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(54) Title: IMPROVEMENTS RELATING TO THE SKIN FEEL OF PRODUCTS

(57) Abstract: A composition comprising an oil phase, wherein the oil phase comprises: a) 2-10%wt of particles of an elastomeric polymer; b) a swelling agent for the elastomeric polymer, and; c) 1-10%wt of a thickener comprising flocculated particles, said particles having a surface area in excess of 100m²/gram, as measured by the BET method using nitrogen adsorption; wherein the ratio of the shear stress (σ) of the composition measured at 316s⁻¹ to the shear stress measured at 0.1 s⁻¹ is such that: $\log_{10}(\sigma 316s^{-1} / \sigma 0.1s^{-1}) \leq 0.64 + (0.4 \times \text{internal phase volume})$ where internal phase volume = internal phase volume%/100%.



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IMPROVEMENTS RELATING TO THE SKIN FEEL OF PRODUCTS**Field of the Invention**

5

The present invention is concerned with compositions providing excellent “silky skin feel” properties.

10 **Background of the Invention**

Aesthetics are an important attribute of topical products for application to human skin, be these deodorants, anti-perspirants, cosmetics, lotions or skin-creams.

15 Consumers' judgement of such products is significantly determined by the aesthetics of skin-feel. “Silky” as opposed to “sticky” skin-feel is a desirable property of many compositions for topical application. However the formulation rules underlying the difference between “silky” and “sticky” products have proven intractable.

20 For example, when antiperspirant or deodorant product have been applied to the axilla (the underarm) the presence of an antiperspirant or deodorant product film in the axilla is almost always perceived by consumers immediately after application, and sometimes still perceived after some time. In this context “stickiness” is one of a number of sensations articulated by consumers. It is a
25 tactile and possibly an auditory sensation which is believed associated with increased adhesion or increased friction between the body-side and the arm-side of the axilla. Stickiness arising from the presence of an antiperspirant or deodorant in the underarm is most often disliked by consumers because it is an intrinsically annoying sensation. Moreover it is likely to clash with a consumer's
30 concept of desirable dryness in the underarm. In recognition of stickiness as a

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perception to be avoided, the attribute of stickiness is included in sensory profile testing rather than being calculated on the basis of formulation composition.

Many attempts at the formulation of non-sticky topical compositions have been
5 made. There remains a need for a product chassis which delivers a silky skin-feel which can be formulated with a variety of actives and/or beneficial ingredients.

US2002/0131946 A1 (Pham et al.) discloses "non-sticky" cosmetic moisturising compositions based on glycerin and polymeric wetting agents one of which is
10 described as "Pemulen TR2". Other than removing stickiness, there is no disclosure that these compositions impart any particular skin-feel advantage.

A broad range of elastomeric, solvents, emulsifying ingredients and solid particles have been suggested for use in topical products.

15

US6548050 disclose a dermatologic or cosmetic composition, including a liquid fatty phase, surfactant, thickener for the liquid fatty phase and particles of a cross-linked elastomeric solid. This results in a film that does not transfer; that has better cosmetic properties, freshness and matte-effect properties; and that is
20 desirably longer-lasting than conventional "transfer-resistant" products, in particular the properties of slipperiness, of not feeling taut and of not drying out the lips, of having good staying power over time, particularly with respect to the colour (no colour change over time) and of not migrating, in particular into the folds of the skin.

25

US6565862 discloses a transfer-resistant, mattifying composition comprising, as a thickener, particles of an at least partially cross-linked elastomeric solid organo-polysiloxane in suspension in an aqueous phase. The composition is more particularly a composition for caring for or making up the lips, or a foundation
30 composition for making up both the human face and the human body. The

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composition is soft and fresh on application, spreads easily, is non-sticky, and does not dry out the skin or lips.

US5859069 discloses a gelatinous external skin treatment composition

5 comprising:

(1) spherical powder of organo-polysiloxane elastomer having an average particle size of 1.0 to 15.0 microns,

10 (2) silicone oil, and,

(3) polyether modified silicone.

WO04105821A discloses a substantially water-free scar management

15 composition in the form of a liquid gel. The composition comprises at least one silicone elastomer and/or gum. The silicone elastomer and/or gum preferably constitutes from 0.01 percent to 80 percent, by weight, of the total composition of the present invention. Additional silicone components which may be present include silicone oils, silicone fluids, silicone solvents, silicone gels, silicone wax,
20 silicone grease, silicone cross-polymers, silicone adhesives, silicone emulsifier, silicone wax emulsifier, silicone copolymer, silicone PSA's and other curing or partially cured silicones.

US5216033A discloses a water-in-silicone oil transparent emulsion is made from
25 a volatile polydimethylsiloxane (1 to 50% by weight), a silicone surfactant (0.1 to 20% by weight), at least one polyhydric alcohol (1 to 50% by weight) and water.

Vehicles other than water can include liquid or solid emollients, solvents, humectants, thickeners and powders. Examples of each of these types of vehicle, which can be used singly or as mixtures of one or more vehicles, include powders,
30 such as chalk, talc, fullers earth, kaolin, starch, gums, colloidal silica, sodium

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polyacrylate, tetra alkyl and/or trialkyl aryl ammonium smectites, chemically modified magnesium aluminium silicate, organically modified montmorillonite clay, hydrated aluminium silicate, fumed silica, carboxyvinyl polymer, sodium carboxymethyl cellulose, ethylene glycol monostearate, titanium dioxide, and
 5 titanium dioxide-coated mica.

Brief Description of the Invention

10 We have determined that excellent sensory results are obtained with a composition comprising an oil phase, wherein the oil phase comprises:

- a) 2-10%wt of particles of an elastomeric polymer;
- 15 b) a swelling agent for the elastomeric polymer, and;
- c) 1-10%wt of a thickener comprising flocculated particles, said particles having a surface area in excess of 100m²/gram, as measured by the BET method using nitrogen adsorption;

20

wherein the ratio of the shear stress (σ) of the composition measured at 316s⁻¹ to the shear stress measured at 0.1s⁻¹ is such that:

$$\text{Log}_{10} (\sigma_{316\text{s}^{-1}} / \sigma_{0.1\text{s}^{-1}}) \leq 0.64 + (0.4 \times \text{internal phase volume})$$

25

and;

wherein internal phase volume = internal phase volume%/100%.

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The quantitative relationship expressed above may be summarised by stating that for this class of formulation stickiness has been found to increase with increasing shear stress at a relatively high shear rate, but to decrease with increasing stress at low shear rates (providing that the shear stress is above a certain threshold value). By formulating components a) b) and c) in accordance with the above quantitative relationship a good agreement is found between the calculated behaviour and the results obtained by stickiness perception measured through *in vivo* sensory testing, and this enables the formulation of compositions which have low "stickiness", as required by end-users.

As can be seen from the above the internal phase volume can be zero, i.e. where no internal phase is present, however it is preferably that some internal phase is present as this reduces cost and may act as a vehicle for benefit agents. Preferably, the major component (by weight) of the internal phase is water.

Preferred ranges for the internal phase volume are from 0 to 95%, and preferably, from 20 to 90%, and most preferably, from 40 to 80% of the composition. The advantage of moving away from low levels of internal phase is that this reduces cost and provides space for further ingredients. As the internal phase volume becomes high then more complex processing is required to get a product with acceptable long-term stability.

The BET method is the method of Brunauer, Emmett, and Teller, and is a well known method of determining the monolayer capacity of a surface from which the surface area of a solid can be computed.

In a second aspect, the present invention is directed to an end use composition comprising the composition of the first aspect of this invention.

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End use composition as used herein means a composition ready for use by a consumer, preferably a water-in-oil emulsion. Illustrative examples of the types of end use compositions include leave-on skin lotions and creams, hair conditioners, shower gels, antiperspirants, deodorants, shaving creams, depilatories, lipsticks, foundations, mascara, sunless tanners, skin lightening compositions and sunscreen lotions. End use compositions may also include a product associated with oral, laundry or household care such as laundry detergents, fabric conditioners or hard surface cleaners.

- 10 In a preferred embodiment, the end use composition of this invention is applied to hair, skin or both, and most preferably skin, where skin is meant to include skin on the face, body (including hands and feet) and scalp.

- 15 Preferably, the compositions of the present invention comprise at least one benefit agent. Benefit agent means a component typically delivered to a surface including a body surface of a human or other animal, preferably a human, in order to enhance/improve a characteristic (e.g., appearance, cleanliness, odour) of the surface. Such an active can include, for example, a skin whitening or lightening ingredient like niacinamide as well as a conditioning agent and moisturizing agent (for example glycerine) as well as those generally classified as silicone polymers and quaternary ammonium compounds.

- 20 In a third aspect, the present invention is directed to a method for treating a condition by applying the composition of the second aspect of this invention.

25

Percentages as used herein are % by weight unless specified as otherwise. Substantially free of as used herein means less than 3.0%, and preferably, less than 1.5%, and most preferably 0.0% by weight, based on total weight. Comprising, as used herein, is meant to include consisting essentially of and

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consisting of. All ranges identified herein are meant to include, implicitly, all ranges subsumed therein if reference to the same is not explicitly made.

5 All other aspects of the present invention will more readily become apparent upon considering the detailed description and examples which follow.

Detailed Description of the Invention

10 It is preferred that at least one of the elastomeric polymer and/or swelling agent is a silicone. Silicones may be divided into the volatile and non-volatile types. The term "volatile" as used herein refers to those materials which have a vapour pressure above 1Pa at 25°C.

15 Elastomeric Polymer

It is highly preferred that the elastomeric polymer is a cross-linked polymer.

Preferably the elastomeric polymer is a non-volatile silicone elastomer. These can be obtained from curable organo-polysiloxanes. Examples in this respect are:

20

- addition reaction-curing organo-polysiloxane which cure under platinum metal catalysis by the addition reaction between SiH-containing diorgano-polysiloxane and organo-polysiloxane having silicon-bonded vinyl groups;
- 25 • condensation-curing organo-polysiloxane which cure in the presence of an organo-tin compound by a dehydrogenation reaction between hydroxyl terminated diorgano-polysiloxane and SiH-containing diorgano-polysiloxane;

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- condensation-curing organo-polysiloxane which cure in the presence of an organo-tin compound or a titanate ester, by a condensation reaction between a hydroxyl terminated diorgano-polysiloxane and a hydrolyzable organo-silane (this condensation reaction is exemplified by dehydration, alcohol-liberating, oxime-liberating, amine-liberating, amide-liberating, carboxyl-liberating, and ketone-liberating reactions);
 - peroxide-curing organo-polysiloxane which thermally cure in the presence of an organo-peroxide catalyst; and
 - organ-opolysiloxane compositions which are cured by high-energy radiation, such as by gamma-rays, ultraviolet radiation, or electron beams.
- 15 The elastomeric polymer of the present invention may either be an emulsifying or non-emulsifying cross-linked organo-polysiloxane elastomer or a combination thereof. The term "non-emulsifying," as used herein, defines cross-linked organo-polysiloxane elastomer from which poly-oxyalkylene units are absent. The term "emulsifying," as used herein, means cross-linked organo-polysiloxane elastomer having at least one poly-oxyalkylene (e.g., poly-oxyethylene or poly-oxypropylene) unit.

Particularly useful elastomers are poly-oxyalkylene-modified elastomers formed from divinyl compounds, particularly siloxane polymers with at least two free vinyl groups, reacting with Si—H linkages on a polysiloxane backbone. Preferably, the elastomers are dimethyl polysiloxanes crosslinked by Si—H sites on a molecularly spherical "MQ"-type resin.

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Preferred silicone elastomers are organo-polysiloxanes available under the INCI names of dimethicone/vinyl dimethicone crosspolymer, dimethicone crosspolymer and Polysilicone-11.

- 5 Dimethicone/vinyl dimethicone cross-polymers and dimethicone cross-polymers are available from a variety of suppliers including Dow Corning (9040, 9041, 9045, 9506 and 9509), General Electric (SFE 839), Shin Etsu (KSG-15, 16, 18 [dimethicone/phenyl vinyl dimethicone cross-polymer]), and Grant Industries (Gransil™ line of materials), and lauryl dimethicone/vinyl dimethicone cross-
10 polymers supplied by Shin Etsu (e.g, KSG-31, KSG-32, KSG-41, KSG-42, KSG-43, and KSG-44).

- Other suitable commercially available silicone elastomer powders include vinyl dimethicone/methicone silsesquioxane cross-polymers from Shin-Etsu sold as
15 KSP-100, KSP-101, KSP-102, KSP-103, KSP-104, KSP-105.

The elastomeric polymers used in the present invention are swellable, rather than being hard resins.

- 20 Typically the elastomers are provided as a 1-30% crosslinked silicone elastomer dissolved or suspended in a dimethicone fluid (usually cyclomethicone). For purposes of definition "cross-linked silicone elastomer" refers to the elastomer alone rather than the total commercial compositions which also include a solvent (eg dimethicone) carrier. Thus the weight of component (a) exclude any solvent
25 such as cyclomethicone found in commercial "elastomer" silicones such as the Dow Corning products 9040 and 9045. For instance, the amount of crosslinked silicone elastomer in 9040 is between 12 and 13% by weight.

- Most preferred as the silicone elastomer is 9040 which has a D5 cyclomethicone
30 swelled elastomer. Typical particle size (based on volume and calculated as

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spherical particles) averages about 38 micron, and may range from about 25 to about 55 micron.

Swelling Agent

5 Silicone elastomer blends may be swollen in a cosmetically acceptable carrier/solvent such as cyclopentasiloxane or isododecane, or an emollient such as dimethicone.

In the present invention the swelling agent is preferably volatile.

10

Preferred swelling agents include silicones.

Particularly preferred materials are volatile silicone oils such as cyclomethicone or linear poly-dimethylsiloxanes containing from 2 to 6, preferably from 3 to 5, silicon
15 atoms. Suitable volatile silicone oils include Dow Corning 200-series dimethicones of varying viscosities, cyclic materials including Dow Corning 244, Dow Corning 245, Dow Corning 344, and Dow Corning 345, (commercially available from Dow Corning Corp.); SF-1204 and SF-1202 Silicone Fluids, GE 7207 and 7158 (commercially available from G.E. Silicones) and SWS-03314
20 (commercially available from SWS Silicones Corp. Alkyl methyl siloxanes including Toray FZ-3196 from Dow Corning Corp. and phenyl methyl siloxanes such as Dow Corning 556 can also be used.

The elastomeric polymer may be obtained as a pre-swollen material.

25 Representative of this category is Dimethicone/Vinyl Dimethicone Cross-polymer available as Dow Corning 9040 and Shin-Etsu KSG-18. Dow Corning 9040 Silicone Elastomer Blend is a mixture of a high molecular weight silicone elastomer (dimethicone cross-polymer) in cyclomethicone (D4 < 1 wt%). It has a viscosity range of 250,000-580,000 cp and, as noted above, typical non-volatile
30 content (as supplied) of 12 to 13 wt %.

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Flocculated Particles

The only limitations with respect to the type of particle that may be used in this invention is that the same meets the surface area requirement, can be employed in a composition suitable for use by consumers and is able to flocculate and
5 thicken the elastomeric polymer/swelling agent combination used herein.

Illustrative yet non-limiting examples of the type of particle that may be used in this invention include oxides of silicon, zinc, iron, cerium, zirconium, titanium or aluminium, as well as stearates of zinc, magnesium, or calcium, including any
10 mixtures thereof or the like. Still other particles suitable for use include metal silicates including calcium and/or magnesium silicate whereby the same may be used alone or in combination with any of the particles described herein.

Clays and organically modified clays that meet the surface area criteria can also
15 be used.

In a preferred embodiment, the particles used in this invention comprises at least 0.1% by weight silicon dioxide (i.e., silica), and preferably, at least 25% by weight silicon dioxide, and most preferably, at least 50% to 100% by weight silicon
20 dioxide, based on total weight of particle in the emulsion and including all ranges subsumed therein. In a preferred embodiment, the particle used is silica, especially pyrogenically produced silica. comprising at least one of the following groups:

25 Such silicas are described in United States Patent No. 7,282,236 and made commercially available from suppliers like Evonik Degussa GmbH under the names Aerosil R812, R8128, R202, MS202 and R805. Silica of the octylsilane type is sold under the name Aerosil R805 and is preferred. The Wacker HDK H30 fumed silica is also preferred.

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The particle used typically have a diameter of 5-30nm, above this it is more difficult to generate the surface area required. As noted above it is essential that area of the particles is in excess of 100m²/gram using the BET method. Typical areas are in the range up to 400m²/gram.

5

Internal Phase

Compositions of the present invention will generally include a cosmetically acceptable internal phase which comprises a carrier. The carrier may be a liquid or solid material. Carriers may be present in amounts ranging from about 0 to 95%, and preferably, from 20 to 90%, and most preferably, from 40 to 80% by volume fraction.

10

Water, comprising, the internal phase, is the most common carrier for this invention. The internal phase may comprise C1-6 alkanols. Other suitable carrier classes include silicones, polyhydric alcohols, fatty alcohols, hydrocarbons, triglycerides, each of which are selected to be immiscible with the external phase of the emulsion.

15

Benefit Agents and Other Components

As noted above, end use compositions according to the invention may optionally comprise co-vehicles, carriers or benefit agents like emollients, lipids including fatty acids and/or fatty alcohols, thickeners or combinations thereof. Some materials can function both as, for example, an emollient and a carrier for further benefit agents.

20

- Emollients:

Amounts of the emollients may range anywhere from 0.0 to about 30%, preferably between 1 and 25% by weight of the end use composition.

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Nonvolatile silicone oils useful as an emollient material include polyalkyl siloxanes, polyalkylaryl siloxanes and polyether siloxane copolymers. The essentially nonvolatile polyalkyl siloxanes useful herein include, for example, polydimethylsiloxanes with viscosities of from about 5 mPas.s to 10,000 mPas.s.

- 5 Among the preferred nonvolatile emollients useful in the present end use composition are the polydimethyl siloxanes having a viscosity of 50-350 mPas.s. (typically measured using an Ostwald rheometer at ambient temperature).

10 Emulsifying silicone waxes such as Silwax WS-L (Dimethicone Copolyol Laurate) may also be useful.

Ether emollients may be employed. Suitable materials are fatty dialkyl ethers, including but not limited to Cetiol OE from Cognis.

15 Among the ester emollients are:

- a) Alkyl esters of saturated fatty acids having 10 to 24 carbon atoms. Examples thereof include behenyl neopentanoate, isononyl isononoate, isopropyl myristate, isopropyl palmitate and octyl stearate.

20

- b) Ether-esters such as fatty acid esters of ethoxylated saturated fatty alcohols.

25

- c) Polyhydric alcohol esters. Ethylene glycol mono- and di-fatty acid esters, diethylene glycol mono- and di-fatty acid esters, polyethylene glycol (200-6000) mono- and di-fatty acid esters, propylene glycol mono- and di-fatty acid esters, polypropylene glycol 2000 monostearate, ethoxylated propylene glycol monostearate, glyceryl mono- and di-fatty acid esters, polyglycerol poly-fatty esters, ethoxylated glyceryl mono-stearate, 1,3-butylene glycol monostearate, 1,3-butylene glycol distearate,

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polyoxyethylene polyol fatty acid ester, sorbitan fatty acid esters, and polyoxyethylene sorbitan fatty acid esters are satisfactory polyhydric alcohol esters. Particularly useful are pentaerythritol, trimethylolpropane and neopentyl glycol esters of C1-C30 alcohols.

5

- d) Wax esters such as beeswax, spermaceti wax and tribehenin wax.
- e) Sugar ester of fatty acids such as sucrose polybehenate and sucrose polycottonseedate.

10

Natural ester emollients principally are based upon mono-, di- and tri- glycerides. Representative glycerides include sunflower seed oil, cottonseed oil, borage oil, borage seed oil, primrose oil, castor and hydrogenated castor oils, rice bran oil, canola oil, soybean oil, olive oil, safflower oil, shea butter, jojoba oil and combinations thereof. Mono- and di-glycerides may also be useful. Illustrative of these categories are glyceryl monostearate and glyceryl distearate. Animal derived emollients are represented by lanolin oil and lanolin derivatives. Amounts of the natural esters may optionally range from about 0.1 to about 20% by weight of the end use compositions.

20

- Hydrocarbons:

Hydrocarbons can optionally be employed as acceptable co-carriers in the present invention and they include petrolatum, mineral oil, and polyalpha-olefins.

25

Examples of preferred hydrocarbons include C7-C15 isoparaffins such as isodecane, isododecane, isohexadecane, and mixtures, such as the Isopar Series available from Exxon Chemicals and the Permethyl series available from Presperse Inc.

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- Fatty Acids:

Fatty acids preferred for use include C8-C30 fatty acids. Illustrative of this

5 category are pelargonic, lauric, myristic, palmitic, stearic, isostearic, oleic, linoleic, linolenic, hydroxystearic and behenic acids, especially caprylic or octanoic acid.

- Fatty Alcohols:

10 Fatty alcohols having from 10 to 30 carbon atoms are another useful category of cosmetically acceptable carrier. These may be branched. Illustrative of this category are isostearyl alcohol, oleyl alcohol and octyl dodecanol.

- Thickeners:

15

Water-phase thickeners can be utilized in the end use compositions according to the present invention. Typical thickeners include crosslinked acrylates (e.g., Carbopol 982® and Carbopol Ultrez 21), hydrophobically-modified acrylates (e.g. Carbopol 1382®), polyacrylamides (e.g. Sepigel 305®), acryloylmethylpropane

20 sulfonic acid/salt polymers and copolymers (e.g. Aristoflex HMB® and AVC®), cellulosic derivatives and natural gums. Among useful cellulosic derivatives are sodium carboxymethylcellulose, hydroxypropyl methocellulose, hydroxypropyl cellulose, hydroxyethyl cellulose, ethyl cellulose and hydroxymethyl cellulose.

Natural gums suitable for the present invention include guar, xanthan, sclerotium,

25 carrageenan, pectin and combinations of these gums.

Clay-based thickeners such as Laponites may also be used.

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- Humectants:

Adjunct humectants may be employed in the end use compositions of the present invention. These are generally polyhydric alcohol-type materials. Typical polyhydric alcohols include propylene glycol, dipropylene glycol, polypropylene glycol, polyethylene glycol, sorbitol, hydroxypropyl sorbitol, hexylene glycol, 1,3-butylene glycol, isoprene glycol, ethoxylated glycerol, propoxylated glycerol and mixtures thereof. Most preferred is glycerol, also known also as glycerine.

If used, the amount of adjunct humectant may range anywhere from 0.5 to 20%, preferably between 1 and 15% by weight of the end use composition.

- Surfactants/Emulsifiers:

Surfactants, while not required or desired to prepare or make compositions of the invention, these are highly preferred as being present in end use compositions. Total concentration of the surfactant when present may range from about 0.1 to about 20%, preferably from about 1 to about 15%, optimally from about 1 to about 10% by weight of the end use composition.

The surfactant may be selected from the group consisting of anionic, nonionic, cationic, zwitterionic and amphoteric actives.

Particularly preferred nonionic surfactants are those with:

- a C10-C20 fatty alcohol or acid hydrophobe condensed with from 2 to 100 moles of ethylene oxide or propylene oxide per mole of hydrophobe;
- C2-C10 alkyl phenols condensed with from 2 to 20 moles of alkylene oxide;

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- mono- and di-fatty acid esters of ethylene glycol including di-polyhydroxy stearic acid esters of ethylene glycol (for example Arlacel™ P135);
- 5 • fatty acid monoglyceride;
- sorbitan, mono- and di- C8-C20 fatty acids;
- and polyoxyethylene sorbitan (e.g., Tweens, like Tween 20 and Tween 40)
- 10 as well as combinations thereof.

Alkyl polyglycosides and saccharide fatty amides (e.g. methyl gluconamides) and trialkylamine oxides are also suitable nonionic surfactants. Silicone emulsifiers can also be used.

15

Suitable anionic surfactants include soap, alkyl ether sulfates and sulfonates, alkyl sulfates and sulfonates, alkylbenzene sulfonates, alkyl and dialkyl sulfosuccinates, C8-C20 acyl isethionates, C8-C20 alkyl ether phosphates, C8-C20 sarcosinates, C8-C20 acyl lactylates, sulfoacetates and combinations thereof.

20

Useful amphoteric surfactants include cocoamidopropyl betaine, C12-C20 trialkyl betaines, sodium lauroamphoacetate, and sodium laurodiamphoacetate.

- Perfumes:

25

Perfumes may optionally be used in the end use composition of this invention.

Illustrative non-limiting examples of the types of perfumes that may be used include those comprising terpenes and terpene derivatives like those described in Bauer, K., et al., Common Fragrance and Flavor Materials, VCH Publishers

30 (1990). Preferably, the amount of fragrance employed in the end use composition

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of this invention is in the range from 0.0% to 10%, more preferably, 0.00001% to 5 wt %, most preferably, 0.0001% to 3%.

- Sunscreens:

5

Sunscreen agents may optionally be included in end use compositions of the present invention. Sunscreens are a highly preferred benefit agent.

Sunscreen agents according to this invention will typically have at least one chromophoric group absorbing within the ultraviolet ranging from 290 to 400
10 nanometers.

Chromophoric organic sunscreen agents may be divided into the following categories (with specific examples) including:

- 15 • p-Aminobenzoic acid, its salts and its derivatives (ethyl, isobutyl, glyceryl esters; p-dimethylaminobenzoic acid);
- Anthranilates (o-aminobenzoates; methyl, menthyl, phenyl, benzyl, phenylethyl, linalyl, terpinyl, and cyclohexenyl esters);
20
- Salicylates (octyl, amyl, phenyl, benzyl, menthyl, glyceryl, and dipropylene glycol esters);
- Cinnamic acid derivatives (menthyl and benzyl esters, alpha-phenyl
25 cinnamionitrile; butyl cinnamoyl pyruvate);
- Dihydroxycinnamic acid derivatives (umbelliferone, methylumbelliferone, methylaceto-umbelliferone);

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- Trihydroxycinnamic acid derivatives (esculetin, methylesculetin, daphnetin, and the glucosides, esculin and daphnin);
- 5 • Hydrocarbons (diphenylbutadiene, stilbene);
- Dibenzalacetone and benzalacetophenone;
- Naphtholsulfonates (sodium salts of 2-naphthol-3,6-disulfonic and of 2-
10 naphthol-6,8-disulfonic acids);
- Dihydroxy-naphthoic acid and its salts;
- o- and p-Hydroxybiphenyldisulfonates;
- 15 • Coumarin derivatives (7-hydroxy, 7-methyl, 3-phenyl);
- Diazoles (2-acetyl-3-bromoindazole, phenyl benzoxazole, methyl
naphthoxazole, various aryl benzothiazoles);
- 20 • Quinine salts (bisulfate, sulfate, chloride, oleate, and tannate);
- Quinoline derivatives (8-hydroxyquinoline salts, 2-phenylquinoline);
Hydroxy- or methoxy-substituted benzophenones;
- 25 • Uric and vilouric acids;
- Tannic acid and its derivatives (e.g., hexaethylether);
- 30 • (Butyl carbityl) (6-propyl piperonyl)ether;

- 20 -

- Hydroquinone;
- Benzophenones (Oxybenzone, Sulisobenzene, Dioxybenzone,
5 Benzoresorcinol, 2,2',4,4'-Tetrahydroxybenzophenone, 2,2'-Dihydroxy-4,4'-
dimethoxybenzophenone, Octabenzene; 4-Isopropylidibenzoylmethane;
- Butylmethoxydibenzoylmethane;
- 10 • Etocrylene; and
- 4-isopropyl-dibenzoylmethane.

Particularly useful sunscreen agents are:

- 15 2-ethylhexyl p-methoxycinnamate,
4,4'-t-butyl methoxydibenzoylmethane,
2-hydroxy-4-methoxybenzophenone (known also as Benzophenone-3),
octyldimethyl p-aminobenzoic acid,
digalloyltrioleate,
- 20 2,2-dihydroxy-4-methoxybenzophenone,
ethyl 4-[bis(hydroxypropyl)]aminobenzoate,
2-ethylhexyl-2-cyano-3,3-diphenylacrylate,
2-ethylhexylsalicylate,
glyceryl p-aminobenzoate,
- 25 3,3,5-trimethylcyclohexylsalicylate,
methylantranilate,
p-dimethylaminobenzoic acid or aminobenzoate,
2-ethylhexyl p-dimethylaminobenzoate,
2-phenylbenzimidazole-5-sulfonic acid,
- 30 2-(p-dimethylaminophenyl)-5-sulfoniobenzoxazoic acid,

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4-methylbenzylidene camphor,
bis-ethylhexyloxyphenol methoxyphenol triazine,
methylene bis-benzotriazolyl tetramethylbutylphenol,
dimethicodiethylbenzal malonate,

- 5 isoamyl methoxycinnamate,
octyl triazone,
terephthalidene dicamphor sulfonic acid
and mixtures thereof.

- 10 Especially preferred are ethylhexyl p-methoxycinnamate, available as Parsol MCX®, Avobenzene, available as Parsol 1789® and benzophenone-3, also known as Oxybenzone.

- 15 Inorganic sunscreen actives may be employed such as microfine titanium dioxide and zinc oxide.

Amounts of the sunscreen agents when present may generally range from 0.0 to 20%, preferably from 0.1 to 12%, optimally from 2 to 8% by weight of the end use composition.

20

- Astringent Actives:

In the event the end use composition is an antiperspirant or deodorant composition, the same may comprise astringent actives.

25

Examples include aluminum chlorohydrate, aluminum chlorhydrex, aluminum-zirconium chlorhydrex glycine, aluminum sulfate, zinc sulfate, zirconium and aluminum chlorohydroglycinate, zirconium hydroxychloride, zirconium and aluminum lactate, zinc phenolsulfonate and combinations thereof.

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Amounts of the astringents may range anywhere from about 0.5 to about 25% by weight of the end use composition.

- Anti Caries Actives:

5

Oral products according to the present invention will optionally contain a fluoride source to prevent dental caries.

Typical anti-caries actives include sodium fluoride, stannous fluoride and sodium monofluoro phosphate. Amounts of these materials will be determined by the amount of fluoride releasable which should range between about 500 to about 8800 ppm of the composition. Other components of dentifrices can include desensitizing agents such as potassium nitrate and strontium nitrate, sweeteners such as sodium saccharine, aspartame, sucralose, and potassium acesulfam.

15

- Preservatives:

Preservatives can desirably be incorporated into the end use compositions of this invention to protect against the growth of potentially harmful microorganisms.

20

Particularly preferred preservatives are phenoxyethanol, methyl paraben, propyl paraben, imidazolidinyl urea, dimethyloldimethylhydantoin, ethylenediaminetetraacetic acid salts, sodium dehydroacetate, methylchloro-isothiazolinone, methylisothiazolinone, iodopropynbutyl-carbamate and benzyl alcohol. The preservatives should be selected having regard for the use of the composition and possible incompatibilities between the preservatives and other ingredients.

25

Preservatives are optionally employed in amounts ranging from 0.01% to 2% by weight of the end use composition.

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End use compositions of the present invention may include vitamins. Illustrative vitamins are Vitamin A (retinol), Vitamin B2, Vitamin B6, Vitamin C, Vitamin E, Folic Acid and Biotin.

5 Derivatives of the vitamins may also be employed. For instance, Vitamin C derivatives include ascorbyl tetraisoalmitate, magnesium ascorbyl phosphate and ascorbyl glycoside. Derivatives of Vitamin E include tocopheryl acetate, tocopheryl palmitate and tocopheryl linoleate. DL-panthenol and derivatives may also be employed.

10

Total amount of vitamins when present in the end use compositions according to the present invention may range from 0.001 to 10%, preferably from 0.01% to 1%, optimally from 0.1 to 0.5% by weight of the end use composition.

15 Still other optional additives suitable for use include sunless tanning agents like dihydroxyacetone, antioxidants like lycopene as well as the skin benefit agents like conjugated linoleic acid, and/or petroselinic acid. Even other optional additives include pH modifiers like HCl and NaOH as well as microspheres to scatter light like those made available by Kobo as, for example, MSP-825 and
20 CL-2080.

Skin lightening compounds may optionally be included in the end use compositions of the invention. Illustrative substances are placental extract, lactic acid, vitamin B3 (niacinamide), arbutin, kojic acid, ferulic acid, resorcinol and
25 derivatives including 4-substituted resorcinols. Tranexamic acid, placental extract, ascorbic acid and derivatives thereof (e.g. magnesium ascorbyl phosphate, sodium ascorbyl phosphate, ascorbyl glucoside, and ascorbyl tetraisoalmitates) and combinations thereof. Other skin lightening materials suitable for use herein include Actiwhite® (Cognis), Emblica® (Rona), Azeloglicina (Sinerga) and
30 extracts (e.g. mulberry extract). Amounts of these agents may range from about

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0.1 to about 10%, preferably from about 0.5 to about 2% by weight of the end use composition.

Desquamation promoters may optionally be present. Illustrative are the alpha-
5 hydroxycarboxylic acids and beta-hydroxycarboxylic acids. The term "acid" is
meant to include not only the free acid but also salts and C1-C30 alkyl or aryl
esters thereof and lactones generated from removal of water to form cyclic or
linear lactone structures. Representative acids are glycolic, lactic and malic acids.
Salicylic acid is representative of the beta-hydroxycarboxylic acids. Amounts of
10 these materials when present may range from about 0.01 to about 15% by weight
of the end use composition.

A variety of herbal extracts may optionally be included in compositions of this
invention. The extracts may either be water soluble or water-insoluble. Illustrative
15 extracts include those from green tea, yarrow, chamomile, licorice, aloe vera,
grape seed, citrus unshui, willow bark, sage, thyme and rosemary.

Also included may be such materials as lipoic acid, retinoyltrimethylsilane
(available from Clariant Corp. under the Silcare 1M-75 trademark),
20 dehydroepiandrosterone (DHEA) and combinations thereof. Ceramides (including
Ceramide 1, Ceramide 3, Ceramide 3B and Ceramide 6) as well as
pseudoceramides may also be useful. Amounts of these materials may optionally
range from about 0.000001 to about 10%, preferably from about 0.0001 to about
1% by weight of the end use composition.

25

Colorants, opacifiers and abrasives may optionally be included in the end use
compositions of the present invention. Each of these substances may range from
about 0.05 to about 5%, preferably between 0.1 and 3% by weight of the
composition. One colorant often preferred is carbon black.

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The compositions may comprise an antimicrobial or antifungal active. Such actives are capable of destroying microbes, preventing the development of microbes or preventing the pathogenic action of microbes. A safe and effective amount of an antimicrobial or antifungal active may be added to the present
5 compositions, preferably, from about 0.001% to about 10%, more preferably from about 0.01% to about 5%, and even more preferably from about 0.05% to about 2% by weight of the composition. Preferred examples of these actives include those selected from the group consisting of salicylic acid, benzoyl peroxide, 3-hydroxy benzoic acid, glycolic acid, lactic acid, 4-hydroxy benzoic acid, acetyl
10 salicylic acid, 2-hydroxybutanoic acid, 2-hydroxypentanoic acid, 2-hydroxyhexanoic acid, cis-retinoic acid, trans-retinoic acid, retinol, phytic acid, N-acetyl-L-cystein, lipoic acid, azelaic acid, arachidonic acid, benzoylperoxide, tetracycline, ibuprofen, naproxen, hydrocortisone, acetaminophen, resorcinol, phenoxyethanol, phenoxypropanol, phenoxyisopropanol, 2,4,4'-trichloro-2'-
15 hydroxy diphenyl ether, 3,4,4'-trichlorocarbanilide, octopirox, ciclopirox, lidocaine hydrochloride, clotrimazole, climbazole, zinc pyrethron, miconazole, ketoconazole, neocycin sulfate, and mixtures thereof.

Especially preferred but optional additives suitable for use in this invention include
20 quaternary ammonium compounds such as 1,2-dihydroxypropyl trimonium chloride as well as derivatives thereof and moisturizing agents such as substituted ureas like hydroxymethyl urea, hydroxyethyl urea, hydroxypropyl urea; bis(hydroxymethyl) urea; bis(hydroxyethyl) urea; bis(hydroxypropyl) urea; N,N'-dihydroxymethyl urea; N,N'-di-hydroxyethyl urea; N,N'-di-hydroxypropyl urea;
25 N,N,N'-tri-hydroxyethyl urea; tetra(hydroxymethyl) urea; tetra(hydroxyethyl) urea; tetra(hydroxypropyl urea; N-methyl, N'-hydroxyethyl urea; N-ethyl-N'-hydroxyethyl urea; N-hydroxypropyl-N'-hydroxyethyl urea and N,N'dimethyl-N-hydroxyethyl urea or mixtures thereof. Where the term hydroxypropyl appears, the meaning is generic for either 3-hydroxy-n-propyl, 2-hydroxy-n-propyl, 3-hydroxy-i-propyl or 2-
30 hydroxy-i-propyl radicals. Most preferred is hydroxyethyl urea. The latter is

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available as a 50% aqueous liquid from the National Starch & Chemical Division of ICI under the trademark Hydrovance.

Amounts of optional quaternary ammonium compound and/or substituted urea, when used, in the end use composition of this invention range from about 0.01 to about 20%, and preferably, from about 0.5 to about 15%, and most preferably, from about 2 to about 10% based on total weight of the end use composition and including all ranges subsumed therein.

A wide variety of packaging, including biodegradable packaging, can be employed to store and deliver the end use compositions. Packaging is often dependent upon the type of personal care end-use. For instance, leave-on skin lotions and creams, conditioners and shower gels generally employ plastic containers with an opening at a dispensing end covered by a closure. Typical closures are screw-caps, non-aerosol pumps and flip-top hinged lids.

Packaging for antiperspirants, deodorants and depilatories may involve a container with a roll-on ball on a dispensing end. Alternatively these types of personal care products may be delivered in a stick composition formulation in a container with propel-repel mechanism where the stick moves on a platform towards a dispensing orifice. Metallic cans pressurised by a propellant and having a spray nozzle serve as packaging for antiperspirants, shave creams and other personal care products.

End use compositions of the present invention, therefore, may be in a variety of forms. These forms may also include mousses, aerosol and non-aerosol sprays and fabric (e.g. nonwoven textile)-applied formulations.

In order that the invention may be further understood and carried forth into practice it will be illustrated by means of the following non-limiting examples.

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Examples**Example 1:**

5 Materials are as identified in table 1 given below. Examples 1a and 1b were prepared using a 1L Esco mixer thermostated at 30°C. The silica HDK H30 was added to the DC245 oil under shear using the scraper at 100rpm. The elastomer DC9040 was then incorporated, and the resulting mixture was sheared using the combination of the scraper at 100rpm and the homogenizer at 4,000rpm. The

10 emulsifier Span 80 was then added under the same shear conditions. The water and glycerol were mixed separately until homogenous, and the resulting aqueous mixture added at 20ml.min⁻¹ to the oil phase under continuous mixing in the same conditions as above. After adding the entirety of the aqueous phase the emulsion was kept under shear for an additional five minutes being transferred to adequate

15 storage vessels.

Table 1

			1a	1b
Trade Name	Chemical Name	Supplier	% w/w	% w/w
Water			65	75
Glycerol	Glycerol		5	5
Span 80	Sorbitan Oleate		5	5
DC 245	Cyclomethicone	Dow Corning	11.9	7.125
DC 9040	Cyclomethicone and dimethicone vinyl crosspolymer	Dow Corning	12.5	7.5
HDK H30	Hydrophobic fumed silica	Wacker	0.6	0.375

20

The products exhibited low stickiness when rubbed on skin.

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Example 2: Further and Comparative Examples:

To prepare the formulations as in Examples 2-A to 2-D, the silica HDK H30 was added to the DC245 or COE oil using a four-bladed mixer at 600 rpm. The mixture
5 was then sheared at 5000 rpm for 2.5 minutes using a Silverson L4RT with 50 mm head and square open screen. The elastomer DC9040 was then incorporated in this initial mixture. The contents were blended with a pallet knife for 10 minutes, and the mixture was then further sheared using an overhead mixer with a four-bladed paddle for 5 minutes at 300 rpm, 5 minutes at 600 rpm and 5 minutes at
10 900 rpm. All samples were prepared at room temperature between 20 and 25°C.

Materials are as mentioned above in Example 1, except that "COE" is Cetiol™ OE (dicapryl ether) ex Cognis.

15 Shear stress was measured in a stress-controlled Bohlin C-VOR rheometer fitted with a serrated cup and bob geometry (C14 DIN 53019). The gap between the tips of the cup and bob serrations was 0.7 millimeters. The measurements were made in controlled rate mode, at a controlled temperature of 25°C. A pre-shear of a minimum of 100s^{-1} was applied for 60 sec and the shear rate was cycled
20 between 0.01 s^{-1} and 1000 s^{-1} in logarithmic steps with 8 points per decade. The shear stress values (Pa) were extracted for shear rates of 0.1 s^{-1} (Y) and 316 s^{-1} (X) and the internal phase volume (Z) was calculated as internal phase volume%/100%. The presence of stickiness (S) was determined by a Skilled Worker (as N= not present, Y= present).

25

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Table 2

		X	Y	Z	S
2a	50% DC 9040, 2.5% HDK H30, 47.5% DC 245	182	119	0	N
2b	60% DC 9040, 2% HDK H30, 38% COE	197	116	0	N
2c	50% DC 9040, 1.5% HDK H30, 48.5% DC 245	236	130	0	N
2d	50% DC 9040, 2.5% HDK H30, 47.5% COE	96	43	0	N
1a	As Example 1A	615	123	69	N
1b	As Example 1B	782	162	79	N
C1	As in Patent US 6,183,766 B1 (comparative)	185	21	14	Y
C2	As in Patent WO 2209/112492 A2 (comparative)	668	56	25	Y
C3	As in Patent US 2002/00187790 A1 (comparative)	72	2	42	Y

- 5 From the above it can be determined that the products 1a, 1b and 2a-d satisfy the criterion, where $\sigma T s^{-1}$ is the shear stress at shear rate $T s^{-1}$ that:

$$\text{Log}_{10} (\sigma 316 s^{-1} / \sigma 0.1 s^{-1}) \leq 0.64 + (0.4 \times \text{internal phase volume})$$

- 10 where internal phase volume = internal phase volume%/100%.

These examples show that products made to meet the formulation and the rheology criteria offer a superior sensory performance.

CLAIMS

1. A composition comprising an oil phase, wherein the oil phase comprises:

- 5 a) 2-10%wt of particles of an elastomeric polymer;
- b) a swelling agent for the elastomeric polymer, and;
- 10 c) 1-10%wt of a thickener comprising flocculated particles, said particles having a surface area in excess of 100m²/gram, as measured by the BET method using nitrogen adsorption;

wherein the ratio of the shear stress (σ) of the composition measured at 316s⁻¹ to the shear stress measured at 0.1s⁻¹ is such that:

$$\text{Log}_{10} (\sigma_{316\text{s}^{-1}} / \sigma_{0.1\text{s}^{-1}}) \leq 0.64 + (0.4 \times \text{internal phase volume})$$

where internal phase volume = internal phase volume%/100%.

2. A composition according to claim 1 wherein the internal phase volume is from 0 to 95%, preferably, from 20 to 90%, most preferably, from 40 to 80% of the composition.

3. A composition according to claim 1 or 2 wherein the elastomeric polymer is cross-linked.

4. A composition according to claim 3 wherein the elastomeric polymer is a poly-oxyalkylene-modified elastomer formed from divinyl compounds.

5. A composition according to claim 3 or 4 wherein the elastomeric polymer is a silicone crosspolymer.

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6. A composition according to any one of claims 1-5 wherein the swelling agent is volatile.
- 5 7. A composition according to any one of claims 1-6 wherein the swelling agent is a silicone.
8. A composition according to claim 7 wherein the swelling agent is a cyclomethicone or linear poly-dimethylsiloxanes containing from 3-9, preferably from 4-5, silicon atoms.
- 10 9. A composition according to any one of claims 1-8 in which the thickener comprising flocculated particles is a silica.
- 15 10. A composition according to any one of claims 1-9 further comprising at least one of, independently, hydrocarbon, fatty acid, and fatty alcohol.
11. A composition according to any one of claims 1-10, further comprising an emollient selected from silicone oils, emulsifying silicone waxes, ether emollient or ester emollient.
- 20 12. An end-use composition comprising the composition of any one of claims 1-11, wherein said end-use composition is a leave-on skin lotions or cream, a hair conditioner, shower gel, antiperspirant, deodorant, shaving cream, depilatory, lipstick, foundation, mascara, sunless tanner, skin lightening composition or sunscreen.
- 25 13. An end-use composition according to claim 12 which further comprises 0.1 to about 20% surfactant, preferably from about 1 to about 15%, optimally from about 1 to about 10% by weight of the end use composition.

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14. An end-use composition according to claim 13, wherein the surfactant is a sugar ester.
 15. A method for treating a condition by applying the end-use composition according to any of claims 12-14.
- 5