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(54) Title: HAIR CARE COMPOSITION COMPRISING SILICONE GRAFTED STARCH

Drying time differences

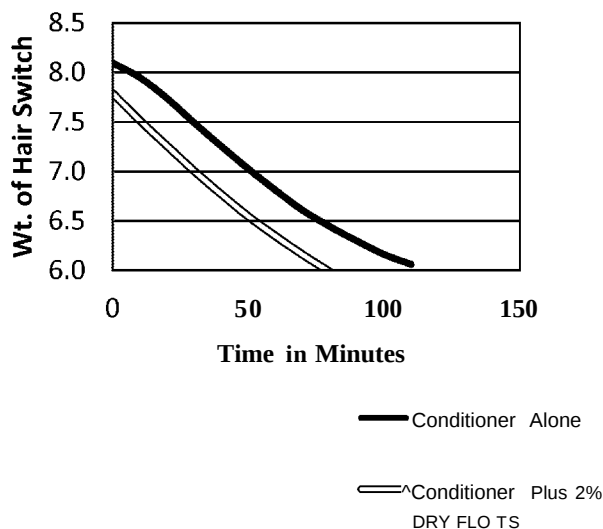


FIGURE 1

(57) Abstract: A hair care composition having from about 0.05% to about 15% of silicone grafted tapioca starch (INCI Tapioca Starch Polymethylsilsesquioxane). The hair care composition further includes a gel matrix phase. The gel matrix has from about 0.1% to about 20% of one or more high melting point fatty compounds, preferably cetyl alcohol, stearyl alcohol, or benenyl alcohol, from about 0.1% to about 10% of a cationic surfactant system, and at least about 20% of an aqueous carrier, by weight of said hair care composition.

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HAIR CARE COMPOSITION COMPRISING SILICONE GRAFTED STARCH

FIELD OF THE INVENTION

5 The present invention relates to a hair care composition that conditions and improves stylability, clean appearance of the hair and decreases drying time of the hair.

BACKGROUND OF THE INVENTION

10 Human hair becomes soiled due to its contact with the surrounding environment and from the sebum secreted by the scalp. The soiling of hair causes it to have a dirty feel and an unattractive appearance.

 Shampooing cleans the hair by removing excess soil and sebum. However, shampooing can leave the hair in a wet, tangled, and generally unmanageable state. Once the hair dries, it is often left in a dry, rough, lusterless, or frizzy condition due to removal of the hair's natural oils.

15 A variety of approaches have been developed to alleviate these after-shampoo problems. One approach is the application of a conditioner after shampooing.

 In order to provide hair conditioning benefits after shampooing, a wide variety of conditioning actives have been proposed. Silicone conditioning agents are known to provide conditioning benefits such as smoothness and combing ease due to the low surface tension of silicone compounds. However, silicone conditioning agents can cause dry feel or frizzy condition to the hair, again, particularly when the hair is dried. It is also desired to have good stylability of hair after washing and drying. Further, it is desired to have improved (faster) drying times. Finally, it is desired to have a long lasting clean appearance of hair, to lengthen the amount of times between hair washing.

BRIEF DESCRIPTION OF THE DRAWINGS

 While the specification concludes with the claims particularly pointing out and distinctly claiming the invention, it is believed that the present invention will be better understood from the following description taken in conjunction with the accompanying drawings in which:

30 Fig. 1 is a graph of hair drying times.

SUMMARY OF THE INVENTION

A hair care composition comprising from about 0.01% to about 5% by weight of the composition of a silicone grafted tapioca starch; **and a gel matrix comprising from about 0.1% to**

about 20% of one or more high melting point fatty compounds, by weight of said hair care composition;
from about 0.1% to about 10% a cationic surfactant system of , by weight of said hair care composition;
and at least about 20% of an aqueous carrier, by weight of said hair care composition.

DETAILED DESCRIPTION OF THE INVENTION

While the specification concludes with claims particularly pointing out and distinctly claiming the invention, it is believed that the present invention will be better understood from the following description.

Herein, "comprising" means that other steps and other ingredients which do not affect the end result can be added. This term encompasses the terms "consisting of" and "consisting essentially of".

All percentages, parts and ratios are based upon the total weight of the compositions of the present invention, unless otherwise specified. All such weights as they pertain to listed ingredients are based on the active level and, therefore, do not include carriers or by-products that may be included in commercially available materials.

Herein, "mixtures" is meant to include a simple combination of materials and any compounds that may result from their combination.

The term "molecular weight" or "M.Wt." as used herein refers to the weight average molecular weight unless otherwise stated.

Hair Care Composition

The hair composition described herein delivers consumer desired conditioning, stylability of hair after washing and drying, improved (faster) drying times, and long lasting clean appearance of hair, to lengthen the amount of times between hair washing. The hair care composition comprises a silicone grafted starch, particularly silicone grafted tapioca starch, in combination with a cationic surfactant and a high melting point fatty compound. Images of mannequin heads treated with Exp. 1 and Comparative Example A were shown to panelists who graded the hair volume of the mannequin heads. The results indicate that statistically the silicone grafted tapioca starch conditioner of Exp. 1 was graded as providing better volume (See Table 1), parody hair feel (See Table 2) to Comparative Exp. A, and improved clean look (See Table 3) over Comparative Exp. A which contains no silicone grafted tapioca starch. Additionally, the drying time of the treated hair switches were measured as loss of water over time and the results indicate that the switches treated with Comparative Exp. A (no silicone grafted tapioca starch) took an additional 30 minutes to air dry to the same dryness level (See Figure 1) as the switches treated with Exp. 1. Conditioners which contain particles, such as

silicone grafted tapioca starch may result in consumer undesirable hair feel, due to the consumer feeling the particles deposited on the hair. However, the results of Table 2 indicate that the conditioner containing silicone grafted tapioca starch (Exp. 1) has a parody hair feel to the conditioner containing no particles (Comparative Exp. A).

A. SILICONE GRAFTED STARCH

The silicone grafted starch is a water insoluble particle (under ambient conditions) that has been modified to improve slip or smooth feel when the starch is applied to a surface. A good combination of benefits is especially realized in using silicone grafted tapioca starch when it is used at a level from about 0.1% to about 5% by weight of the hair care composition, from about 0.1 to about 2% by weight of the hair care composition, from about 0.5 to about 1.5% by weight of the hair care composition, from about 0.5 to about 1% by weight of the hair care composition, from about 2% to about 5% by weight of the hair care composition, and/or from about 1% to about 3% by weight of the hair care composition.

Silicone grafted starches suitable for producing the benefits of consumer desired conditioning, stylability of hair after washing and drying, improved (faster) drying times, and long lasting clean appearance of hair, to lengthen the amount of times between hair washing include the silicone grafted tapioca starches made by Akzo Nobel. The trade name is Dry Flo TS and the INCI name is Tapioca Starch Polymethylsilsesquioxane. It is produced by a reaction of methyl sodium silicate (polymethylsilsesquioxane) and tapioca starch. Tapioca starch is sourced from the Cassava root by standard means known in the art. This silicone grafted tapioca starch is commercially available as CAS no. 68989-12-8. In one embodiment the tapioca starch comprises about 83% amylopectin and about 17% amylase. This is grafted to sodium methyl silicate. The silicone grafted tapioca starch can be formed using any known means, including, but not limited to those methods described in U.S. Patent Nos 7,375,214, 7,799,909, 6,037,466, 2,852,404, 5,672,699, and 5,776,476.

B. CATIONIC SURFACTANT SYSTEM

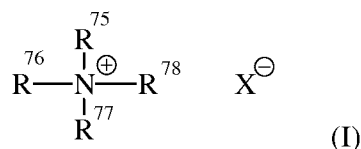
The composition of the present invention comprises a cationic surfactant system. The cationic surfactant system can be one cationic surfactant or a mixture of two or more cationic surfactants. The cationic surfactant system can be selected from: mono-long alkyl quaternized ammonium salt; a combination of mono-long alkyl quaternized ammonium salt and di-long alkyl quaternized ammonium salt; mono-long alkyl amidoamine salt; a combination of mono-long alkyl amidoamine salt and di-long alkyl quaternized ammonium salt, a combination of mono-long alkyl amidoamine salt and mono-long alkyl quaternized ammonium salt.

The cationic surfactant system can be included in the composition at a level by weight of from about 0.1% to about 10%, from about 0.5% to about 8%, from about 0.8 % to about 5%, and from about 1.0% to about 4%.

Mono-long alkyl quaternized ammonium salt

The monoalkyl quaternized ammonium salt cationic surfactants useful herein are those having one long alkyl chain which has from 12 to 30 carbon atoms, from 16 to 24 carbon atoms, and in one embodiment at C18-22 alkyl group. The remaining groups attached to nitrogen are independently selected from an alkyl group of from 1 to about 4 carbon atoms or an alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to about 4 carbon atoms.

Mono-long alkyl quaternized ammonium salts useful herein are those having the formula (I):



wherein one of R^{75} , R^{76} , R^{77} and R^{78} is selected from an alkyl group of from 12 to 30 carbon atoms or an aromatic, alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to about 30 carbon atoms; the remainder of R^{75} , R^{76} , R^{77} and R^{78} are independently selected from an alkyl group of from 1 to about 4 carbon atoms or an alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to about 4 carbon atoms; and X^- is a salt-forming anion such as those selected from halogen, (e.g. chloride, bromide), acetate, citrate, lactate, glycolate, phosphate, nitrate, sulfonate, sulfate, alkylsulfate, and alkyl sulfonate radicals. The alkyl groups can contain, in addition to carbon and hydrogen atoms, ether and/or ester linkages, and other groups such as amino groups. The longer chain alkyl groups, e.g., those of about 12 carbons, or higher, can be saturated or unsaturated. One of R^{75} , R^{76} , R^{77} and R^{78} can be selected from an alkyl group of from 12 to 30 carbon atoms, from 16 to 24 carbon atoms, from 18 to 22 carbon atoms, an/or 22 carbon atoms; the remainder of R^{75} , R^{76} , R^{77} and R^{78} are independently selected from C_1H_3 , C_2H_5 , $\text{C}_2\text{H}_4\text{OH}$, and mixtures thereof; and X is selected from the group consisting of Cl , Br , CH_3OSO_3 , $\text{C}_2\text{H}_5\text{OSO}_3$, and mixtures thereof.

Nonlimiting examples of such mono-long alkyl quaternized ammonium salt cationic surfactants include: behenyl trimethyl ammonium salt; stearyl trimethyl ammonium salt; cetyl trimethyl ammonium salt; and hydrogenated tallow alkyl trimethyl ammonium salt.

Mono-long alkyl amidoamine salt

Mono-long alkyl amines are also suitable as cationic surfactants. Primary, secondary, and tertiary fatty amines are useful. Particularly useful are tertiary amido amines having an alkyl

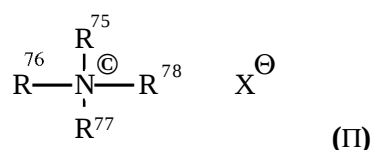
group of from about 12 to about 22 carbons. Exemplary tertiary amido amines include: stearamidopropyldimethylamine, stearamidopropyldiethylamine, stearamidoethyldiethylamine, stearamidoethyldimethylamine, palmitamidopropyldimethylamine, palmitamidopropyldiethylamine, palmitamidoethyldiethylamine, palmitamidoethyldimethylamine, behenamidopropyldimethylamine, behenamidopropyldiethylamine, behenamidoethyldiethylamine, behenamidoethyldimethylamine, arachidamidopropyldimethylamine, arachidamidopropyldiethylamine, arachidamidoethyldiethylamine, arachidamidoethyldimethylamine, diethylaminoethylstearamide. Useful amines in the present invention are disclosed in U.S. Patent 4,275,055, Nachtigal, et al. These amines can also be used in combination with acids such as Δ -glutamic acid, lactic acid, hydrochloric acid, malic acid, succinic acid, acetic acid, fumaric acid, tartaric acid, citric acid, Δ -glutamic hydrochloride, maleic acid, and mixtures thereof; in one embodiment Δ -glutamic acid, lactic acid, and/or citric acid. The amines herein can be partially neutralized with any of the acids at a molar ratio of the amine to the acid of from about 1 : 0.3 to about 1 : 2, and/or from about 1 : 0.4 to about 1 : 1.

Di-long alkyl quaternized ammonium salt

Di-long alkyl quaternized ammonium salt can be combined with a mono-long alkyl quaternized ammonium salt or mono-long alkyl amidoamine salt. It is believed that such combination can provide easy-to rinse feel, compared to single use of a monoalkyl quaternized ammonium salt or mono-long alkyl amidoamine salt. In such combination with a mono-long alkyl quaternized ammonium salt or mono-long alkyl amidoamine salt, the di-long alkyl quaternized ammonium salts are used at a level such that the wt% of the dialkyl quaternized ammonium salt in the cationic surfactant system is in the range of from about 10% to about 50%, and/or from about 30% to about 45%.

The dialkyl quaternized ammonium salt cationic surfactants useful herein are those having two long alkyl chains having 12-30 carbon atoms, and/or 16-24 carbon atoms, and/or 18-22 carbon atoms. The remaining groups attached to nitrogen are independently selected from an alkyl group of from 1 to about 4 carbon atoms or an alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to about 4 carbon atoms.

Di-long alkyl quaternized ammonium salts useful herein are those having the formula (II):



wherein two of R^{75} , R^{76} , R^{77} and R^{78} is selected from an alkyl group of from 12 to 30 carbon atoms or an aromatic, alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to about 30 carbon atoms; the remainder of R^{75} , R^{76} , R^{77} and R^{78} are independently selected from an alkyl group of from 1 to about 4 carbon atoms or an alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to about 4 carbon atoms; and X^- is a salt-forming anion such as those selected from halogen, (e.g. chloride, bromide), acetate, citrate, lactate, glycolate, phosphate, nitrate, sulfonate, sulfate, alkylsulfate, and alkyl sulfonate radicals. The alkyl groups can contain, in addition to carbon and hydrogen atoms, ether and/or ester linkages, and other groups such as amino groups. The longer chain alkyl groups, e.g., those of about 12 carbons, or higher, can be saturated or unsaturated. One of R^{75} , R^{76} , R^{77} and R^{78} can be selected from an alkyl group of from 12 to 30 carbon atoms, from 16 to 24 carbon atoms, from 18 to 22 carbon atoms, and/or 22 carbon atoms; the remainder of R^{75} , R^{76} , R^{77} and R^{78} are independently selected from C_8H_{17} , C_2H_5 , C_2H_4OH , and mixtures thereof; and X is selected from the group consisting of Cl , Br , CH_3OSO_3 , $C_2H_5OSO_3$, and mixtures thereof.

Such dialkyl quaternized ammonium salt cationic surfactants include, for example, dialkyl (14-18) dimethyl ammonium chloride, ditallow alkyl dimethyl ammonium chloride, dihydrogenated tallow alkyl dimethyl ammonium chloride, distearyl dimethyl ammonium chloride, and dicetyl dimethyl ammonium chloride. Such dialkyl quaternized ammonium salt cationic surfactants also include, for example, asymmetric dialkyl quaternized ammonium salt cationic surfactants.

C. HIGH MELTING POINT FATTY COMPOUND

The high melting point fatty compound useful herein have a melting point of $25^\circ C$ or higher, and is selected from the group consisting of fatty alcohols, fatty acids, fatty alcohol derivatives, fatty acid derivatives, and mixtures thereof. It is understood by the artisan that the compounds disclosed in this section of the specification can in some instances fall into more than one classification, e.g., some fatty alcohol derivatives can also be classified as fatty acid derivatives. However, a given classification is not intended to be a limitation on that particular compound, but is done so for convenience of classification and nomenclature. Further, it is understood by the artisan that, depending on the number and position of double bonds, and length and position of the branches, certain compounds having certain required carbon atoms may have a melting point of less than $25^\circ C$. Such compounds of low melting point are not intended to be included in this section. Nonlimiting examples of the high melting point

compounds are found in International Cosmetic Ingredient Dictionary, Fifth Edition, 1993, and CTFA Cosmetic Ingredient Handbook, Second Edition, 1992.

Among a variety of high melting point fatty compounds, fatty alcohols are suitable for use in the composition of the present invention. The fatty alcohols useful herein are those having
5 from about 14 to about 30 carbon atoms, from about 16 to about 22 carbon atoms. These fatty alcohols are saturated and can be straight or branched chain alcohols. Suitable fatty alcohols include, for example, cetyl alcohol, stearyl alcohol, behenyl alcohol, and mixtures thereof.

High melting point fatty compounds of a single compound of high purity can be used. Single compounds of pure fatty alcohols selected from the group of pure cetyl alcohol, stearyl
10 alcohol, and behenyl alcohol can also be used. By "pure" herein, what is meant is that the compound has a purity of at least about 90%, and/or at least about 95%. These single compounds of high purity provide good rinsability from the hair when the consumer rinses off the composition.

The high melting point fatty compound is included in the composition at a level of from
15 about 0.1% to about 20%, from about 1% to about 15%, and/or from about 1.5% to about 8% by weight of the composition, in view of providing improved conditioning benefits such as slippery feel during the application to wet hair, softness and moisturized feel on dry hair.

D. AQUEOUS CARRIER

20 The gel matrix of the hair care composition of the present invention includes an aqueous carrier. Accordingly, the formulations of the present invention can be in the form of pourable liquids (under ambient conditions). Such compositions will therefore typically comprise an aqueous carrier, which is present at a level of from about 20 wt% to about 95 wt%, or from about 60 wt% to about 85 wt%. The aqueous carrier may comprise water, or a miscible mixture of
25 water and organic solvent, and in one aspect may comprise water with minimal or no significant concentrations of organic solvent, except as otherwise incidentally incorporated into the composition as minor ingredients of other components.

The aqueous carrier useful in the present invention includes water and water solutions of lower alkyl alcohols and polyhydric alcohols. The lower alkyl alcohols useful herein are
30 monohydric alcohols having 1 to 6 carbons, in one aspect, ethanol and isopropanol. The polyhydric alcohols useful herein include propylene glycol, hexylene glycol, glycerin, and propane diol.

According to embodiments of the present invention, the hair care compositions may have a pH in the range from about 2 to about 10, at 25°C. In one embodiment, the hair care

composition has a pH in the range from about 2 to about 6, which may help to solubilize minerals and redox metals already deposited on the hair. Thus, the hair care composition can also be effective toward washing out the existing minerals and redox metals deposits, which can reduce cuticle distortion and thereby reduce cuticle chipping and damage.

E. GEL MATRIX

The composition of the present invention comprises a gel matrix. The gel matrix comprises a cationic surfactant, a high melting point fatty compound, and an aqueous carrier.

The gel matrix is suitable for providing various conditioning benefits such as slippery feel during the application to wet hair and softness and moisturized feel on dry hair. In view of providing the above gel matrix, the cationic surfactant and the high melting point fatty compound are contained at a level such that the weight ratio of the cationic surfactant to the high melting point fatty compound is in the range of, from about 1:1 to about 1:10, and/or from about 1:1 to about 1:6.

F. Additional Components

1. Silicone Conditioning Agent

According to embodiments of the present invention, the hair care composition includes a silicone conditioning agent which comprises a silicone compound. The silicone compound may comprise volatile silicone, non-volatile silicones, or combinations thereof. In one aspect, non-volatile silicones are employed. If volatile silicones are present, it will typically be incidental to their use as a solvent or carrier for commercially available forms of non-volatile silicone materials ingredients, such as silicone gums and resins. The silicone compounds may comprise a silicone fluid conditioning agent and may also comprise other ingredients, such as a silicone resin to improve silicone fluid deposition efficiency or enhance glossiness of the hair. The concentration of the silicone compound in the conditioner composition typically ranges from about 0.01 wt% to about 10 wt%, from about 0.1 wt% to about 8 wt%, from about 0.1 wt% to about 5 wt%, or even from about 0.2 wt% to about 3 wt%, for example

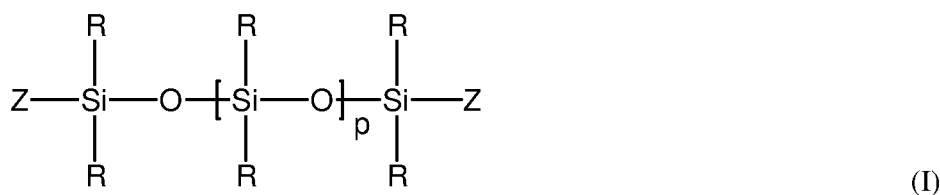
Exemplary silicone compounds include (a) a first polysiloxane which is non-volatile, substantially free of amino groups, and has a viscosity of from about 100,000 mmV^1 to about 30,000,000 mmV^1 ; (b) a second polysiloxane which is non-volatile, substantially free of amino groups, and has a viscosity of from about 5 mmV^1 to about 10,000 mmV^1 ; (c) an aminosilicone having less than about 0.5 wt% nitrogen by weight of the aminosilicone; (d) a silicone

copolymer emulsion with an internal phase viscosity of greater than about 100×10^6 mmV¹, as measured at 25°C; (e) a silicone polymer containing quaternary groups; or (f) a grafted silicone polyol, wherein the silicone compounds (a) - (f) are disclosed in U.S. Patent Application Publication Nos. 2008/0292574, 2007/0041929, 2008/0292575, and 2007/0286837, each of which is incorporated by reference herein in its entirety.

a. First Polysiloxane

The hair care composition of the present invention may comprise a first polysiloxane. The first polysiloxane is non-volatile, and substantially free of amino groups. In the present invention, the first polysiloxanes being "substantially free of amino groups" means that the first polysiloxane contains 0 wt% of amino groups. The first polysiloxane has a viscosity of from about 100,000 mmV¹ to about 30,000,000 mmV¹ at 25°C. For example, the viscosity may range from about 300,000 mmV¹ to about 25,000,000 mmV¹, or from about 10,000,000 mmV¹ to about 20,000,000 mmV¹. The first polysiloxane has a molecular weight from about 100,000 to about 1,000,000. For example, the molecular weight may range from about 130,000 to about 800,000, or from about 230,000 to about 600,000. According to one aspect, the first polysiloxane may be nonionic.

Exemplary first non-volatile polysiloxanes useful herein include those in accordance with the following the general formula (I):



wherein R is alkyl or aryl, and p is an integer from about 1,300 to about 15,000, such as from about 1,700 to about 11,000, or from about 3,000 to about 8,000. Z represents groups which block the ends of the silicone chains. The alkyl or aryl groups substituted on the siloxane chain (R) or at the ends of the siloxane chains Z can have any structure as long as the resulting silicone remains fluid at room temperature, is dispersible, is neither irritating, toxic nor otherwise harmful when applied to the hair, is compatible with the other components of the composition, is chemically stable under normal use and storage conditions, and is capable of being deposited on and conditions the hair. According to an embodiment, suitable Z groups include hydroxy, methyl, methoxy, ethoxy, propoxy, and aryloxy. The two R groups on each silicon atom may

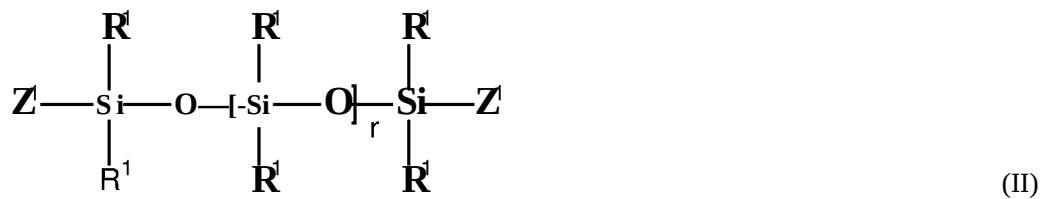
represent the same group or different groups. According to one embodiment, the two R groups may represent the same group. Suitable R groups include methyl, ethyl, propyl, phenyl, methylphenyl and phenylmethyl. Exemplary silicone compounds include polydimethylsiloxane, polydiethylsiloxane, and polymethylphenylsiloxane. According to one embodiment, polydimethylsiloxane is the first polysiloxane. Commercially available silicone compounds useful herein include, for example, those available from the General Electric Company in their TSF451 series, and those available from Dow Corning in their Dow Corning SH200 series.

The silicone compounds that can be used herein also include a silicone gum. The term "silicone gum", as used herein, means a polyorganosiloxane material having a viscosity at 25°C of greater than or equal to 1,000,000 mmV^1 . It is recognized that the silicone gums described herein can also have some overlap with the above-disclosed silicone compounds. This overlap is not intended as a limitation on any of these materials. The "silicone gums" will typically have a mass molecular weight in excess of about 165,000, generally between about 165,000 and about 1,000,000. Specific examples include polydimethylsiloxane, poly(dimethylsiloxane methylvinylsiloxane) copolymer, poly(dimethylsiloxane diphenylsiloxane methylvinylsiloxane) copolymer and mixtures thereof. Commercially available silicone gums useful herein include, for example, TSE200A available from the General Electric Company.

b. Second Polysiloxane

The hair care composition of the present invention may comprise a second polysiloxane. The second polysiloxane is non-volatile, and substantially free of amino groups. In the present invention, the second polysiloxane being "substantially free of amino groups" means that the second polysiloxane contains 0 wt% of amino groups. The second polysiloxane has a viscosity of from about 5 mmV^1 to about 10,000 mmV^1 at 25°C, such as from about 5 mmV^1 to about 5,000 mmV^1 , from about 10 mmV^1 to about 1,000 mmV^1 , or from about 20 mmV^1 to about 350 mmV^1 . The second polysiloxane has a molecular weight of from about 400 to about 65,000. For example, the molecular weight of the second polysiloxane may range from about 800 to about 50,000, from about 400 to about 30,000, or from about 400 to about 15,000. According to one aspect, the second polysiloxane may be nonionic. According to another aspect, the second polysiloxane may be a linear silicone.

Exemplary second non-volatile polysiloxanes useful herein include polyalkyl or polyaryl siloxanes in accordance with the following the general formula (II):



wherein R^1 is alkyl or aryl, and r is an integer from about 7 to about 850, such as from about 7 to about 665, from about 7 to about 400, or from about 7 to about 200. Z^1 represents groups which block the ends of the silicone chains. The alkyl or aryl groups substituted on the siloxane chain (R^1) or at the ends of the siloxane chains Z^1 can have any structure as long as the resulting silicone remains fluid at room temperature, is dispersible, is neither irritating, toxic nor otherwise harmful when applied to the hair, is compatible with the other components of the composition, is chemically stable under normal use and storage conditions, and is capable of being deposited on and conditions the hair. According to an embodiment, suitable Z^1 groups include hydroxy, methyl, methoxy, ethoxy, propoxy, and aryloxy. The two R^1 groups on each silicon atom may represent the same group or different groups. According to one embodiment, the two R^1 groups may represent the same group. Suitable R^1 groups include methyl, ethyl, propyl, phenyl, methylphenyl and phenylmethyl. Exemplary silicone compounds include polydimethylsiloxane, polydiethylsiloxane, and polymethylphenylsiloxane. According to one embodiment, polydimethylsiloxane is the second polysiloxane. Commercially available silicone compounds useful herein include, for example, those available from the General Electric Company in their TSF451 series, and those available from Dow Corning in their Dow Corning SH200 series,

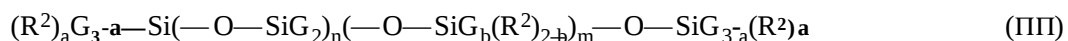
c. Aminosilicone

The hair care composition of the present invention may comprise an amino silicone having less than about 0.5 wt% nitrogen by weight of the aminosilicone, such as less than about 0.2 wt%, or less than about 0.1 wt%, in view of friction reduction benefit. It has been surprisingly found that higher levels of nitrogen (amine functional groups) in the amino silicone tend to result in less friction reduction, and consequently less conditioning benefit from the aminosilicone. The aminosilicone useful herein may have at least one silicone block with greater than 200 siloxane units, in view of friction reduction benefit. The aminosilicones useful herein include, for example, quaternized aminosilicone and non-quaternized aminosilicone.

In one embodiment, the aminosilicones useful herein are water-insoluble. In the present invention, "water-insoluble aminosilicone" means that the aminosilicone has a solubility of 10g or less per 100g water at 25°C, in another embodiment 5g or less per 100g water at 25°C, and in

another embodiment 1g or less per 100g water at 25°C. In the present invention, "water-insoluble aminosilicone" means that the aminosilicone is substantially free of copolyol groups. If copolyol groups are present, they are present at a level of less than 10 wt%, less than 1 wt%, or less than 0.1 wt% by weight of the aminosilicone.

5 According to one embodiment, aminosilicone useful herein are those which conform to the general formula (III):



10 wherein G is hydrogen, phenyl, hydroxy, or Ci-C₈ alkyl, such as methyl; a is an integer having a value from 1 to 3, such as 1; b is an integer having a value from 0 to 2, such as 1; n is a number from 1 to 2,000, such as from 100 to 1,800, from 300 to 800, or from 500 to 600; m is an integer having a value from 0 to 1,999, such as from 0 to 10, or 0; R² is a monovalent radical conforming to the general formula C_{qH 2q}L, wherein q is an integer having a value from 2 to 8
 15 and L is selected from the following groups: —N(R³)₂CH₂—CH₂—N(R³)₂; —N(R³)₂; —N⁺(R³)₃A[−]; —N(R³)CH₂—CH₂—N⁺R³H₂A[−]; wherein R³ is hydrogen, phenyl, benzyl, or a saturated hydrocarbon radical, such as an alkyl radical from about Ci to about C₂₀; A[−] is a halide ion. According to an embodiment, L is —N(CH₃)₂ or —NH₂. According to another embodiment, L is —NH₂.

20 The aminosilicone of the above formula is used at levels by weight of the composition of from about 0.1 wt% to about 5 wt%, alternatively from about 0.2 wt% to about 2 wt%, alternatively from about 0.2 wt% to about 1.0 wt%, and alternatively from about 0.3 wt% to about 0.8 wt%.

According to one embodiment, the aminosilicone may include those compounds
 25 corresponding to formula (III) wherein m=0; a=1; q=3; G=methyl; n is from about 1400 to about 1700, such as about 1600; and L is —N(CH₃)₂ or —NH₂, such as —NH₂. According to another embodiment, the aminosilicone may include those compounds corresponding to formula (III) wherein m=0; a=1; q=3; G=methyl; n is from about 400 to about 800, such as from about 500 to around 600; and L is L is —N(CH₃)₂ or —NH₂, such as —NH₂. Accordingly, the
 30 aforementioned aminosilicones can be called terminal aminosilicones, as one or both ends of the silicone chain are terminated by nitrogen containing group. Such terminal aminosilicones may provide improved friction reduction compared to graft aminosilicones.

Another example of an aminosilicone useful herein includes, for example, quaternized aminosilicone having a tradename KF8020 available from Shinetsu.

The above aminosilicones, when incorporated into the hair care composition, can be mixed with solvent having a lower viscosity. Such solvents include, for example, polar or non-polar, volatile or non-volatile oils. Such oils include, for example, silicone oils, hydrocarbons, and esters. Among such a variety of solvents, exemplary solvents include those selected from the group consisting of non-polar, volatile hydrocarbons, volatile cyclic silicones, non-volatile linear silicones, and mixtures thereof. The non-volatile linear silicones useful herein are those having a viscosity of from about 1 mmV^1 to about 20,000 mmV^1 , such as from about 20 mmV^1 to about 10,000 mmV^1 , at 25°C. According to one embodiment, the solvents are non-polar, volatile hydrocarbons, especially non-polar, volatile isoparaffins, in view of reducing the viscosity of the aminosilicones and providing improved hair conditioning benefits such as reduced friction on dry hair. Such mixtures may have a viscosity of from about 1,000 mPa.s to about 100,000 mPa.s, and alternatively from about 5,000 mPa.s to about 50,000 mPa.s.

d. Silicone Copolymer Emulsion

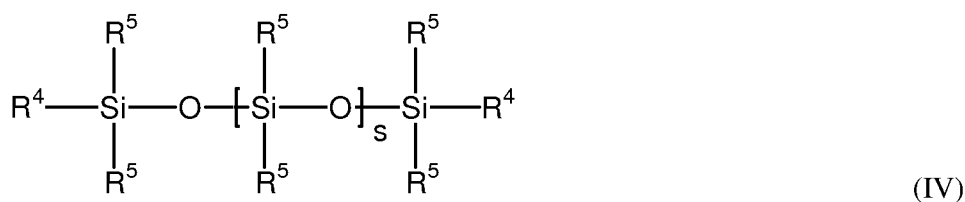
The hair care composition of the present invention may comprise a silicone copolymer emulsion with an internal phase viscosity of greater than about $100 \times 10^6 \text{ mmV}^1$. The silicone copolymer emulsion may be present in an amount of from about 0.1 wt% to about 15 wt%, alternatively from about 0.3 wt% to about 10 wt%, and alternatively about 0.5 wt% to about 5 wt%, by weight of the composition, in view of providing clean feel.

According to one embodiment, the silicone copolymer emulsion has a viscosity at 25°C of greater than about $100 \times 10^6 \text{ mmV}^1$, alternatively greater than about $120 \times 10^6 \text{ mmV}^1$, and alternatively greater than about $150 \times 10^6 \text{ mmV}^1$. According to another embodiment, the silicone copolymer emulsion has a viscosity at 25°C of less than about $1000 \times 10^6 \text{ mmV}^1$, alternatively less than about $500 \times 10^6 \text{ mmV}^1$, and alternatively less than about $300 \times 10^6 \text{ mmV}^1$. To measure the internal phase viscosity of the silicone copolymer emulsion, one may first break the polymer from the emulsion. By way of example, the following procedure can be used to break the polymer from the emulsion: 1) add 10 grams of an emulsion sample to 15 milliliters of isopropyl alcohol; 2) mix well with a spatula; 3) decant the isopropyl alcohol; 4) add 10 milliliters of acetone and knead polymer with spatula; 5) decant the acetone; 6) place polymer in an aluminum container and flatten/dry with a paper towel; and 7) dry for two hours in an 80°C. The polymer can then be tested using any known rheometer, such as, for example, a CarriMed, Haake, or Monsanto rheometer, which operates in the dynamic shear mode. The internal phase viscosity values can be obtained by recording the dynamic viscosity (η') at a 9.900×10^{-3} Hz frequency point. According to one embodiment, the average particle size of the emulsions is less than about 1 micron, such as less than about 0.7 micron.

The silicone copolymer emulsions of the present invention may comprise a silicone copolymer, at least one surfactant, and water.

The silicone copolymer results from the addition reaction of the following two materials in the presence of a metal containing catalyst:

- 5 (i) a polysiloxane with reactive groups on both termini, represented by a general formula (IV):



10 wherein:

R^4 is a group capable of reacting by chain addition reaction such as, for example, a hydrogen atom, an aliphatic group with ethylenic unsaturation (i.e., vinyl, allyl, or hexenyl), a hydroxyl group, an alkoxy group (i.e., methoxy, ethoxy, or propoxy), an acetoxyl group, or an amino or alkylamino group;

- 15 R^5 is alkyl, cycloalkyl, aryl, or alkylaryl and may include additional functional groups such as ethers, hydroxyls, amines, carboxyls, thiols esters, and sulfonates; in an embodiment, R^5 is methyl. Optionally, a small mole percentage of the groups may be reactive groups as described above for R^5 , to produce a polymer which is substantially linear but with a small amount of branching. In this case, the level of R^5 groups equivalent to R^4 groups may be less
20 than about 10% on a mole percentage basis, such as less than about 2%;

s is an integer having a value such that the polysiloxane of formula (IV) has a viscosity of from about 1 mmV^{-1} to about $1 \times 10^6 \text{ mmV}^{-1}$;

and,

- 25 (ii) at least one silicone compound or non-silicone compound comprising at least one or at most two groups capable of reacting with the R^4 groups of the polysiloxane in formula (IV). According to one embodiment, the reactive group is an aliphatic group with ethylenic unsaturation.

- The metal containing catalysts used in the above described reactions are often specific to the particular reaction. Such catalysts are known in the art. Generally, they are materials
30 containing metals such as platinum, rhodium, tin, titanium, copper, lead, etc.

The mixture used to form the emulsion also may contain at least one surfactant. This can include non-ionic surfactants, cationic surfactants, anionic surfactants, alkylpolysaccharides, amphoteric surfactants, and the like. The above surfactants can be used individually or in combination.

5 An exemplary method of making the silicone copolymer emulsions described herein comprises the steps of 1) mixing materials (a) described above with material (b) described above, followed by mixing in an appropriate metal containing catalyst, such that material (b) is capable of reacting with material (a) in the presence of the metal containing catalyst; 2) further mixing in at least one surfactant and water; and 3) emulsifying the mixture. Methods of making such
10 silicone copolymer emulsions are disclosed in U.S. Pat. No. 6,013,682; PCT Application No. WO 01/58986 A1; and European Patent Application No. EP0874017 A2.

A commercially available example of a silicone copolymer emulsion is an emulsion of about 60-70 wt% of divinylmethicone/dimethicone copolymer having an internal phase viscosity of minimum $120 \times 10^6 \text{ mmV}^1$, available from Dow Corning with a tradename
15 HMW2220.

e. Silicone polymer containing quaternary groups

The hair care composition of the present invention may comprise a silicone polymer containing quaternary groups (i.e., a quaternized silicone polymer). The quaternized silicone polymer provides improved conditioning benefits such as smooth feel, reduced friction,
20 prevention of hair damage. Especially, the quaternary group can have good affinity with damaged/colorant hairs. The quaternized silicone polymer is present in an amount of from about 0.1 wt% to about 15 wt%, based on the total weight of the hair conditioning composition. For example, according to an embodiment, the quaternized silicone polymer may be present in an amount from about 0.2 wt% to about 10 wt%, alternatively from about 0.3 wt% to about 5 wt%,
25 and alternatively from about 0.5 wt% to about 4 wt%, by weight of the composition.

The quaternized silicone polymer of the present invention is comprised of at least one silicone block and at least one non-silicone block containing quaternary nitrogen groups, wherein the number of the non-silicone blocks is one greater than the number of the silicone blocks. The silicone polymers correspond to the general structure (V):

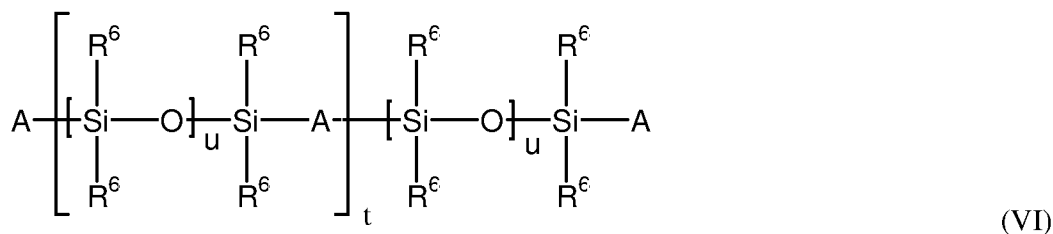


wherein, B is a silicone block having greater than 200 siloxane units; A^1 is an end group which may contain quaternary groups; A^2 is a non-silicone blocks containing quaternary nitrogen

groups; and m is an integer 0 or greater, with the proviso that if m=0 then the A¹ group contains quaternary groups.

Structures corresponding to the general formula, for example, are disclosed in U.S. Pat. No. 4,833,225, in U.S. Patent Application Publication No. 2004/0138400, in U.S. Patent Application Publication No. 2004/0048996, and in U.S. Patent Application Publication No. 2008/0292575.

In one embodiment, the silicone polymers can be represented by the following structure (VI)



wherein, A is a group which contains at least one quaternary nitrogen group, and which is linked to the silicon atoms of the silicone block by a silicon-carbon bond, each A independently can be the same or different; R⁶ is an alkyl group of from about 1 to about 22 carbon atoms or an aryl group; each R⁶ independently can be the same or different; t is an integer having a value of from 0 or greater, for example t can be less than 20, or less than 10; and u is an integer greater than about 200, such as greater than about 250, or greater than about 300, and u may be less than about 700, or less than about 500. According to an embodiment, R⁶ is methyl.

f. Grafted Silicone Copolyol

The hair care composition of the present invention may comprise a grafted silicone copolyol in combination with the quaternized silicone polymer. It is believed that this grafted silicone copolyol can improve the spreadability of the quaternized silicone polymer by reducing the viscosity of the quaternized silicone polymer, and also can stabilize the quaternized silicone polymer in aqueous conditioner matrix. It is also believed that, by such improved spreadability, the hair care compositions of the present invention can provide better dry conditioning benefits such as friction reduction and/or prevention of damage with reduced tacky feel. It has been surprisingly found that the combination of the quaternized silicone polymer, grafted silicone copolyol, and cationic surfactant system comprising di-alkyl quaternized ammonium salt cationic surfactants provides improved friction reduction benefit, compared to a similar combination. Such similar combinations are, for example, a combination in which the grafted

silicone copolyol is replaced with end-capped silicone copolyol, and another combination in which the cationic surfactant system is substantially free of di-alkyl quaternized ammonium salt cationic surfactants.

The grafted silicone copolyol is contained in the composition at a level such that the weight % of the grafted silicone copolyol to its mixture with quaternized silicone copolymer is in the range of from about 1 wt% to about 50 wt%, alternatively from about 5 wt% to about 40 wt%, and alternatively from about 10 wt% to 30 wt%.

The grafted silicone copolyols useful herein are those having a silicone backbone such as dimethicone backbone and polyoxyalkylene substitutions such as polyethylene oxide and/or polypropylene oxide substitutions. The grafted silicone copolyols useful herein have a hydrophilic-lipophilic balance (HLB) value of from about 5 to about 17, such as from about 8 to about 17, or from about 8 to about 12. The grafted silicone copolyols having the same INCI name have a variety of the weight ratio, depending on the molecular weight of the silicone portion and the number of the polyethylene oxide and/or polypropylene oxide substitutions.

According to an embodiment, exemplary commercially available grafted dimethicone copolyols include, for example: those having a tradename Silsoft 430 having an HLB value of from about 9 to about 12 (INCI name "PEG/PPG-20/23 dimethicone") available from GE; those having a tradename Silsoft 475 having an HLB value of from about 13 to about 17 (INCI name "PEG-23/PPG-6 dimethicone"); those having a tradename Silsoft 880 having an HLB value of from about 13 to about 17 (INCI name "PEG-12 dimethicone"); those having a tradename Silsoft 440 having an HLB value of from about 9 to about 12 (INCI name "PEG-20/PPG-23 dimethicone"); those having a tradename DC5330 (INCI name "PEG-15/PPG-15 dimethicone") available from Dow Corning.

The above quaternized silicone polymer and the grafted silicone copolyol may be mixed and emulsified by a emulsifying surfactant, prior to incorporating them into a gel matrix formed by cationic surfactants and high melting point fatty compounds, as discussed below. It is believed that, this pre-mixture can improve behavior of the quaternized silicone polymer and the grafted silicone copolyol, for example, increase the stability and reduce the viscosity to form more homogenized formulation together with the other components. Such emulsifying surfactant can be used at a level of about 0.001 wt% to about 1.5 wt%, alternatively from about 0.005% to about 1.0%, and alternatively from about 0.01 wt% to about 0.5 wt%, based on the total weight of the hair conditioning composition. Such surfactants may be nonionic, and have an HLB value of from about 2 to about 15, such as from about 3 to about 14, or from about 3 to about 10. Commercially available examples of emulsifying surfactant include nonionic

surfactants having an INCI name C12-C14 Pareth-3 and having an HLB value of about 8 supplied from NIKKO Chemicals Co., Ltd. with tradename NIKKOL BT-3.

According to one embodiment, the hair care composition comprises a combination of two or more silicone conditioning agents, along with an EDDS sequestering agent and a gel matrix.

In one embodiment, the hair care composition comprises a polyalkylsiloxane mixture comprising (i) a first polyalkylsiloxane which is non-volatile, substantially free of amino groups, and has a viscosity of from about 100,000 mmV^1 to about 30,000,000 mmV^1 , and (ii) a second polyalkylsiloxane which is non-volatile, substantially free of amino groups, and has a viscosity of from about 5 mmV^1 to about 10,000 mmV^1 ; an aminosilicone having less than about 0.5 wt% nitrogen by weight of the aminosilicone; and a silicone copolymer emulsion with an internal phase viscosity of greater than about $100 \times 10^6 \text{ mmV}^1$, as measured at 25°C. For example, in another embodiment, the hair care composition comprises from about 0.5 wt% to about 10 wt% of a polyalkylsiloxane mixture comprising (i) a first polyalkylsiloxane which is non-volatile, substantially free of amino groups, and has a viscosity of from about 100,000 mmV^1 to about 30,000,000 mm^2s^{-1} , and (ii) a second polyalkylsiloxane which is non-volatile, substantially free of amino groups, and has a viscosity of from about 5 mmV^1 to about 10,000 mmV^1 ; from about 0.1 wt% to about 5 wt% of an aminosilicone having less than about 0.5 wt% nitrogen by weight of the aminosilicone; and from about 0.1 wt% to about 5 wt% of a silicone copolymer emulsion with an internal phase viscosity of greater than about $100 \times 10^6 \text{ mmV}^1$, as measured at 25°C.

In another embodiment, the hair care composition comprises a silicone polymer containing quaternary groups wherein said silicone polymer comprises silicone blocks with greater than about 200 siloxane units; and a grafted silicone copolyol. For example, in another embodiment, the hair care composition comprises from about 0.1 wt% to about 15 wt% of a silicone polymer containing quaternary groups wherein said silicone polymer comprises silicone blocks with greater than about 200 siloxane units; and a grafted silicone copolyol at a level such that the weight % of the grafted silicone copolyol in its mixture with the quaternized silicone polymer is in the range of from about 1 wt% to about 50 wt%.

In yet another embodiment, the hair care composition comprises an aminosilicone having a viscosity of from about 1,000 centistokes to about 1,000,000 centistokes, and less than about 0.5% nitrogen by weight of the aminosilicone; and (2) a silicone copolymer emulsion with an internal phase viscosity of greater than about 120×10^6 centistokes, as measured at 25°C.

2. Other Conditioning Agents

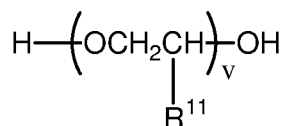
Also suitable for use in the hair care compositions herein are the conditioning agents described by the Procter & Gamble Company in U.S. Pat. Nos. 5,674,478, and 5,750,122. Also suitable for use herein are those conditioning agents described in U.S. Pat. Nos. 4,529,586, 4,507,280, 4,663,158, 4,197,865, 4,217, 914, 4,381,919, and 4,422, 853.

5 a. Organic Conditioning Oils

The hair care compositions of the present invention may also further comprise an organic conditioning oil. According to embodiments of the present invention, the hair care composition may comprise from about 0.05 wt% to about 3 wt%, from about 0.08 wt% to about 1.5 wt%, or even from about 0.1 wt% to about 1 wt%, of at least one organic conditioning oil as the conditioning agent, in combination with other conditioning agents, such as the silicones (described herein). Suitable conditioning oils include hydrocarbon oils, polyolefins, and fatty esters. Suitable hydrocarbon oils include, but are not limited to, hydrocarbon oils having at least about 10 carbon atoms, such as cyclic hydrocarbons, straight chain aliphatic hydrocarbons (saturated or unsaturated), and branched chain aliphatic hydrocarbons (saturated or unsaturated), including polymers and mixtures thereof. Straight chain hydrocarbon oils are typically from about C12 to about C19. Branched chain hydrocarbon oils, including hydrocarbon polymers, typically will contain more than 19 carbon atoms. Suitable polyolefins include liquid polyolefins, liquid poly-oc-olefins, or even hydrogenated liquid poly-oc-olefins. Polyolefins for use herein may be prepared by polymerization of C4 to about C14 or even C6 to about C12. Suitable fatty esters include, but are not limited to, fatty esters having at least 10 carbon atoms. These fatty esters include esters with hydrocarbyl chains derived from fatty acids or alcohols (e.g. mono-esters, polyhydric alcohol esters, and di- and tri-carboxylic acid esters). The hydrocarbyl radicals of the fatty esters hereof may include or have covalently bonded thereto other compatible functionalities, such as amides and alkoxy moieties (e.g., ethoxy or ether linkages, etc.).

3. Nonionic Polymers

The hair care composition of the present invention may also further comprise a nonionic polymer. According to an embodiment, the conditioning agent for use in the hair care composition of the present invention may include a polyalkylene glycol polymer. For example, polyalkylene glycols having a molecular weight of more than about 1000 are useful herein. Useful are those having the following general formula (VIII):



(VIII)

wherein R¹¹ is selected from the group consisting of H, methyl, and mixtures thereof; and v is the number of ethoxy units. The polyalkylene glycols, such as polyethylene glycols, can be included in the hair care compositions of the present invention at a level of from about 0.001 wt% to about 10 wt%. In an embodiment, the polyethylene glycol is present in an amount up to about 5 wt% based on the weight of the composition. Polyethylene glycol polymers useful herein are PEG-2M (also known as Polyox WSR[®] N-10, which is available from Union Carbide and as PEG-2,000); PEG-5M (also known as Polyox WSR[®] N-35 and Polyox WSR[®] N-80, available from Union Carbide and as PEG-5,000 and Polyethylene Glycol 300,000); PEG-7M (also known as Polyox WSR[®] N-750 available from Union Carbide); PEG-9M (also known as Polyox WSR[®] N-3333 available from Union Carbide); and PEG-14 M (also known as Polyox WSR[®] N-3000 available from Union Carbide).

4. Suspending Agent

The hair care compositions of the present invention may further comprise a suspending agent at concentrations effective for suspending water-insoluble material in dispersed form in the compositions or for modifying the viscosity of the composition. Such concentrations range from about 0.1 wt% to about 10 wt%, or even from about 0.3 wt% to about 5.0 wt%.

Suspending agents useful herein include anionic polymers and nonionic polymers. Useful herein are vinyl polymers such as cross linked acrylic acid polymers with the CTFA name Carbomer, cellulose derivatives and modified cellulose polymers such as methyl cellulose, ethyl cellulose, hydroxyethyl cellulose, hydroxypropyl methyl cellulose, nitro cellulose, sodium cellulose sulfate, sodium carboxymethyl cellulose, crystalline cellulose, cellulose powder, polyvinylpyrrolidone, polyvinyl alcohol, guar gum, hydroxypropyl guar gum, xanthan gum, arabia gum, tragacanth, galactan, carob gum, guar gum, karaya gum, carrageenan, pectin, agar, quince seed (*Cydonia oblonga* Mill), starch (rice, corn, potato, wheat), algae colloids (algae extract), microbiological polymers such as dextran, succinoglucan, pulleran, starch-based polymers such as carboxymethyl starch, methylhydroxypropyl starch, alginic acid-based polymers such as sodium alginate, alginic acid propylene glycol esters, acrylate polymers such as sodium polyacrylate, polyethylacrylate, polyacrylamide, polyethyleneimine, and inorganic water soluble material such as bentonite, aluminum magnesium silicate, laponite, hectonite, and anhydrous silicic acid.

Commercially available viscosity modifiers highly useful herein include Carbomers with trade names Carbopol[®] 934, Carbopol[®] 940, Carbopol[®] 950, Carbopol[®] 980, and Carbopol[®] 981, all available from B. F. Goodrich Company, acrylates/steareth-20 methacrylate copolymer with trade name ACRYSOL[™] 22 available from Rohm and Hass, nonoxynyl hydroxyethylcellulose

with trade name Amercell™ POLYMER HM-1500 available from Amerchol, methylcellulose with trade name BENECEL®, hydroxyethyl cellulose with trade name NATROSOL®, hydroxypropyl cellulose with trade name KLUCEL®, cetyl hydroxyethyl cellulose with trade name POLYSURF® 67, all supplied by Hercules, ethylene oxide and/or propylene oxide based polymers with trade names CARBOWAX® PEGs, POLYOX WASRs, and UCON® FLUIDS, all supplied by Amerchol.

Other optional suspending agents include crystalline suspending agents which can be categorized as acyl derivatives, long chain amine oxides, and mixtures thereof. These suspending agents are described in U.S. Pat. No. 4,741,855.

These suspending agents include ethylene glycol esters of fatty acids in one aspect having from about 16 to about 22 carbon atoms. In one aspect, useful suspending agents include ethylene glycol stearates, both mono and distearate, but in one aspect, the distearate containing less than about 7% of the mono stearate. Other suitable suspending agents include alkanol amides of fatty acids, having from about 16 to about 22 carbon atoms, or even about 16 to 18 carbon atoms, examples of which include stearic monoethanolamide, stearic diethanolamide, stearic monoisopropanolamide and stearic monoethanolamide stearate. Other long chain acyl derivatives include long chain esters of long chain fatty acids (e.g., stearyl stearate, cetyl palmitate, etc.); long chain esters of long chain alkanol amides (e.g., stearamide diethanolamide distearate, stearamide monoethanolamide stearate); and glyceryl esters (e.g., glyceryl distearate, trihydroxystearin, tribehenin) a commercial example of which is Thixin® R available from Rheox, Inc. Long chain acyl derivatives, ethylene glycol esters of long chain carboxylic acids, long chain amine oxides, and alkanol amides of long chain carboxylic acids in addition to the materials listed above may be used as suspending agents.

Other long chain acyl derivatives suitable for use as suspending agents include N,N-dihydrocarbyl amido benzoic acid and soluble salts thereof (e.g., Na, K), particularly N,N-di(hydrogenated) CI6, CI8 and tallow amido benzoic acid species of this family, which are commercially available from Stepan Company (Northfield, IL, USA).

Examples of suitable long chain amine oxides for use as suspending agents include alkyl dimethyl amine oxides, e.g., stearyl dimethyl amine oxide.

Other suitable suspending agents include primary amines having a fatty alkyl moiety having at least about 16 carbon atoms, examples of which include palmitamine or stearamine, and secondary amines having two fatty alkyl moieties each having at least about 12 carbon atoms, examples of which include dipalmitoylamine or di(hydrogenated tallow)amine. Still other suitable suspending agents include di(hydrogenated tallow)phthalic acid amide, and

crosslinked maleic anhydride-methyl vinyl ether copolymer.

5. Benefit Agents

In an embodiment, the hair care composition further comprises one or more additional benefit agents. The benefit agents comprise a material selected from the group consisting of anti-dandruff agents, vitamins, lipid soluble vitamins, chelants, perfumes, brighteners, enzymes, sensates, attractants, anti-bacterial agents, dyes, pigments, bleaches, and mixtures thereof.

In one aspect said benefit agent may comprise an anti-dandruff agent. Such anti-dandruff particulate should be physically and chemically compatible with the components of the composition, and should not otherwise unduly impair product stability, aesthetics or performance.

According to an embodiment, the hair care composition comprises an anti-dandruff active, which may be an anti-dandruff active particulate. In an embodiment, the anti-dandruff active is selected from the group consisting of: pyridinethione salts; azoles, such as ketoconazole, econazole, and elubiol; selenium sulphide; particulate sulfur; keratolytic agents such as salicylic acid; and mixtures thereof. In an embodiment, the anti-dandruff particulate is a pyridinethione salt.

Pyridinethione particulates are suitable particulate anti-dandruff actives. In an embodiment, the anti-dandruff active is a 1-hydroxy-2-pyridinethione salt and is in particulate form. In an embodiment, the concentration of pyridinethione anti-dandruff particulate ranges from about 0.01 wt% to about 5 wt%, or from about 0.1 wt% to about 3 wt%, or from about 0.1 wt% to about 2 wt%. In an embodiment, the pyridinethione salts are those formed from heavy metals such as zinc, tin, cadmium, magnesium, aluminium and zirconium, generally zinc, typically the zinc salt of 1-hydroxy-2-pyridinethione (known as "zinc pyridinethione" or "ZPT"), commonly 1-hydroxy-2-pyridinethione salts in platelet particle form. In an embodiment, the 1-hydroxy-2-pyridinethione salts in platelet particle form have an average particle size of up to about 20 microns, or up to about 5 microns, or up to about 2.5 microns. Salts formed from other cations, such as sodium, may also be suitable. Pyridinethione anti-dandruff actives are described, for example, in U.S. Pat. No. 2,809,971; U.S. Pat. No. 3,236,733; U.S. Pat. No. 3,753,196; U.S. Pat. No. 3,761,418; U.S. Pat. No. 4,345,080; U.S. Pat. No. 4,323,683; U.S. Pat. No. 4,379,753; and U.S. Pat. No. 4,470,982.

In an embodiment, in addition to the anti-dandruff active selected from polyvalent metal salts of pyridinethione, the composition further comprises one or more anti-fungal and/or anti-microbial actives. In an embodiment, the anti-microbial active is selected from the group consisting of: coal tar, sulfur, fcharcoal, whitfield's ointment, castellani's paint, aluminum

chloride, gentian violet, octopirox (piroctone olamine), ciclopirox olamine, undecylenic acid and its metal salts, potassium permanganate, selenium sulphide, sodium thiosulfate, propylene glycol, oil of bitter orange, urea preparations, griseofulvin, 8-hydroxyquinoline ciloquinol, thiobendazole, thiocarbamates, haloprogin, polyenes, hydroxypyridone, morpholine, benzylamine, allylamines (such as terbinafine), tea tree oil, clove leaf oil, coriander, palmarosa, berberine, thyme red, cinnamon oil, cinnamic aldehyde, citronellic acid, hinokitol, ichthyol pale, Sensiva SC-50, Elestab HP-100, azelaic acid, lyticase, iodopropynyl butylcarbamate (IPBC), isothiazalinones such as octyl isothiazalinone, and azoles, and mixtures thereof. In an embodiment, the anti-microbial is selected from the group consisting of: itraconazole, ketoconazole, selenium sulphide, coal tar, and mixtures thereof.

In an embodiment, the azole anti-microbials is an imidazole selected from the group consisting of: benzimidazole, benzothiazole, bifonazole, butaconazole nitrate, climbazole, clotrimazole, croconazole, eberconazole, econazole, elubiol, fenticonazole, fluconazole, flutimazole, isoconazole, ketoconazole, lanoconazole, metronidazole, miconazole, neticonazole, omoconazole, oxiconazole nitrate, sertaconazole, sulconazole nitrate, tioconazole, thiazole, and mixtures thereof, or the azole anti-microbials is a triazole selected from the group consisting of: terconazole, itraconazole, and mixtures thereof. When present in the hair care composition, the azole anti-microbial active is included in an amount of from about 0.01 wt% to about 5 wt%, or from about 0.1 wt% to about 3 wt%, or from about 0.3 wt% to about 2 wt%. In an embodiment, the azole anti-microbial active is ketoconazole. In an embodiment, the sole anti-microbial active is ketoconazole.

Embodiments of the hair care composition may also comprise a combination of anti-microbial actives. In an embodiment, the combination of anti-microbial active is selected from the group of combinations consisting of: octopirox and zinc pyrithione, pine tar and sulfur, salicylic acid and zinc pyrithione, salicylic acid and elubiol, zinc pyrithione and elubiol, zinc pyrithione and climbazole, octopirox and climbazole, salicylic acid and octopirox, and mixtures thereof.

In an embodiment, the composition comprises an effective amount of a zinc-containing layered material. In an embodiment, the composition comprises from about 0.001 wt% to about 10 wt%, or from about 0.01 wt% to about 7 wt%, or from about 0.1 wt% to about 5 wt% of a zinc-containing layered material, by total weight of the composition.

Zinc-containing layered materials may be those with crystal growth primarily occurring in two dimensions. It is conventional to describe layer structures as not only those in which all the atoms are incorporated in well-defined layers, but also those in which there are ions or

molecules between the layers, called gallery ions (A.F. Wells "Structural Inorganic Chemistry" Clarendon Press, 1975). Zinc-containing layered materials (ZLMs) may have zinc incorporated in the layers and/or be components of the gallery ions. The following classes of ZLMs represent relatively common examples of the general category and are not intended to be limiting as to the broader scope of materials which fit this definition.

Many ZLMs occur naturally as minerals. In an embodiment, the ZLM is selected from the group consisting of: hydrozincite (zinc carbonate hydroxide), aurichalcite (zinc copper carbonate hydroxide), rosasite (copper zinc carbonate hydroxide), and mixtures thereof. Related minerals that are zinc-containing may also be included in the composition. Natural ZLMs can also occur wherein anionic layer species such as clay-type minerals (e.g., phyllosilicates) contain ion-exchanged zinc gallery ions. All of these natural materials can also be obtained synthetically or formed *in situ* in a composition or during a production process.

Another common class of ZLMs, which are often, but not always, synthetic, is layered double hydroxides. In an embodiment, the ZLM is a layered double hydroxide conforming to the formula $[M^{2+}_{1-x}M^{3+}_x(OH)_2]^{x+} A^{m-}_{x/m} \cdot nH_2O$ wherein some or all of the divalent ions (M^{2+}) are zinc ions (Crepaldi, EL, Pava, PC, Tronto, J, Valim, JB *J. Colloid Interfac. Sci.* 2002, 248, 429-42).

Yet another class of ZLMs can be prepared called hydroxy double salts (Morioka, H., Tagaya, H., Karasu, M, Kadokawa, J, Chiba, K *Inorg. Chem.* 1999, 38, 4211-6). In an embodiment, the ZLM is a hydroxy double salt conforming to the formula $[M^{2+}_{1-x}M^{2+}_{1+x}(OH)_3(i_y)]^+ A^{n-}_{(1=3y)/n} \cdot nH_2O$ where the two metal ions (M^{2+}) may be the same or different. If they are the same and represented by zinc, the formula simplifies to $[Zn_{1+x}(OH)_2]^{2x+} 2x A^{-} \cdot nH_2O$. This latter formula represents (where $x=0.4$) materials such as zinc hydroxychloride and zinc hydroxynitrate. In an embodiment, the ZLM is zinc hydroxychloride and/or zinc hydroxynitrate. These are related to hydrozincite as well wherein a divalent anion replace the monovalent anion. These materials can also be formed *in situ* in a composition or in or during a production process.

In embodiments having a zinc-containing layered material and a pyrrhione or polyvalent metal salt of pyrrhione, the ratio of zinc-containing layered material to pyrrhione or a polyvalent metal salt of pyrrhione is from about 5:100 to about 10:1, or from about 2:10 to about 5:1, or from about 1:2 to about 3:1.

The on-scalp deposition of the anti-dandruff active is at least about 1 microgram/cm². The on-scalp deposition of the anti-dandruff active is important in view of ensuring that the anti-dandruff active reaches the scalp where it is able to perform its function. In an embodiment, the deposition of the anti-dandruff active on the scalp is at least about 1.5 microgram/cm², or at least

about 2.5 microgram/cm², or at least about 3 microgram/cm², or at least about 4 microgram/cm², or at least about 6 microgram/cm², or at least about 7 microgram/cm², or at least about 8 microgram/cm², or at least about 8 microgram/cm², or at least about 10 microgram/cm². The on-scalp deposition of the anti-dandruff active is measured by having the hair of individuals washed with a composition comprising an anti-dandruff active, for example a composition pursuant to the present invention, by trained a cosmetician according to a conventional washing protocol. The hair is then parted on an area of the scalp to allow an open-ended glass cylinder to be held on the surface while an aliquot of an extraction solution is added and agitated prior to recovery and analytical determination of anti-dandruff active content by conventional methodology, such as HPLC.

TEST METHODS

It is understood that the test methods that are disclosed in the Test Methods Section of the present application should be used to determine the respective values of the parameters of Applicants' invention as such invention is described and claimed herein.

A. Wet and Dry Conditioning Test Method

This test method is designed to allow for a subjective evaluation of the basic performance of rinse-off conditioners for both wet combing and dry combing efficacy. In a typical test, 3 to 5 separate formulations may be assessed for their performance. The assessment may include control treatments containing no silicone and an elevated silicone level to facilitate differentiation of performance. The substrate is virgin brown hair obtainable from a variety of sources that is screened to insure uniformity and lack of meaningful surface damage or low lift bleach damaged hair.

B. Treatment Procedure

Four to five 4 gram, 8 inch length switches are combined in a hair switch holder, wet for ten seconds with manipulation with 39±1°C water of hardness (3-10 gpg) to ensure complete and even wetting. The switch is deliquored lightly and Clarifying shampoo is applied uniformly over the length of the combined switches from one inch below the holder towards the tip at a level of 0.1 gram product per one gram of dry hair (0.1 g/g of hair or 2 g for 20 g hair). The switch combo is lathered for 30 seconds by a rubbing motion typical of that used by consumers and rinsed with 39±1°C water flowing at 1.5 gal/min (with the hair being manipulated) for a further

30 seconds to ensure completeness. This step is repeated. The conditioner treatments are applied in the same way as shampoo above (0.1 g/g of hair or reduced to 0.05 g/g of hair for more concentrated prototypes), milked throughout the switch combo for about 30 seconds, left to sit for a further about 30 seconds, and rinsed thoroughly with manipulation, again for about 30 seconds. The switches are deliquored lightly, separated from each other, hung on a rack so that they are not in contact, and detangled with a wide tooth comb.

C. Grading Procedures

For wet combing evaluations using trained graders, the switches are separated on the rack into the five sets with one switch from each treatment included in the grading set. Only two combing evaluations are performed on each switch. The graders are asked to compare the treatments by combing with a narrow tooth nylon comb typical of those used by consumers and rate the ease/difficulty on a zero to ten scale. Ten separate evaluations are collected and the results analyzed by a statistical analysis package for establishing statistical significance. Statistical significance in differences between treatments is determined using Statgraphics Plus 5.1.

For dry combing evaluations, the switches from above are moved into a controlled temperature and humidity room (22°C/50% RH) and allowed to dry overnight. They remain separated as above and panelists are requested to evaluate dry conditioning performance by making three assessments; dry combing ease of the middle of the switch, dry combing ease of the tips, and a tactile assessment of tip feel. The same ten point scale is used for these comparisons. Again, only two panelists make an assessment of each switch set. Statistical analysis to separate differences is performed using the same method as above.

D. Friction Reduction on Dry Hair (IFM)

Dry conditioning performance is also evaluated via hair friction force measurements with an Instron Tester instrument (Instron 5542, Instron, Inc.; Canton, Mass., USA). In a typical procedure, hair switches are first prepared according to treatment protocol C and dried overnight in a controlled temperature and humidity room (22°C/50% RH). The friction force (grams) between the hair surface and a urethane pad along the hair is measured, with three measurements per switch.

EXAMPLES

The following examples illustrate the present invention. The exemplified compositions can be prepared by conventional formulation and mixing techniques. It will be appreciated that other modifications of the present invention within the skill of those in the hair care formulation art can be undertaken without departing from the spirit and scope of this invention. All parts, percentages, and ratios herein are by weight unless otherwise specified. Some components may come from suppliers as dilute solutions. The amount stated reflects the weight percent of the active material, unless otherwise specified.

The following are non-limiting examples of hair care compositions encompassed by embodiments of the present invention.

Rinse-Off Conditioner Examples

Conditioner Formulations	Exp. 1	Exp. 2	Comparative Exp. A
Components	Wt. % as active	Wt. % as active	Wt. % as active
Aminosilicone ¹	0.5	0.5	0.5
Stearamidopropyldimethylamine ²	1.0	1.0	1.0
Ditallow dimethyl ammonium chloride ³	0.75	0.75	0.75
Cetyl alcohol ⁴	1.3	1.3	1.3
Stearyl alcohol ⁵	1.1	1.1	1.1
Oleyl alcohol ⁶	0.25	0.25	0.25
Polysorbate-60 ⁷	0.1	0.1	0.1
Glycerylmonostearate ⁸	0.25	0.25	0.25
Citric acid	0.13	0.13	0.13
EDTA	0.1	0.1	0.1
Disodium EDTA	-	-	-
Preservatives	0.4	0.4	0.4
Perfume	0.35	0.35	0.35
Panthenol	0.05	0.05	0.05
Panthenyl ethyl ether	0.05	0.05	0.05
Tapioca Starch Polymethylsilsesquioxane ⁹	2.0	5.0	-
Deionized Water	q.s. to 100%	q.s. to 100%	q.s. to 100%

1 Terminal aminosilicone which is available from GE having a viscosity of about 10,000mPa·s, and having following formula: $(R_1)_a G_{3-a} - Si(-OSiG_2)_n - O - SiG_{3-a} (R_1)_a$ wherein G is methyl; a is an integer of 1; n is a number from 400 to about 600; R_1 is a monovalent radical conforming to the general formula $C_q H_{2q} L$, wherein q is an integer of 3 and L is $-NH_2$.

2	INCROMECTANT™ AQ, from Croda, also available from Cognis and BASF
3	Available from Croda, BASF, & Cognis
4	Supplier: P&G Chemicals
5	Supplier: P&G Chemicals
6	Available from Croda, BASF, & Cognis
7	secondary materials that comes in with quats
8	secondary material that comes in with quats
9	Dry Flo TS, silicone grafted high MW Tapioca Starch, available from Akzo Nobel

Method of Preparation

The conditioning compositions of Examples as shown above can be prepared by any conventional method well known in the art. They are suitably made by one of the following Methods I or II as shown below.

Method I

Cationic surfactants and high melting point fatty compounds are added to water with agitation, and heated to about 80°C. The mixture is cooled down to about 55°C and gel matrix is formed. Silicones, perfumes, preservatives, zinc carbonates are added to the gel matrix with agitation. Then, if included, polymers are added with agitation at about 30°C. Then, if included, other components are added with agitation.

Method II

Cationic surfactants and high melting point fatty compounds are mixed and heated to from about 66°C to about 85°C to form an oil phase. Separately, water is heated to from about 20°C to about 48°C to form an aqueous phase. In Becomix® direct injection rotor-stator homogenizer, the oil phase is injected and it takes 0.2 second or less for the oils phase to reach to a high shear field having an energy density of from 1.0×10^5 J/m³ to 1.0×10^7 J/m³ where the aqueous phase is already present. A gel matrix is formed at a temperature of above 50°C to about 60°C. Silicones, and preservatives, are added to the gel matrix with agitation. Then, if included, polymers are added with agitation at about 32°C. Then, if included, other components such as perfumes are added with agitation. Then the composition is cooled down to room temperature.

Mousse Formula A	Water, Isobutane, Propane, Polyquaternium 11, PVP, VP/VA Copolymer, Phenoxyethanol, Polyethylene, Chitosan, Fragrance, Polyquaternium 16, Laureth 4, Disodium EDTA, Methylparaben, Panthenol, Panthenyl Ethyl Ether, Cetrimonium Chloride, Formic Acid.
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Test Methods/Results

Mannequin heads were treated with Examples 1 and Comparative Example A. Additionally a mannequin head was treated with Mouse Formula A.

5 A. Volume Test

The mannequin head hair was treated with water until thoroughly saturated. It was then parted in the middle to provide 2 equal sides for treatment. Approximately 10 ml of a clarifying shampoo (no silicone containing shampoo) was applied to each side and thoroughly rinsed. For the conditioner treated hair, 5cc of conditioner was worked into the hair for approximately 15 sec for each side and then rinsed for 1 min. With two separate combs, one per side the hair was combed through to detangle. A blow drier and a round brush were used to dry and style the hair (starting at the bottom and working up) in an equal manner on each side. Then photographs of the hair were taken and shown to panelists.

The mannequin heads were graded for the amount of volume on each side by 19 different panelists on a score of 1 to 10 using the scale below:

1	2	3	4	5	6	7	8	9	10

No Volume Lots of Volume

Table #1 - results of Hair Volume grades					
Panelist#	Mannequin Head J			Mannequin Head C	
	Mousse Formula A	Exp. 1		Comparative Exp. A	Exp. 1
1	6	8		3	9
2	8	8		6	8
3	5	6		5	10
4	6	8		6	8
5	6	7		3	7
6	7	9		4	9
7	8	9		4	8
8	5	7		5	9
9	7	8		6	9
10	7	8		7	8
11	6	9		4	9
12	7	9		5	9
13	6	8		5	9
14	4	7		3	8
15	5	8		3	7
16	4	8		3	9
17	4	8		3	9

18	8	9		5	8
19	6	8		6	8
Average Rating	6.05	8.00		4.53	8.47
	Ttest	3.1002E-07		Ttest	7.607E-10
	Test product significantly different			Test product significantly different	

B. Hair Feel

Hair switches were also treated with the two conditioners Examples 1 and Comparative Ex. A. The hair switches were 6 grams and 8 in. in length. A dosage of 0.1 grams/gram of hair of conditioner was applied to the switch and worked for about 15 sec. and the switch was then rinsed for about 30 sec. and gently excess water was removed while drawing two fingers down the length of the switch. The switches were then allowed to dry overnight. Then panelists graded the switches using a 1 to 5 scale (1=best & 5= worst) for combing ease, smooth feel between the finger tips while pulling down the hair switch, and inter-fiber friction (with the switch between two finger the resistance of hair upon hair is grade while moving the fingers in opposite directions). The grades for the panelists are shown below. Essentially, the hair feel is not significantly different - both hair switches felt smooth, were easy to comb and had a low inter-fiber friction.

Table#2 Hair Feel Results							15
Conditioner Comp. Exp. A	Panelist 1	Panelist 2	Pan 3	Pan 4	Pan 5	Total	St.Dev
Dry Comb	1	2	1	1	1	1.20	0.45
Dry Smooth	1	1	1	1	2	1.20	0.45
Dry IFF	1	1	1	2	1	1.20	0.45
Conditioner Example 1	Panelist 1	Panelist 2	Pan 3	Pan 4	Pan 5	Total	St.Dev
Dry Comb	1	1	2	2	1	1.40	0.55
Dry Smooth	1	1	1	2	1	1.20	0.55
Dry IFF	1	1	1	2	2	1.40	0.55

C. Drying Time

Shown below is loss in weight data for wet hair versus time. The hair switches were treated with the Examples 1 and Comparative Ex. A using the same treatment protocol as used for the hair feel experiment. The drying time of the hair switches was then measured as a loss in weight (water loss) over time. See Figure 1 for results. With air drying, it took an additional 30 min. to get to the same dryness level (6 gr. switch) for the Comparative Example A switch versus the Example 1 switch. The data would suggest that the hair fiber separation accomplished with

silicone grafted tapioca starch lowered both the initial water left on the hair after rinsing and also changed the slope of the line to accomplish faster drying.

D. Clean Hair Look

Clean look/appearance is another benefit that was observed with Exp. 1. Hair was washed with a clarifying shampoo (no cationic deposition polymer or silicone) and then treated with a conditioner - 0.1 grams of conditioner per gram of hair was used to simulate heavy conditioner usage. Then the hair was air dried overnight. The next day olive oil was applied to the hair using a fine mist/pump olive oil sprayer to simulate human sebum soiling. The hair was combed to help distribute the olive oil on the hair and 2 different levels of olive oil were compared to understand the trend. Then panelist were asked to grade the level of oily/greasy appearance versus clean (not clumped) appearance of the hair switches on a 5 point scale, where 1= Very Clean and 5= Very Oily/Greasy. The data below shows a clean look advantage for hair that was treated with Exp. 1 versus hair treated with Comparative Exp. A. This data suggests that silicone grafted tapioca starch may help conditioner users maintain a cleaner appearance to their hair for a longer period of time.

Table #3 Clean Look Data					
Panelist	Applied 0.05 grams of Olive Oil			Applied 0.02 grams of Olive Oil	
	Comparative Exp. A	Exp. 1		Comparative Exp. A	Exp. 1
	A	B		C	D
1	5.00	2.00		4.00	2.00
2	4.00	2.00		4.00	1.00
3	5.00	3.00		4.00	2.00
4	5.00	3.00		3.00	2.00
5	4.00	3.00		4.00	1.00
6	5.00	2.00		4.00	1.00
Avg.	4.67	2.50		3.83	1.50
St. dev	0.52	0.55		0.41	0.55

The hair care compositions of the present invention may be presented in typical hair care formulations. They may be in the form of solutions, dispersion, emulsions, powders, talcs, encapsulated spheres, spongers, solid dosage forms, foams, and other delivery mechanisms. The compositions of the embodiments of the present invention may be hair tonics, leave-on hair products such as treatment and styling products, rinse-off hair products such as shampoos and conditioners, and any other form that may be applied to hair.

According to one embodiment, the hair care compositions may be provided in the form of a porous, dissolvable solid structure, such as those disclosed in U.S. Patent Application Publication Nos. 2009/0232873; and 2010/0179083, which are incorporated herein by reference in their entirety.

5 The hair care compositions are generally prepared by conventional methods such as those known in the art of making the compositions. Such methods typically involve mixing of the ingredients in one or more steps to a relatively uniform state, with or without heating, cooling, application of vacuum, and the like. The compositions are prepared such as to optimize stability (physical stability, chemical stability, photostability) and/or delivery of the active materials. The
10 hair care composition may be in a single phase or a single product, or the hair care composition may be in a separate phases or separate products. If two products are used, the products may be used together, at the same time or sequentially. Sequential use may occur in a short period of time, such as immediately after the use of one product, or it may occur over a period of hours or days.

15 The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as "40 mm" is intended to mean "about 40 mm."

20 Every document cited herein, including any cross referenced or related patent or application, is hereby incorporated herein by reference in its entirety unless expressly excluded or otherwise limited. The citation of any document is not an admission that it is prior art with respect to any invention disclosed or claimed herein or that it alone, or in any combination with any other reference or references, teaches, suggests, or discloses any such invention. Further, to
25 the extent that any meaning or definition of a term in this document conflicts with any meaning or definition of the same term in a document incorporated by reference, the meaning or definition assigned to that term in this document shall govern.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and
30 modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

CLAIMS

What is claimed is:

- 1) A hair care composition comprising:
 - a. from 0.01% to 5% by weight of the composition of a silicone grafted tapioca starch;
 - b. a gel matrix comprising:
 - i. from 0.1% to 20% of one or more high melting point fatty compounds, by weight of said hair care composition;
 - ii. from 0.1% to 10% of a cationic surfactant system, by weight of said hair care composition; and
 - iii. at least 20% of an aqueous carrier, by weight of said hair care composition.
- 2) The hair care composition according to claim 1, wherein said hair care composition comprises from 0.1 to 2% of said silicone grafted tapioca starch, by weight of said hair care composition.
- 3) The hair care composition according to claim 1, wherein said hair care composition comprises from 0.5 to 1.5% of said silicone grafted tapioca starch, by weight of said hair care composition.
- 4) The hair care composition according to claim 1, wherein said hair care composition comprises from 0.5 to 1% of said silicone grafted tapioca starch, by weight of said hair care composition.
- 5) The hair care composition according to claim 1, wherein said hair care composition comprises from 2% to 5% of said silicone grafted tapioca starch, by weight of said hair care composition.
- 6) The hair care composition according to claim 1, wherein said hair care composition comprises from 1% to 3% of said silicone grafted tapioca starch, by weight of said hair care composition.

- 7) The hair care composition according to any of the preceding claims, wherein said silicone grafted tapioca starch is tapioca starch polymethylsilsesquioxane.
- 8) The hair care composition according to any of the preceding claims, wherein said hair care composition further comprises one or more additional conditioning agents.
- 9) The hair care composition according to claim 8, wherein said one or more additional conditioning agents is a silicone.
- 10) The hair care composition according to any of the preceding claims, wherein said hair care composition further comprises one or more additional benefit agents.
- 11) The hair care composition according to claim 10, wherein said one or more additional benefit agents is selected from the group consisting of anti-dandruff agents, vitamins, chelants, perfumes, brighteners, enzymes, sensates, attractants, anti-bacterial agents, dyes, pigments, bleaches, and mixtures thereof.
- 12) A method for conditioning hair comprising the step of applying an effective amount of the hair care composition according to any of the preceding claims to the hair.

1/1

Drying time differences

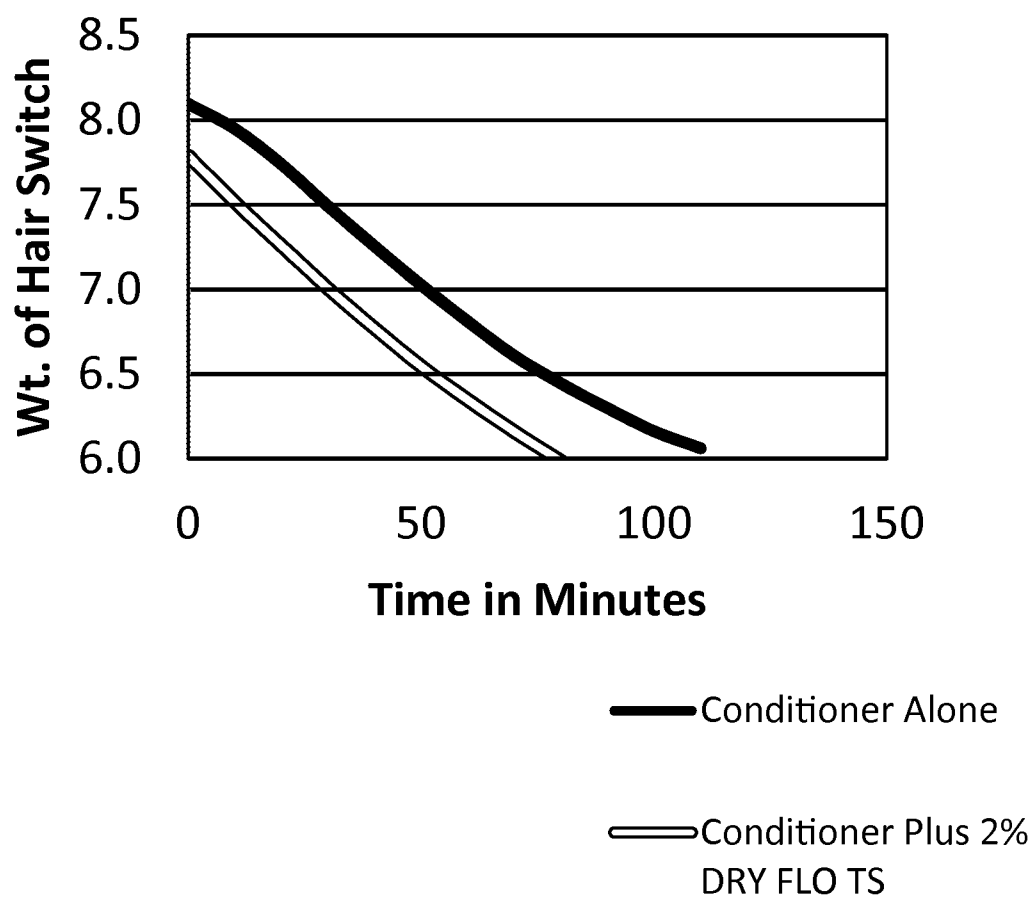


FIGURE 1

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/037320

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K8/34 A61K8/41 A61Q5/12 A61K8/89
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)

A61K A61Q

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 , WPI Data, BEI LSTEIN Data, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 1 557 154 A1 (BEI ERS DORF AG [DE]) 27 July 2005 (2005-07-27) paragraph [0004] - paragraph [0006] paragraph [0048] -----	1-12
Y	wo 2012/104362 A2 (AKZO NOBEL CHEMICALS INT BV [NL] ; RUSSELL MICHAEL [US] ; MARTINO GARY T) 9 August 2012 (2012-08-09) page 19, line 11 - page 20, line 12 -----	1-12

I1 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

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Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2014/037320

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
EP 1557154	AI	27-07-2005	DE	10361853 AI		28-07-2005
			EP	1557154 AI		27-07-2005

W0 2012104362	A2	09-08-2012	CN	103327959 A		25-09-2013
			EP	2670383 A2		11-12-2013
			JP	2014507428 A		27-03-2014
			US	2014030196 AI		30-01-2014
			W0	2012104362 A2		09-08-2012
