilla wax, microcrystalline waxes, paraffins, ozokerite, polyethylene waxes, synthetic wax, ceresin, lanolin, lanolin derivatives, cocoa butter, shellac wax, bran wax, capok wax, sugar cane wax, montan wax, whale wax, bayberry wax, silicone waxes (e.g., polymethylsiloxane alkyls, alkoxys and/or esters, C30-45 alkyldimethylsilyl polypropylsilsesquioxane), and mixtures thereof.

[0089] Examples of moisturizers include lower molecular weight aliphatic diols such as propylene glycol and butylene glycol; polyols such as glycerine and sorbitol; and polyoxyethylene polymers such as polyethylene glycol 200; hyaluronic acid and its derivatives, and mixtures thereof.

[0090] Examples of electrolytes includes alkali metal salts and alkaline earth salts, especially the chloride, borate, citrate, and sulfate salts of sodium, potassium, calcium and magnesium, as well as aluminum chlorohydrate, and polyelectrolytes, especially hyaluronic acid and sodium hyaluronate, polyols (glycerine, propylene glycol, butylene glycol, and sorbitol), alcohols such as ethyl alcohol, and hydrocolloids, and mixtures thereof.

[0091] Examples of pH controlling agents include any water soluble acid such as a carboxylic acid or a mineral acid such as hydrochloric acid, sulphuric acid, and phosphoric acid, monocarboxylic acid such as acetic acid and lactic acid, and polycarboxylic acids such as succinic acid, adipic acid, citric acid, and mixtures thereof.

[0092] Example of preservatives and cosmetic biocides include paraben derivatives, hydantoin derivatives, chlorhexidine and its derivatives, imidazolidinyl urea, phenoxyethanol, silver derivatives, salicylate derivatives, triclosan, ciclopirox olamine, hexamidine, oxyquinoline and its derivatives, PVP-iodine, zinc salts and derivatives such as zinc pyrithione, and mixtures thereof.

[0093] Examples of sebum absorbants or sebum control agents include silica silylate, silica dimethyl silylate, dimethicone/vinyl dimethicone crosspolymer, polymethyl methacrylate, cross-linked methylmethacrylate, aluminum starch octenylsuccinate, and mixtures thereof.

[0094] Examples of vegetable or botanical extracts are derived from plants (herbs, roots, flowers, fruits, or seeds) in oil or water soluble form, such as coconut, green tea, white tea, black tea, horsetail, ginkgo biloba, sunflower, wheat germ, seaweed, olive, grape, pomegranate, aloe, apricot kernel, apricot, carrot, tomato, tobacco, bean,

potato, actzuki bean, catechu, orange, cucumber, avocado, watermelon, banana, lemon or palm. Examples of herbal extracts include dill, horseradish, oats, neem, beet, broccoli, tea, pumpkin, soybean, barley, walnut, flax, ginseng, poppy, avocado, pea, sesame, and mixtures thereof.

5 **[0095]** Examples of vitamins include a variety of different organic compounds such as alcohols, acids, sterols, and quinones. They may be classified into two solubility groups: lipid-soluble vitamins and water-soluble vitamins. Lipid-soluble vitamins that have utility in personal care formulations include retinol (vitamin A), ergocalciferol (vitamin D2), cholecalciferol (vitamin D3), phytonadione (vitamin K1), and tocopherol
10 (vitamin E). Water-soluble vitamins that have utility in personal care formulations include ascorbic acid (vitamin C), thiamin (vitamin B1) niacin (nicotinic acid), niacinamide (vitamin B3), riboflavin (vitamin B2), pantothenic acid (vitamin B5), biotin, folic acid, pyridoxine (vitamin B6), and cyanocobalamin (vitamin B12). Additional examples of vitamins include derivatives of vitamins such as retinyl palmitate (vitamin
15 A palmitate), retinyl acetate (vitamin A acetate), retinyl linoleate (vitamin A linoleate), and retinyl propionate (vitamin A propionate), tocopheryl acetate (vitamin E acetate), tocopheryl linoleate (vitamin E linoleate), tocopheryl succinate (vitamin E succinate), tocophereth-5, tocophereth-10, tocophereth-12, tocophereth-18, tocophereth-50 (ethoxylated vitamin E derivatives), PPG-2 tocophereth-5, PPG-5 tocophereth-2, PPG-
20 10 tocophereth-30, PPG-20 tocophereth-50, PPG-30 tocophereth-70, PPG-70 tocophereth-100 (propoxylated and ethoxylated vitamin E derivatives), sodium tocopheryl phosphate, ascorbyl palmitate, ascorbyl dipalmitate, ascorbyl glucoside, ascorbyl tetraispalmitate, tetrahexadecyl ascorbate, ascorbyl tocopheryl maleate, potassium ascorbyl tocopheryl phosphate, tocopheryl nicotinate, and mixtures thereof.

25 **[0096]** Examples of proteins or amino-acids and their derivatives include those extracted from wheat, soy, rice, corn, keratin, elastin or silk. Proteins may be in the hydrolyzed form and they may also be quaternized, such as hydrolyzed elastin, hydrolyzed wheat powder, hydrolyzed silk. Examples of protein include enzymes such as hydrolases, cutinases, oxidases, transferases, reductases, hemicellulases,
30 esterases, isomerases, pectinases, lactases, peroxidases, laccases, catalases, and mixtures thereof. Examples of hydrolases include proteases (bacterial, fungal, acid, neutral or alkaline), amylases (alpha or beta), lipases, mannanases, cellulases, collagenases, lysozymes, superoxide dismutase, catalase, and mixtures thereof.

[0097] Examples of pigments and colorants include surface treated or untreated iron
35 oxides, surface treated or untreated titanium dioxide, surface treated or untreated mica, silver oxide, silicates, chromium oxides, carotenoids, carbon black, ultramarines,

chlorophyllin derivatives and yellow ocher. Examples of organic pigments include aromatic types including azo, indigoid, triphenylmethane, anthraquinone, and xanthine dyes which are designated as D&C and FD&C blues, browns, greens, oranges, reds, yellows, etc, and mixtures thereof.

5 **[0098]** Examples of fillers include talc, micas, kaolin, zinc or titanium oxides, calcium or magnesium carbonates, silica, silica silylate, titanium dioxide, glass or ceramic beads, polymethylmethacrylate beads, boron nitride, aluminum silicate, aluminum starch octenylsuccinate, bentonite, magnesium aluminum silicate, nylon, silk powder
10 synthetic polymer powders, expanded powders and powders from natural organic compounds, such as cereal starches, which may or may not be crosslinked, copolymer microspheres, polytrap, silicone resin microbeads, and mixtures thereof. The fillers may be surface treated to modify affinity or compatibility with remaining ingredients.

[0099] Examples of silicone conditioning agents include silicone oils such as
15 dimethicone; silicone gums such as dimethiconol; silicone resins such as trimethylsiloxy silicate, polypropyl silsesquioxane; silicone elastomers; alkylmethylsiloxanes; organomodified silicone oils, such as amodimethicone, aminopropyl phenyl trimethicone, phenyl trimethicone, trimethyl pentaphenyl trisiloxane, silicone quaternium-16/glycidoxy dimethicone crosspolymer, silicone
20 quaternium-16; saccharide functional siloxanes; carbinol functional siloxanes; silicone polyethers; siloxane copolymers (divinyldimethicone / dimethicone copolymer); acrylate or acrylic functional siloxanes; and mixtures or emulsions thereof.

[00100] Examples of cationic conditioning agents include guar derivatives such as hydroxypropyltrimethylammonium derivative of guar gum; cationic cellulose
25 derivatives, cationic starch derivatives; quaternary nitrogen derivatives of cellulose ethers; homopolymers of dimethyldiallyl ammonium chloride; copolymers of acrylamide and dimethyldiallyl ammonium chloride; homopolymers or copolymers derived from acrylic acid or methacrylic acid which contain cationic nitrogen functional groups attached to the polymer by ester or amide linkages; polymeric quaternary ammonium
30 salts of hydroxyethyl cellulose reacted with a fatty alkyl dimethyl ammonium substituted epoxide ; polycondensation products of N,N'-bis-(2,3-epoxypropyl)-piperazine or piperazine-bis-acrylamide and piperazine; and copolymers of vinylpyrrolidone and acrylic acid esters with quaternary nitrogen functionality. Specific materials include the various polyquats Polyquaternium-7, Polyquaternium-8,
35 Polyquaternium-10, Polyquaternium-11, and Polyquaternium-23. Other categories of conditioners include cationic surfactants such as cetyl trimethylammonium chloride,

cetyl trimethylammonium bromide, stearyltrimethylammonium chloride, and mixtures thereof. In some instances, the cationic conditioning agent is also hydrophobically modified, such as hydrophobically modified quaternized hydroxyethylcellulose polymers; cationic hydrophobically modified galactomannan ether; and mixtures thereof.

[00101] Examples of hydrophobic conditioning agents include guar derivatives; galactomannan gum derivatives; cellulose derivatives; and mixtures thereof.

[00102] UV absorbers and sunscreen agents include those which absorb ultraviolet light between about 290-320 nanometers (the UV-B region) and those which absorb ultraviolet light in the range of 320-400 nanometers (the UV-A region).

[00103] Some examples of sunscreen agents are aminobenzoic acid, cinoxate, diethanolamine methoxycinnamate, digalloyl trioleate, dioxybenzone, ethyl 4-[bis(Hydroxypropyl)] aminobenzoate, glyceryl aminobenzoate, homosalate, lawsone with dihydroxyacetone, menthyl anthranilate, octocrylene, ethyl hexyl methoxycinnamate, octyl salicylate, oxybenzone, padimate O, phenylbenzimidazole sulfonic acid, red petrolatum, sulisobenzene, titanium dioxide, trolamine salicylate, and mixtures thereof.

[00104] Some examples of UV absorbers are acetaminosalol, allatoin PABA, benzaldehyde, benzophenone, benzophenone 1-12, 3-benzylidene camphor, benzylidenecamphor hydrolyzed collagen sulfonamide, benzylidene camphor sulfonic Acid, benzyl salicylate, bornelone, bumetizole, butyl Methoxydibenzoylmethane, butyl PABA, ceria/silica, ceria/silica talc, cinoxate, DEA-methoxycinnamate, dibenzoxazol naphthalene, di-t-butyl hydroxybenzylidene camphor, digalloyl trioleate, diisopropyl methyl cinnamate, dimethyl PABA ethyl cetearyldimonium tosylate, dioctyl butamido triazone, diphenyl carbomethoxy acetoxymethoxy naphthopyran, disodium bisethylphenyl tiamminotriazine stilbenedisulfonate, disodium distyrylbiphenyl triaminotriazine stilbenedisulfonate, disodium distyrylbiphenyl disulfonate, drometizole, drometizole trisiloxane, ethyl dihydroxypropyl PABA, ethyl diisopropylcinnamate, ethyl methoxycinnamate, ethyl PABA, ethyl urocanate, octocrylene ferulic acid, glyceryl octanoate dimethoxycinnamate, glyceryl PABA, glycol salicylate, homosalate, isoamyl p-methoxycinnamate, isopropylbenzyl salicylate, isopropyl dibenzoylmethane, isopropyl methoxycinnamate, menthyl anthranilate, menthyl salicylate, 4-methylbenzylidene, camphor, octocrylene, octrizole, octyl dimethyl PABA, ethyl hexyl methoxycinnamate, octyl salicylate, octyl triazone, PABA, PEG-25 PABA, pentyl dimethyl PABA, phenylbenzimidazole sulfonic acid, polyacrylamidomethyl benzylidene camphor, potassium methoxycinnamate, potassium

phenylbenzimidazole sulfonate, red petrolatum, sodium phenylbenzimidazole sulfonate, sodium urocanate, TEA-phenylbenzimidazole sulfonate, TEA-salicylate, terephthalylidene dicamphor sulfonic acid, titanium dioxide, triPABA panthenol, urocanic acid, VA/crotonates/methacryloxybenzophenone-1 copolymer, and mixtures thereof.

[00105] Examples of antidandruff agents include pyridinethione salts, selenium compounds such as selenium disulfide, and soluble antidandruff agents, and mixtures thereof.

[00106] Examples of antiperspirant agents and deodorant agents include aluminum chloride, aluminum zirconium tetrachlorohydrate GLY, aluminum zirconium tetrachlorohydrate PEG, aluminum chlorohydrate, aluminum zirconium tetrachlorohydrate PG, aluminum chlorohydrate PEG, aluminum zirconium trichlorohydrate, aluminum chlorohydrate PG, aluminum zirconium trichlorohydrate GLY, hexachlorophene, benzalkonium chloride, aluminum sesquichlorohydrate, sodium bicarbonate, aluminum sesquichlorohydrate PEG, chlorophyllin-copper complex, triclosan, aluminum zirconium octachlorohydrate, zinc ricinoleate, and mixtures thereof.

[00107] Examples of skin protectants include allantoin, aluminium acetate, aluminium hydroxide, aluminium sulfate, calamine, cocoa butter, cod liver oil, colloidal oatmeal, dimethicone, glycerin, kaolin, lanolin, mineral oil, petrolatum, shark liver oil, sodium bicarbonate, talc, witch hazel, zinc acetate, zinc carbonate, zinc oxide, and mixtures thereof.

[00108] Examples of hair dyes include 1-acetoxy-2-methylnaphthalene; acid dyes; 5-amino-4-chloro-o-cresol; 5-amino-2,6-dimethoxy-3-hydroxypyridine; 3-amino-2,6-dimethylphenol; 2-amino-5-ethylphenol HCl; 5-amino-4-fluoro-2-methylphenol sulfate; 2-amino-4-hydroxyethylaminoanisole; 2-amino-4-hydroxyethylaminoanisole sulfate; 2-amino-5-nitrophenol; 4-amino-2-nitrophenol; 4-amino-3-nitrophenol; 2-amino-4-nitrophenol sulfate; m-aminophenol HCl; p-aminophenol HCl; m-aminophenol; o-aminophenol; 4,6-bis(2-hydroxyethoxy)-m-phenylenediamine HCl; 2,6-bis(2-hydroxyethoxy)-3,5-pyridinediamine HCl; 2-chloro-6-ethylamino-4-nitrophenol; 2-chloro-5-nitro-N-hydroxyethyl p-phenylenediamine; 2-chloro-p-phenylenediamine; 3,4-diaminobenzoic acid; 4,5-diamino-1-((4-chlorophenyl)methyl)-1H-pyrazole-sulfate; 2,3-diaminodihydropyrazolo pyrazolone dimethosulfonate; 2,6-diaminopyridine; 2,6-diamino-3-((pyridin-3-yl)azo)pyridine; dihydroxyindole; dihydroxyindoline; N,N-dimethyl-p-phenylenediamine; 2,6-dimethyl-p-phenylenediamine; N,N-dimethyl-p-phenylenediamine sulfate; direct dyes; 4-ethoxy-m-phenylenediamine sulfate; 3-

ethylamino-p-cresol sulfate; N-ethyl-3-nitro PABA; gluconamidopropyl aminopropyl dimethicone; Haematoxylon brasiletto wood extract; HC dyes; Lawsonia inermis (Henna) extract; hydroxyethyl-3,4-methylenedioxyaniline HCl; hydroxyethyl-2-nitro-p-toluidine; hydroxyethyl-p-phenylenediamine sulfate; 2-hydroxyethyl picramic acid; hydroxypyridinone; hydroxysuccinimidyl C21-22 isoalkyl acidate; isatin; Isatis tinctoria leaf powder; 2-methoxymethyl-p-phenylenediamine sulfate; 2-methoxy-p-phenylenediamine sulfate ; 6-methoxy-2,3-pyridinediamine HCl; 4-methylbenzyl 4,5-diamino pyrazole sulfate; 2,2'-methylenebis 4-aminophenol; 2,2'-methylenebis-4-aminophenol HCl; 3,4-methylenedioxyaniline; 2-methylresorcinol; methylrosanilinium chloride; 1,5-naphthalenediol; 1,7-naphthalenediol; 3-nitro-p-Cresol; 2-nitro-5-glyceryl methylaniline; 4-nitroguaiacol; 3-nitro-p-hydroxyethylaminophenol; 2-nitro-N-hydroxyethyl-p-anisidine; nitrophenol; 4-nitrophenyl aminoethylurea; 4-nitro-o-phenylenediamine dihydrochloride; 2-nitro-p-phenylenediamine dihydrochloride; 4-nitro-o-phenylenediamine HCl; 4-nitro-m-phenylenediamine; 4-nitro-o-phenylenediamine; 2-nitro-p-phenylenediamine; 4-nitro-m-phenylenediamine sulfate; 4-nitro-o-phenylenediamine sulfate; 2-nitro-p-phenylenediamine sulfate; 6-nitro-2,5-pyridinediamine; 6-nitro-o-toluidine; PEG-3 2,2'-di-p-phenylenediamine; p-phenylenediamine HCl; p-phenylenediamine sulfate; phenyl methyl pyrazolone; N-phenyl-p-phenylenediamine HCl; pigment blue 15:1; pigment violet 23; pigment yellow 13; pyrocatechol; pyrogallol; resorcinol; sodium picramate; sodium sulfanilate; solvent yellow 85; solvent yellow 172; tetraaminopyrimidine sulfate; tetrabromophenol blue; 2,5,6-triamino-4-pyrimidinol sulfate; 1,2,4-trihydroxybenzene.

[00109] Example of nail care ingredients include butyl acetate; ethyl acetate; nitrocellulose; acetyl tributyl citrate; isopropyl alcohol; adipic acid/neopentyl glycol/trimellitic anhydride copolymer; stearalkonium bentonite; acrylates copolymer; calcium pantothenate; Cetraria islandica extract; Chondrus crispus; styrene/acrylates copolymer; trimethylpentanediyl dibenzoate-1; polyvinyl butyral; N-butyl alcohol; propylene glycol; butylene glycol; mica; silica; tin oxide; calcium borosilicate; synthetic fluorphlogopite; polyethylene terephthalate; sorbitan laurate derivatives; talc; jojoba extract; diamond powder; isobutylphenoxy epoxy resin; silk powder; and mixtures thereof.

[00110] Examples of fragrances or perfume include hexyl cinnamic aldehyde; anisaldehyde; methyl- 2-n-hexyl-3-oxo-cyclopentane carboxylate; dodecalactone gamma; methylphenylcarbinyl acetate; 4-acetyl-6-tert-butyl-1,1-dimethyl indane; patchouli; olibanum resinoid; labdanum; vetivert; copaiba balsam; fir balsam; 4-(4-hydroxy- 4- methyl pentyl)-3-cyclohexene-1-carboxaldehyde; methyl anthranilate;

geraniol; geranyl acetate; linalool; citronellol; terpinyl acetate; benzyl salicylate; 2-methyl-3-(p-isopropylphenyl)-propanal; phenoxyethyl isobutyrate; cedryl acetal; aubepine; musk fragrances; macrocyclic ketones; macrolactone musk fragrances; ethylene brassylate; and mixtures thereof. Further perfume ingredients are described in detail in standard textbook references such as *Perfume and Flavour Chemicals*, 1969, S. Arctander, Montclair, New Jersey.

[00111] Examples of antioxidants are acetyl cysteine, arbutin, ascorbic acid, ascorbic acid polypeptide, ascorbyl dipalmitate, ascorbyl methylsilanol pectinate, ascorbyl palmitate, ascorbyl stearate, BHA, p-hydroxyanisole, BHT, t-butyl hydroquinone, caffeic acid, Camellia sinensis Oil, chitosan ascorbate, chitosan glycolate, chitosan salicylate, chlorogenic acids, cysteine, cysteine HCl, decyl mercaptomethylimidazole, erythorbic acid, diamylhydroquinone, di-t-butylhydroquinone, dicetyl thiodipropionate, dicyclopentadiene/t-butylcresol copolymer, digalloyl trioleate, dilauryl thiodipropionate, dimyristyl thiodipropionate, dioleoyl tocopheryl methylsilanol, isoquercitrin, diosmine, disodium ascorbyl sulfate, disodium rutinyl disulfate, distearyl thiodipropionate, ditridecyl thiodipropionate, dodecyl gallate, ethyl ferulate, ferulic acid, hydroquinone, hydroxylamine HCl, hydroxylamine sulfate, isooctyl thioglycolate, kojic acid, madecassicoside, magnesium ascorbate, magnesium ascorbyl phosphate, melatonin, methoxy-PEG-7 rutinyl succinate, methylene di-t-butylcresol, methylsilanol ascorbate, nordihydroguaiaretic acid, octyl gallate, phenylthioglycolic acid, phloroglucinol, potassium ascorbyl tocopheryl phosphate, thiodiglycolamide, potassium sulfite, propyl gallate, rosmarinic acid, rutin, sodium ascorbate, sodium ascorbyl/cholesteryl phosphate, sodium bisulfite, sodium erythorbate, sodium metabisulfide, sodium sulfite, sodium thioglycolate, sorbityl furfural, tea tree (*Melaleuca alternifolia*) oil, tocopheryl acetate, tetrahexyldecyl ascorbate, tetrahydrodiferuloylmethane, tocopheryl linoleate/oleate, thiodiglycol, tocopheryl succinate, thiodiglycolic acid, thioglycolic acid, thiolactic acid, thiosalicylic acid, thiotaurine, retinol, tocophereth-5, tocophereth-10, tocophereth-12, tocophereth-18, tocophereth-50, tocopherol, tocophersolan, tocopheryl linoleate, tocopheryl nicotinate, tocoquinone, o-tolyl biguanide, tris(nonylphenyl) phosphite, ubiquinone, zinc dibutyldithiocarbamate, and mixtures thereof.

[00112] Examples of oxidizing agents are ammonium persulfate, calcium peroxide, hydrogen peroxide, magnesium peroxide, melamine peroxide, potassium bromate, potassium caroate, potassium chlorate, potassium persulfate, sodium bromate, sodium carbonate peroxide, sodium chlorate, sodium iodate, sodium

perborate, sodium persulfate, strontium dioxide, strontium peroxide, urea peroxide, zinc peroxide, and mixtures thereof.

[00113] Examples of reducing agents are ammonium bisulfite, ammonium sulfite, ammonium thioglycolate, ammonium thiolactate, cysteamine HCl, cystein,
5 cysteine HCl, ethanolamine thioglycolate, glutathione, glyceryl thioglycolate, glyceryl thiopropionate, hydroquinone, p-hydroxyanisole, isooctyl thioglycolate, magnesium thioglycolate, mercaptopropionic acid, potassium metabisulfite, potassium sulfite, potassium thioglycolate, sodium bisulfite, sodium hydrosulfite, sodium hydroxymethane sulfonate, sodium metabisulfite, sodium sulfite, sodium thioglycolate,
10 strontium thioglycolate, superoxide dismutase, thioglycerin, thioglycolic acid, thiolactic acid, thiosalicylic acid, zinc formaldehyde sulfoxylate, and mixtures thereof.

[00114] Examples of propellant gases include carbon dioxide, nitrogen, nitrous oxide, volatile hydrocarbons such as butane, isobutane, or propane, and chlorinated or fluorinated hydrocarbons such as dichlorodifluoromethane and
15 dichlorotetrafluoroethane or dimethylether; and mixtures thereof.

[00115] Examples of antiacne agents include salicylic acid, sulfur benzoyl, peroxide, tretinoin, and mixtures thereof.

[00116] Examples of antibacterial agents include chlorohexadiene gluconate, alcohol, benzalkonium chloride, benzethonium chloride, hydrogen peroxide,
20 methylbenzethonium chloride, phenol, poloxamer 188, povidone-iodine, and mixtures thereof.

[00117] Examples of antifungal agents include miconazole nitrate, calcium undecylenate, undecylenic acid, zinc undecylenate, and mixtures thereof.

[00118] Examples of therapeutic active agents include penicillins,
25 cephalosporins, tetracyclines, macrolides, epinephrine, amphetamines, aspirin, acetaminophen, barbiturates, catecholamines, benzodiazepine, thiopental, codeine, morphine, procaine, lidocaine, benzocaine, sulphonamides, ticonazole, perbuterol, furosamide, prazosin, hormones, prostaglandins, carbenicillin, salbutamol, haloperidol, suramin, indomethicane, diclofenac, glafenine, dipyridamole, theophylline,
30 hydrocortisone, steroids, scopolamine, and mixtures thereof.

[00119] Examples of external analgesics are benzyl alcohol, capsicum oleoresin (Capsicum frutescens oleoresin), methyl salicylate, camphor, phenol, capsaicin, juniper tar (Juniperus oxycedrus tar), phenolate sodium (sodium phenoxide), capsicum (Capsicum frutescens), menthol, resorcinol, methyl nicotinate, turpentine oil
35 (turpentine) , and mixtures thereof.

[00120] An example of a skin bleaching agent is hydroquinone.

[00121] Examples of anti-cancer agents include alkylating agents (such as busulfan, fluorodopan), antimitotic agents (such as colchicine, rhizoxin), topoisomerase I inhibitors (such as camptothecin and its derivatives), topoisomerase II inhibitors (such as menogaril, amonafide), RNA/DNA or DNA anti-metabolites (such as acivicin, guuanazole), plant alkaloids and terpenoids, antineoplastics, some plant-derived compounds (such as podophyllotoxin, vinca alkaloids), and mixtures thereof.

[00122] Examples of diuretics include loop diuretics (such as bumetanide, furosemide), thiazide diuretics (such as chlorothiazide, hydroflumethiazide), potassium-sparing diuretics (such as amiloride, spironolactone), carbonic anhydrase inhibitors (such as acetazolamide), osmotic diuretics (such as mannitol), and mixtures thereof.

[00123] Examples of agents for treating gastric and duodenal ulcers include proton pump inhibitor (such as lansoprazole, omeprazole), acid blockers or H₂ histamine blockers (such as cimetidine, ranitidine), bismuth, sucralfate, and mixtures thereof.

[00124] Examples of proteolytic enzymes include nattokinase, serratiopeptidase, bromelain, papain, and mixtures thereof.

[00125] Examples of antihistamine or H₁ histamine blockers include brompheniramine, clemastine, cetirizine, loratadine, fexofenadine, and mixtures thereof.

[00126] Examples of sedatives include barbiturates (such as phenobarbitol), benzodiazepines (such as lorazepam), herbal sedatives, benzodiazepine-like drugs (such as zolpidem, zopiclone), and mixtures thereof.

[00127] Examples of bronchodilators include short-acting β ₂-agonists and long-acting β ₂-agonists, anticholinergics, and mixtures thereof.

[00128] The formulations of the present invention also include diluents. Such diluents are often necessary to decrease the viscosity of the formulation sufficiently for application.

[00129] Examples of diluents include silicon containing diluents such as hexamethyldisiloxane, octamethyltrisiloxane, and other short chain linear siloxanes such as octamethyltrisiloxane, decamethyltetrasiloxane, dodecamethylpentasiloxane, tetradecamethylhexasiloxane, hexadecamethylheptasiloxane, heptamethyl-3-{{(trimethylsilyl)oxy}}trisiloxane, cyclic siloxanes such as hexamethylcyclotrisiloxane, octamethylcyclotetrasiloxane, decamethylcyclopentasiloxane, dodecamethylcyclohexasiloxane; organic diluents such as butyl acetate, alkanes, alcohols, ketones, esters, ethers, glycols, glycol ethers, hydrofluorocarbons or any

other material which can dilute the formulation without adversely affecting any of the component materials of the cosmetic composition. Hydrocarbons include isododecane, isohexadecane, Isopar L (C11-C 13), Isopar H (C11- C12), hydrogentated polydecene. Ethers and esters include isodecyl neopentanoate, neopentylglycol heptanoate, glycol distearate, dicaprylyl carbonate, diethylhexyl carbonate, propylene glycol n butyl ether, ethyl-3 ethoxypropionate, propylene glycol methyl ether acetate, tridecyl neopentanoate, propylene glycol methylether acetate (PGMEA), propylene glycol methylether (PGME), octyldodecyl neopentanoate, diisobutyl adipate, diisopropyl adipate, propylene glycol dicaprylate / dicaprinate, and octyl palmitate. Additional organic diluents include fats, oils, fatty acids, and fatty alcohols.

[00130] Further materials suitable for the personal care and health care are well known to the person skilled in the art and are described in many text books as well as other publications.

[00131] The general level of silicone resin emulsion in the cosmetic compositions may vary from 0.1% to 80% by weight, alternatively from 0.2% to 10%, alternatively from 0.5% to 5%, relative to the total weight of the cosmetic composition. The cosmetic ingredient (C) is present at a level of from 0.01% to 99.99% by weight, relative to the total weight of the cosmetic composition. The cosmetic ingredient (C) may be a mixture of cosmetic ingredients (C) as listed above.

[00132] In some instances, the silicone resin emulsion is used in conjunction with a cosmetic ingredient (C) selected from a cationic conditioning agent, a hydrophobic conditioning agent, or mixtures thereof, in a cosmetically acceptable medium.

[00133] The personal care composition may be prepared by a process comprising the steps of

- i. mixing a silicone resin emulsion as described above,
- ii. and at least one personal care cosmetic ingredient (C),
- iii. optionally in the presence of a cosmetically acceptable medium.

[00134] The personal care compositions may be prepared by mixing the silicone resin emulsion in the aqueous phase with the appropriate aqueous phase ingredients, and optionally provide for a non aqueous phase, and mix the aqueous and non aqueous phases together, optionally under heating.

[00135] The process may be conducted at temperatures ranging of from 15 to 90 °C, alternatively of from 20 to 60 °C, alternatively at room temperature (25 °C), using simple propeller mixers, counter-rotating mixers, or homogenizing mixers. No special

equipment or processing conditions are typically required. Depending on the type of composition prepared, the method of preparation will be different, but such methods are well known in the art.

[00136] The personal care compositions may be in the form of a cream, a gel, a powder (free flowing powder or pressed), a paste, a solid, freely pourable liquid, an aerosol. The personal care compositions may be in the form of monophasic systems, biphasic or alternate multi phasic systems; emulsions, e.g. oil-in-water, water-in-oil, silicone-in-water, water-in-silicone; multiple emulsions, e.g. oil-in-water-in-oil, polyol-in-silicone-in-water, oil-in-water-in-silicone.

[00137] Skin care compositions include shower gels, soaps, hydrogels, creams, lotions and balms; antiperspirants; deodorants such as sticks, soft solid, roll on, aerosol, and pump sprays; skin creams; skin care lotions; moisturizers; facial treatments such as wrinkle control or diminishment treatments; exfoliates; body and facial cleansers; bath oils; perfumes; colognes; sachets; sunscreens; mousses; patches; pre-shave and after-shave lotions; shaving soaps; shaving lathers; depilatories; make-ups; color cosmetics; foundations; concealers; blushes; lipsticks; eyeliners; mascaras; oil removers; color cosmetic removers, powders, and kits thereof.

[00138] Hair care compositions include shampoos, rinse-off conditioners, leave-in conditioners and styling aids, gels, sprays, pomades, mousses, waxes, cuticle coats, hair colorants, hair relaxants, hair straighteners, permanents, and kits thereof.

[00139] Nail care compositions include color coats, base coats, nail hardeners, and kits thereof.

[00140] The personal care compositions may be used by the standard methods, such as applying them to the human or animal body, e.g. skin or hair, using applicators, brushes, applying by hand, pouring them and/or possibly rubbing or massaging the composition onto or into the body. Removal methods, for example for colour cosmetics are also well known standard methods, including washing, wiping, peeling and the like.

[00141] The invention also comprises a method of treating keratinous substrates, such as hair or skin, by applying to it a cosmetic composition according to the first aspect of the invention.

[00142] The personal care compositions may be used on hair in a conventional manner. An effective amount of the composition for washing or conditioning hair is applied to the hair. Such effective amounts generally range from about 1g to about 50g, preferably from about 1g to about 20g. Application to the hair typically includes working the cosmetic composition through the hair such that most or all of the hair is

contacted with the cosmetic composition. These steps can be repeated as many times as desired to achieve the desired benefit.

[00143] Benefits obtained from using the personal care compositions on hair include one or more of the following benefits: hair conditioning, softness, detangling ease, silicone deposition, anti-static, anti-frizz, lubricity, shine, strengthening, viscosity, tactile, wet combing, dry combing, improvement in coloration process, color retention, straightening, heat protection, styling, or curl retention.

[00144] The personal care compositions may be used on skin in a conventional manner. An effective amount of the composition for the purpose is applied to the skin.

Such effective amounts generally range from about 1mg/cm² to about 3 mg/cm². Application to the skin typically includes working the cosmetic composition into the skin. This method for applying to the skin comprises the steps of contacting the skin with the cosmetic composition in an effective amount and then rubbing the composition into the skin. These steps can be repeated as many times as desired to achieve the desired benefit.

[00145] Benefits obtained from using the cosmetic compositions on skin include one or more of the following benefits: skin softness, suppleness, moisturization, skin feel, foam generation.

[00146] A process of caring for keratinous fibers comprises the steps of

i. mixing a silicone resin emulsion as described above; with at least one cosmetic ingredient (B) optionally in the presence of a cosmetically acceptable medium,

ii. applying the mixture to the keratinous fibers;

iii. optionally let the mixture stand on the keratinous fibers;

iv. optionally rinsing the keratinous fibers.

[00147] A process of conditioning keratinous fibers comprises the steps of

i. mixing a silicone resin emulsion with at least one cosmetic ingredient (C) selected from cationic conditioning polymer, hydrophobic conditioning polymer, optionally in the presence of a cosmetically acceptable medium,

ii. applying the mixture to the keratinous fibers;

iii. optionally let the mixture stand on the keratinous fibers;

iv. optionally rinsing the keratinous fibers.

[00148] The optional standing time of the process of caring or conditioning keratinous fibers may range of from 10 seconds to 1 hour, alternatively of from 30 seconds to 30 minutes, alternatively of from 30 seconds to 10 minutes.

[00149] The personal care composition may be used to care for keratinous substrates, that is, to wash, to cleanse, to condition, to refresh, to make up, to remove make up, to fix hair.

[00150] Personal care compositions of the present invention include shampoo compositions. The shampoo compositions may be in the form of a gel, paste, or a freely pourable liquid. The shampoo compositions can be used on the hair of humans or animals to cleanse and improve the appearance of their coats, respectively. The shampoo compositions are expected to be used by the usual method of adding the shampoo to the hair, massaging the shampoo into the hair and removing the shampoo from the hair by rinsing with water.

[00151] The shampoo compositions may be prepared by simply mixing all ingredients together, and stirring thoroughly. Heat may be applied to improve the dispersion of the ingredients. The shampoo compositions can be prepared by emulsification or by microemulsification.

[00152] Microemulsions are mixtures of oil and water where the particle size of the resulting droplets is small enough so the resulting mixture is clear or translucent. Because of their relative clarity microemulsions are distinguishable from standard opaque emulsions in that certain microemulsions can be used to prepare clear cosmetics. The clarity of these compositions is advantageous in cosmetic applications such as in the hair care art. Microemulsions are also more temperature, dilution, and formulation stable than standard emulsions. Microemulsion droplet sizes are variously defined in the chemical art with an upper limit on the droplet size typically being placed somewhere between 0.10 and 0.15 micron to distinguish microemulsions from opaque standard emulsions. In general, microemulsions can also be defined by their appearance: microemulsions are transparent or translucent, and do not display the opalescence of standard emulsions. While microemulsions with average droplet sizes between 0.10 and 0.15 micron display the properties of microemulsions, microemulsions with average droplet sizes less than 0.06 micron are especially preferred for their even greater clarity and stability. A surfactant should be present in the microemulsion of an emulsified component in an amount ranging from 0.1 to 250 parts by weight, and preferably 2 to 100 parts by weight per 100 parts by weight of the emulsified component. The microemulsions of this invention can be prepared by two different methods. The first is the mechanical method described in U.S. Pat. No. 4620878 which is hereby incorporated by reference. The method involves forming a "translucent concentrate" of surfactant, emulsified component, and water in select proportions. The "concentrate" is then rapidly dispersed in additional water to form the

microemulsion. The second method by which microemulsions can be produced is described in European Patent No.0459500 in which an oil free microemulsions by emulsion polymerization is produced. The method comprising a mixture of at least one precursor to the emulsified component (e.g. an oligomer), cationic or anionic
5 surfactant, nonionic surfactant, catalyst and water, whereby the oligomer is reacted in the presence of water and the surfactants to form the emulsified component in microemulsions. The order the ingredients are combined in is not critical, but agitation during and following the addition of the ingredients is used and heating to the polymerization temperature when all the ingredients have been combined.

10 **[00153]** The personal care compositions of the present invention are used in a conventional manner for cleansing and conditioning hair or skin. An effective amount of the composition for cleansing and conditioning the hair or skin is applied to the hair or skin, that has preferably been wetted with water, and then rinsed off. Such effective amounts generally range from about 1g to about 50g, or from about 1g to about 20g.

15 Application to the hair typically includes working the composition through the hair such that most or all of the hair is contacted with the composition. This method for cleansing and conditioning the hair or skin comprises the steps of: a) wetting the hair or skin with water, b) applying an effective amount of the personal care composition to the hair or skin, c) massaging the composition onto the hair or skin, and d) rinsing the
20 composition from the hair or skin using water. These steps can be repeated as many times as desired to achieve the desired cleansing and conditioning benefit.

[00154] Having described the invention with reference to certain embodiments, other embodiments will become apparent to one skilled in the art from consideration of the specification. The invention is further illustrated by reference to the following
25 examples describing the preparation of the emulsions and processes of the invention. It will be apparent to those skilled in the art that many modifications, both to materials and methods, may be practiced without departing from the scope of the invention.

EXAMPLES

30 **[00155]** The following examples are included to demonstrate certain embodiments of the invention. It should be appreciated by those of skill in the art that the techniques disclosed in the examples which follow represent techniques discovered by the inventors to function well in the practice of the invention, and thus can be considered to constitute preferred modes for its practice. However, those of
35 skill in the art should, in light of the present disclosure, appreciate that many changes can be made in the specific embodiments which are disclosed and still obtain a like or

similar result without departing from the spirit and scope of the invention. All percentages are in wt. %. All measurements were conducted at 23°C unless indicated otherwise.

Example 1 Emulsification of Silicone Resin using Pluronic® F-108

5 **[00156]** The following were weighed into a Max 100 cup in the following order:
35g silicone flake resin (Xiameter® RSN-6018 Resin) having a number average molecular weight of 1200 and a specific gravity of 1.25, 16g of 3mm spherical glass beads (Fisher) and 7g of Pluronic® F-108 nonionic surfactant. The cup was closed and placed into a DAC-150 SpeedMixer® and the cup was spun at maximum speed
10 (3450 RPM) for two minutes. The cup was opened and inspected. The mixture, which had become very warm, had taken on a creamy white appearance. The cup was closed and allowed to stand undisturbed for five minutes in order for the mixture to cool slightly. The cup was placed back in the mixer and spun for an additional 1 minute at maximum speed. The mixture was diluted with 28g of deionized (DI) water in five
15 increments by adding aliquots of water and spinning the cup for 25 seconds after addition of each aliquot. The increments of water were as follows: 2g, 3g, 5g, 8g and 10g. Following the last dilution, the resulting composition consisted of an o/w emulsion of silicone resin having a silicone content of 50 percent by weight. Particle size of the emulsion was measured using a Malvern® Mastersizer 2000 and found to be: Dv50 =
20 0.56µm; Dv90 = 0.94µm. A 4 mil (100µm) wet film of this emulsion was drawn down onto an aluminum Q-Panel and dried for 24 hours at ambient laboratory temperature. A clear, tack-free film resulted.

Example 2 Emulsification of Silicone Resin using Pluronic® F-108

[00157] The following were weighed into a Max 100 cup in the following order:

25 35g silicone flake resin (Xiameter® RSN-0217 Resin) having a T_g of 64°C and a melt viscosity of 92,000 cP at 107°C, 16g of 3mm spherical glass beads (Fisher), 3.15g of DI water and 10.5g of Pluronic® F-108 nonionic surfactant. The cup was closed and placed into a DAC-150 SpeedMixer® and the cup was spun at maximum speed (3450 RPM) for two minutes. The cup was opened and inspected. The mixture, which had
30 become very warm, had taken on a creamy white appearance. The cup was closed and allowed to stand undisturbed for five minutes in order for the mixture to cool slightly. The cup was placed back in the mixer and spun for an additional 1 minute at maximum speed. The mixture was diluted with 8g of DI water in three increments by adding aliquots of water and spinning the cup for 25 seconds after addition of each
35 aliquot. The increments of water were as follows: 1g, 3g and 4g. The mixture was

inspected after the last increment of added water and it had appeared to not have inverted, or in other words the composition was a w/o (water-in-oil) emulsion. Next 3.0g of Carbowax[®] PEG 1000 (warmed to 50°C so it was a liquid) was added to the cup and the cup was spun for 30 seconds at maximum speed. Dilution water was added next in three increments of 2g, 3g and 5g such that a total of 10g of additional water was added. The cup was spun for 20 seconds at maximum speed between each water addition. The total amount of water added was 21.15g. Following the last dilution, the resulting composition consisted of an o/w, of silicone resin having a silicone content of 50 percent by weight and having a milky white appearance. Particle size of the emulsion was measured using a Malvern[®] Mastersizer 2000 and found to be: Dv50 = 0.36µm; Dv90 = 3.67. A 4 mil (100µm) wet film of this emulsion was drawn down onto an aluminum Q-Panel and dried for 24 hours at ambient laboratory temperature. A clear, slightly tacky film resulted. The film was dried at 70°C for four hours after which it became tack-free.

Example 3 Emulsification of Methyl Silicone Resin Powder using Pluronic[®] F-108
[00158] The following were weighed into a Max 40 cup in the following order: 10

g methyl silicone resin powder (Silres[®] MK methyl silicone resin) having a melting range of 35-55°C and a bulk density of 500kg/m², 16g of 3mm spherical glass beads (Fisher) and 2.5g of Pluronic[®] F-108 nonionic surfactant. The cup was closed and placed into a DAC-150 SpeedMixer[®] and the cup was spun at maximum speed (3450 RPM) for two minutes. The cup was opened and inspected. The mixture, which had become very warm, had taken on a creamy white appearance. The cup was closed, placed back in the mixer and spun for an additional 1 minute at maximum speed. The mixture was diluted with 9.72g of deionized water in seven increments by adding aliquots of water and spinning the cup for 25 seconds after addition of each aliquot. The increments of water were as follows: 0.3g, 0.50g, 0.9g, 1.4g, 2.0g, 2.5g and 2.12g. Following the last dilution, the resulting composition consisted of an o/w emulsion of silicone resin having a silicone content of 45 percent by weight. Particle size of the emulsion was measured using a Malvern[®] Mastersizer 2000 and found to be: Dv50 = 33.6µm; Dv90 = 79.4µm. A 4 mil (100µm) wet film of this emulsion was drawn down onto an aluminum Q-Panel and dried for 24 hours at ambient laboratory temperature. A white, tack-free film resulted.

Example 4 Emulsification of Trimethylsiloxy silicate resin (MQ) Pluronic[®] F-108
[00159] The following were weighed into a Max 40 cup in the following order:

5.0g of trimethylsiloxy silicate flake resin (Dow Corning[®] MQ 1600 Resin) having a

specific gravity of 1.23, 10g of 3mm spherical glass beads (Fisher) and 10.0g of Pluronic® F-108 nonionic surfactant. The cup was closed and placed into a DAC-150 SpeedMixer® and the cup was spun at maximum speed (3450 RPM) for two minutes. The cup was opened and inspected. The mixture, which had become very warm, had
5 taken on a creamy white appearance. The cup was closed, placed back in the mixer and spun for an additional 1 minute at maximum speed. The mixture was diluted with 20.0g of deionized water in six increments by adding aliquots of water and spinning the cup for 25 seconds after addition of each aliquot. The increments of water were as follows: 0.5g, 1.0g, 2.0g, 4.0g, 6.0g and 6.5g. Following the last dilution, the resulting
10 composition consisted of a dispersion of silicone resin in water having a silicone content of 14.3 percent by weight. Particle size of the emulsion was measured using a Malvern® Mastersizer 2000 and found to be: Dv50 = 7.3µm; Dv90 = 26.9µm. The dispersion had the appearance of an opaque paste. A portion of the dispersion was smeared into a film using a spatula and dried at ambient temperature to form a white,
15 coherent, tack-free film.

[00160] The following listing describes the silicone PSA's used in the following examples.

[00161] SILICONE PSA 1 is a very high tack silicone hot melt PSA, prepared by adding 15% of 100 cSt polydimethylsiloxane fluid to SILICONE PSA 4 (as described
20 below), followed by removal of solvent.

[00162] SILICONE PSA 2 is an amine-compatible, silicone PSA that is produced through a condensation reaction of a silanol endblocked polydimethylsiloxane (PDMS) with a silicate resin and that is fully capped with trimethylsiloxy groups and is 60% weight solids in ethyl acetate. It is a high tack
25 silicone PSA that has a Resin/Polymer ratio of 55/45. Approximately 100 grams of this PSA were dried in a forced air oven at 110°C for 150 minutes to remove the ethyl acetate solvent prior to use.

[00163] SILICONE PSA 3 is a conventional, i.e., uncapped, silicone PSA that is produced through a condensation reaction of a silanol endblocked
30 polydimethylsiloxane (PDMS) with a silicate resin and is 60% weight solids in ethyl acetate. It is a low tack silicone PSA that has a Resin/Polymer ratio of 65/35. Approximately 100 grams of this PSA were dried in a forced air oven at 110°C for 150 minutes to remove the ethyl acetate solvent prior to use.

[00164] SILICONE PSA 4 is a conventional, i.e., uncapped, silicone PSA that is
35 produced through a condensation reaction of a silanol endblocked polydimethylsiloxane (PDMS) with a silicate resin and is 60% weight solids in ethyl

acetate. It is a medium tack silicone PSA that has a Resin/Polymer ratio of 60/40. Approximately 100 grams of this PSA were dried in a forced air oven at 110 °C for 150 minutes to remove the ethyl acetate solvent prior to use.

[00165] SILICONE PSA 5 is a conventional, i.e., uncapped, silicone PSA that is produced through a condensation reaction of a silanol endblocked polydimethylsiloxane (PDMS) with a silicate resin and is 60% weight solids in ethyl acetate. It is a high tack silicone PSA that has a Resin/Polymer ratio of 55/45. Approximately 100 grams of this PSA were dried in a forced air oven at 110 °C for 150 minutes to remove the ethyl acetate solvent prior to use.

[00166] SILICONE PSA 6 is a silicone-acrylic hybrid pressure sensitive adhesive, prepared according to the techniques taught in WO2007/145996, by a radical polymerization between a silicon-containing PSA, 2-ethylhexyl acrylate and methyl acrylate and is 42% solids in ethyl acetate. Approximately 100 grams of this PSA were dried in a forced air oven at 110 °C for 150 minutes to remove the ethyl acetate solvent prior to use.

[00167] SILICONE PSA 7 is a conventional, i.e., uncapped, high tack, industrial silicone PSA that is produced through a condensation reaction of a silanol endblocked polydimethylsiloxane (PDMS) with a silicate resin and is nominally 60% weight solids in xylene and toluene. Approximately 100 grams of this PSA were dried in a forced air oven at 150 °C for 150 minutes to remove the xylene and toluene solvents prior to use.

[00168] SILICONE PSA 8 is a conventional, i.e., uncapped, medium tack, industrial silicone PSA that is produced through a condensation reaction of a silanol endblocked polydimethylsiloxane (PDMS) with a silicate resin and is nominally 60% weight solids in xylene and toluene. Approximately 100 grams of this PSA were dried in a forced air oven at 150 °C for 150 minutes to remove the xylene and toluene solvents prior to use.

[00169] PSA 9 is a conventional, i.e., uncapped, silicone PSA that is produced through a condensation reaction of a silanol endblocked polydimethylsiloxane (PDMS) with a silicate resin. It is a low tack silicone PSA that has a Resin/Polymer ratio of 65/35. PSA 9 is the same as PSA 3 but without any solvent.

Example 5

[00170] The following were weighed into a Max 40 cup in the following order: 15g of SILICONE PSA 1 having a dynamic viscosity of 75M (million) cP (centipoises) at 0.01 Hz, 4.5g of Pluronic[®] F-108 nonionic surfactant and 6.4g of 3mm spherical glass beads (Fisher). The cup was closed and placed into a DAC-150 SpeedMixer[®] and the cup was spun at maximum speed (3450 RPM) for two minutes. The cup was

opened and inspected. The mixture appeared to be not entirely homogeneous as there were domains of white interspersed with domains of opaque. The cup was placed into a 70°C oven for 15 minutes after which it was spun again in the DAC 150 SpeedMixer® for two minutes. Inspection of the contents revealed it to be

5 homogeneous in appearance so the composition was diluted with 10.5g of deionized (DI) water in five increments. The cup was spun at maximum speed after each incremental water addition and the increments were as follows: 1.0g 1.5g, 1.5g, 2.5g, 4.0g. After the final dilution, the emulsion had a consistency of paste and was white in appearance. Particle size was determined for the emulsion using a Malvern®

10 Mastersizer 2000 and found to be: Dv50 = 3.68µm; Dv90 = 6.24µm. A 4 mil (100 µm) wet film of this emulsion was drawn down onto an aluminum Q-Panel and dried for one hour in a 70°C forced air oven. The resulting film was whitish-gray in appearance and it was slightly tacky. Prior to emulsification, rheological properties of the silicone PSA were determined using a TA Instruments ARES® (New Castle Delaware) rheometer

15 equipped with 25mm diameter parallel plates and operated at 25 degrees C in a frequency sweep mode from 0.01Hz to 80 Hz using a dynamic strain of 10 percent. This polymer has a viscosity of 75,063 Pa-sec. at 0.01Hz.

Example 6

[00171] The following were weighed into a Max 60 cup in the following order:

20 17.5g of SILICONE PSA 2 solids, 7.5g of Pluronic® F-108 nonionic surfactant and 8.00g of 3mm spherical glass beads (Fisher). The cup was closed and placed into a DAC-150 SpeedMixer® and the cup was spun at maximum speed (3500 RPM) for two minutes. The cup was opened and inspected. Inspection of the contents revealed it to be homogeneous in appearance so the composition was diluted with 16.8g of

25 deionized (DI) water in 7 increments. The cup was spun at maximum speed after each incremental water addition and the increments were as follows: 0.50g, 1.40g, 0.62g, 2.76g, 1.92g, 3.42g and 6.18g. After the final dilution, the emulsion had a consistency of a cream and was white in appearance. Particle size was determined for the emulsion using a Malvern® Mastersizer 2000 and found to be: Dv50 = 0.91µm; Dv90 =

30 2.55µm.

Example 7

[00172] The following were weighed into a Max 60 cup in the following order:

25.43g of SILICONE PSA 3 solids, 2.83g of isododecane and 7.98g of 3mm spherical glass beads (Fisher). The cup was closed and placed into a DAC-150 SpeedMixer®

35 and the cup was spun at maximum speed (3500 RPM) for four minutes. The cup was

opened and inspected. Inspection of the contents revealed it to be homogeneous in appearance, so 5.05g of Pluronic® F-108 nonionic surfactant was added to the mixture. The cup was closed and spun at maximum speed for 4 minutes. The cup was opened and inspected. Inspection of the contents revealed it to be homogeneous in appearance so the composition was diluted with 22.42g of deionized (DI) water in 8 increments. The cup was spun at maximum speed after each incremental water addition and the increments were as follows: 1.16g, 2.04g, 2.00g, 2.83g, 3.02g, 3.85g, 3.12g and 4.40g. After the final dilution, the emulsion had a consistency of paste and was white in appearance. Particle size was determined for the emulsion using a Malvern® Mastersizer 2000 and found to be: Dv50 = 9.23µm; Dv90 = 19.22µm.

Example 8

[00173] The following were weighed into a Max 60 cup in the following order: 17.5g of 7 SILICONE PSA 4 solids, 7.49g of Pluronic® F-108 nonionic surfactant and 8.01g of 3mm spherical glass beads (Fisher). The cup was closed and placed into a DAC-150 SpeedMixer® and the cup was spun at maximum speed (3500 RPM) for five minutes. The cup was opened and inspected. Inspection of the contents revealed it to be homogeneous in appearance so the composition was diluted with 16.8g of deionized (DI) water in 9 increments. The cup was spun at maximum speed after each incremental water addition and the increments were as follows: 0.68g, 0.39g, 0.94g, 1.47g, 1.65g, 3.11g, 2.11g, 1.95g and 4.50g. After the final dilution, the emulsion had a consistency of a cream and was white in appearance. Particle size was determined for the emulsion using a Malvern® Mastersizer 2000 and found to be: Dv50 = 0.60µm; Dv90 = 1.70µm.

Example 9

[00174] The following were weighed into a Max 60 cup in the following order: 17.52g of SILICONE PSA 5 solids, 7.49g of Pluronic® F-108 nonionic surfactant and 8.00g of 3mm spherical glass beads (Fisher). The cup was closed and placed into a DAC-150 SpeedMixer® and the cup was spun at maximum speed (3500 RPM) for three minutes. The cup was opened and inspected. Inspection of the contents revealed it to be homogeneous in appearance so the composition was diluted with 16.7g of deionized (DI) water in 8 increments. The cup was spun at maximum speed after each incremental water addition and the increments were as follows: 0.58g, 0.68g, 1.08g, 1.06g, 2.02g, 3.05g, 2.53g and 5.70g. After the final dilution, the emulsion had a consistency of a cream and was white in appearance. Particle size

was determined for the emulsion using a Malvern® Mastersizer 2000 and found to be: Dv50 = 0.41µm; Dv90 = 1.78µm.

Example 10

[00175] The following were weighed into a Max 60 cup in the following order:

- 5 17.5g of SILICONE PSA 5 solids, 3.5g of Pluronic® F-108 nonionic surfactant and 8.00g of 3mm spherical glass beads (Fisher). The cup was closed and placed into a DAC-150 SpeedMixer® and the cup was spun at maximum speed (3500 RPM) for three minutes. The cup was opened and inspected. Inspection of the contents revealed it to be homogeneous in appearance so the composition was diluted with
- 10 14.29g of deionized (DI) water in 9 increments. The cup was spun at maximum speed after each incremental water addition and the increments were as follows: 0.52g, 0.75g, 0.62g, 0.80g, 1.26g, 1.46g, 2.28g, 5.00g and 1.60g. After the final dilution, the emulsion had a liquid consistency and was white in appearance. Particle size was determined for the emulsion using a Malvern® Mastersizer 2000 and found to be:
- 15 Dv50 = 1.38µm; Dv90 = 3.44µm.

Example 11

[00176] The following were weighed into a Max 60 cup in the following order:

- 17.49g of SILICONE PSA 6 solids, 7.5g of Pluronic® F-108 nonionic surfactant and 7.96g of 3mm spherical glass beads (Fisher). The cup was closed and placed into a
- 20 DAC-150 SpeedMixer® and the cup was spun at maximum speed (3500 RPM) for one minute. The cup was opened and inspected. Inspection of the contents revealed it to be homogeneous in appearance so the composition was diluted with 16.7g of deionized (DI) water in 6 increments. The cup was spun at maximum speed after each incremental water addition and the increments were as follows: 0.54g, 2.01g, 2.12g,
- 25 2.85g, 3.04g and 6.14g. After the final dilution, the emulsion had a consistency of a cream and was white in appearance. Particle size was determined for the emulsion using a Malvern® Mastersizer 2000 and found to be: Dv50 = 3.84µm; Dv90 = 8.52µm.

Example 12

[00177] The following were weighed into a Max 60 cup in the following order:

- 30 17.46g of SILICONE PSA 6 solids, 3.5g of Pluronic® F-108 nonionic surfactant and 7.96g of 3mm spherical glass beads (Fisher). The cup was closed and placed into a DAC-150 SpeedMixer® and the cup was spun at maximum speed (3500 RPM) for two minutes. The cup was opened and inspected. Inspection of the contents revealed it to be homogeneous in appearance so the composition was diluted with 14.08g of
- 35 deionized (DI) water in 5 increments. The cup was spun at maximum speed after each

incremental water addition and the increments were as follows: 0.83g, 2.02g, 2.01g, 3.32g and 5.09g. After the final dilution, the emulsion had a liquid consistency and was white in appearance. Particle size was determined for the emulsion using a Malvern® Mastersizer 2000 and found to be: $Dv_{50} = 15.04\mu\text{m}$; $Dv_{90} = 25.61\mu\text{m}$.

5 Example 13

[00178] The following were weighed into a Max 60 cup in the following order: 17.54g of SILICONE PSA 7 solids, 7.5g of Pluronic® F-108 nonionic surfactant and 7.99g of 3mm spherical glass beads (Fisher). The cup was closed and placed into a DAC-150 SpeedMixer® and the cup was spun at maximum speed (3500 RPM) for two
10 minutes. The cup was opened and inspected. Inspection of the contents revealed it to be homogeneous in appearance so the composition was diluted with 16.7g of deionized (DI) water in 7 increments. The cup was spun at maximum speed after each incremental water addition and the increments were as follows: 0.5g, 1.09g, 1.42g, 2.39g, 2.83g, 3.37g and 5.10g. After the final dilution, the emulsion had a consistency
15 of a cream and was white in appearance. Particle size was determined for the emulsion using a Malvern® Mastersizer 2000 and found to be: $Dv_{50} = 1.09\mu\text{m}$; $Dv_{90} = 2.28\mu\text{m}$.

Example 14

[00179] The following were weighed into a Max 60 cup in the following order:
20 17.52g of SILICONE PSA 8 solids, 7.5g of Pluronic® F-108 nonionic surfactant and 8.00g of 3mm spherical glass beads (Fisher). The cup was closed and placed into a DAC-150 SpeedMixer® and the cup was spun at maximum speed (3500 RPM) for four minutes. The cup was opened and inspected. Inspection of the contents revealed it to be homogeneous in appearance so the composition was diluted with 16.7g of
25 deionized (DI) water in 9 increments. The cup was spun at maximum speed after each incremental water addition and the increments were as follows: 0.6g, 0.42g, 1.15g, 1.13g, 2.05g, 2.76g, 2.94g, 3.09g and 2.68g. After the final dilution, the emulsion had a liquid consistency and was white in appearance. Particle size was determined for the emulsion using a Malvern® Mastersizer 2000 and found to be: $Dv_{50} = 4.19\mu\text{m}$;
30 $Dv_{90} = 8.98\mu\text{m}$.

Example 15

[00180] 20g of SILICONE PSA 9 solids was weighed into a Max 60 cup followed by 10g of 3mm diameter glass beads and 6g of Pluronic® F-108. The cup was heated for 15 minutes in a 70 degree C air circulating oven after which it was removed from
35 the oven and spun for 2 minutes at maximum speed (3400 RPM) using a SpeedMixer®

DAC-150 high speed mixer. The cup was placed back into the oven and heated for 10 minutes after which it was spun again for 2 minutes in the SpeedMixer® high speed mixer. The contents of the cup were inspected and found to be a nearly

homogeneously-looking white paste. The composition was stirred with a spatula and

the cup was returned to the SpeedMixer® high speed mixer and spun at maximum speed for four 1-minute cycles with an approximately 2-3 minute rest period between each cycle. 1g of deionized water was added to the cup and it was spun for 30

seconds. The cup was cooled for one minute in an ice batch after which a second 1g portion of water was added followed by spinning for 30 seconds and cooling in an ice

bath for one minute. Two more 2g portions of deionized water were added to the cup followed by spinning 30 seconds and cooling in an ice bath 1 minute between each

spin. Next two 4g portions of deionized water were added to the cup followed by

spinning at maximum speed for 30 seconds. The composition now contained a total of 14g of deionized water. Its consistency was now a viscous, white liquid and it

consisted of an aqueous emulsion of silicone PSA in water having a silicone content of about 50 percent by weight. Particle size of the emulsion was measured using a Malvern® Mastersizer 2000 and found to be: $Dv_{50} = 7.71\mu m$; $Dv_{90} = 21.53\mu m$.

Example 16 Hair Conditioner Formulations

[00181] Samples of silicone resin emulsions are added to rinse-off conditioning formulations using two percent by weight of the silicone emulsions. The conditioning formulations are shown in Table 1. The conditioners of the present invention can be prepared using the emulsions of Examples 1, 4, 5 and 15. A conditioner containing a commercial nonionic amino siloxane microemulsion, cationic amino siloxane emulsion, and comparative silicone amino SPE ABn copolymer emulsion can also be tested for comparison purposes.

Table 1 - Conditioners

Ingredient	Weight %	Weight %	Weight %	Weight %	Weight %	Weight %	Weight %
Deionized Water	q.s. to 100 %	q.s. to 100 %	q.s. to 100 %	q.s. to 100 %	q.s. to 100 %	q.s. to 100 %	q.s. to 100 %
Hydroxyethyl-cellulose ¹	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Cetearyl Alcohol ²	1.0	1.0	1.0	1.0	1.0	1.0	1.0
PEG-100 Stearate & Glyceryl Stearate ³	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Example 5	3.3	----	----	----	----	----	----
Example 15	----	10.0	----	----	----	----	----

Example 4	----	----	3.4	----	----	----	----
Example 1	----	----	----	9.6	----	----	----
Amino Siloxane Microemulsion ⁴	----	----	----	----	10.0	----	----
Amino Siloxane Emulsion ⁵	----	----	----	----	----	5.7	----
Comparative Silicone Amino Polyether Block Copolymer Emulsion ⁶	----	----	----	----	----	----	9.3
DMDM Hydantoin ⁷	0.2	0.2	0.2	0.2	0.2	0.2	0.2

1. Natrosol® 250 HHR available from Hercules of Wilmington, DE

2. Crodocol CS-50® available from Croda Inc. of Edison, NJ

3. Arlacel® 165 available from Uniqema of Wilmington, DE

5 4. Dow Corning® CE- 8170 AF Microemulsion available from Dow Corning, Midland, MI, concentration based on 2% active silicone level (20% active)

5. Dow Corning® 949 Emulsion available from Dow Corning, Midland, MI, concentration based on 2% active silicone level (35% active)

6. Dow Corning® CE 8401 Emulsion available from Dow Corning, Midland, MI, concentration based on 2% active silicone level (21.5% active)

10 7. Glydant® available from Lonza, Inc. of Fairlawn, NJ

[00182] Deionized water is added to a mixing vessel and heated to 75°C. With moderate agitation, the hydroxyethyl cellulose is dispersed until fully dissolved. Heat is decreased to 60°C and cetearyl alcohol and PEG-100 stearate and glyceryl stearate is added. Heat is then decreased to 40° and the silicone silicone amino polyether block copolymer emulsion is added to the base conditioner. The conditioner is mixed for 5-10 minutes and then DMDM hydantoin is added. The water loss is compensated for and the formulation is mixed for an additional 5 minutes. The final pH of the conditioner formulations are all approximately 6-7.

20 Example 17 Conditioning Shampoo Formulations

[00183] Samples of silicone resin emulsions is added to shampoo formulations using two percent by weight of the silicone resin. The shampoo formulations are shown in Table 2. The shampoos of the present invention can be prepared using the emulsions of Examples 1, 4, 5 and 15. A shampoo containing a commercial nonionic amino siloxane microemulsion and comparative silicone amino SPE (AB)_n copolymer emulsion can also be tested for comparison purposes.

Table 2 – Conditioning Shampoos

Ingredient	Weight %	Weight %	Weight %	Weight %	Weight %	Weight %
Deionized Water	q.s. to 100%	q.s. to 100%	q.s. to 100%	q.s. to 100%	q.s. to 100%	q.s. to 100%
Sodium Laureth	30	30	30	30	30	30

Sulfate ¹						
Cocamide DEA ²	3.0	3.0	3.0	3.0	3.0	3.0
Cocamidopropyl Betaine ³	7.0	7.0	7.0	7.0	7.0	7.0
Polyquaternium-10 ⁴	0.3	0.3	0.3	0.3	0.3	0.3
PEG-150 Pentaerythrityl Tetrastearate ⁵	1.5	1.5	1.5	1.5	1.5	1.5
Example 5	3.3	----	----	----	----	----
Example 15	----	10.0	----	----	----	----
Example 4	----	----	3.4	----	----	----
Example 1	----	----	----	9.6	----	----
Amino Siloxane Microemulsion ⁶	----	----	----	----	10.0	----
Comparative Silicone Amino Polyether Block Copolymer Emulsion ⁷	----	----	----	----	----	9.3
DMDM Hydantoin ⁸	0.4	0.4	0.4	0.4	0.4	0.4

1. Standapol ES-3® available from Cognis Corp. of Cincinnati, OH

2. Monamid 705® available from Uniqema of New Castle, DE

3. Monateric CAB-LC® available from Uniquema of New Castle, DE

4. UCARE Polymer JR-30M available from Dow/Amerchol of Midland, MI

5. Crothix ® available from Croda Inc. of Edison, NJ

6. Dow Corning® CE- 8170 AF Microemulsion available from Dow Corning, Midland, MI, concentration based on 2% active silicone level (20% active)

7. Dow Corning® CE 8401 Emulsion available from Dow Corning, Midland, MI, concentration based on 2% active silicone level (21.5% active)

8. Glydant ® available from Lonza, Inc. of Fairlawn, NJ

[00184] Deionized water is added to the mixing vessel. In order to keep the active silicone loading constant throughout testing, it is necessary to adjust the water level added depending on the percent active silicone in the various emulsions used.

15 With moderate agitation, the polyquaternium-10 is dispersed until fully dissolved. This is then heated to 75°C and the PEG-150 pentaerythrityl tetrastearate is added with continual mixing. Heat is decreased to 40°C and sodium lauryl ether sulfate, cocamide DEA cocamidopropyl betaine are added in that order. When completely incorporated, silicone amino polyether block copolymer emulsion is added to the base shampoo.

20 The shampoo is mixed for 5-10 minutes and then DMDM hydantoin is added. The water loss is compensated for and the formulation is mixed for an additional 5 minutes. The final pH of the shampoo formulations are approximately 5.5-6.0.

Example 18 Procedure for Evaluating Hair Conditioners and Shampoos

[00185] Slightly bleached European human hair from International Hair Importer and Products, Inc. is used for testing the conditioners prepared herein. A master hand of hair about eight inches in length is subdivided into a series of individual hair tresses.

Each tress weigh about 2.5 grams. A 0.5 inch (1.27 cm) of the root end of the hair is trimmed and glued to a 2 inch by 2 inch (5.08 cm by 5.08 cm) plastic tab using DUCO CEMENT®. The cement is allowed to dry, and the hair tress is combed and trimmed to a length such that six inches (15.24 cm) of hair extends below the bottom of the plastic tab. A hole is punched in middle of tab about one fourth inch (0.635 cm) from its top. Each tress is rinsed for 15 seconds under a stream of 40 °C tap water. Using a pipette, 1.0 gram of a solution containing nine percent of sodium lauryl sulfate is applied and lathered through the tress for 30 seconds. The tress is rinsed for 30 seconds under running water. Excess water is removed from the tress by passing the tress between the index and middle fingers of the hand. The tresses is placed on a tray covered with paper towels and dried overnight. Each tress is hand combed three times with the narrow teeth of an ACE® comb, and is evaluated using INSTRON™ WET and INSTRON™ DRY COMBING procedures.

[00186] INSTRON procedures are standard, recognized, and industrially acceptable protocols, see for example, US Patents 5,389,364, 5,409,695, 5,419,627, and 5,504,149, all of which are incorporated by reference in their entirety.

[00187] For tests involving conditioners, hair tresses is rinsed with tap water for 30 seconds at 40°C. The test conditioner is applied to the tress in the amount of 0.8 gram, and the tress is stroked for 30 seconds. The tress is rinsed for 30 seconds under tap water at 40°C. Excess water is removed by pulling the tress through the index and middle fingers of the hand. The tresses are allowed to dry separately on a paper towel overnight at room temperature. The tresses are combed once before performing an INSTRON study.

[00188] Dark brown "virgin" European human hair is used for testing the shampoos. A master hank of hair about eight inches in length is subdivided into a series of individual hair tresses. Each tress weighs about 2.5 grams. The top one inch (2.54 cm) portion of the hair tress is trimmed and glued to a 2" x 2" (5.01 x 5.01 cm) plastic tab using DUCOCEMENT™. The cement is allowed to dry and the hair tress is combed and trimmed to a length which allowed six inches (15.2 cm) of hair to extend below the bottom of the plastic tab. Each "virgin" tress is rinsed for thirty seconds with 40°C tap water. The tress is shampooed and lathered with two milliliters of a fifty percent solution of PRELL™ shampoo for sixty seconds by stroking the tress downwardly. The tress is rinsed for sixty seconds with tap water. Excess water is removed from the tress by passing the tress between the index and middle fingers. Instead of employing a commercial brand shampoo for treating the "virgin" tress, a blank shampoo is prepared by combining 450 grams of ammonium lauryl sulfate

(STANDAPOL™ A - 30 percent active) with 450 grams of distilled water. The tress is hand combed and evaluated using the INSTRON™ WET and the INSTRON™ DRY COMBING procedures.

[00189] Wet and dry combing: Wet combing evaluation is done by using ready prepared slightly bleached swatches or oriental hair of 2 g, 25 cm and a Matador® comb, reference 2618/6 – GB. The swatches are pre-treated by washing, using 5 g of the 30% sodium lauryl sulphate (SLS) solution (Empicol LX28/Albright & Wilson), stroking the tresses downward and leaving the surfactant to act for 30 sec, followed by rinsing the swatches for 1 minute with tap water at 37°C, removing the excess of water, allowing the swatches to dry overnight on a paper towel (Room Temperature). The swatches are then treated with solvent to standardise them and remove traces of SLS: and allowed to dry overnight on a paper tissue (Room Temperature). Every new hair batch must undergo, after the washing and pre-treatment, a validation in order to set a baseline for the combability. Three sets of tresses are combed by each of the panellists. After treatment with the shampoo or leave-on conditioner, each panellist takes the top of the tress to be tested in the palm of the hand, holding it with the fingers and combs the tress along the volar forearm of the other hand. The time to detangle a tress is measured in seconds and entered in a table.

[00190] Dry combing evaluation is carried out by running sensory evaluation using a triangular test, which is a known test in sensory evaluation.

[00191] INSTRON™ combing is an industry recognized test for determining hair conditioning by the ease of wet combing and the ease of dry combing. The test employs an INSTRON™ strain gauge which is equipped to measure the force required to comb the hair. Conditioning performance is based on the ability of a particular hair treating formulation such as a shampoo or a hair conditioner to reduce the force required to comb the hair with the INSTRON™ strain gauge. The force is reported as Average Combing Load (ACL). The lower (ACL) value, the better is the conditioning effect imparted by the formulation being tested. Typically, (ACL) base lines are initially established with "untreated" tresses. The Average Combining Load is defined as the area under the force curve divided by the length or distance traveled by the INSTRON™ comb. This number is reported in grams or kilograms of force. The effectiveness of a treatment is the percent change in (ACL) after treatment and this value is calculated as $\% \text{ Change ACL} = \frac{\text{treated hair ACL} - \text{untreated hair ACL}}{\text{untreated ACL}} \times 100 \%$. An effective treatment is a negative number. A positive number indicates that the hair is more difficult to comb than in its untreated state.

[00192] For tests involving a conditioning shampoo, the hair tress is rinsed with tap water at 40 °C for thirty seconds. The test shampoo is applied to the tress in the amount of 0.5 milliliters and lathered for thirty seconds by stroking the tress downwardly. The tress is rinsed for thirty seconds with 40 °C tap water and 0.5 milliliters of the test shampoo are applied to the tress for a second time and lathered for thirty seconds by stroking the tress downwardly. The tress is rinsed for thirty seconds with 40 °C tap water and excess water is removed by passing the tress between the index and middle fingers. For tests involving a hair conditioner, the hair tress is rinsed with tap water at 40 °C for thirty seconds. The test conditioner is applied to the tress in the amount of one milliliter and the tress is stroked for thirty seconds. The tress is rinsed for thirty seconds with 40 °C tap water and excess water is removed by passing the tress between the index and middle fingers.

[00193] According to the INSTRON™ WET COMBING method, each hair tress is soaked for 15-30 minutes in distilled water. Excess water is removed by passing the tress through the index and middle fingers. The tress is untangled by combing the tress by hand three times. The tress is retangled by dipping the tress in distilled water three times and excess water is removed by passing the tress through the index and middle fingers twice. The tress is placed on a hanger and INSTRON™ combed.

[00194] According to the INSTRON™ DRY COMBING method, each hair tress is stored overnight in a constant environment to normalize the water content of the hair. The tress is untangled by combing the tress by hand three times. The tress is retangled by swirling the tress three times clockwise and three times counter-clockwise. The tress is placed on a hanger and INSTRON™ combed.

[00195] Hair gloss evaluation: The test consists of comparing treated pairs of swatches in a shine box according to their level of gloss. A complete description of the apparatus used for this evaluation can be found in US 5419627 which is incorporated by reference in its entirety. Following statistical evaluation of the opinions of the panellists conclusions are drawn.

[00196] Static and fly away evaluation: Static and fly away of hair is designed to measure the ability of various products and formulations to affect the relative static reaction of hair. It is assessed by measuring and comparing the opening angle of hair tresses after dry combing at constant humidity and temperature against a rectangle panel of 45 cm of width and 31 cm of height with drawn increasing angles is realised. A first measurement of the angle is made before combing by aligning the tress on the central line (<bef) and a second measurement of angle is made after having passed the comb 3 times through the swatch (<aft). This is repeated for 5 swatches per

product application. The difference is calculated: (<aft) - (<bef). A statistical t-test is conducted on the 5 values (differences) per product, in order to show significant differences of static behaviour between the different tested products.

Example 19 Skin Cream

- 5 **[00197]** A skin cream composition is prepared by combining the following components utilizing conventional mixing techniques.

Table 3

<u>Formulation</u>	<u>A</u>	<u>B</u>	<u>C</u>
<u>Ingredient</u>	<u>Weight %</u>	<u>Weight %</u>	<u>Weight %</u>
<u>Phase A</u>			
C12-15 Alkyl Benzoate	2.5	2.5	2.5
Example 15	2.0	-	-
Synthetic Beeswax	-	2.0	-
Cyclopentasiloxane (and) PEG-12 Dimethicone Crosspolymer DC® 9011 Silicone Elastomer	10.0	10.0	10.0
Dimethicone and Trisiloxane (DC® 2-1184 Fluid)	6.0	6.0	7.2
<u>Phase B</u>			
Deionized Water	77.0	77.0	77.0
Magnesium Sulfate	1.0	1.0	1.0

- 10 **[00198]** Sensory testing for skin feel attributes is performed on formulations A, B, and C, according to ISO 5495-1983 "Sensory Analysis - Methodology - Paired Comparison" and a book by Meilgaard, Civille, and Carr, entitled 'Sensory Evaluation Techniques, 3rd Edition', CRC Press, Boca Raton, 1999. Attributes is evaluated immediately after rub-in and again 5 minutes later.

What is Claimed is:

1. A personal care composition comprising:
 - i) a silicone resin emulsion comprising:
 - 5 A) 0.5 wt % to 95 wt % of a silicone resin or pressure sensitive adhesive (PSA);
 - B) 0.1 to 90 wt % of a ethylene oxide/propylene oxide block copolymer; and sufficient amount of water to sum to 100 weight percent;
 - ii) at least one personal care ingredient (C); and
 - 10 iii) optionally in a cosmetically acceptable medium.
2. A hair care composition, wherein the composition comprises:
 - i) a silicone resin emulsion comprising:
 - 15 A) 0.5 wt % to 95 wt % of a silicone resin or pressure sensitive adhesive (PSA);
 - B) 0.1 to 90 wt % of a ethylene oxide/propylene oxide block copolymer; and sufficient amount of water to sum to 100 weight percent;
 - ii) at least one personal care ingredient (C); and
 - 20 iii) optionally in a cosmetically acceptable medium.
3. A skin care composition, wherein the composition comprises:
 - i) a silicone resin emulsion comprising:
 - 25 A) 0.5 wt % to 95 wt % of a silicone resin or pressure sensitive adhesive (PSA);
 - B) 0.1 to 90 wt % of a ethylene oxide/propylene oxide block copolymer; and sufficient amount of water to sum to 100 weight percent;
 - ii) at least one personal care ingredient (C); and
 - iii) optionally in a cosmetically acceptable medium.
- 30 4. The composition of any of claims 1 to 3, wherein the silicone emulsion contains a silicone MQ resin.
5. The composition of claim 4, wherein the silicone MQ resin comprises siloxy units of the formula $(R^1_3SiO_{1/2})_a$ and $(SiO_{4/2})_d$, where R^1 is an alkyl group having
35 from 1 to 8 carbon atoms, an aryl group, a carbinol group, or an amino group, with the

proviso that at least 95 mole % of the R¹ groups are alkyl groups, a and d each have a value greater than zero, a + d ≥ 0.8, and the ratio of a/d is 0.5 to 1.5.

5 6. The composition of any of claims 1 to 3, wherein the silicone resin emulsion contains a silsesquioxane resin.

7. The composition of claim 6, wherein the silsesquioxane resin comprises at least 80 mole % of R³SiO_{3/2} units, where R³ is independently a C₁ to C₂₀ hydrocarbyl, a carbinol group, or an amino group.

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8. The composition of claim 7, wherein R³ is methyl, phenyl, propyl, or a combination of these.

15 9. The composition of claim 7, wherein R³ is a mixture of 60 to 80 mole percent phenyl and 20 to 40 mole percent propyl.

10. The composition of any of the preceding claims, wherein the silicone resin emulsion is a water continuous emulsion.

20 11. The composition of any of the preceding claims, where the silicone resin emulsion comprises a PSA that is the reaction product of a hydroxy endblocked polydimethylsiloxane and a hydroxy functional silicate resin.

25 12. The composition of any of the preceding claims, wherein the PSA is a silicone acrylate hybrid composition.

13. The composition of any of the preceding claims, wherein the personal care ingredient (C) is selected from emollients, waxes, moisturizers, surface active materials, thickeners, water phase stabilizing agents, pH controlling agents, 30 preservatives and cosmetic biocides, sebum absorbants, sebum control agents, vegetable extracts, botanical extracts, vitamins, proteins and their derivatives, amino-acids and their derivatives, pigments, colorants, fillers, silicone conditioning agents, cationic conditioning agents, UV absorbers, sunscreen agents, antidandruff agents, antiperspirant agents, deodorant agents, skin protectants, hair dyes, nail care 35 ingredients, fragrances, perfume, antioxidants, oxidizing agents, reducing agents,

propellant gases, fatty alcohols, color care additives, pearlising agents, chelating agents, film formers, styling agents, ceramides, suspending agents, and mixtures thereof.

- 5 14. The composition of any of the preceding claims, wherein the composition is in the form of a cream, a gel, a powder (free flowing powder or pressed), a paste, a solid, a freely pourable liquid, an aerosol, a shampoo, a cream, a rinse-off conditioner, a leave-in conditioner, a hair conditioner, a hair fixative, a hair styling aid, a hair colorant, a hair relaxer, a shower gel, a skin moisturizer, a skin conditioner, a body conditioner, color cosmetic, a lipstick, a foundation, a sun protection product, an antiperspirant, or a deodorant.

15. A method of treating hair or skin comprising apply to hair or skin a personal care composition comprising:

- 15 i) a silicone resin emulsion comprising:
 A) 0.5 wt % to 95 wt % of a silicone resin or pressure sensitive adhesive (PSA);
 B) 0.1 to 90 wt % of a ethylene oxide/propylene oxide block copolymer;
 and sufficient amount of water to sum to 100 weight percent;
- 20 ii) at least one personal care ingredient (C); and
 iii) optionally in a cosmetically acceptable medium.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/027856

A. CLASSIFICATION OF SUBJECT MATTER		
INV.	C09J183/04 A61K8/892	C08L83/12 A61K8/90
	A61Q5/00 A61K8/06	A61Q19/00 C09J183/06
	A61K8/891 C08L83/06	
ADD.		
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) C09J C08L A61Q 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 practicable, search terms used) EPO-Internal, CHEM ABS Data, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
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Y	examples IVB, IVD	4-9,12, 15
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family 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 application or patent 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 15 July 2014		Date of mailing of the international search report 22/07/2014
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Grenouillat, N

INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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