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(54) Title: WATER-IN-OIL EMULSION COMPOSITIONS COMPRISING POLYALKYLENE GLYCOL STYLING AGENTS

(57) Abstract: Hair care water-in-oil emulsion compositions comprise a discontinuous phase which comprises a water-soluble polyalkylene glycol having a number average molecular weight of from about 200 to about 900 and from about 4 to about 18 repeating alkylene oxide radicals, wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and a continuous phase which comprises a silicone emulsifier, and a volatile, hydrophobic solvent. Methods for styling hair comprise applying the emulsion compositions to hair.

WATER-IN-OIL EMULSION COMPOSITIONS COMPRISING POLYALKYLENE GLYCOL STYLING AGENTS

FIELD OF THE INVENTION

The present invention is directed to water-in-oil emulsion compositions which include polyalkylene glycol styling agents and which provide for improved hair look and/or feel without causing the hair to look or feel oily or greasy.

BACKGROUND OF THE INVENTION

Hair styling compositions are well known and are commercially available in a variety of forms including mousses, gels, lotions, pumps, or hair sprays. Many of these products contain various hair styling agents to provide temporary hair styling benefits such as body, hold, luster, improved hair feel, and good style retention.

One method of providing temporary hair styling benefits from a styling product involves the use of a hair lotion. Many hair lotion products have been formulated such that the hair styling lotion composition can be applied to wet or damp hair before styling or "setting" the hair. Typically, the hair lotion compositions are aqueous formulations which contain water-soluble styling agents that provide adhesive properties to the hair while the hair is wet and being styled. These styling agents, however, can form hard breakable films on the hair as the styling process is near completion, and this can result in an unacceptable hair style or in a hair style that cannot be restyled unless additional water and/or supplemental styling products are added to the hair. Moreover, the use of aqueous hair lotion compositions which contain water-soluble styling agents can leave the hair feeling unduly sticky and stiff.

Various other aqueous hair lotion compositions have been employed in attempts to improve hair styling performance and hair feel. Oftentimes, however, these hair lotion compositions are applied to wet or damp hair to achieve the desired hair conditioning benefits and generally require reapplication of the composition or another styling product

to maintain or modify the original hairstyle.

A recent method of making a hair styling composition that can be applied to wet and/or dry hair during the styling process is described in JP 8-346608, published June 23, 1998. The hair styling compositions disclosed in this publication contain polyalkylene glyceryl ether styling agents to provide for sustained hair styling performance and aesthetics such as luster to the hair. These polyalkylene glyceryl ether styling agents typically do not readily penetrate into the hair and can remain on the hair fibers to provide hair styling benefits. The polyalkylene glyceryl ether-containing compositions disclosed in this particular publication, however, tend to provide minimal or no hold to the hair, and this can result in poor style achievement and poor style retention performance.

Another hair styling composition that can be applied during the styling process is described in WO 98/38969, published September 11, 1998. The compositions disclosed in this publication use certain styling agents which deliver hair style performance to dry hair, and provide for the dry hair to be restyled without having to reapply the composition and without requiring the use of another styling product. The styling agents described in this reference include anionic, cationic, amphoteric, and nonionic styling polymers, preferably sulfonated anionic styling polymers which have an average molecular weight of from about 500 to about 5,000,000. These styling agents, however, have exceptional cohesive strength which provides for the hair fibers to be firmly held together, and this can cause the dry hair to feel coarse and to be difficult to comb, style and restyle.

Recently, it has become known to utilize hair styling compositions containing polyalkylene glycol styling agents. These hair styling compositions are described in U.S. Application Serial No. 09/305,502 and are advantageous in that they provide for improved dry hair restyling performance without the need to reapply the composition and/or apply additional styling aids. Typically, the compositions of this reference are in the form of oil-in-water emulsions. In certain embodiments, the compositions tend to impart an oily look or feel to the hair.

Accordingly, it would be advantageous to provide the styling strength delivered by the polyalkylene glycol styling agents, without importing an oily look or feel to the hair.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide improved hair care compositions. It is a more specific object of the invention to provide hair care compositions which provide desirable wet and/or dry hair restyling performance. It is a further object of the invention to provide such compositions which also provide good hair look and feel without causing the hair to look or feel oily or greasy. It is a further object of the present invention to provide leave-on hair styling compositions which do not look or feel greasy after the composition has been applied and allowed to dry on the hair.

These and additional objects and advantages are provided by the present invention. In a first embodiment, the present invention is directed to water-in-oil emulsion compositions which comprise (a) a discontinuous phase comprising a water-soluble polyalkylene glycol having a number average molecular weight of from about 200 to about 900 and from about 4 to about 18 repeating alkylene oxide radicals, wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and (b) a continuous phase which comprises (i) a silicone emulsifier, and (ii) a volatile, hydrophobic solvent.

Another embodiment of the present invention is directed to water-in-oil emulsion compositions which comprise (a) a discontinuous phase comprising from about 5% to about 20% of a water-soluble polyalkylene glycol having a number average molecular weight of from about 200 to about 900 and from about 4 to about 18 repeating alkylene oxide radicals, wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and (b) a continuous phase which comprises: (i) a silicone emulsifier, and (ii) a volatile, hydrophobic solvent.

Another embodiment of the present invention is directed to water-in-oil emulsion compositions which comprise (a) a discontinuous phase comprising from about 5% to about 12%, by weight, of a water-soluble polyalkylene glycol having a number average molecular weight of from about 200 to about 900 and from about 4 to about 18 repeating alkylene oxide radicals, wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and (b) a continuous phase which comprises: (i) from about 0.5% to

about 3%, by weight, of a silicone emulsifier, and (ii) from about 8% to about 25%, by weight, of a volatile, hydrophobic solvent.

The invention is also directed to methods for styling hair by applying an effective amount of such compositions to hair.

The water-in-oil emulsion compositions of the present invention provides good styling and restyling properties to hair, without causing the hair to look or feel oily or greasy. Thus, the compositions provide desirable wet and/or dry hair restyling performance, for example, hair styling and restyling without reapplication of the compositions, or application of water and/or an additional styling aid, hair restyling for several days by simply combing or brushing, and/or improved styling aesthetics including frizz and volume control, superior hold, in combination with superior non-oily hair look and feel.

These and additional objects and advantages will be more readily apparent in view of the following detailed description.

DETAILED DESCRIPTION

The water-in-oil emulsion compositions of the present invention comprise polyalkylene glycols which are deposited on the hair. While not intending to be limited by theory, it is believed that the compositions form reformable welds on the hair fibers. As will be understood hereafter, the most preferred embodiments of the present invention relate to leave-on hair styling products.

The term "leave-on" as used herein refers to compositions that contain ingredients that are intended to be deposited and left on the hair for extended periods (e.g., several hours or days) until the ingredients are subsequently removed by water and/or shampooing the hair.

The term "reformable weld" as used herein refers to residues which are left on dry hair and which contain materials that are liquid or semisolid at ambient conditions, and that can remain as a liquid or semisolid after the compositions described herein have been applied and allowed to dry on the hair.

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

All percentages, parts and ratios are by weight of the total composition, unless otherwise specified.

An emulsion is generally a substantially stable mixture of two or more immiscible phases held in suspension by one or more emulsifiers. In addition, emulsions typically consist of a continuous phase and a discontinuous phase. In a water-in-oil emulsion, the oil phase is the continuous phase and the water phase is the discontinuous phase. In its simplest form, the present invention comprises compositions having a continuous phase which comprises a silicon emulsifier and a volatile, hydrophobic solvent and a discontinuous phase which comprises a water-soluble polyalkylene styling agent.

Discontinuous Phase

The discontinuous phase of the emulsion compositions of the present invention comprises a water-soluble liquid or semisolid hair styling agent suitable for being left on dry hair as a liquid or semisolid after the composition has been applied and allowed to dry on the hair. It has been found that low molecular weight polyalkylene glycol liquid or semisolid styling agents can be delivered to the hair as droplets which can be characterized as reformable welds that provide dry hair restyling performance. In particular, the reformable welds allow the hair fibers to be separated by forces such as wind, and then re-adhered using styling techniques such as combing, brushing, or running one's fingers through the hair. This separation/re-adherence property provided by the styling agents defined herein results in improved dry hair restyling performance for several days without leaving the hair feeling unduly sticky or stiff, and without reapplication of the compositions described herein and/or application of additional styling aids on the hair.

Styling agents which are suitable for use in the present compositions comprise water-soluble polyalkylene glycols including, but not limited to, polyalkylene glycol homopolymers, polyethylene/polypropylene glycol copolymers, polyethylene/polypropylene diol copolymers, polyglycerins, and mixtures thereof, and/or their derivatives, and/or mixtures thereof. Within the scope of the present invention, the term "polyalkylene glycols" does not include polyalkylene glyceryl ethers. Additionally,

in this context, "water-soluble" refers to those styling materials that have a solubility in water at 25°C. of greater than 0.6%, preferably greater than 1.0%, more preferably greater than about 1.5% by weight.

Preferred styling agents suitable for use herein include those water-soluble polyalkylene glycols of the formula:

$$A\ (OCH_2CH)_n\text{-}OA$$

$$*$$

$$R$$

wherein each A is individually methyl or hydrogen and wherein each R is individually hydrogen, methyl, or mixtures thereof. When R is hydrogen, 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 4 to about 18, more preferably from about 6 to about 12, and even more preferably from about 8 to about 12.

In one embodiment, the polyalkylene glycol comprises a polyethylene glycol, polypropylene glycol or an alkoxy polyethylene/polypropylene glycol copolymer. Specific examples of suitable polyalkylene glycol polymers include: polyethylene/polypropylene glycol copolymers (e.g., methoxy, ethoxy, propoxy, butoxy, and pentoxy polyethylene/polypropylene glycols), triglycerin, hexaglycerin, PPG-4, PPG-6, PEG-5, PEG-6, PEG-8, PEG-12, PEG-14, PEG-18, and mixtures thereof. Preferred in some embodiments are those polyalkylene glycols which have a number average molecular weight of from about 200 to about 900, specifically from about 300 to about 600, more specifically from about 400 to about 600, and from about 4 to about 18, preferably from about 6 to about 12, more preferably from about 8 to about 12, repeating alkylene oxide radicals wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms. Specific examples of the preferred polyalkylene glycols include, but are not

limited to, PPG-4, wherein R equals methyl and n has an average value of about 4; PEG-8, wherein R equals hydrogen and n has an average value of about 8 (PEG-8 is available as Carbowax 400 from Union Carbide); PEG-12, wherein R equals hydrogen and n has an average value of about 12 (PEG-12 is available as Carbowax 600 from Union Carbide); and PEG-18, wherein R equals hydrogen and n has an average value of about 18 (PEG-18 is available as Carbowax 900 from Union Carbide).

In one embodiment, the compositions are substantially free of polyalkylene glycerol ethers. The term "substantially free" as used herein, unless otherwise specified, refers to preferred negative limitations of some embodiments of the compositions of the present invention, and are particularly directed to the amount and concentration of polyalkylene glyceryl ether styling agents, or derivatives thereof, in the compositions. The terms "substantially free" means that the compositions preferably contain less than an effective amount of such agents when used alone to provide any hair styling performance when the compositions are applied to the hair. In this context, the negative limitations pertain only to those polyalkylene glyceryl ether styling agents which are also a liquid or semi-solid under ambient conditions, and to compositions which do not contain silicone-containing materials. In further embodiments, the compositions preferably contain less than about 5%, more preferably, less than about 2%, even more preferably, less than about 1%, most preferably 0%, of such agents by weight of the compositions.

The water-in-oil emulsion compositions typically comprise the styling agent in an amount which provides the desired styling properties. In one embodiment, the water-in-oil emulsion compositions comprise the styling agent in an amount of from about 5% to about 20%, more specifically in an amount of from about 5% to about 12%, even more specifically in an amount of from about 7% to about 10%, based on the weight of the emulsion composition.

The discontinuous phase of the emulsion compositions of the present invention also comprises any known or otherwise effective solvent or carrier that is suitable for use in formulations intended for topical applications to human hair. The solvent or carrier helps to solubilize or disperse the styling agents described hereinbefore and is substantially non-

soluble in the continuous phase. While it is recognized that the polyalkylene glycol styling agent may be dispersed, rather than solubilized, in this component in the discontinuous phase, the term solvent is employed to describe this component herein. The solvent may comprise one or more solvents provided that the selected styling agent is sufficiently miscible or dispersible in the selected solvent.

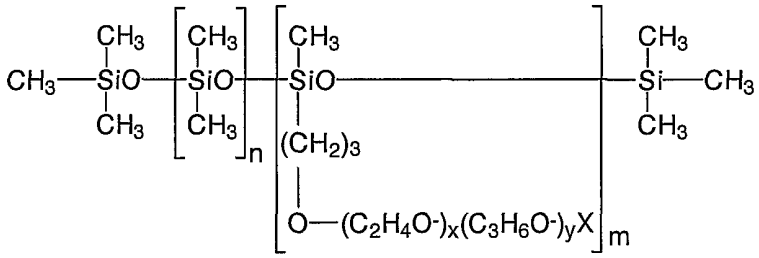
Suitable solvent for the discontinuous phase of the water-in-oil emulsion compositions of the present invention include volatile discontinuous phase solvents. In this context, "volatile discontinuous phase solvent" refers to materials which have a boiling point of less than about 260°C, preferably from about 50°C to about 260°C, more preferably from about 60°C to about 200°C (at about one atmosphere of pressure). Nonlimiting examples of such solvents include water, organic solvents such as C_1-C_6 alkanols, mono- and dialkyl ethers of diethylene (commercially available as Carbitol), and combinations thereof. Specific examples of suitable C_1-C_6 alkanols include, but are not limited to, ethanol, n-propanol, isopropanol, n-butanol, amyl alcohol and mixtures thereof. In one embodiment, the discontinuous phase solvent comprises water. In further embodiments, the discontinuous phase solvent comprises at least 80% water, more preferably at least 90% water. In yet another embodiment, the discontinuous phase solvent consists essentially of water.

The total concentration of the discontinuous phase in the compositions of the present invention will vary with the type of discontinuous phase solvent selected, the type of styling agent used in combination with the solvent, and the solubility or dispersibility of the selected styling agent in the solvent. Preferred total concentration of the discontinuous phase ranges from about 58% to about 95%, more preferably from about 75% to about 92%, and even more preferably from about 80% to about 90%, based on the weight of the emulsion composition.

Continuous Phase

The continuous phase of the emulsion compositions of the present invention comprises a silicone emulsifier. It is believed that the silicone emulsifier provides for improved hair look and feel in the present compositions. Preferred silicone emulsifiers

suitable for use in the present invention include those emulsifiers having the general formula (I)



wherein X is selected from the group consisting of hydrogen, alkyl, alkoxy and acyl groups having from about 1 to about 16 carbon atoms, n is from about 1 to about 100, m is from about 1 to about 40, the molecular weight of the residue $(C_2H_4O\text{-})_x(C_3H_6O\text{-})_yX$ is from about 50 to about 2000, and x and y are such that the weight ratio of oxyethylene:oxypropylene is from about 100:0 to about 0:100.

Silicone emulsifiers which are suitable for use in the present compositions include, but are not limited to, dimethicone copolyols, cetyl dimethicone copolyols, laurylmethicone copolyols, including crosslinked forms thereof, and mixtures thereof. Specific examples of preferred silicone emulsifiers include, but are not limited to, dimethicone copolyols such as DC5225C, DC3225C and DC 5000 (commercially available from Dow Corning Corp.); SF1228, SF1328 and SF1528 (commercially available from General Electric Co.); Silwet L-7602 and Silwet L-7622 (commercially available from CKWitco); and KF6015, KF6016 and KF6017 (commercially available from Shin-Etsu); cetyl dimethicone copolyols such as Abil WE-09, Abil WS-08 and Abil EM 90 (commercially available from Goldsmith); octyldimethicone ethoxyglucoside copolyols such as Belsil SPG 128 VP (commercially available from Wacker); dimethicone copolyol crosspolymers such as KGS21 (commercially available from Shin-

Etsu); and laurylmethicone copolyols such as DC 5200 (commercially available from Dow Corning Corp.).

The water-in-oil emulsion compositions typically comprise the silicone emulsifier in an amount of from about 0.25% to about 7%, more preferably in an amount of from about 0.5% to about 3%, even more preferably in an amount of from about 0.5% to about 1.5%, based on the weight of the emulsion composition.

The continuous phase of the emulsion compositions of the present invention also includes a volatile, hydrophobic solvent. It is recognized that the emulsifier may be dispersed in the hydrophobic solvent, rather than solubilized therein. Nevertheless, this component is referred to as a solvent for the continuous phase described herein. In this context, the term "volatile hydrophobic solvent" means that the solvent exhibits a significant vapor pressure at ambient conditions (e.g., 1 atmosphere at 25°C.), as understood by those skilled in the scientific arts. Specially, the solvent has a boiling point at one atmosphere of about 260°C or less, preferably about 230°C or less, more preferably about 215°C. or less, and most preferably about 210°C or less and a solubility parameter of about 8.5 $(cal/cm^3)^{1/2}$ or less. The solvent component should also be acceptable for topical application to the hair.

Hydrophobic solvents which are suitable for use in the present compositions include, but are not limited to, volatile silicones, branched chain hydrocarbons and mixtures thereof. Preferred silicones useful as the volatile hydrophobic solvent include, but are not limited to, volatile siloxanes such as phenyl pentamethyl disiloxane, phenylethylpentamethyl disiloxane, hexamethyl disiloxane, methoxy propylheptamethyl cyclotetrasiloxane, chloropropyl pentamethyl disiloxane, hydroxypropyl pentamethyl disiloxane, octamethyl cyclotetrasiloxane, decamethyl cylcopentasiloxane, and mixtures thereof. More preferred among the volatile silicones are cyclomethicones, examples of which include hexamethyl disiloxane, octamethyl cyclo tetrasiloxane and decamethyl cyclopentasiloxane, which are commonly referred to as D4 and D5 cyclomethicone, respectively.

Additional examples of preferred volatile silicones, include, but are not limited to,

cyclopentasiloxane (commercially available from General Electric Co. as SF1202), hexymethicone (commercially available from Archimica as Silcare 41M10), caprylil methicone (commercially available from Archimica as Silcare 41M15), stearoxytrimethylsilane and mixtures thereof.

Hydrophobic branched chain hydrocarbons useful as the volatile, hydrophobic solvent herein include, but are not limited to, those containing from about 7 to about 14, more preferably from about 10 to about 13, and most preferably from about 11 to about 12 carbon atoms. Saturated hydrocarbons are preferred, although it is not intended to exclude unsaturated hydrocarbons. Examples of such preferred branched chain hydrocarbons include isoparaffins of the above chain sizes. Specific examples of isoparaffins include Isopar E (C_8-C_9 isoparaffins), Isopar H and K (C_{11}-C_{12} isoparaffins), and Isopar L (C_{11} - C_{13} isoparaffins) or mixtures thereof (all commercially available form Exxon Chemical Co.) Other suitable branched chain hydrocarbons are isododecane and isoundecane. Isododecane is preferred and is commercially available from Presperse, Inc. as Permethyl TM 99A.

The water-in-oil emulsion compositions typically comprise the volatile, hydrophobic solvent in an amount suitable to form a continuous phase with the silicone emulsifier. In one embodiment, the emulsion composition comprises from about 5% to about 35%, more preferably from about 8% to about 25%, even more preferably from about 10% to about 20%, of the volatile hydrophobic solvent, based on the weight of the composition.

The emulsion compositions of the present invention provide hair care compositions which exhibit good dry hair restyling performance and good hair look and feel for extended periods of time without the need to reapply the compositions or to apply any other styling aids. The emulsion compositions of the present invention also provide leave-on hair styling compositions which do not feel oily or greasy, or unduly sticky or stiff after the composition has been applied and allowed to dry. Additionally, the emulsion compositions of the present invention exhibit good styling aesthetics, including frizz and volume control, superior hold, and superior hair look and feel.

Optional Components

In addition to the components described above, the water-in-oil emulsion compositions of the present invention may further comprise one or more optional components known or otherwise effective for use in hair care or personal care products, provided that the optional components are physically and chemically compatible with the components described above, or do not otherwise unduly impair product stability, aesthetics or performance. Nonlimiting examples of such optional components are disclosed in *International Cosmetic Ingredient Dictionary*, Fifth Edition, 1993, and *CTFA Cosmetic Ingredient Handbook*, Second Edition, 1992, both of which are incorporated by reference herein in their entirety.

Optional Styling Polymer

For example, the hereinbefore described water-in-oil emulsion compositions of the present invention may further comprise one or more optional styling polymers which can help provide improved initial hair hold performance. The total concentration of such optional styling polymers ranges from about 0.25% to about 1.5%, preferably from about 0.5% to about 4.0%, by weight of the emulsion compositions. Optional styling polymers for use in combination with the styling agents defined herein include any known or otherwise effective styling polymer. Such optional styling polymers include, but are not limited to, polysaccharide styling polymers, polyvinylpyrrolidone polymers and copolymers, polyvinylcaprolactam polymers and copolymers, hydrophilic polyurethanes, vinylacetate / crotonate / vinylneodecanoate terpolymers, isobutylene ethylmaleimide / hydroxyethylmaleimide copolymers, octylacrylamide / (meth)acrylate / alkylaminoalkyl(meth)acrylate terpolymers, and mixtures thereof, and/or their derivatives, and/or mixtures thereof.

Specific nonlimiting examples of suitable polysaccharide styling polymers include anionic polysaccharides, cationic polysaccharides, and glucosamine polysaccharide derivatives.

Suitable optional cationic polysaccharide styling polymers for use herein include,

but are not limited to, hydroxyalkyl cellulose polymers such as hydroxyethyl cellulose polymers and copolymers, for example copolymers of hydroxyethyl cellulose and diallyldimethyl ammonium chloride (referred to in the industry by CTFA as Polyquaternium-4) such as those commercially available from National Starch (Bridgewater, New Jersey) under the CELQUAT tradename (e.g., CELQUAT L-200 and CELQUAT H-100); and cationic quaternary ammonium-containing polymers, including, for example, homopolymers of hydroxyethyl cellulose reacted with a trimethyl ammonium substituted epoxide, (referred to in the industry by CTFA as Polyquaternium-10) such as those commercially available from Amerchol Corp. (Edison, New Jersey) under the UCARE tradename (e.g. UCARE POLYMER JR-400, and UCARE POLYMER LR-400), and those commercially available from National Starch (Bridgewater, New Jersey) under the CELQUAT tradename (e.g., CELQUAT SC 230 and CELQUAT SC 240).

Also useful are the nonionic cellulosic derivatives, such as methyl and hydroxyalkyl celluloses. More specifically, the hydroxyethyl celluloses, sold under various tradenames (e.g., Natrosol by Aqualon, and Cellosize by Union Carbide) are available in a wide variety of molecular weights and degrees of substitution. Methyl celluloses are available from Dow Chemical Company and hydroxypropyl methylcellulose is available from Aqualon. Examples of such materials include Klucel H, Natrosol 300H, and Cellosize QP-40.

Suitable optional polyvinylpyrrolidone polymers and copolymers for use herein include, but are not limited to, polyvinylpyrrolidone/vinyl acetate copolymers, polyvinylpyrrolidone / polyvinylcaprolactam copolymers, polyvinylpyrrolidone / dialkylaminoalkyl(meth)acrylamide copolymers, polyvinylpyrrolidone / polyvinylcaprolactam / dialkylaminoalkyl(meth)acrylamide terpolymers, polyvinylpyrrolidone / dialkylaminoalkylacrylate copolymers, and polyvinylpyrrolidone / polyvinylcaprolactam / dialkylaminoalkyl(meth)acrylate terpolymers.

Other optional polysaccharide styling polymers for use in combination with the styling agent in the water-in-oil emulsion compositions of the present invention include

those polysaccharide styling polymers which are derived from chitin, a glucosamine polysaccharide that is extracted from the shells of crabs, lobsters, and the like. An example of the use of chitin to make a chitin derivative for use in the compositions herein is the preparation of Chitosan, a water-soluble chitin derivative that is prepared by the known process of deacylation of the chitin compound. The chitin derivatives can also be prepared by other methods well known in the art for the preparation of such materials, including the hydroxypropylation of the chitin compound. The chitin derivatives suitable for use as an optional styling polymer herein include those chitin derivatives which are commercially available in a neutralized or unneutralized form. In the event that a neutralized chitin derivative is used, suitable neutralizing agents include, but are not limited to, lactic acid, pyrrolidone carboxylic acid, and glycolic acid.

Specific examples of preferred chitin derivatives for use as an optional styling polymer include, but are not limited to, Kytamer L and Kytamer PC (both are neutralized Chitosan materials commercially available from the Amerchol Corp., located in Edison, New Jersey); and Hydagen HCMF having a molecular weight (MW) of 50,000 to 1,000,000, Hydagen DCMF having a MW of 300,000 to 2,000,000, and Hydagen CMFP having a MW of 500,000 to 5,000,000 (all are unneutralized Chitosan materials commercially available from the Henkel Corp., located in Hoboken, New Jersey). Kytamer L is the most preferred chitin derivative.

Gelling Agent / Thickener

The water-in-oil emulsion compositions of the present invention may further comprise a gelling agent or thickener in the discontinuous phase to help provide the desired viscosity to the residue which remains on the hair after the composition has been applied and allowed to dry on the hair. The preferred optional gelling agent also helps to provide for improved hair hold performance. Suitable optional gelling agents include any material known or otherwise effective in providing any gelling or measurable viscosity increase to the residue. The concentration of the optional gelling agent in the compositions typically ranges from about 0.1% to about 2%, preferably from about 0.2% to about 0.5%, by weight of the compositions.

Nonlimiting examples of suitable optional gelling agents include crosslinked carboxylic acid polymers; unneutralized crosslinked carboxylic acid polymers; unneutralized modified crosslinked carboxylic acid polymers; crosslinked ethylene/maleic anhydride copolymers; unneutralized crosslinked ethylene/maleic anhydride copolymers (e.g., EMA 81 commercially available from Monsanto); unneutralized crosslinked allyl ether/acrylate copolymers (e.g., Salcare SC90 commercially available from Allied Colloids); unneutralized crosslinked copolymers of sodium polyacrylate, mineral oil, and PPG-1 trideceth-6 (e.g., Salcare SC91 commercially available from Allied Colloids); unneutralized crosslinked copolymers of methyl vinyl ether and maleic anhydride (e.g., Stabileze QM-PVM/MA copolymer commercially available from International Speciality Products); hydrophobically modified nonionic cellulose polymers; hydrophobically modified nonionic cellulose polymers; hydrophobically modified ethoxylate urethane polymers (e.g., Ucare Polyphobe Series of alkali swellable polymers commercially available from Union Carbide); and combinations thereof. In this context, the term "unneutralized" means that the optional polymer and copolymer gelling agent materials contain unneutralized acid monomers.

Preferred optional gelling agents include water-soluble unneutralized crosslinked ethylene/maleic anhydride copolymers, water-soluble unneutralized crosslinked carboxylic acid polymers, and water-soluble hydrophobically modified nonionic cellulose polymers.

Examples of commercially available crosslinked carboxylic acid homopolymers suitable for use herein include the carbomers, which are homopolymers of acrylic acid crosslinked with allyl ethers of sucrose or pentaerytritol. The carbomers are available as the Carbopol® 900 series from B.F. Goodrich. Most preferred are the commercially available carbomers which have unneutralized acid monomers.

Examples of commercially available crosslinked carboxylic acid copolymers suitable for use herein include copolymers of C_{10-30} alkyl acrylates with one or more monomers of acrylic acid, methacrylic acid, or one of their short chain (i.e. C_{1-4} alcohol)

esters, wherein the crosslinking agent is an allyl ether of sucrose or pentaerytritol. These copolymers are known as acrylates/C_{10-30} alkyl acrylate crosspolymers and are commercially available as Carbopol® 1342, Pemulen TR-1, and Pemulen TR-2, from B.F. Goodrich.

Suitable crosslinked carboxylic acid polymers are more fully described in U.S. Patent No. 5,087,445, to Haffey et al., issued February 11, 1992; U.S. Patent No. 4,509,949, to Huang et al., issued April 5, 1985; U.S. Patent No. 2,798,053, to Brown, issued July 2, 1957; which descriptions are incorporated by reference herein. See also, *CTFA International Cosmetic Ingredient Dictionary*, fourth edition, 1991, pp. 12 and 80; which description is also incorporated herein by reference.

Additional Optional Materials

Other optional materials suitable for use in the water-in-oil emulsion compositions of the present invention include, but are not limited to, preservatives, surfactants, conditioning polymers, electrolytes, fatty alcohols, hair dyes, anti-dandruff actives, odor masking agents, pH adjusting agents, perfume oils, perfume solubilizing agents, sequestering agents, emollients, lubricants and penetrates such as various lanolin compounds and protein hydrolysates. The concentration of such optional ingredients generally ranges from zero to about 25%, more typically from about 0.05% to about 15%, even more typically from about 0.1% to about 10%, by weight of the composition.

The water-in-oil emulsion compositions of the present invention are used in conventional ways, including lotions and creams, to provide hair style/hold benefits without having to reapply the compositions for several days. An effective amount of the composition is applied either onto dry or wet hair before the hair is styled. As used herein, "effective amount" means an amount sufficient to provide the hair hold and style performance desired according to the length and texture of the hair. Additionally, the hair styling and hold benefits are provided without causing the hair to look or feel oily or greasy.

The following examples further illustrate various embodiments within the scope of

the present invention. The examples are given solely for the purposes of illustration and are not to be construed as limitations of the present invention, as many variations of the invention are possible without departing from the spirit and scope of the invention. In the examples and throughout the present specification, parts and percentages are by weight unless otherwise indicated. Ingredients are identified by chemical or CFTA name. In the following tables, all such weight percentages, as they pertain to listed ingredients, are based on the commercial products employed, and in the case of commercial products which are not in neat form, the active level is shown in parentheses by weight percent of the composition.

EXAMPLES I-X

The following Examples I-X describe water-in-oil emulsion compositions of the present invention. Each of the exemplified compositions are prepared according to the following procedure. In a suitable vessel, the continuous phase ingredients are combined and mixed until uniform. In a separate vessel, the discontinuous phase ingredients (except perfume) are combined and heated to approximately 50°C until melted. Dispersion of each of the discontinuous phase ingredients should be complete before proceeding to the next addition. The discontinuous phase is then cooled to ambient temperature. Next, the discontinuous phase is slowly added to the continuous phase while maintaining adequate mixing. If needed, the resultant mixture can be homogenized to build viscosity. Each of the exemplified compositions provides improved dry hair restyle performance without the need to reapply the composition or to apply any other additional styling aids.

Table I

Component wt. %	I	II	III	IV	V
Continuous Phase					
Silicone Emulsifier (1) (% active)	10.0 (1.05)	7.0 (0.74)	10.0 (1.05)	7.0 (0.74)	10.0 (1.05)

Component wt. %	I	II	III	IV	V
Solvent:					
Hexymethicone (2)	--	--	5.0	2.5	–
Caprylil Methicone (3)	--	--	--	2.5	2.0
Cyclopentasiloxane (4)	7.0	4.9	2.0	--	5.0
Thickening Agent (5)	--	5.0	--	--	--
Discontinuous Phase					
Water	69.03	70.63	66.03	75.03	67.28
Polyquaternium 4 (6)	--	0.5	--	--	--
PVP/VA (7) (% active)	2.0 (1.0)	--	--	1.0 (0.5)	2.0 (1.0)
PEG-12 (8)	10.0	10	15.0	10	12.0
Isosteareth-20	0.65	0.65	0.4	0.35	0.5
Undeceth-9	--	--	0.25	0.3	--
Benzyl Alcohol	0.5	0.5	0.5	0.5	0.5
Phenoxyethanol	0.3	0.3	0.3	0.3	0.3
Methyl Paraben	0.2	0.2	0.2	0.2	0.2
Disodium EDTA	0.12	0.12	0.12	0.12	0.12
Perfume	0.2	0.2	0.2	0.2	0.1

(1) DC5225C Formulation Aid (10.5% dimethicone copolyol; 89.5% cyclopentasiloxane) supplied by Dow Corning

(2) Silcare 41M10 from Archimica

(3) Silcare 41M15 from Archemica

(4) SF1202 from GE

(5) Dimethicone DC 200 Fluid from Dow Corning

(6) Celquat H-100 from National Starch

(7) Luviscol VA 73W (50% active) from BASF

(8) Carbowax 600 from Union Carbide

Table II

Component wt. %	VI	VII	VIII	IX	X
Continuous Phase					
Silicone Emulsifier:					
Cetyl Dimethicone Copolyol (1) (% active)	10.0 (1.0)	--	--	--	--
Laurylmethicone Copolyol (2)	--	2.0	--	--	--
Dimethicone Copolyol (3) (% active)	--	--	10.0 (1.0)	--	7.0 (0.7)
Dimethicone Copolyol Crosspolymer (4)	--	--	--	5.0 (1.5)	--
Solvent:					
Hexymethicone (5)	1.0	8.0	2.0	--	3.0
Caprylil Methicone (6)	--	--	1.0	--	2.0
Stearoxytrimethylsilane	7.0	1.0	1.0	--	--
Cyclopentasiloxane (7)	--	5.0	6.0	8.0	5.0
Cyclomethicone (3)			9.0		6.3
Polyglyceryl-4-isostearate and Hexyl Laurate (1)	9.0				
Dimethicone (4)				3.5	
Thickening Agent (8)	1.0	--	0.3	--	--
Discontinuous Phase					
Water	68.58	69.53	63.28	74.78	68.78

Component wt. %	VI	VII	VIII	IX	X
Polyquaternium 4 (9)	--	0.5	--	0.5	--
PVP/VA (10) (%active)	2.0 (1.0)	--	--	--	0.5 (0.25)
PEG-12 (11)	9.0	12.0	10.0	10	12.0
PEG - 8 (12)	--	--	5.0	--	--
Isosteareth-20	0.15	0.65	0.5	0.3	0.5
Undeceth-9	0.15	--	--	0.3	--
Benzyl Alcohol	0.5	0.5	0.5	0.5	0.5
Phenoxyethanol	0.3	0.3	--	0.3	0.3
Methyl Paraben	–	0.2	0.2	--	0.2
Disodium EDTA	0.12	0.12	0.12	0.12	0.12
Perfume	0.2	0.2	0.1	0.2	0.1

(1) Abil EM 90 (10% dimethicone copolyol; 90% polyglyceryl-4-Isostearate and Hexyl Laurate)from Goldsmith

(2) DC 5200C from Dow Corning

(3) SF1328 (10% dimethicone copolyol; 90% cyclomethicone) from GE

(4) KGS21 (30% dimethicone copolyol crosspolymer; 70% dimethicone) from Shin-Etsu

(5) Silcare 41M10 from Archimica

(6) Silcare 41M15 from Archemica

(7) SF1202 from GE

(8) Dimethicone F-100 fluid from Lambent

(9) Celquat H-100 from National Starch

(10) Luviscol VA 73W (50% active) from BASF

(11) Carbowax 600 from Union Carbide

(12) Carbowax 400 from Union Carbide

The specific embodiments and examples set forth above are provided for illustrative purposes only and are not intended to limit the scope of the following claims. Additional embodiments of the invention and advantages provided thereby will be apparent to one of ordinary skill in the art and are within the scope of the claims.

WHAT IS CLAIMED IS:

1. A hair care water-in-oil emulsion composition comprising:

a) a discontinuous phase comprising a water-soluble polyalkylene glycol having a number average molecular weight of from about 200 to about 900 and from about 4 to about 18 repeating alkylene oxide radicals, wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and

b) a continuous phase comprising

i) a silicone emulsifier, and

ii) a volatile, hydrophobic solvent.

2. A hair care water-in-oil emulsion composition comprising:

a) a discontinuous phase comprising from about 5% to about 20% of a water-soluble polyalkylene glycol having a number average molecular weight of from about 200 to about 900 and from about 4 to about 18 repeating alkylene oxide radicals, wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and

b) a continuous phase comprising:

i) a silicone emulsifier, and

ii) a volatile, hydrophobic solvent.

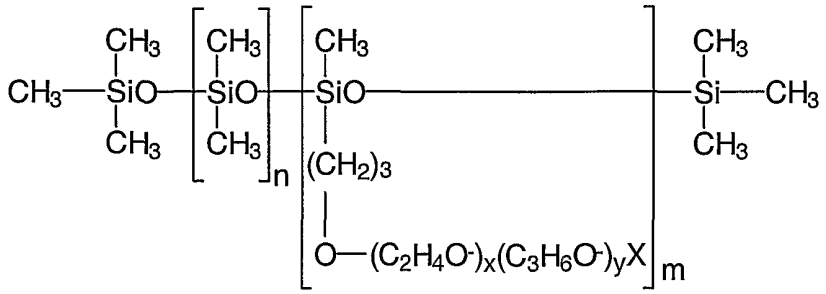
3. The composition of claim 2, wherein the water-soluble polyalkylene glycol comprises polyethylene glycol, polypropylene glycol or alkoxy polyethylene/polypropylene glycol copolymer.

4. The composition of claim 3, wherein the water-soluble polyalkylene glycol is selected from the group consisting of ethoxy polyethylene/polypropylene glycol copolymers, methoxy polyethylene/polypropylene glycol copolymers, propoxy polyethylene/polypropylene glycol copolymers, butoxy polyethylene/polypropylene glycol copolymers, pentoxy polyethylene/polypropylene glycol copolymers, triglycerin, hexglycerin, PPG-4, PPG-6, PEG-5, PEG-6, PEG-8, PEG-12, PEG-14, PEG-18, and mixtures thereof.

5. The composition of claim 2, wherein the composition comprises from about 5% to about 12% by weight of the water-soluble polyalkylene glycol.

6. The composition of claim 2, wherein the composition comprises from about 7% to about 10% by weight of the water-soluble polyalkylene glycol.

7. The composition of claim 2, wherein the silicone emulsifier has the general formula (I)



wherein X is selected from the group consisting of hydrogen, alkyl, alkoxy and acyl groups having from about 1 to about 16 carbon atoms, n is from about 1 to about 100, m is from about 1 to about 40, the molecular weight of the residue $(C_2H_4O-)_x(C_3H_6O-)_yX$ is from about 50 to about 2000, and x and y are such that the weight ratio of oxyethylene:oxypropylene is from about 100:0 to about 0:100.

8. The composition of claim 7, wherein the silicone emulsifier comprises dimethicone copolyol, laurylmethicone copolyol, cetyl dimethicone copolyol, or mixtures thereof.

9. The composition of claim 2, wherein the composition comprises from about 0.25% to about 7% by weight of the silicone emulsifier.

10. The composition of claim 2, wherein the composition comprises from about 0.5% to about 3% by weight of the silicone emulsifier.

11. The composition of claim 2, wherein the volatile, hydrophic solvent comprises a volatile silicone, a volatile C_7-C_{14} branched hydrocarbon, or mixtures thereof.

12. The composition of claim 11, wherein the volatile, hydrophobic solvent is selected from the group consisting of phenyl pentamethyl disiloxane, phenylethylpentamethyl disiloxane, hexamethyl disiloxane, methoxy propylheptamethyl cyclotetrasiloxane, chloropropyl pentamethyl disiloxane, hydroxypropyl pentamethyl disiloxane, octamethyl cyclotetrasiloxane, decamethyl cylcopentasiloxane, hexymethicone, caprylil methicone, cyclopentasiloxane, stearoxytrimethylsilane, isoparaffins, isododecane and mixtures thereof.

13. The composition of claim 2, wherein the composition comprises from about 5% to about 35% by weight of the volatile, hydrophobic solvent.

14. The composition of claim 2, wherein the composition further comprises a polysaccharide styling polymer.

15. The composition of claim 2, wherein the composition further comprises a styling polymer selected from the group consisting of polyvinylpyrrolidone polymers and copolymers, polyvinylcaprolactam polymers and copolymers, hydrophilic polyurethanes, vinylacetate / crotonate / vinylneodecanoate terpolymers, isobutylene ethylmaleimide / hydroxyethylmaleimide copolymers, octylacrylamide / (meth)acrylate / alkylaminoalkyl(meth)acrylate terpolymers, and mixtures thereof.

16. A water-in-oil emulsion composition comprising:

a) a discontinuous phase comprising from about 5% to about 12%, by weight, of a water-soluble polyalkylene glycol having a number average molecular weight of from about 200 to about 900 and from about 4 to about 18 repeating alkylene oxide radicals, wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and

b) a continuous phase comprising:

i) from about 0.5% to about 3%, by weight, of a silicone emulsifier, and

ii) from about 8% to about 25%, by weight, of a volatile, hydrophobic solvent.

17. A method for styling hair, which method comprises applying an effective amount of the composition of claim 1 to the hair.

18. A method for styling hair, which method comprises applying an effective amount of

the composition of claim 2 to the hair.

19. A method for styling hair, which method comprises applying an effective amount of the composition of claim 16 to the hair.