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(54) Titre : COMPOSITION CAPILLAIRE REVITALISANTE COMPRENANT UN POLYMERE EPAISSISSANT ET UN  
SURFACTIF CATIONIQUE

(54) Title: HAIR CONDITIONING COMPOSITION COMPRISING THICKENING POLYMER AND CATIONIC  
SURFACTANT

(57) **Abrégé/Abstract:**

Disclosed is a hair conditioning composition comprising by weight: (a) from about 0.01 % to about 10% of a thickening polymer; (b) from about 0.05% to about 10% of a cationic surfactant; and (c) an aqueous carrier; and wherein the composition is substantially free of a water-insoluble high melting point oily compound. The composition of the present invention can provide conditioning benefits such as softness and smoothness while leaving the hair with a clean feel.

**ABSTRACT**

Disclosed is a hair conditioning composition comprising by weight: (a) from about 0.01% to about 10% of a thickening polymer; (b) from about 0.05% to about 10% of a cationic surfactant; and (c) an aqueous carrier; and wherein the composition is substantially free of a water-insoluble high melting point oily compound. The composition of the present invention can provide conditioning benefits such as softness and smoothness while leaving the hair with a clean feel.

## **HAIR CONDITIONING COMPOSITION COMPRISING THICKENING POLYMER AND CATIONIC SURFACTANT**

### Field of Invention

The present invention relates to a hair conditioning composition comprising a thickening polymer, a cationic surfactant, and the composition being substantially free of water-insoluble high melting point oily compounds. The hair conditioning composition of the present invention can provide conditioning benefits such as softness and smoothness, while leaving the hair with a clean feel.

### Background of the Invention

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. The soiling of the hair necessitates shampooing with frequent regularity.

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 and other natural conditioning and moisturizing components. The hair can further be left with increased levels of static upon drying, which can interfere with combing and result in a condition commonly referred to as "fly-away hair", or contribute to an undesirable phenomena of "split ends", particularly for long hair.

A variety of approaches have been developed to condition the hair. A common method of providing conditioning benefit to the hair is through the use of hair conditioning agents such as cationic surfactants and polymers, high melting point oily compounds, low melting point oils, silicone compounds, and mixtures thereof. Most of these conditioning agents are known to provide various conditioning benefits such as moisturized feel, softness, and static control to the hair.

A common method of providing conditioning benefit to the hair is through the use of hair conditioning agents such as cationic surfactants and polymers, silicone conditioning agents, hydrocarbon oils, and fatty alcohols. Cationic surfactants and polymers, hydrocarbon oils and fatty alcohols are known to enhance hair shine and provide moistness, softness, and static control

to the hair. However, such components can also provide greasy or waxy feeling on wet and dry hair.

Furthermore, most of these conditioning agents are also known to weigh down the hair, when these conditioning agents are included in a hair conditioning composition. The weighed down hair gives an appearance of reduced bulk hair volume. For consumers who desire maintaining or increasing hair volume such as consumers having fine hair, the effect of hair weighing down is not desirable. The term "Increasing hair volume" as used herein is not equal to fly-away hair. Fly-away hair is due to the increased level of static, and represents volume increase of only very minor amount of the hair as a whole, and is not desirable. On the other hand, increasing hair volume as used herein relates to increase of the bulk of the hair volume. Consumers having fine hair have the desire to achieve increased hair volume while controlling undesirable fly-away of the hair.

Based on the foregoing, there remains a desire for hair conditioning compositions which provide conditioning benefits such as softness and smoothness, while leaving the hair with a clean feel.

There also exists a desire for hair conditioning compositions being easy to rinse-off, when the compositions are in the form of rinse-off products.

There further exists a desire for hair conditioning compositions which provide the above benefits, while not weighing down the hair.

None of the existing art provides all of the advantages and benefits of the present invention.

#### Summary of the Invention

The present invention is directed to a hair conditioning composition comprising by weight:

- (a) from about 0.01% to about 10% of a thickening polymer;
- (b) from about 0.05% to about 10% of a cationic surfactant; and
- (c) an aqueous carrier;

and wherein the composition is substantially free of a water-insoluble high melting point oily compound.

The composition of the present invention can provide conditioning benefits such as softness and smoothness, while leaving the hair with a clean feel.

These and other features, aspects, and advantages of the present invention will become better understood from a reading of the following description, and appended claims.

All documents cited are, in relevant part, incorporated herein by reference; the citation of any document is not to be construed as an admission that it is prior art with respect to the present invention.

#### 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.

#### COMPOSITIONS

The hair conditioning composition of the present invention comprises by weight:

- (a) from about 0.01% to about 10% of a thickening polymer;
- (b) from about 0.05% to about 10% of a cationic surfactant; and
- (c) an aqueous carrier;

and wherein the composition is substantially free of a water-insoluble high melting point oily compound.

The composition of the present invention can provide conditioning benefits such as softness and smoothness, while leaving the hair with a clean feel. The composition of the present invention can be easy to rinse-off, when the composition is in the form of rinse-off products. The compositions of the present invention can provide the above benefits, while not weighing down the hair.

In the present invention, the composition being "substantially free of water-insoluble high melting point oily compound" means that the composition includes 1.0% or less, preferably 0.5% or less, more preferably 0.1% or less, still more preferably 0% of water-insoluble high melting point oily compounds. The water-insoluble high melting point oily compounds herein are those having a melting point of at least about 25°C, and a solubility in water at 25°C of less than about

1g/100g water, preferably less than about 0.5g/100g water, more preferably less than about 0g/100g water. Such water-insoluble high melting point oily compound include, for example, fatty alcohols such as cetyl alcohol and stearyl alcohol, fatty acids such as stearic acid, fatty alcohol derivatives and fatty acid derivatives such as cetyl palmitate, hydrocarbons such as waxes, steroids such as cholesterol, and mixtures thereof.

In one preferred embodiment of the present invention, the composition (Composition A) comprises by weight:

- (a) from about 0.01% to about 10% of the thickening polymer, preferably the thickening polymer comprising a cationic crosslinked polymer and a cellulose polymer;
- (b) from about 0.05% to about 10% of the cationic surfactant; and
- (c) an aqueous carrier;

and wherein the composition is substantially free of a water-insoluble high melting point oily compound.

Preferably the composition A further comprises a silicone compound. The composition A may further contain a humectant. The composition A may also contain a low melting point oil.

The composition A can provide conditioning benefits such as slippery feel on wet hair, in addition to the benefits such as softness and smoothness while leaving the hair with a clean feel as described above.

#### THICKENING POLYMER

The compositions of the present invention comprise a thickening polymer. The thickening polymers useful herein are those which can provide appropriate viscosity and rheology properties to the composition, so that the composition of the present composition has a suitable viscosity, preferably from about 100 cps to about 100,000 cps, more preferably from about 1,000 cps to about 50,000cps. The viscosity herein can be suitably measured by Brookfield RVT at a shear rate of  $2 \cdot s^{-1}$  at 26.7°C.

In the composition A, the thickening polymer is included in the composition of the present invention at a level by weight of from about 0.01% to about 10%, preferably from about 0.05% to about 8%, more preferably from about 0.1% to about 5%.

A variety of thickening polymers can be used in the compositions of the present invention. Thickening polymers useful herein include, for example, cellulose and its derivatives such as cellulose ethers, hydrophobically modified cellulose ethers, and quaternized celluloses; guar gums including cationic guar gums and nonionic guar gums; crosslinked polymers such as nonionic crosslinked polymers and cationic crosslinked polymers; and acrylate polymers such as sodium polyacrylate, polyethylacrylate, and polyacrylamide. The thickening polymers useful

herein may include the polymers disclosed below under the title "CATIONIC CONDITIONING POLYMER".

Among a variety of thickening polymers, nonionic or cationic thickening polymers are preferably used in the compositions of the present invention, in view of providing conditioning benefits. More preferred are cationic thickening polymers. In the composition of the present invention, two or more thickening polymers can be contained as a thickening system. In view of providing conditioning benefits, in the composition of the present invention, the thickening system is preferably a nonionic or cationic system, more preferably a cationic system. In the present invention, what is meant by "a nonionic system" is that the system comprises only nonionic thickening agents, but no cationic thickening agents. In the present invention, what is meant by "a cationic system" is that the system comprises at least one cationic thickening agent. The cationic system can include nonionic thickening agents. In such preferable nonionic or cationic thickening systems, the composition is substantially free of anionic compounds such as anionic surfactants and anionic polymers. In the present invention, the composition being "substantially free of anionic compounds" means that the composition includes 1% or less, preferably 0.5% or less, more preferably 0% of anionic compounds. The thickening polymer or system useful herein has improved compatibility with cationic conditioning agents such as cationic surfactants.

#### CATIONIC CROSSLINKED POLYMER AND CELLULOSE

In the composition A, cationic crosslinked polymers and cellulose polymers are preferably used among a variety of thickening polymers. Cationic crosslinked polymers can be included in the composition at a level by weight of from about 0.01% to about 5%, more preferably from about 0.1% to about 3%. Cellulose polymers can be included in the composition at a level by weight of preferably from about 0.01% to about 5%, more preferably from about 0.1% to about 3%.

Cellulose polymers useful herein are preferably nonionic. Such nonionic cellulose polymers include, for example, hydroxymethyl cellulose, hydroxyethyl cellulose, hydroxyethylethylcellulose, cetyl hydroxyethylcellulose. Among them, highly preferred is hydroxyethylethylcellulose. Commercially available nonionic celluloses useful herein include, for example, hydroxyethylethyl cellulose with a tradename Elfacos CD481 available from Akzo Nobel, cetyl hydroxyethyl cellulose with a tradename of Polysurf 67 available from Aqualon.

Cationic crosslinked polymers useful herein include, for example, those comprising the monomer units and has the formula  $(A)_m(B)_n(C)_p$  wherein: (A) is a quaternized dialkylaminoalkyl acrylate, an acid addition salt of a dialkylaminoalkyl acrylate, or mixtures thereof; (B) is a quaternized dialkylaminoalkyl methacrylate, an acid addition salt of a dialkylaminoalkyl

methacrylate, or mixtures thereof; (C) is a nonionic monomer polymerizable with (A) or (B); m, n, and p are independently zero or greater, but at least one of m or n is one or greater.

The monomer (C) can be selected from any of the commonly used monomers. Non-limiting examples of these monomers include acrylamide; methacrylamide; acrylate esters and methacrylate esters such as methylmethacrylate, 2-ethylhexylmethacrylate, and t-butylacrylate; (meth)acrylamide derivatives such as N-isopropylacrylamide, N, N-dimethyl acrylamide; and styrene. In the present invention, the monomer (C) is preferably acrylamide.

The alkyl portions of the monomers (A) and (B) are preferably short chain length alkyls such as C<sub>1</sub>-C<sub>8</sub>, more preferably C<sub>1</sub>-C<sub>5</sub>, still more preferably C<sub>1</sub>-C<sub>3</sub>, even still more preferably C<sub>1</sub>-C<sub>2</sub>. When quaternized, the polymers are preferably quaternized with short chain alkyls, i.e., C<sub>1</sub>-C<sub>8</sub>, more preferably C<sub>1</sub>-C<sub>5</sub>, still more preferably C<sub>1</sub>-C<sub>3</sub>, even still more preferably C<sub>1</sub>-C<sub>2</sub>. The acid addition salts refer to polymers having protonated amino groups. Acid addition salts can be performed through the use of halogen (e.g. chloride), acetic, phosphoric, nitric, citric, or other acids.

When the polymer contains the monomer (C), the molar proportion of the monomer (C) can be from 0% to about 80% based on the total molar proportions of the monomers (A), (B), and (C). The molar proportions of (A) and (B) can independently be from 0% to about 100%. When acrylamide is used as the monomer (C), it will preferably be included at a level of from about 5% to about 80%.

The crosslinked polymers also contain a crosslinking agent, which is typically a material containing two or more unsaturated functional groups. The crosslinking agent is reacted with the monomer units of the polymer and is incorporated into the polymer, forming either links or covalent bonds between two or more individual polymer chains or between two or more sections of the same polymer chain. Nonlimiting examples of suitable crosslinking agents include those selected from the group consisting of methylenebisacrylamides, diacrylates, dimethacrylates, di-vinyl aryl (e.g. di-vinyl phenyl ring) compounds, polyalkenyl polyethers of polyhydric alcohols, and allyl acrylates. Specific examples of crosslinking agents useful herein include those selected from the group consisting of methylenebisacrylamide, ethylene glycol di-(meth)acrylate, propylene glycol di-(meth)acrylate, butylene glycol di-(meth)acrylate, di-(meth)acrylamide, 1,4-di-ethylene benzene, and allyl acrylate. Preferred herein is methylenebisacrylamide.

Widely varying amounts of the crosslinking agents can be employed depending upon the properties desired in the final polymer, e.g. viscosifying effect. The crosslinking agents preferably comprise from about 50ppm to about 1,000ppm, preferably from about 50ppm to

about 600ppm, more preferably from about 50ppm to about 250ppm of the total weight of the polymer on a weight/weight basis.

Exemplary, the crosslinked polymers useful herein include those conforming to the general structure  $(A)_m(B)_n(C)_p$  wherein m is zero, (B) is methyl quaternized dimethylaminoethyl methacrylate, (C) is acrylamide, and the crosslinking agent is methylenebisacrylamide. An example of such a crosslinking polymer is one that has the CTFA designation, "Polyquaternium 32".

More preferred cationic crosslinked polymers useful herein include those not containing acrylamide or other monomer (C), i.e. p is zero. In these polymers, the monomers (A) and (B) are as described above. An especially preferred group of these polymers is one in which m is also zero. In this instance, the polymer is essentially a homopolymer of dialkylaminoalkyl methacrylate monomer or its quaternary ammonium or acid addition salt. These dialkylaminoalkyl methacrylate copolymers and homopolymers also contain a crosslinking agent as described above.

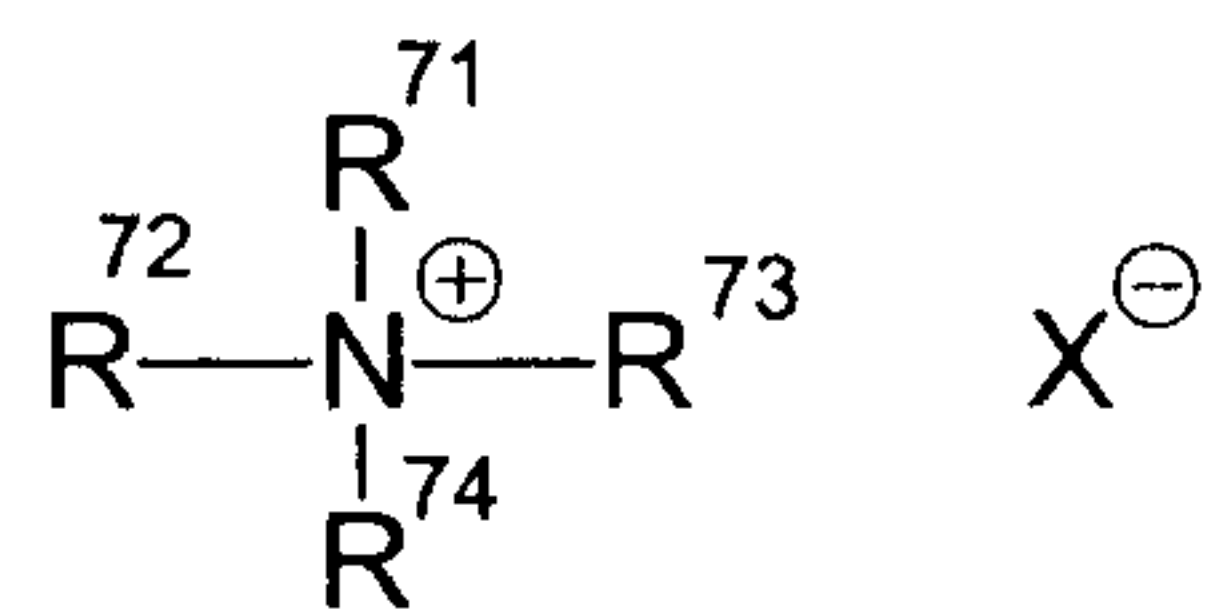
Highly preferred cationic crosslinked polymer is a homopolymer which does not contain acrylamide or other monomer (C). The homopolymers useful herein can be those conforming to the general structure  $(A)_m(B)_n(C)_p$  wherein m is zero, (B) is methyl quaternized dimethylaminoethyl methacrylate, p is zero, and the crosslinking agent is methylenebisacrylamide. An example of such a homopolymer is one that has the CTFA designation, "Polyquaternium 37". Commercially available such polyquaternium-37 useful herein include, for example, the one available as a neat material, under the tradenames Synthalen CR, Synthalen CU, and Synthalen CN, all from 3V Sigma.

#### CATIONIC SURFACTANT

The compositions of the present invention comprise a cationic surfactant. In the composition A, the cationic surfactant is included in the composition at a level by weight of from about 0.05% to about 10%, preferably from about 0.1% to about 5%.

In the composition A, mono-long alkyl trimethyl ammonium salts are preferably used among a variety of cationic surfactants described below. The mono-long alkyl trimethyl ammonium salts useful herein are those in which the alkyl has from 12 to 28 carbon atoms, preferably from 16 to 22 carbon atoms. The mono-long alkyl trimethyl ammonium salts useful herein includes, for example, cetyl trimethyl ammonium chloride, stearyl trimethyl ammonium chloride.

Cationic surfactants useful herein include, for example, those corresponding to the general formula (I):



(I)

wherein at least one of  $\text{R}^{71}$ ,  $\text{R}^{72}$ ,  $\text{R}^{73}$  and  $\text{R}^{74}$  is selected from an aliphatic group of from 8 to 30 carbon atoms or an aromatic, alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to about 22 carbon atoms, the remainder of  $\text{R}^{71}$ ,  $\text{R}^{72}$ ,  $\text{R}^{73}$  and  $\text{R}^{74}$  are independently selected from an aliphatic group of from 1 to about 22 carbon atoms or an aromatic, alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to about 22 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 aliphatic groups can contain, in addition to carbon and hydrogen atoms, ether linkages, and other groups such as amino groups. The longer chain aliphatic groups, *e.g.*, those of about 12 carbons, or higher, can be saturated or unsaturated. Preferred is when  $\text{R}^{71}$ ,  $\text{R}^{72}$ ,  $\text{R}^{73}$  and  $\text{R}^{74}$  are independently selected from  $\text{C}_1$  to about  $\text{C}_{22}$  alkyl. Nonlimiting examples of cationic surfactants useful in the present invention include the materials having the following CTFA designations: quaternium-8, quaternium-14, quaternium-18, quaternium-18 methosulfate, quaternium-24, and mixtures thereof.

Among the cationic surfactants of general formula (I), preferred are those containing in the molecule at least one alkyl chain having at least 16 carbons. Nonlimiting examples of such preferred cationic surfactants include: behenyl trimethyl ammonium chloride available, for example, with tradename Genamine KDMP from Clariant, with tradename INCROQUAT TMC-80 from Croda, and with tradename ECONOL TM22 from Sanyo Kasei; cetyl trimethyl ammonium chloride available, for example, with tradename CTAC 30KC from KCI, and with tradename CA-2350 from Nikko Chemicals; stearyl trimethyl ammonium chloride available, for example, with tradename Genamine STACP from Clariant; hydrogenated tallow alkyl trimethyl ammonium chloride, dialkyl (14-18) dimethyl ammonium chloride, ditallow alkyl dimethyl ammonium chloride, dihydrogenated tallow alkyl dimethyl ammonium chloride, distearyl dimethyl ammonium chloride, dicetyl dimethyl ammonium chloride, di(behenyl/arachidyl) dimethyl ammonium chloride, dibehenyl dimethyl ammonium chloride, stearyl dimethyl benzyl ammonium chloride, stearyl propyleneglycol phosphate dimethyl ammonium chloride, stearyl amidopropyl dimethyl benzyl ammonium chloride, stearyl amidopropyl dimethyl (myristylacetate) ammonium chloride, and N-(stearyl colamino formyl methyl) pyridinium chloride.

Also preferred are hydrophilically substituted cationic surfactants in which at least one of the substituents contain one or more aromatic, ether, ester, amido, or amino moieties present as substituents or as linkages in the radical chain, wherein at least one of the  $R^{71}$ - $R^{74}$  radicals contain one or more hydrophilic moieties selected from alkoxy (preferably  $C_1$ - $C_3$  alkoxy), polyoxyalkylene (preferably  $C_1$ - $C_3$  polyoxyalkylene), alkylamido, hydroxyalkyl, alkylester, and combinations thereof. Preferably, the hydrophilically substituted cationic conditioning surfactant contains from 2 to about 10 nonionic hydrophile moieties located within the above stated ranges. Highly preferred hydrophilically substituted cationic surfactants include dialkylamido ethyl hydroxyethylmonium salt, dialkylamidoethyl dimonium salt, dialkylol ethyl hydroxyethylmonium salt, dialkylol ethyldimonium salt, and mixtures thereof; for example, commercially available under the following tradenames; VARISOFT 110, VARISOFT 222, VARIQUAT K1215 and VARIQUAT 638 from Witco Chemical, MACKPRO KLP, MACKPRO WLW, MACKPRO MLP, MACKPRO NSP, MACKPRO NLW, MACKPRO WWP, MACKPRO NLP, MACKPRO SLP from McIntyre, ETHOQUAD 18/25, ETHOQUAD O/12PG, ETHOQUAD C/25, ETHOQUAD S/25, and ETHODUOQUAD from Akzo, DEHYQUAT SP from Henkel, and ATLAS G265 from ICI Americas.

Amines are 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. Also useful are dimethylstearamine, dimethylsoyamine, soyamine, myristylamine, tridecylamine, ethylstearylamine, N-tallowpropane diamine, ethoxylated (with 5 moles of ethylene oxide) stearylamine, dihydroxyethylstearylamine, and arachidylbehenylamine. 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 *l*-glutamic acid, lactic acid, hydrochloric acid, malic acid, succinic acid, acetic acid, fumaric acid, tartaric acid, citric acid, *l*-glutamic hydrochloride, maleic acid, and mixtures thereof; more preferably *l*-glutamic acid, lactic acid, citric acid. The amines herein are preferably 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, more preferably from about 1 : 0.4 to about 1 : 1.

#### AQUEOUS CARRIER

The compositions of the present invention comprise an aqueous carrier. The level and species of the carrier are selected according to the compatibility with other components, and other desired characteristic of the product.

Carriers useful in the present invention include water and water solutions of lower alkyl alcohols. Lower alkyl alcohols useful herein are monohydric alcohols having 1 to 6 carbons, more preferably ethanol and isopropanol.

Preferably, the aqueous carrier is substantially water. Deionized water is preferably used. Water from natural sources including mineral cations can also be used, depending on the desired characteristic of the product. Generally, the compositions of the present invention comprise from about 20% to about 99%, preferably from about 40% to about 98%, and more preferably from about 50% to about 98% water.

The pH of the present composition is preferably from about 3 to about 9, more preferably from about 3 to about 7. Buffers and other pH adjusting agents can be included to achieve the desirable pH.

#### SILICONE COMPOUND

Preferably, the compositions of the present invention contain a silicone compound. The silicone compounds may further be incorporated in the present composition in the form of an emulsion, wherein the emulsion is made by mechanical mixing, or in the stage of synthesis through emulsion polymerization, with or without the aid of a surfactant selected from anionic surfactants, nonionic surfactants, cationic surfactants, and mixtures thereof.

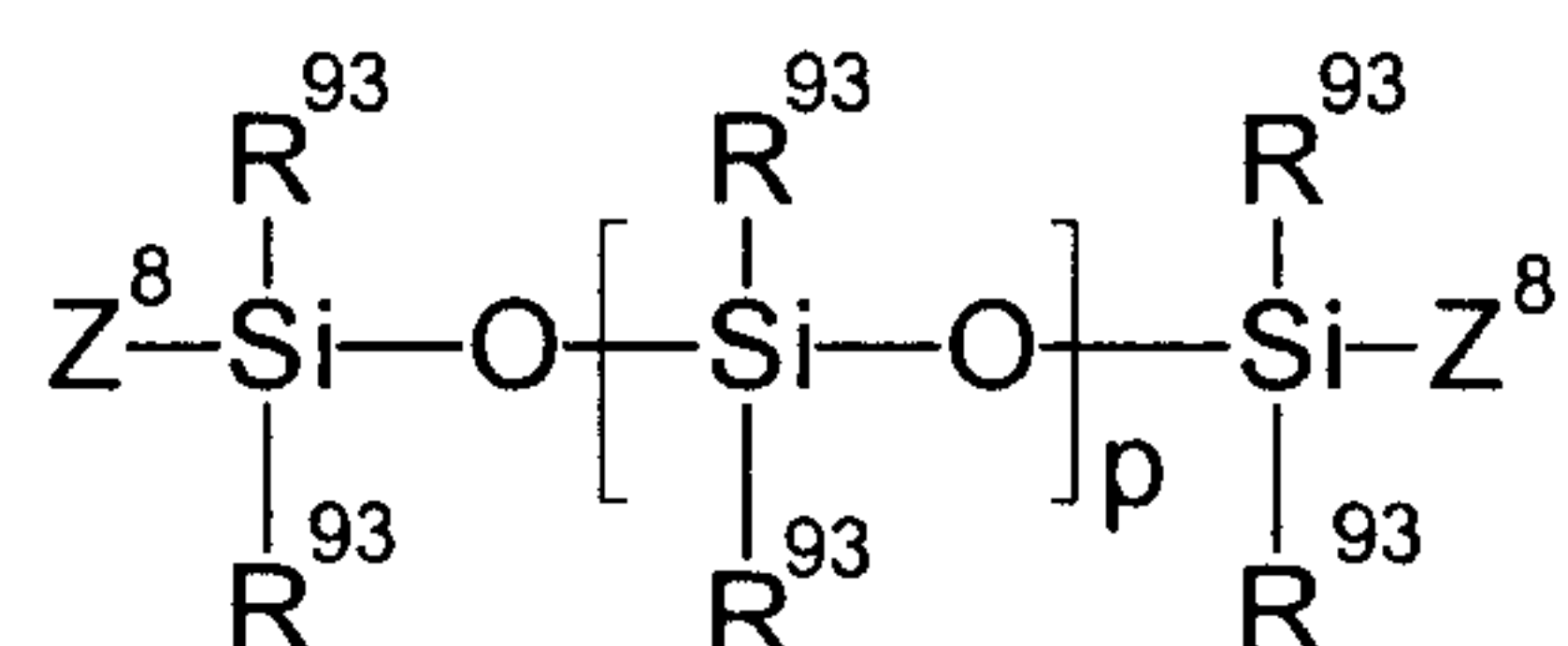
The silicone compounds herein are preferably used at levels by weight of the compositions of from about 0.1% to about 20%, more preferably from about 0.1% to about 10%, still more preferably from about 0.2% to about 5%.

The silicone compounds for use herein will preferably have a viscosity of from about 100 to about 2,000,000 centistokes at 25°C. In the composition A, the silicone compounds have a viscosity of more preferably from about 10,000 to about 1,800,000, and even more preferably from about 100,000 to about 1,500,000. The viscosity can be measured by means of a glass capillary viscometer as set forth in Dow Corning Corporate Test Method CTM0004, July 20, 1970. Suitable silicone fluids include polyalkyl siloxanes, polyaryl siloxanes, polyalkylaryl siloxanes, polyether siloxane copolymers, amino substituted silicones, quaternized silicones, and

mixtures thereof. Other nonvolatile silicone compounds having hair conditioning properties can also be used.

When the composition A contains a silicone compound, the silicone compound is preferably water-soluble or a nanoemulsion. In the present invention, a "water-soluble" silicone compound means that the silicone compound has a solubility in water at 25°C of at least 0.05g/100g water, preferably at least 0.1g/100g water, more preferably at least 0.2g/100g water. Dimethicone copolyols, amodimethicone copolyols, and quaternized silicones can be water-soluble depending on the level of alkoxyate chains and quaternized groups in their structure. In the present invention, a "nanoemulsion" of silicone compound means that the silicone compound is dispersed in the composition in the form of emulsion having an average diameter of 200nm or less.

The silicone compounds herein also include polyalkyl or polyaryl siloxanes with the following structure:



wherein  $\text{R}^{93}$  is alkyl or aryl, and  $x$  is an integer from about 7 to about 8,000.  $\text{Z}^8$  represents groups which block the ends of the silicone chains. The alkyl or aryl groups substituted on the siloxane chain ( $\text{R}^{93}$ ) or at the ends of the siloxane chains  $\text{Z}^8$  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. Suitable  $\text{Z}^8$  groups include hydroxy, methyl, methoxy, ethoxy, propoxy, and aryloxy. The two  $\text{R}^{93}$  groups on the silicon atom may represent the same group or different groups. Preferably, the two  $\text{R}^{93}$  groups represent the same group. Suitable  $\text{R}^{93}$  groups include methyl, ethyl, propyl, phenyl, methylphenyl and phenylmethyl. The preferred silicone compounds are polydimethylsiloxane, polydiethylsiloxane, and polymethylphenylsiloxane. Polydimethylsiloxane, which is also known as dimethicone, is especially preferred. The polyalkylsiloxanes that can be used include, for example, polydimethylsiloxanes. These silicone compounds are available, for example, from the General Electric Company in their TSF 451 series, and from Dow Corning in their Dow Corning SH200 series.

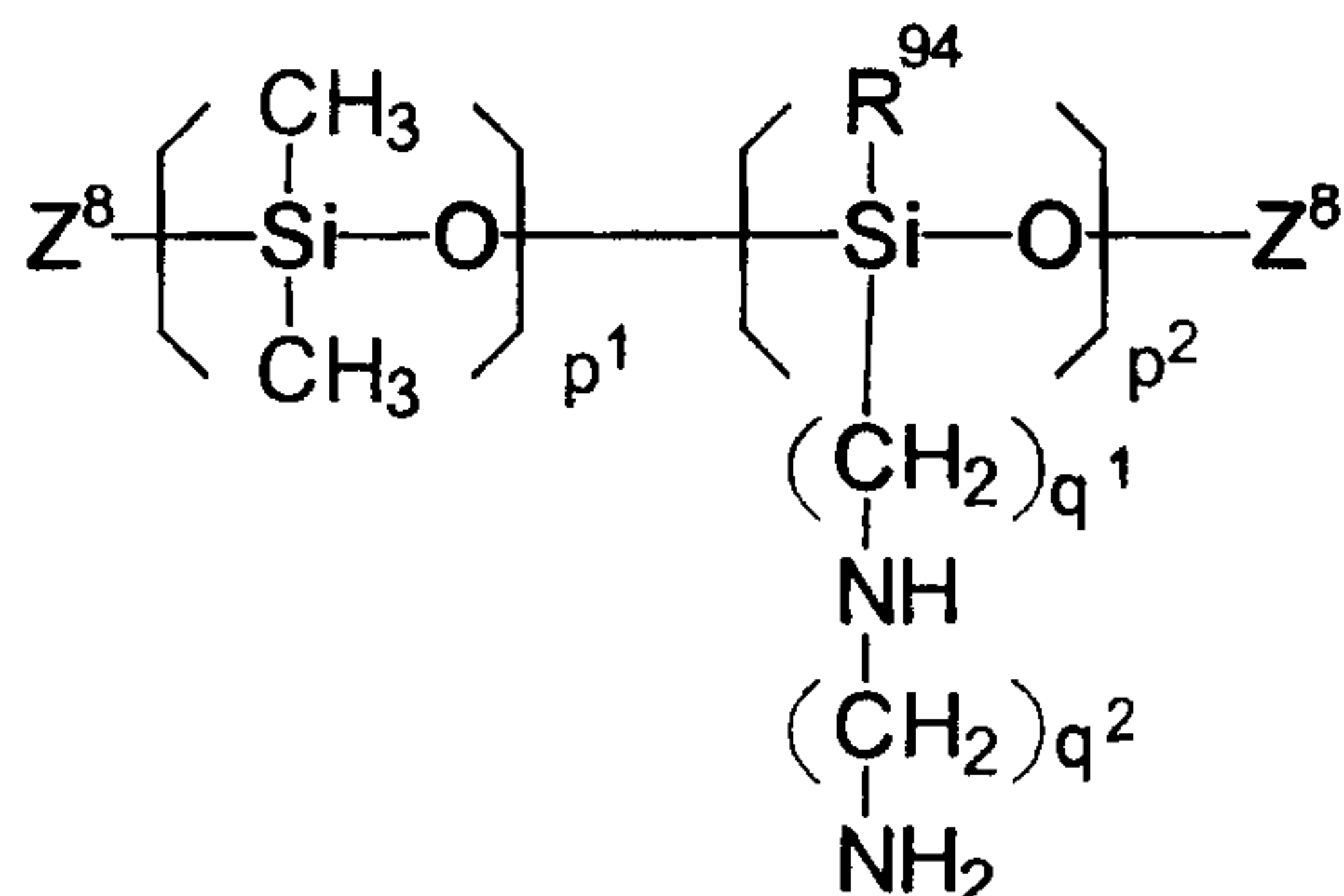
A nonvolatile dispersed silicone that can be especially useful is a silicone gum. The term "silicone gum", as used herein, means a polyorganosiloxane material having a viscosity at 25°C of greater than or equal to 1,000,000 centistokes. It is recognized that the silicone gums

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 200,000, generally between about 200,000 and about 1,000,000. Specific examples include polydimethylsiloxane, poly(dimethylsiloxane methylvinylsiloxane) copolymer, poly(dimethylsiloxane diphenylsiloxane methylvinylsiloxane) copolymer and mixtures thereof.

The above silicone compounds such as polyalkylsiloxanes and silicone gums are available, for example, as a mixture with silicone compounds having a lower viscosity. Such mixtures useful herein include, for example, Gum/Cyclomethicone blend available from Shin-Etsu, and blend of dimethicone having a viscosity of 500,000mPa•s and dimethicone having a viscosity of 200mPa•s available from GE Toshiba

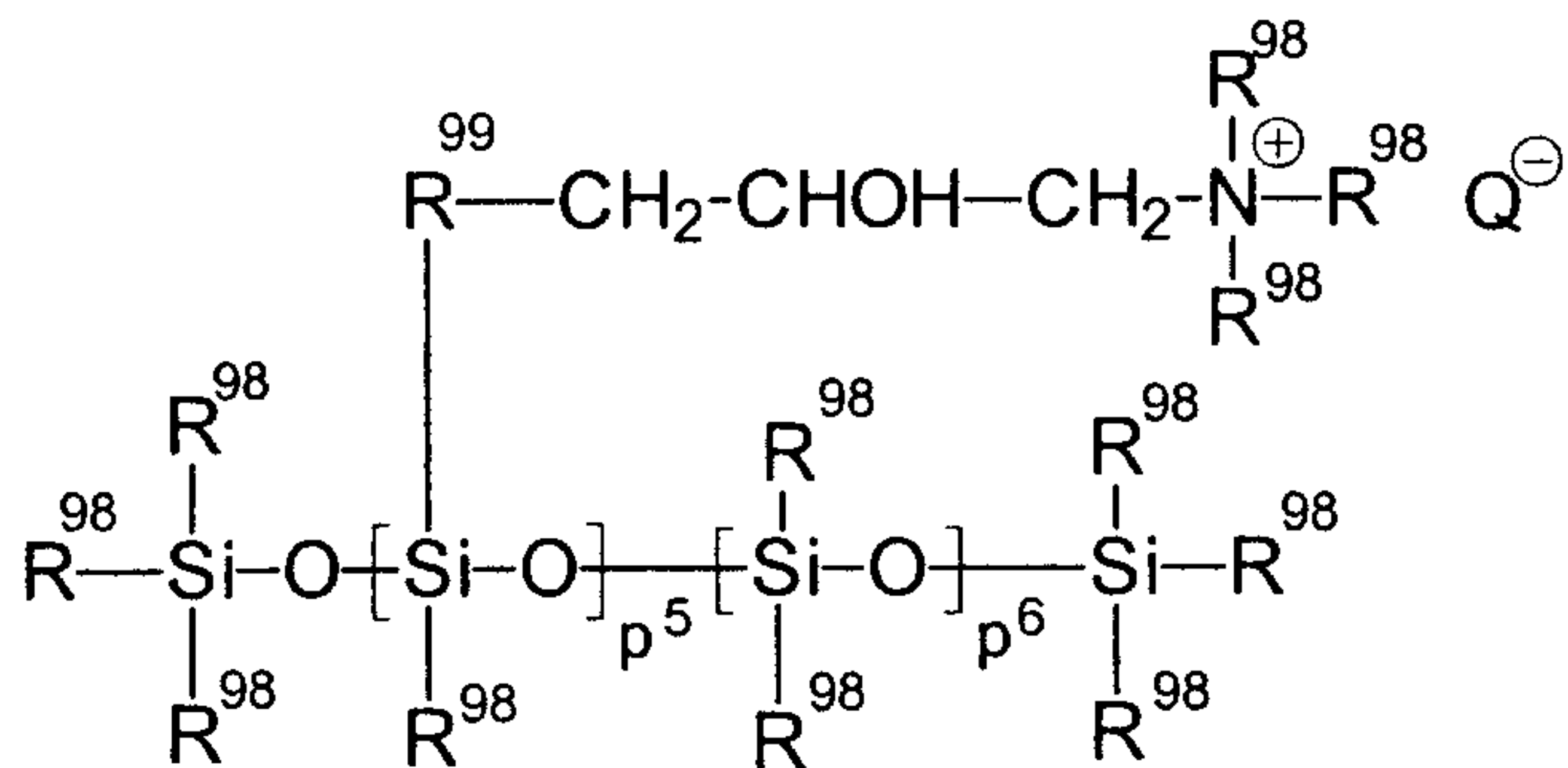
The silicone compounds that can be used include, for example, a polypropylene oxide modified polydimethylsiloxane although ethylene oxide or mixtures of ethylene oxide and propylene oxide can also be used. The ethylene oxide and polypropylene oxide level should be sufficiently low so as not to interfere with the dispersibility characteristics of the silicone. These material are also known as dimethicone copolyols. Commercially available dimethicone copolyols useful herein include, for example, PEG/PPG-15/15 Dimethicone with a tradename Silicone DC-5330 available from Dow Corning.

Other silicone compounds include amino substituted materials. Suitable alkylamino substituted silicone compounds include those represented by the following structure:



wherein  $\text{R}^{94}$  is H,  $\text{CH}_3$  or OH;  $p^1$  and  $p^2$  are integers of 1 or above, and wherein sum of  $p^1$  and  $p^2$  is from 650 to 1,500;  $q^1$  and  $q^2$  are integers of from 1 to 10.  $\text{Z}^8$  represents groups which block the ends of the silicone chains. Suitable  $\text{Z}^8$  groups include hydroxy, methyl, methoxy, ethoxy, propoxy, and aryloxy. More preferred  $\text{Z}^8$  groups include hydroxy and methyl. Highly preferred are those known as "amodimethicone". Commercially available amodimethicone useful herein includes, for example, BY16-872 available from Dow Corning.

Other amino substituted silicone polymers which can be used are represented by the formula:



where  $\text{R}^{98}$  denotes a monovalent hydrocarbon radical having from 1 to 18 carbon atoms, preferably an alkyl or alkenyl radical such as methyl;  $\text{R}^{99}$  denotes a hydrocarbon radical, preferably a  $\text{C}_1$ - $\text{C}_{18}$  alkylene radical or a  $\text{C}_1$ - $\text{C}_{18}$ , and more preferably  $\text{C}_1$ - $\text{C}_8$ , alkyleneoxy radical;  $\text{Q}^-$  is a halide ion, preferably chloride;  $p^5$  denotes an average statistical value from 2 to 20, preferably from 2 to 8;  $p^6$  denotes an average statistical value from 20 to 200, and preferably from 20 to 50. A preferred polymer of this class is available from Union Carbide under the name "UCAR SILICONE ALE 56."

#### CATIONIC CONDITIONING POLYMER

The hair conditioning compositions of the present invention preferably include cationic conditioning polymers. The cationic polymers hereof will generally have a weight average molecular weight which is at least about 5,000, typically at least about 10,000, and is less than about 10 million, preferably, the molecular weight is from about 100,000 to about 2 million. The cationic polymers useful herein may include the polymers disclosed above under the title "THICKENING POLYMER".

The cationic conditioning polymer can be included in the compositions at a level by weight of preferably from about 0.01% to about 10%, more preferably from about 0.05% to about 5%.

The cationic polymers will generally have cationic nitrogen-containing moieties such as quaternary ammonium or cationic amino moieties, and mixtures thereof. The cationic amines can be primary, secondary, or tertiary amines, depending upon the particular species and the pH of the composition. In general, secondary and tertiary amines, especially tertiary amines, are preferred. Amine-substituted vinyl monomers can be polymerized in the amine form, and then optionally can be converted to ammonium by a quaternization reaction. Amines can also be similarly quaternized subsequent to formation of the polymer. For example, tertiary amine functionalities can be quaternized by reaction with a salt of the formula  $\text{R}^{88}\text{X}$  wherein  $\text{R}^{88}$  is a short chain alkyl, preferably a  $\text{C}_1$  -  $\text{C}_7$  alkyl, more preferably a  $\text{C}_1$  -  $\text{C}_3$  alkyl, and X is a salt forming anion as defined above. Any anionic counterions can be utilized for the cationic polymers so long as the water solubility criteria is met. Suitable counterions include halides

(e.g., Cl, Br, I, or F, preferably Cl, Br, or I), sulfate, and methylsulfate. Others can also be used, as this list is not exclusive.

Suitable cationic conditioning polymers include, for example: copolymers of 1-vinyl-2-pyrrolidone and 1-vinyl-3-methylimidazolium salt (e.g., chloride salt) (referred to in the industry by the Cosmetic, Toiletry, and Fragrance Association, "CTFA", as Polyquaternium-16), such as those commercially available from BASF Wyandotte Corp. (Parsippany, NJ, USA) under the LUVIQUAT tradename (e.g., LUVIQUAT FC 370); copolymers of 1-vinyl-2-pyrrolidone and dimethylaminoethyl methacrylate (referred to in the industry by CTFA as Polyquaternium-11) such as those commercially available from Gaf Corporation (Wayne, NJ, USA) under the GAFQUAT tradename (e.g., GAFQUAT 755N); cationic diallyl quaternary ammonium-containing polymers, including, for example, dimethyldiallylammonium chloride homopolymer and copolymers of acrylamide and dimethyldiallylammonium chloride, referred to in the industry (CTFA) as Polyquaternium 6 and Polyquaternium 7, Polyquaternium-7 including that commercially available with a tradename Merquat 550 from Ondo Nalco; polymethacrylamidopropyl trimonium chloride such as that commercially available with a tradename Polycare 133 from Rhone-Poulenc; and Polyquaternium-37 available from 3V Sigma with a tradename Synthalen CN.

Also suitable cationic conditioning polymers herein include cationic cellulose derivatives. Cationic cellulose derivative useful herein include, for example, salts of hydroxyethyl cellulose reacted with trimethyl ammonium substituted epoxide, referred to in the industry (CTFA) as Polyquaternium 10, available from Amerchol Corp. (Edison, NJ, USA) in their Polymer JR<sup>®</sup> and LR<sup>®</sup> series, and also available from National Starch & Chemical with a tradename Celquat SC-230M; polymeric quaternary ammonium salts of hydroxyethyl cellulose reacted with lauryl dimethyl ammonium-substituted epoxide, referred to in the industry (CTFA) as Polyquaternium 24, available from Amerchol Corp. (Edison, NJ, USA) under the tradename Polymer LM-200<sup>®</sup>; and Polyquaternium-4 with tradename Celquat H-100 available from National Starch & Chemical.

Other suitable cationic conditioning polymers include cationic guar gum derivatives, such as guar hydroxypropyltrimonium chloride commercially available from Rhodia in their Jaguar R series.

#### HUMECTANT

Preferably, the compositions of the present invention contain a humectant. The humectants herein are selected from the group consisting of polyhydric alcohols, water soluble alkoxylated nonionic polymers, and mixtures thereof. The humectants herein are preferably used at levels by

weight of the composition of from about 0.1% to about 20%, more preferably from about 0.5% to about 5%.

Polyhydric alcohols useful herein include glycerin, sorbitol, propylene glycol, butylene glycol, hexylene glycol, ethoxylated glucose, 1, 2-hexane diol, hexanetriol, dipropylene glycol, erythritol, trehalose, diglycerin, xylitol, maltitol, maltose, glucose, fructose, sodium chondroitin sulfate, sodium hyaluronate, sodium adenosin phosphate, sodium lactate, pyrrolidone carbonate, glucosamine, cyclodextrin, and mixtures thereof.

Water soluble alkoxylated nonionic polymers useful herein include polyethylene glycols and polypropylene glycols having a molecular weight of up to about 10,000 such as those with CTFA names PEG-4, PEG-8, PEG-12, PEG-20, PEG-150 and mixtures thereof.

#### ADDITIONAL COMPONENTS

The composition of the present invention may include other additional components, which may be selected by the artisan according to the desired characteristics of the final product and which are suitable for rendering the composition more cosmetically or aesthetically acceptable or to provide them with additional usage benefits. Such other additional components generally are used individually at levels of from about 0.001% to about 10%, preferably up to about 5% by weight of the composition.

#### PRODUCT FORMS

The hair conditioning compositions of the present invention can be in the form of rinse-off products or leave-on products, can be transparent or opaque, and can be formulated in a wide variety of product forms, including but not limited to creams, gels, emulsions, mousses and sprays.

#### **EXAMPLES**

The following examples further describe and demonstrate embodiments within the scope of the present invention. The examples are given solely for the purpose of illustration and are not to be construed as limitations of the present invention, as many variations thereof are possible without departing from the spirit and scope of the invention. Ingredients are identified by chemical or CTFA name, or otherwise defined below.

The hair conditioning compositions of the present invention are suitable for rinse-off products and leave-on products, and are particularly useful for making products in the form of emulsion, cream, gel, spray or, mousse.

Compositions A (wt%)

|                                                                | Ex.1 | Ex.2 | Ex.3 | Ex.4 | Ex.5 | Ex.6 | Ex.7 |
|----------------------------------------------------------------|------|------|------|------|------|------|------|
| Cationic crosslinked polymer-1 *1                              | 0.5  | 0.7  | 0.7  | 0.7  | 0.7  | 0.7  | 1.0  |
| Hydroxyethylethylcellulose *2                                  | 0.5  | 0.3  | 0.5  | 0.7  | 0.5  | 0.5  | -    |
| Cationic crosslinked polymer-2 *3                              | -    | 0.5  | -    | -    | -    | 0.5  | -    |
| Polyquaternium-4 *4                                            | -    | -    | 0.5  | -    | 0.5  | -    | -    |
| Polyquaternium-7 *5                                            | -    | -    | -    | 0.5  | -    | -    | -    |
| Polyquaternium-10 *6                                           | -    | -    | -    | -    | -    | -    | 0.5  |
| Acrylamidopropyltrimonium Chloride/<br>Acrylamide Copolymer *7 | -    | -    | -    | -    | -    | -    | 0.5  |
| Cetyl trimethyl ammonium chloride *8                           | -    | -    | -    | 1.0  | 0.5  | 0.5  | -    |
| Behentrimonium chloride *9                                     | 1.5  | 1.0  | 1.0  | -    | 0.6  | 0.7  | 0.5  |
| Glyceryl stearate *10                                          | -    | 1.0  | -    | 1.0  | -    | -    | -    |
| Polysorbate-20 *11                                             | -    | -    | -    | 0.2  | -    | -    | -    |
| Dimethicone/Cycromethicone *12                                 | -    | -    | 4.2  | -    | -    | 1.0  | -    |
| Dimethicone blend *13                                          | -    | -    | -    | 4.2  | 2.1  | -    | -    |
| Aminosilicone *14                                              | -    | -    | -    | -    | 0.5  | 0.25 | -    |
| Dimethicone emulsion *15                                       | -    | 2.0  | -    | -    | -    | -    | 2.5  |
| PEG-200 *16                                                    | -    | -    | -    | -    | 0.2  | -    | 0.1  |
| PPG-34 *17                                                     | -    | -    | 0.5  | -    | -    | 0.5  | -    |
| Poly-.olefin oil *18                                           | -    | -    | -    | 0.5  | -    | -    | -    |
| Vitamin E *19                                                  | -    | 0.05 | -    | 0.05 | -    | 0.05 | -    |
| Hydrolyzed collagen *20                                        | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Panthenyl ethyl ether *21                                      | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| Pantenol *22                                                   | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| Benzophenone-4 *23                                             | -    | -    | -    | -    | 0.1  | -    | -    |
| Octyl Methoxycinnamate *24                                     | -    | -    | -    | -    | -    | 0.2  | -    |
| Benzyl alcohol                                                 | 0.4  | 0.4  | 0.4  | 0.4  | 0.4  | 0.4  | 0.4  |
| Methylchloroisothiazolinone/<br>Methylisothiazolinone *25      | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | -    | -    |
| Methyl Paraben                                                 | -    | -    | -    | -    | -    | 0.2  | 0.2  |
| Phenoxyethanol                                                 | -    | -    | -    | -    | -    | 0.3  | 0.3  |

|                  |                          |      |      |      |      |      |      |
|------------------|--------------------------|------|------|------|------|------|------|
| EDTA             | 0.1                      | 0.1  | -    | -    | -    | -    |      |
| Disodium EDTA    | -                        | -    | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 |
| Perfume solution | 0.25                     | 0.25 | 0.25 | 0.30 | 0.30 | 0.35 | 0.50 |
| Deionized Water  | ----- q.s. to 100% ----- |      |      |      |      |      |      |

#### Definitions of Components

- \*1 Cationic crosslinked polymer-1: Polyquaternium-37 available from 3V Sigma with a tradename Synthalen CR
- \*2 Hydroxyethylethylcellulose: Elfacos CD481 available from Akzo Nobel
- \*3 Cationic crosslinked polymer-2: Polyquaternium-37 available from 3V Sigma with a tradename Synthalen CN
- \*4 Polyquaternium-4: Celquat H-100 available from National Starch & Chemical
- \*5 Polyquaternium-7: Merquat 550 available from Onda Nalco
- \*6 Polyquaternium-10: Celquat SC-230M available from National Starch & Chemical
- \*7 Acrylamidopropyltrimonium Chloride/ Acrylamide Copolymer: Salcare SC60 available from Ciba
- \*8 Cetyl trimethyl ammonium chloride: CTAC 30KC available from KCI
- \*9 Behentrimonium chloride: Genamine KDMP available from Clariant
- \*10 Glyceryl stearate: Kessco GMS available from Stepan
- \*11 Polysorbate-20: Glycosperse L-20K available from Lonza
- \*12 Cyclomethicone/Dimethicone: Gum/Cyclomethicone blend available from Shin-Etsu
- \*13 Dimethicone blend: Blend of dimethicone having a viscosity of 500,000mPa•s and dimethicone having a viscosity of 200mPa•s available from GE Toshiba
- \*14 Aminosilicone: BY16-872 available from Dow Corning
- \*15 Dimethicone emulsion: Emulsion of dimethicone wherein the dimethicone has a viscosity of 100,000mPa•s, with a tradename BY22-067R available from Dow Corning
- \*16 PEG-200: Emkapol 8000 available from ICI
- \*17 PPG-34: New Pol PP-2000 available from Sanyo Kasei
- \*18 Poly- $\alpha$ -olefine Oil: PureSyn100 available from Exxon Mobil
- \*19 Vitamin E: Emix-d Available from Eisai
- \*20 Hydrolyzed collagen: Peptin 2000 available from Hormel
- \*21 Panthenyl ethyl ether available from Roche
- \*22 Panthenol: Panthenol Available from Roche
- \*23 Benzophenone-4: Uvnul MS-40 available from BASF

- \*24 Octyl Methoxycinnamate: Parasol MCX available from Roche
- \*25 Methylchloroisothiazolinone/ Methylisothiazolinone: Kathon CG available from Rohm&Haas

Method of Preparation for the composition A

The hair conditioning compositions of "Ex.1" to "Ex.7" as shown above can be prepared by any conventional method well known in the art. They are suitably made as follows:

Deionized water is heated to 85°C. The polymeric materials, cationic surfactants, and if included, nonionic surfactants are added to water with agitation. The water is maintained at a temperature about 85°C until the components are homogenized and no solids are observed. Then the mixture is cooled to about 55°C, and the remaining components such as silicones, perfume, and preservatives, if included, are added with agitation. After it is homogenized, it is cooled to room temperature.

Examples 1 through 7 are hair conditioning compositions of the present invention which are particularly useful for rinse-off use. These examples have many advantages. For example, the compositions of "Ex.1" through "Ex.7" can provide conditioning benefits to the hair such as softness and smoothness, and leave the hair with a clean feel. They can also provide benefits such as being easy to rinse-off, and not weighing down the hair. They can also provide slippery feel on wet hair.

What is claimed is:

1. A hair conditioning composition comprising by weight:
  - (a) from about 0.01% to about 10% of a thickening polymer;
  - (b) from about 0.05% to about 10% of a cationic surfactant; and
  - (c) an aqueous carrier;and wherein the composition is substantially free of a water-insoluble high melting point oily compound.
2. The hair conditioning composition of Claim 1 wherein the thickening polymer comprises a cationic crosslinked polymer and a cellulose polymer.
3. The hair conditioning composition of Claim 1 further comprising from about 0.1% to about 20% of a silicone compound.
4. The hair conditioning composition of Claim 3 wherein the silicone compound is water-soluble or a nanoemulsion.
5. The hair conditioning composition of Claim 1 further comprising from about 0.1% to about 20% of a humectant.
6. The hair conditioning composition of Claim 1 further comprising a cationic hair conditioning polymer.