Cosmetic or dermatological compositions of saccharose substitutes

Abstract: The present invention relates to scalp and hair care formulations capable of providing enhanced moisturization. Formulations of the invention include a saccharose substitute having appreciable scalp conditioning properties and at least one additional ingredient. Methods of improving the moisturization of the scalp are also described.
BACKGROUND OF THE INVENTION

Our current knowledge of the physiology of the scalp now enables us to propose cosmetic solutions to the various dysfunctions induced by external aggression and aging. However, many things remain poorly elucidated, poorly understood and poorly controlled. This is true, for instance, in the case of the general symptoms of irritations, dryness, increased transepidermal water loss, itching and scaly appearance of the skin on the head (scalp). The treatment of those symptoms is an important subject of research for the cosmetic market.

External or internal factors can both lead to the emergence of symptoms of scalp irritation. Aggressive shampoos, permanent waving, blow drying, but also stress, pollution and excessive sunlight contribute to this.

Numerous cosmetic compositions intended to improve the appearance of the scalp and the hair that emerges from it have been proposed to date. These include shampoos, conditioners, leave-on masks, friction lotions, sprays, styling gels and the like. Frequently, however, those products have side effects, are associated with stability problems and/or do not make good their promise over time. A number of ingredients have been over time proposed for inclusion in these types of finished cosmetic preparations; they range from glycerine and urea (typical moisturizers) to octopyrox and ketokonazole (anti-microbial compounds) to camomilla and kava-kava extracts with soothing and anti-inflammatory properties. This is, in particular, the case for formulae containing vitamins and plant extracts.

A product is currently sold by Sederma, 29 rue du Chemin Vert, BP 33, 78612 Le Perray en Yvelines, Cedex France, under the name Ecodermine, which contains 30% lactitol, 30% xylitol and
40% glycerine. This material is sold to the cosmetic and personal care industry. See also FR 2 713 086; WO 95/15149. The present invention is designed to assist in resolving the esthetic problems posed by scalp irritation and dryness symptoms and, preferably, to address the underlying causes thereof.

SUMMARY OF THE INVENTION

In one particularly preferred aspect of the present invention there is provided a personal care product, which includes amounts of at least one saccharose substitute exhibiting "scalp conditioning". More particularly, there is provided a personal care product comprising at least an effective amount of a saccharose substitute possessing "scalp conditioning" properties, such as xylitol or lactitol or a combination thereof. These should be contrasted with, for example, adonitol, which, while possibly a saccharide substitute structurally, possesses insufficient "scalp conditioning" properties as described herein.

"Appreciable scalp conditioning" means a capacity for treating or preventing one or more signs, symptoms and/or causes of scalp dryness when tested in a standard formulation using a method as described herein. In a preferred embodiment, appreciable scalp conditioning means that there is at least a 25% increase in scalp conditioning, e.g. moisturization of scalp tissue, over a base line, 2.5 hours after application of a leave on formulation as provided herein, formulated with the saccharose substitute in question, as tested in a manner consistent with that described in this document and its examples. In an even more preferred embodiment, at least a 30% increase in moisturization is realized. Any sugar, sugar alcohol, ketose, aldose, mono-, di- or trisaccharide may be used as a saccharose substitute so long as it exhibits sufficient scalp conditioning properties as described herein.
The recognition that only certain saccharose substitutes may be useful is one other aspect of the invention. Certain saccharose substitutes as described and claimed herein, when properly formulated and applied, can be used therapeutically and/or cosmetically to reduce signs of scalp deterioration and, in a preferred embodiment, reduce skin irritation and/or dryness. It has now been found that when effective amounts of such saccharose substitutes are used in hair care products, the resulting degree of, for example, scalp moisturization observed is higher than that observed for the standard shampoos or conditioners alone. In particular, the drying out of the skin is reduced by the discovery of an unexpected effect of barrier repair, i.e. a significant increase in moisture retention and/or a decrease in trans-epidermal water loss ("TEWL"). It has also been found that the pH of the products used in accordance with the present invention should be neutral to slightly acidic. Preferably, these products have a pH of about 7 or less, and more preferably about 3.5-7. Even more preferably the pH ranges from about 3.5 to about 6.5. Personal care formulations or products (used interchangeably) including saccharose substitutes, in accordance with the invention, further comprise at least one additional ingredient, such as, for example, the materials used to produce a shampoo, rinse off conditioner or leave on conditioner. The resulting personal care product may be formed as a solution, dispersion, colloid, milk, liquid, mousse, ointment, suspension, spray on formulation, rinse off formulation and leave on formulation, cream rinse and the like, cream, gel or lotion. The use of such formulations for the production of a medicament useful for the treatment of scalp dryness and irritation, as well as methods of their use, are also contemplated.
The present invention also relates to the use of such compositions to make personal care products for reducing visible or perceived signs of such scalp deterioration, in particular dryness, increased transepidermal water loss, irritation and/or itching. This is accomplished by topical application of products in accordance with the invention, including saccharose substitutes, to the scalp of a patient, often a human, needing such treatment. The present invention also relates to methods of using such compositions to improve the state and appearance of the scalp and to prevent and/or reduce the visible or perceivable signs of scalp deterioration. These methods generally include the topical application of a desired amount of a formulation in accordance with the present invention to the scalp where needed. This is repeated at a frequency best suited for the specific formulation and purpose.

In accordance with another preferred embodiment of the present invention, there is provided a method of treating or preventing at least one sign of scalp deterioration in a human, such as, without limitation, dryness, and/or irritation. The method includes at least the steps of obtaining an amount of a composition which comprises an effective amount of at least one saccharose substitute having appreciable scalp conditioning properties as defined herein. The composition also includes at least one additional ingredient. The method also includes the step of applying an amount of the cosmetic composition to the scalp of a human in need of scalp improving treatment or protection. Often, the composition is applied to the scalp in need of treatment or protection once a day or twice a day. This continues for at least one week.

Also contemplated are kits or systems wherein two or more hair/scalp compositions are designed to be used in coordination to provide even greater performance. These
products may be distributed together or separately and may include directions indicating how each may be used in coordination.

More particularly, in one embodiment, the present invention provides a personal care composition comprising: at least one saccharose substitute exhibiting appreciable scalp conditioning, in an amount of about 0.01 to about 10% by weight of said composition, and at least one additional ingredient, said composition having a pH of about 7 or less. Appreciable scalp conditioning means that there is at least a 25% increase in scalp conditioning, moisturization of scalp tissue, over a base line, 2.5 hours after application of a leave on formulation as provided herein formulated with the saccharose substitute in question, as tested in a manner consistent with that described in this document and its examples. In an even more preferred embodiment, the saccharose substitute is provided in an amount of about 0.05 to about 5% by weight of said composition.

In an even more preferred embodiment, the saccharose substitute provides an increase in scalp moisturization of at least about 30% 2.5 hours after application of said composition. This, determined as described above in connection with the term appreciable scalp conditioning, is a more preferred definition of appreciable scalp conditioning. The personal care composition preferably includes at least one additional ingredient which is a surfactant, detergent, skin conditioner, hair conditioner, pH adjuster, quat, protein, polypeptide, viscosity modifier, salt, gel former or water. Of course, this means that these may be provided in combination with or without other materials that may or may not also be classified as additional ingredients as defined herein.

In another embodiment, the present invention includes a scalp treatment kit comprising: a shampoo and a conditioner, wherein
each of said shampoo and said conditioner includes at least one saccharose substitute exhibiting appreciable scalp conditioning, in an amount of about 0.01 to about 10 % by weight of each of said shampoo and said conditioner, and each of said shampoo and said conditioner include at least one additional ingredient, said shampoo having a pH of about 4.5 to about 7 and said conditioner having a pH of about 3.5 to about 6.5. Appreciable scalp conditioning is defined in the same manner as discussed in the preceding paragraphs and this document. The saccharose substitute in each of the shampoo and the conditioner are more preferably provided in an amount of about 0.05 to about 5 % by weight thereof.
The scalp treatment kit may include a leave on conditioner and preferably, a shampoo, rinse off conditioner and a leave on conditioner.

Another aspect of the present invention is method of improving the moisturization of the scalp of a subject in need thereof, comprising the steps of: providing a personal care composition comprising: at least one saccharose substitute exhibiting appreciable scalp conditioning, in an amount of about 0.01 to about 10 % by weight of said composition, and at least one additional ingredient, said composition having a pH of about 7 or less and applying an amount of said composition sufficient to cover a desired area of said scalp. Providing may include removing the composition from a container and placing the composition in a subjects hand or directly on the subjects hair/scalp. Applying means, placing the dispensed amount of the compositon on the head of the subject and/or, as appropriate, spreading the provided amount of the composition to cover the desired area of the scalp. The amount of the composition applied should be sufficient to cover the area of the scalp in need of treatment or on which treatment or prevention is desirable.

BRIEF DESCRIPTION OF THE DRAWINGS
Figure 1 is a graphical representation of the results of a comparative test between a product containing a saccharose substitute of the invention and a product containing adonitol.

**DETAILED DESCRIPTION**

All terms such as "scalp condition", "signs of scalp irritation, dryness, increased transepidermal water loss, itching", "topical application", and the like are used in the sense in which they are generally and widely used in the art of developing, testing and marketing cosmetic and personal care products. The terms "personal care composition", "cosmetic composition" or more briefly just "composition" in accordance with the present invention relates to a formulation that can be used for cosmetic purposes, purposes of hygiene or as a basis for delivery of one or more pharmaceutical ingredients. "Composition" "formulation" and "product" are used interchangeably unless the contexts suggest otherwise. It is also possible that these formulations are used for two or more of these same purposes at one time. A medicated dandruff shampoo, for example, has pharmacological properties and is used as a personal care product to provide clean hair. These compositions may also include additional ingredients such as a dermatologically acceptable carrier.

"Signs of scalp deterioration" and other phrases similarly referring to, for example, symptoms of scalp dryness and the like include, but are not limited to, all outward visibly and perceptible manifestations as well as any other macro or micro effects due to scalp deterioration. Such signs may be induced or caused by intrinsic factors and/or extrinsic factors, e.g., chronological aging and/or environmental damage. These signs may result from processes which include, but are not limited to, the development of dryness, increased transepidermal water loss, irritation, itching, redness, microbial colonization, textural discontinuities such as scales and dandruff.
While the specification concludes with the claims particularly pointing and distinctly claiming the invention, it is believed that the present invention will be better understood from the description. The terms “comprising”, “having”, and “including” are to be construed as open-ended unless the context suggests otherwise.

All percentages and ratios used herein are by weight of the total composition and all measurements made are at 25°C unless otherwise designated.

In accordance with the present invention, the saccharose substitutes used singly or in combination with each other are polyols possessing scalp conditioning properties. The term "saccharose substitute" in accordance with the present invention means a compound that contains at least three, preferably 5 or 6 carbon atoms, in linear or cyclic molecules, bearing two or more hydroxyl groups in various configurations in addition to hydrogen and other substituents. Saccharose substitutes such as erythritol, butanediol, butanetriol, adonitol, arabitol, pentaerythritol, pentitol, xylitol, pentanediols, pentanetriols, galactitol, hexanetriol, hexylene glycol, mannitol, sorbitol, hexanediols, isomalt, lactitol, maltitol, and the like; sugars (e.g., xylulose, fructose, melibiose, sucrose, maltose) are all contemplated so long as they have the requisite scalp conditioning properties. More preferably, the saccharose substitutes used in are chosen among xylitol, sorbitol, lactitol arabinol, xylulose or mixtures thereof. They must, however, provide sufficient scalp conditioning when tested as described herein. Mixtures of these saccharose substitutes are also contemplated.

Not all compounds which could structurally be classified as a saccharose substitute or a polyol will be useful in providing sufficient "scalp conditioning". For example, as is illustrated in the examples, adonitol was tested in a head-to-head comparison with a mixture of equal amounts of
xylitol and lactitol in otherwise identical formulations. While the xylitol/lactitol mixture provided improved scalp conditioning as measured by conductance in microsiemens of at least about 25% at 2.5 hours after application compared to prior to the application, a comparable formulation with a like amount of adonitol exhibited much less of an improvement. Specifically, scalp conditioning of a particular saccharose substitute can be evaluated by formulating same in a leave-on conditioning formulation having the following formulation shown in Table I.

### Table I

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>INCI name</th>
<th>Supplier</th>
<th>Adonitol formula (%)</th>
<th>HAIRSPA™ Formula (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incroquat CTC 30</td>
<td>Cetrimonium chloride</td>
<td>CRODA</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>Citric Acid</td>
<td></td>
<td>0.22</td>
<td>0.22</td>
</tr>
<tr>
<td>Citrate Trisodique</td>
<td>Citrate trisodique</td>
<td></td>
<td>1.20</td>
<td>1.20</td>
</tr>
<tr>
<td>Potassium Sorbate</td>
<td>Potassium Sorbate</td>
<td></td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>H₂O</td>
<td></td>
<td></td>
<td>92.18</td>
<td>92.18</td>
</tr>
<tr>
<td>Phase B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methyl Paraben</td>
<td>Methyl paraben</td>
<td></td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Procetyl AWS</td>
<td>PPG 5 Ceteth 20</td>
<td>CRODA</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Phase C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glycerin</td>
<td></td>
<td></td>
<td>0.80</td>
<td>0.80</td>
</tr>
<tr>
<td>Lactitol</td>
<td></td>
<td></td>
<td>0.00</td>
<td>0.60</td>
</tr>
<tr>
<td>Xylitol</td>
<td></td>
<td></td>
<td>0.00</td>
<td>0.60</td>
</tr>
<tr>
<td>Adonitol</td>
<td></td>
<td></td>
<td>1.20</td>
<td>0.00</td>
</tr>
<tr>
<td>Phase D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crillet 1</td>
<td>Polysorbate 20</td>
<td>CRODA</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>
The saccharose substitute to be tested replaces those identified in Phase C of Table 1. Both of the formulations in Table 1 had a pH of 5.7.

Measurements of retained moisture in the scalp are obtained using a DERMALAB device available from Cortex Technologies; and specifically, DermaLab® Serial n° C-02000.01-142, Cortex Technology Aps, Smedevaenget, 10, 9560 HADSUND, DENMARK; with an 8-pin probe (Moisture Pin Probe Serial n° C-0600201-137; “Moisturizing power”, also referred to herein, as the context suggests, as “measured moisture content”, “moisturizing”, “retaining scalp moisture”, “moisture retention”, and similar terms, is generally measured along the median side of the head from the ear to the vertex of the head (that area on the top where the spiral portion of the hair pattern of a person's head generally begins). Moisture readings are obtained in this way prior to the application of the material in question and again at 2.5 hours thereafter (T 2.5). A successful saccharose substitute, one with appreciable scalp conditioning properties, will yield a percent increase in measured moisture content of 25 % compared to the baseline or T 0 reading, taken before the application of the product. More preferably, 30 % improvement over baseline at 2.5 hours will be realized. If a compound that would otherwise structurally fall within the definition of a saccharose substitute, formulated and tested this way, does not exhibit at least 25 % increase in measured moisture content compared to a baseline of T0, such as adonitol in the formulation identified in Table I, it does not have appreciable scalp conditioning or appreciable scalp conditioning properties and would not constitute a saccharide substitute in accordance for the present invention. This type of testing is further described in the examples. The amount used in each will vary somewhat given the subject and size of
their scalp. However, generally an amount sufficient to completely coat the hair and scalp in the tested area without leaving a residue which would be found unacceptable to professional hair care specialists will be used, about 0.1 gram of the formulation over approximately a square inch per application.

While the above test can tell one whether or not a particular saccharose substitute can be used as a saccharose substitute in accordance with the present invention, i.e., it provides appreciably scalp conditioning, it does not define an effective amount thereof. It is possible to use a greater or lesser concentration of a saccharose substitute in accordance with the present invention in a given formulation as long as the amount actually used is sufficient to provide an improvement in scalp conditioning/measured moisture content. If more than one product is to be used, such as a kit or system of a shampoo, rinse-off conditioner, and leave-on conditioner, for example, the effective amount may be spread over one or more of these three products. More specifically, the amount of saccharose substitute in accordance with the present invention can generally range from as little as about 0.01 to as much as about 10 and more preferably ranges from between 0.05 to about 5 % by weight of the total formulation.

The amount of saccharose substitute will vary widely with the nature and composition of the personal care product, the degree of TEWL reduction desired, and/or the degree of moisturization of moisture retention desired, particularly in a given period, whether or not the personal care product will be used in a system of products which are used to supplement one another, the saccharose substitute selected and the like. In a particularly preferred embodiment in accordance with the present invention, the saccharose substitute is xylitol, lactitol or mixtures thereof.
One or more "additional ingredients" including one or more dermatologically acceptable carrier(s) are also preferably used in these saccharose substitute compositions. The term "dermatologically acceptable" as used herein, means that the compositions or components described are suitable for use in contact with human scalp without risk of toxicity, incompatibility, instability, allergic response, and the like. The additional ingredients can include the complete balance of the formulation, other than the saccharose substitutes. In Table I, for example, everything but the xylitol and lactitol under the heading HAIRSPA™ are "additional ingredients". To the extent that the formulations include something not considered a saccharose substitute or an additional ingredient, the amount of additional ingredients is the balance other than the saccharose substitute and this other material.

The formulations and compositions of the invention are intended to be applied to the hair and/or scalp. These can be in the form of mousse, sprays, gels, creams, milks, lotions, ointments, emulsions, colloids, solutions, suspensions, spray-on formulations, brush-on formulations, leave-on formulations and the like. "Personal care products" of the compositions include, without limitation, bath and shower gels, shampoos, conditioners, cream rinses, leave-on conditioners, hair sprays, depilatories and permanent waving solutions. Most preferably, these are designed so as to be as gentle as possible so that the personal care product does not undo the benefits of the use of the saccharose substitutes of the invention. "Pharmaceutical preparations" in accordance with the present invention further include, without limitation, some therapeutically active ingredient in addition to the saccharose substitutes to be applied to the scalp or scalp hair.
As used herein, "prophylactically regulating" a scalp condition includes delaying, minimizing and/or preventing visible and/or perceived signs of scalp deterioration including signs of dryness, increased transepidermal water loss, irritation, itching.

Some of the products produced using the compositions of the present invention and indeed the compositions themselves may be used for prophylactically or therapeutically to provide or to maintain a desired level of scalp conditioning.

Some of the compositions of the present invention may also provide additional benefits, including stability, absence of significant (consumer-unacceptable) scalp irritation, anti-inflammatory activity and good aesthetics.

In certain preferred aspects, the present invention is useful for improving the physiological state and/or the physical appearance of human scalp, and in particular to reduce the signs of scalp deterioration that are generated by aggressive scalp treatment (shampoos, brushing, blow drying, permanent waving, hair dyeing), sun exposure, physical and hormonal stress, abrasion, nutritional effects and other similar causes. The compositions may often be used to prevent the signs of scalp deterioration and/or to treat them in order to afford the consumer who uses them, a more youthful appearance and sensation of well being.

Preferably the personal care products of the invention, which include personal grooming, cosmetic, and dermapharmaceutical products, can be applied in any known manner and at any time interval over any time period known for like products of similar composition and/or objective. Thus, the products can be applied once, twice, three times or even four times a day, or more. They can also be applied over a period of days, weeks, or months, typically for one week or longer, more typically two weeks or longer. If used propylactically, those
products may be used less often per day, but over an extended period of time. The compositions of the present invention can comprise or consist essentially of the components of the present invention as well as other ingredients described herein. As used herein, “consisting essentially of” means that the composition or component may include additional ingredients, but only if the additional ingredients do not materially alter the basic and novel characteristics of the claimed compositions or methods. Preferably, such additives will not be present at all or only in trace amounts. However, it may be possible to include up to about 10% by weight of materials that could materially alter the basic and novel characteristics of the invention as long as the utility of the compounds (as opposed to the degree of utility) is maintained.

Xylitol

Lactitol

Xylitol is an hydrogenation product obtained from xylose. Lactitol (4-O-(β-galactosyl) D-glucitol) is an hydrogenation product obtained from lactose. In order to implement the invention, it is sufficient to incorporate the saccharose substitutes of the invention, at sufficient and effective concentrations, into cosmetic or dermopharmaceutical compositions, including but not limited to those currently on the market, and to apply a sufficient and effective quantity to the affected parts of the scalp as
needed, often for a period ranging from 2 weeks to 2 months or more.
Saccharose substitutes may be obtained by conventional chemical synthesis, semisynthesis, or by enzymatic synthesis. Polyols can be obtained from plant or vegetable extraction (e.g. xylitol, arabitol), or, in a preferred embodiment, by catalytic hydrogenation of simple sugars like xylose for xylitol, lactose for lactitol and reduction of the carbonyl group of arabinose to form the sugar alcohol arabitol.
The saccharose substitutes may also be obtained by fermentation of a bacterial strain that has or has not been modified by genetic engineering to produce the required sequences or their various fragments.
Other more simple or more complex processes yielding cheaper or more pure products may readily be envisaged by the professional with an understanding of the extraction and purification of sugars and derivatives thereof.

[0010] The saccharose substitutes of the present invention are used in the cosmetic compositions and personal care products compliant with the invention at concentrations ranging from about 0.01 % (w/w) to about 10 % (w/w), but preferably from about 0.05 % (w/w) to about 5 % (w/w).
In a preferred embodiment, the amount of one saccharose substitute to the other, in a mixture, such as one of xylitol relative to the amount of lactitol is equal. The ratio of saccharose substitutes such as xylitol to lactitol can range from about 1:100, to about 100:1. The effective amount of saccharose substitute will differ with the type of saccharose substitute selected, the type of formulation in which it is compounded, and the methods by which and for which it is used. In one particular mode of implementation of the invention, personal care products of the invention contain the xylitol and lactitol, each at a concentration ranging from 0.1 % (w/w) to 5.0 % (w/w) with glycerin as a carrier or solvent.
The combination of the saccharose substitutes that constitute the subject of the present invention with other cosmetic or pharmaceutically active substances (vide infra), is an advantageous implementation of the invention.
The saccharose substitute compliant with the present invention, may be used in compositions compliant with the invention either as the saccharose substitute themselves or in the form a premix in a suitable excipient and/or additional ingredient and they may be used in the form as previously discussed. They may individually or with other active substances, cited or not cited, be carried by various vectors such as macro-, micro- or nanocapsules, macro-, micro- or nanospheres, liposomes, oleosomes or chylomicrons, macro-, micro- or nanoparticles, macro-, micro- or nanosponges. They may also be adsorbed on powdered organic polymers, talcs, bentonites and other inorganic carriers.
Additional Ingredients
In addition to the saccharose substitutes, the compositions of the invention may include various other and additional ingredients, which may be active, functional, conventionally used in cosmetic, personal care or topical/transdermal pharmaceutical products or otherwise. Of course, a decision to include an additional ingredient and the choice of specific additional ingredients depends on the specific application and product formulation. Also, the line of demarcation between an "active" ingredient and an "inactive ingredient" is artificial and dependent on the specific application and product type. A substance that is an "active" ingredient in one application or product may be a "functional" ingredient in another, and vice versa. A particular ingredient might provide substantivity in one formulation, facilitate transdermal application in another, and merely provide proper viscosity in a third. Which of these is functional and which is active is subject to debate. But, regardless of the outcome, the material in
question would qualify as an additional ingredient in accordance with the present invention. Thus, the compositions of the invention may include one or more additional ingredients, which provide some benefit to the object of the composition. Such additional ingredients may include one or more substances such as, without limitations, cleaning agents, surfactants, hair conditioning agents, skin conditioning agents, hair styling agents, antidandruff agents, hair growth promoters, sunscreen and/or sunblock compounds for hair and/or skin, moisturizers/humectants, film formers, thickening agents, emulsifiers, emollients, dermatologically acceptable carriers. In a preferred embodiment, where the composition is to be in contact with human keratinous scalp tissue and/or hair, the additional ingredients should be suitable for application to keratinous scalp tissue and/or hair, that is, when incorporated into the composition they are suitable for use in contact with human keratinous scalp tissue and/or hair without undue toxicity, incompatibility, instability, allergic response, and the like within the scope of sound medical judgment. The CTFA Cosmetic Ingredient Handbook, Tenth Edition (2004) describes a wide variety of nonlimiting cosmetic and pharmaceutical ingredients commonly used in the skin care industry, which are suitable for use as additional ingredients in the compositions of the present invention. Non-limiting examples of these additional ingredient classes include: aesthetic components such as fragrances, colorings/colorants, essential oils, astringents, etc. (e.g., clove oil, menthol, camphor, eucalyptus oil, eugenol, menthol lactate, witch hazel distillate), antimicrobial agents, antioxidants, binders, biological additives, buffering agents, chelating agents, chemical additives, colorants, cosmetic astringents, cosmetic biocides, denaturants, film formers or materials, e.g., polymers, for aiding the film-forming properties and substantivity of the
composition of opacifying agents, pH adjusters, propellants, reducing agents, sequestrants, skin-conditioning agents skin soothing and/or healing agents (e.g., panthenol and derivatives, aloe vera, pantothenic acid and its derivatives, allantoin, bisabolol, and dipotassium glycyrrhizinate), skin treating agents, thickeners, and vitamins and derivatives thereof. More particularly, additional ingredients include glycerol, sorbitol, pentaerythritol, pyrrolidone acid and its salts, sunscreens, plant tissue extracts, polysaccharide; anti-dandruff agents; antiseborrheic agents, an oxidant, a bleaching agent, a reducing agent, a vitamin, a steroid, an enzyme, a non-steroidal anti-inflammatory, an antimicrobial, substances intended to improve the state of dry or aged skin, tocopherols, vitamins E, F or A and their esters, antioxidants, essential fatty acids, glycyrrhetinic acid, keratolytics and carotenoids, ceramides and pseudo-ceramides, and all lipid complexes of a form similar to that of the natural ceramides of the scalp.

In any embodiment of the present invention, however, the additional ingredients useful herein can be categorized by the benefit they provide or by their postulated mode of action. However, it is to be understood that the additional ingredients useful herein can in some instances provide more than one benefit or operate via more than one mode of action. Therefore, classifications herein are made for the sake of convenience and are not intended to limit the additional ingredients to that particular application or applications listed.

Farnesol

The topical compositions of the present invention may contain a safe and effective amount of farnesol. Farnesol is a naturally occurring substance which is believed to act as a precursor and/or intermediate in the biosynthesis of squalene and sterols, especially cholesterol. Farnesol is also involved
in protein modification and regulation (e.g., farnesylation of proteins), and there is a cell nuclear receptor which is responsive to farnesol.

Chemically, farnesol is [2E,6E]-3,7,11-trimethyl-2,6,10-dodecatrien-1-ol and as used herein "farnesol" includes isomers and tautomers of such. Farnesol is commercially available, e.g., under the names farnesol (a mixture of isomers from Dragoco, 10 Gordon Drive, Totowa, N.J.) and trans-trans-farnesol (Sigma Chemical Company, P.O. Box 14508, St. Louis, Mo.).

When present in the compositions of the present invention, the composition preferably contains from about 0.001% to about 50 %, by weight of the composition, more preferably from about 0.01 % to about 20 %, even more preferably from about 0.1 % to about 15 %, even more preferably from about 0.1 % to about 10 %, still more preferably from about 0.5 % to about 5 %, and still more preferably from about 1 % to about 5 % of farnesol.

Phytantriol

The topical compositions of the present invention may contain a safe and effective amount of phytantriol. Phytantriol is the common name for the chemical known as 3,7,11,15, tetramethylhexadecane-1,2,3, -triol. Phytantriol is commercially available from BASF (1609 Biddle Avenue, Whyandotte, Mich.). For example, phytantriol is useful as a spider vessel/red blotchiness repair agent, a dark circle/puffy eye repair agent, sallowness repair agent, a sagging repair agent, an anti-itch agent, a skin thickening agent, a pore reduction agent, oil/shine reduction agent, a post-inflammatory hyperpigmentation repair agent, wound treating agent, an anti-cellulite agent, and regulating skin texture, including wrinkles and fine lines.

In the compositions of the present invention, the phytantriol preferably is included in an amount from about 0.001 % to about 50 % by weight of the composition, more preferably from
about 0.01 % to about 20 %, even more preferably from about 0.1 % to about 15 %, even more preferably from about 0.2 % to about 10 %, still more preferably from about 0.5 % to about 10 %, and still more preferably from about 1 % to about 5 %.

Desquamation Actives
A safe and effective amount of a desquamation active may be added to the compositions of the present invention, more preferably from about 0.1% to about 10%, even more preferably from about 0.2% to about 5%, also preferably from about 0.5% to about 4%, by weight of the composition. Desquamation actives enhance the skin appearance benefits of the present invention. For example, the desquamation actives tend to improve the texture of the skin (e.g., smoothness). One desquamation system that is suitable for use herein contains sulfhydryl compounds and zwitterionic surfactants and is described in U.S. Pat. No. 5,681,852, to Bissett, incorporated herein by reference. Another desquamation system that is suitable for use herein contains salicylic acid and zwitterionic surfactants and is described in U.S. Pat. No. 5,652,228 to Bissett, incorporated herein by reference. Zwitterionic surfactants such as described in these applications are also useful as desquamatory agents herein, with cetyl betaine being particularly preferred.

Vitamin B₃ Compounds
The compositions of the present invention may contain a safe and effective amount of a vitamin B₃ compound. Vitamin B₃ compounds are particularly useful for regulating skin condition as described in co-pending U.S. application Ser. No. 08/834,010, filed Apr. 11, 1997 (corresponding to international publication WO 97/39733 A1, published Oct. 30, 1997). When vitamin B₃ compounds are present in the compositions of the instant invention, the compositions preferably contain from about 0.01% to about 50%, more preferably from about 0.1% to about 10%, even more preferably
from about 0.5% to about 10%, and still more preferably from about 1% to about 5%, still more preferably from about 2% to about 5%, by weight of the composition, of the vitamin B₃ compound.

As used herein, "vitamin B₃ compound" means a compound having the formula:

\[
\text{\[ R \]}
\]

wherein R is —CONH₂ (i.e., niacinamide), —COOH (i.e., nicotinic acid) or —CH₂OH (i.e., nicotinyl alcohol); derivatives thereof; and salts of any of the foregoing.

Exemplary derivatives of the foregoing vitamin B₃ compounds include nicotinic acid esters, including non-vasodilating esters of nicotinic acid (e.g., tocoferyl nicotinate), nicotinyl amino acids, nicotinyl alcohol esters of carboxylic acids, nicotinic acid N-oxide and niacinamide N-oxide.

Examples of suitable vitamin B₃ compounds are well known in the art and are commercially available from a number of sources, e.g., the Sigma Chemical Company (St. Louis, Mo.); ICN Biomedicals, Inc. (Irvin, Calif.) and Aldrich Chemical Company (Milwaukee, Wis.).

The vitamin compounds may be included as the substantially pure material, or as an extract obtained by suitable physical and/or chemical isolation from natural (e.g., plant) sources.

Hydroxy Acids

The compositions of the present invention may contain a safe and effective amount of a hydroxy acid. Preferred hydroxy acids for use in the compositions of the present invention include salicylic acid and salicylic acid derivatives. When present in the compositions of the present invention, salicylic acid is preferably used in an amount of from about 0.01% to about 50%, more preferably from about 0.1% to about 20%, even more preferably from about 0.1% to about 10%, still
more preferably from about 0.5% to about 5%, and still more preferably from about 0.5% to about 2%.

Anti-Oxidants/Radical Scavengers

The compositions of the present invention may include a safe and effective amount of an anti-oxidant/radical scavenger or an oxidizer/reducing agent. The anti-oxidant/radical scavenger or oxidizer/reducing agent is especially useful for providing protection against UV radiation which can cause increased scaling or texture changes in the stratum corneum and against other environmental agents which can cause skin damage. These compounds may also be useful in hair drying and other cosmetic applications.

A safe and effective amount of an anti-oxidant/radical scavenger or an oxidizer/reducing agent may be added to the compositions of the subject invention, preferably from about 0.1% to about 10%, more preferably from about 1% to about 5%, of the composition.

Anti-oxidants/radical scavengers such as ascorbic acid (vitamin C) and its salts, ascorbyl esters of fatty acids, ascorbic acid derivatives (e.g., magnesium ascorbyl phosphate, sodium ascorbyl phosphate, ascorbyl sorbate), tocopherol (vitamin E), tocopherol sorbate, tocopherol acetate, other esters of tocopherol, butylated hydroxy benzoic acids and their salts, peroxides including hydrogen peroxide, perborate, thioglycolates, persulfate salts, 6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid (commercially available under the tradename Trolox®), gallic acid and its alkyl esters, especially propyl gallate, uric acid and its salts and alkyl esters, sorbic acid and its salts, lipoic acid, amines (e.g., N,N-diethylhydroxylamine, amino-guanidine), sulfhydryl compounds (e.g., glutathione), dihydroxy fumaric acid and its salts, lycine pidolate, arginine pilolate, nordihydroguaiaretic acid, bioflavonoids, curcumin, lysine, l-methionine, proline, superoxide dismutase, silymarin, tea
extracts, grape skin/seed extracts, melanin, and rosemary extracts may be used. Preferred anti-oxidants-radical scavengers are selected from tocopherol sorbate and other esters of tocopherol, more preferably tocopherol sorbate. For example, the use of tocopherol sorbate in topical compositions and applicable to the present invention is described in U.S. Pat. No. 4,847,071, issued on Jul. 11, 1989 to Donald L. Bissett, Rodney D. Bush and Ranjit Chatterjee. Especially useful are combinations with the antioxidant enzymes called VENUCEANE® offered by SEDERMA, described in WO 02/066668 published on August 29, 2002.

Chelators

The compositions of the present invention may also contain a safe and effective amount of a chelator or chelating agent. As used herein, "chelator" or "chelating agent" means an active agent capable of removing a metal ion from a system by forming a complex so that the metal ion cannot readily participate in or catalyze chemical reactions. The inclusion of a chelating agent is especially useful for providing protection against UV radiation which can contribute to excessive scaling or skin texture changes and against other environmental agents which can cause skin damage.

A safe and effective amount of a chelating agent may be added to the compositions of the subject invention, preferably from about 0.1% to about 10%, more preferably from about 1% to about 5%, of the composition. Exemplary chelators that are useful herein are disclosed in U.S. Pat. No. 5,487,884, issued Jan. 30, 1996 to Bissett et al.; International Publication No. 91/16035, Bush et al., published Oct. 31, 1995; and International Publication No. 91/16034, Bush et al., published Oct. 31, 1995. Preferred chelators useful in compositions of the subject invention are furilidioxide, furilmonoxime, and derivatives thereof.

Anti-Inflammatory Agents
A safe and effective amount of an anti-inflammatory agent may be added to the compositions of the present invention, preferably from about 0.1% to about 10%, more preferably from about 0.5% to about 5%, of the composition. The anti-inflammatory agent enhances the skin appearance benefits of the present invention, e.g., such agents contribute to a more uniform and acceptable skin tone or color. The exact amount of anti-inflammatory agent to be used in the compositions will depend on the particular anti-inflammatory agent utilized since such agents vary widely in potency.

Steroidal anti-inflammatory agents, including but not limited to, corticosteroids such as hydrocortisone, hydroxyfluriamcinolone, alpha-methyl dexamethasone, dexamethasone-phosphate, beclomethasone dipropionates, clobetasol valerate, desonide, desoxymethasone, desoxycorticosterone acetate, dexamethasone, dichlorisone, diflorasone diacetate, diflucortolone valerate, fludronolone, fluclorolone acetonide, fludrocortisone, flumethasone pivalate, fluosinolone acetonide, fluocinonide, flucortine butylesters, fluocortolone, fluprednidene (fluprednylidene) acetate, flurandrenolone, halcinonide, hydrocortisone acetate, hydrocortisone butyrate, methylprednisolone, triamcinolone acetonide, cortisone, cortodoxone, flucetonide, fludrocortisone, difluorosone diacetate, fluradrenolone, fludrocortisone, difluorosone diacetate, fluradrenolone acetonide, medrysone, amcinafel, amcinafide, betamethasone and the balance of its esters, chloroprednisone, chloroprednisone acetate, clofcortolone, clescinolone, dichlorisone, diflurprednate, flucloronide, flunisolide, fluoromethalone, fluperolone, fluprednisolone, hydrocortisone valerate, hydrocortisone cyclopentylpropionate, hydrocortamate, meprednisone, paramethasone, prednisolone, prednisone, beclomethasone dipropionate, triamcinolone, and mixtures
thereof may be used. The preferred steroidal anti-inflammatory for use is hydrocortisone.

A second class of anti-inflammatory agents which is useful in the compositions includes the nonsteroidal anti-inflammatory agents. The variety of compounds encompassed by this group are well-known to those skilled in the art. For detailed disclosure of the chemical structure, synthesis, side effects, etc. of non-steroidal anti-inflammatory agents, one may refer to standard texts, including Anti-inflammatory and Anti-Rheumatic Drugs, K. D. Rainsford, Vol. I-III, CRC Press, Boca Raton, (1985), and Anti-inflammatory Agents, Chemistry and Pharmacology, 1, R. A. Scherrer, et al., Academic Press, New York (1974).

Specific non-steroidal anti-inflammatory agents useful in the composition invention include, but are not limited to:

1) the oxicams, such as piroxicam, isoxicam, tenoxicam, sudoxicam, and CP-14,304;
2) the salicylates, such as aspirin, disalcid, benorylate, trilisate, safapryn, solprin, diflunisal, and fendosal;
3) the acetic acid derivatives, such as diclofenac, fenclofenac, indomethacin, sulindac, tolmetin, isoxxepac, furofenac, tiopinac, zidometacin, acematacin, fentiazac, zomepirac, clindanac, oxepinac, felbinac, and ketorolac;
4) the fenamates, such as mefenamic, meclofenamic, flufenamic, niflumic, and tolfenamic acids;
5) the propionic acid derivatives, such as ibuprofen, naproxen, benoxaprofen, flurbiprofen, ketoprofen, fenoprofen, fenbufen, indoprofen, pirprofen, carprofen, oxaprozin, pranoprofen, miprofen, tioxaprofen, suprofen, alminoprofen, and tiaprofenic; and
6) the pyrazoles, such as phenylbutazone, oxyphenbutazone, feprazone, azapropazone, and trimethazone.
Mixtures of these non-steroidal anti-inflammatory agents may also be employed, as well as the dermatologically acceptable salts and esters of these agents. For example, etofenamate, a flufenamic acid derivative, is particularly useful for topical application. Of the nonsteroidal anti-inflammatory agents, ibuprofen, naproxen, flufenamic acid, etofenamate, aspirin, mefenamic acid, meclofenamic acid, piroxicam and felbinac are preferred; ibuprofen, naproxen, ketoprofen, etofenamate, aspirin and flufenamic acid are more preferred. Finally, so-called "natural" anti-inflammatory agents are useful in methods of the present invention. Such agents may suitably be obtained as an extract by suitable physical and/or chemical isolation from natural sources (e.g., plants, fungi, by-products of microorganisms) or can be synthetically prepared. For example, candelilla wax, bisabolol (e.g., alpha bisabolol), aloe vera, plant sterols (e.g., phytosterol), Manjistha (extracted from plants in the genus Rubia, particularly Rubia Cordifolia), and Guggal (extracted from plants in the genus Commiphora, particularly Commiphora Mukul), kola extract, chamomile, red clover extract, Piper methysticum extract (Kava Kava from SEDERMA, disclosed in FR 2 771 002 of March 31, 2000 and WO 99/25369 published on May 27, 1999), Bacopa monieri extract (Bacocalmine from SEDERMA, disclosed in WO 99/40897 of August 19, 1999) and sea whip extract, may be used.

Additional anti-inflammatory agents useful herein include compounds of the Licorice (the plant genus/species Glycyrrhiza glabra) family, including glycyrrhetic acid, glycyrrhizic acid, and derivatives thereof (e.g., salts and esters). Suitable salts of the foregoing compounds include metal and ammonium salts. Suitable esters include C_{2}-C_{4}, saturated or unsaturated esters of the acids, preferably C_{10}-C_{24}, more preferably C_{16}-C_{24}. Specific examples of the foregoing include oil soluble licorice extract, the glycyrrhizic and
glycyrrhetic acids themselves, monoammonium glycyrrhizinate, monopotassium glycyrrhizinate, dipotassium glycyrrhizinate, 1-beta-glycyrrhetic acid, stearyl glycyrrhetinate, and 3-stearyloxy-glycyrrhetinic acid, and disodium 3-succinyloxy-beta-glycyrrhetinate. Stearyl glycyrrhetinate is preferred.

Skin Soothing and Skin Healing Actives

The compositions of the present invention may comprise a skin soothing or skin healing active. Skin soothing or skin healing actives suitable for use herein include panthenic acid derivatives (including panthenol, dexampanthenol, ethyl panthenol), aloe vera, allantoin, bisabolol, and dipotassium glycyrrhizinate. A safe and effective amount of a skin soothing or skin healing active may be added to the present composition, preferably, from about 0.1% to about 30%, more preferably from about 0.5% to about 20%, still more preferably from about 0.5% to about 10%, by weight of the composition formed. Especially useful are combinations with the skin soothing and healing agents called Calmosensine and Bacocalmine offered by SEDERMA and described in WO 98/07744 of February 26, 1998 and WO 99/40897 of August 19, 1999 respectively.

Bisabolol

The topical compositions of the present invention may also contain a safe and effective amount of bisabolol. Bisabolol is a naturally occurring unsaturated monocyclic terpene alcohol having the following structure:

\[
\begin{align*}
\text{HO} & \\
\text{C} & \\
\text{C} & \\
\text{C} & \\
\text{C} & \\
\end{align*}
\]

It is the primary active component of chamomile extract/oil. Bisabolol can be synthetic (d,l-alpha-isomer or (+/-)-alpha-
isomer) or natural (α)-alpha-isomer in origin and can be used as essentially pure compounds or mixtures of compounds (e.g., extracts from natural sources such as chamomile). The alpha form of bisabolol (α-bisabolol) is used in a variety of cosmetic products as a skin conditioning or soothing agent. As used herein, "bisabolol" includes chamomile extract or oil and any isomers and tautomers of such. Suitable bisabolol compounds are commercially available as a natural material from Dragoco (Totowa, N.J.) under the product name alpha-bisabolol natural and as a synthetic material from Fluka (Milwaukee, Wis.) under the product name alpha-bisabolol.

In the compositions of the present invention, the composition preferably contains from about 0.001% to about 50%, by weight of the composition, more preferably from about 0.01% to about 20%, even more preferably from about 0.01% to about 15%, and still more preferably from about 0.1% to about 10%, of bisabolol, even more preferably from about 0.1% to about 5%.

Antimicrobial and Antifungal Actives

The compositions of the present invention may contain 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 compositions, preferably, from about 0.001% to about 10%, more preferably from about 0.01% to about 5%, and still more preferably from about 0.05% to about 2%.

Examples of antimicrobial and antifungal actives include β-lactam drugs, quinolone drugs, ciprofloxacin, norfloxacin, tetracycline, erythromycin, amikacin, 2,4,4'-trichloro-2'-hydroxy diphenyl ether, 3,4,4'-trichlorobanilide, phenoxyethanol, phenoxy propanol, phenoxyisopropanol, doxycycline, capreomycin, chlorhexidine, chlortetracycline, oxytetracycline, clindamycin, ethambutol, hexamidine isethionate, metronidazole, pentamidine, gentamicin,
kanamycin, lineomycin, methacycline, methenamine, minocycline, neomycin, netilmicin, paromomycin, streptomycin, tobramycin, miconazole, tetracycline hydrochloride, erythromycin, zinc erythromycin, erythromycin estolate, erythromycin stearate, amikacin sulfate, doxycycline hydrochloride, capreomycin sulfate, chlorhexidine gluconate, chlorhexidine hydrochloride, chlortetracycline hydrochloride, oxytetracycline hydrochloride, clindamycin hydrochloride, ethambutol hydrochloride, metronidazole hydrochloride, pentamidine hydrochloride, gentamicin sulfate, kanamycin sulfate, lineomycin hydrochloride, methacycline hydrochloride, methenamine hippurate, methenamine mandelate, minocycline hydrochloride, neomycin sulfate, netilmicin sulfate, paromomycin sulfate, streptomycin sulfate, tobramycin sulfate, miconazole hydrochloride, ketoconazole, amanfaldine hydrochloride, amanfaldine sulfate, octopirox, parachlorometaxylenol, nystatin, tolnaftate, zinc pyrithione and clotrimazole. Especially useful are combinations with the ingredient range called OSMOCIDE offered by SEDERMA and described in WO 97 / 05856 of February 20, 1997.

Preferred examples of actives useful herein include those selected from salicylic acid, benzoyl peroxide, 3-hydroxy benzoic acid, glycolic acid, lactic acid, 4-hydroxy benzoic acid, acetyl salicylic acid, 2-hydroxybutanoic acid, 2-hydroxypentanoic acid, 2-hydroxyhexanoic acid, cis-retinoic acid, trans-retinoic acid, retinol, phytic acid, N-acetyl-L-cysteine, lipoic acid, azelaic acid, arachidonic acid, benzoylperoxide, tetracycline, ibuprofen, naproxen, hydrocortisone, acetaminophen, resorcinol, phenoxyethanol, phenoxypropanol, phenoxyisopropanol, 2,4,4'-trichloro-2'-hydroxy diphenyl ether, 3,4,4'-trichlorocarbanilide, octopirox, lidocaine hydrochloride, clotrimazole, miconazole, ketoconazole, neocycin sulfate, and mixtures thereof.
Sunscreen Actives

Exposure to ultraviolet light can result in excessive scaling and texture changes of the stratum corneum. Therefore, the compositions of the subject invention may optionally contain a sunscreen active. As used herein, “sunscreen active” includes both sunscreen agents and physical sunblocks. Suitable sunscreen actives may be organic or inorganic.

Inorganic sunscreens useful herein include the following metallic oxides; titanium dioxide having an average primary particle size of from about 15 nm to about 100 nm, zinc oxide having an average primary particle size of from about 15 nm to about 150 nm, zirconium oxide having an average primary particle size of from about 15 nm to about 150 nm, iron oxide having an average primary particle size of from about 15 nm to about 500 nm, and mixtures thereof. When used herein, the inorganic sunscreens are present in the amount of from about 0.1% to about 20%, preferably from about 0.5% to about 10%, more preferably from about 1% to about 5%, by weight of the composition.

A wide variety of conventional organic sunscreen actives are suitable for use herein. Sagarin, et al., at Chapter VIII, pages 189 et seq., of Cosmetics Science and Technology (1972), discloses numerous suitable actives. Specific suitable sunscreen actives include, for example: p-aminobenzoic acid, its salts and its derivatives (ethyl, isobutyl, glyceryl esters; p-dimethylaminobenzoic acid); anthranilates (i.e., o-amino-benzoates; methyl, menthyl, phenyl, benzyl, phenylethyl, linalyl, terpinyl, and cyclohexenyl esters); salicylates (amyl, phenyl, octyl, benzyl, menthyl, glyceryl, and di-propyleneglycol esters); cinnamic acid derivatives (menthyl and benzyl esters, a-phenyl cinnamonic; butyl cinnamoyl pyruvate); dihydroxycinnamic acid derivatives (umbelliferone, methylumbelliferone, methylaceto-umbelliferone); trihydroxycinnamic acid derivatives (esculetin, methylesculetin,
daphnetin, and the glucosides, esculin and daphnin; hydrocarbons (diphenylbutadiene, stilbene); dibenzalacetone and benzalacetophenone; naphtholsulfonates (sodium salts of 2-naphthol-3,6-disulfonic and of 2-naphthol-6,8-disulfonic acids); di-hydroxynaphthoic acid and its salts; o- and p-hydroxybiphenyldisulfonates; coumarin derivatives (7-hydroxy, 7-methyl, 3-phenyl); diazoles (2-acetyl-3-bromoindazole, phenyl benzoxazole, methyl naphthoxazole, various aryl benzothiazoles); quinine salts (bisulfate, sulfate, chloride, oleate, and tannate); quinoline derivatives (8-hydroxyquinoline salts, 2-phenylquinoline); hydroxy- or methoxy-substituted benzophenones; uric and violuric acids; tannic acid and its derivatives (e.g., hexaethylether); (butyl carbotol) (6-propyl piperonyl) ether; hydroquinone; benzophenones (oxybenzene, sulisobenzone, dioxybenzone, benzoresorcinol, 2,2',4,4'-tetrahydroxybenzophenone, 2,2'-dihydroxy-4,4'-dimethoxybenzophenone, octabenzene; 4-isopropyldibenzoylmethane; butylmethoxydibenzoylmethane; etocrylene; octocrylene; [3-(4'-methylbenzylidene boman-2-one), terephthalylidene dicamphor sulfonic acid and 4-isopropyl-di-benzoylmethane.

Of these, 2-ethylhexyl-p-methoxycinnamate (commercially available as PARSOL MCX), 4,4'-t-butyl methoxydibenzoylmethane (commercially available as PARSOL 1789), 2-hydroxy-4-methoxybenzophenone, octyldimethyl-p-aminobenzoic acid, digalloyltriololate, 2,2-dihydroxy-4-methoxybenzophenone, ethyl-4-(bis(hydroxy-propyl))aminobenzoate, 2-ethylhexyl-2-cyano-3,3-diphenylacrylate, 2-ethylhexyl-salicylate, glyceryl-p-aminobenzoate, 3,3,5-tri-methylcyclohexylsalicylate, methylanthranilate, p-dimethyl-aminobenzoic acid or aminobenzoate, 2-ethylhexyl-p-dimethyl-amino-benzoate, 2-phenylbenzimidazole-5-sulfonic acid, 2-(p-dimethylaminophenyl)-5-sulfonicbenzoxazoic acid, octocrylene and mixtures of these compounds, are preferred.
Also preferred are the compositions and combinations described and claimed in U.S. Patent No. 6,190,645 to SaNogueira et al. and in particular, sunscreen agents disclosed at col. 3, lns. 4-23, in combination with a cinnamido alkyl amine cationic quaternary salt such as cinnamidopropyl trimethyl ammonium chloride sold under the trademark INCROQUAT-UV-283 manufactured by Croda, Inc., 7 Century Road, Parsippany, New Jersey. These portions of the 6,190,645 patent are hereby incorporated by reference. More preferred organic sunscreen actives useful in the compositions useful in the subject invention are 2-ethylhexyl-p-methoxycinnamate, butylmethoxydibenzoyl-methane, 2-hydroxy-4-methoxybenzophenone, 2-phenylbenzimidazole-5-sulfonic acid, octyldimethyl-p-aminobenzoic acid, octocrylene and mixtures thereof.

Also particularly useful in the compositions are sunscreen actives such as those disclosed in U.S. Pat. No. 4,937,370 issued to Sabatelli on Jun. 26, 1990, and U.S. Pat. No. 4,999,186 issued to Sabatelli & Spirnak on Mar. 12, 1991. The screening agents disclosed therein have, in a single molecule, two distinct chromophore moieties which exhibit different ultra-violet radiation absorption spectra. One of the chromophore moieties absorbs predominantly in the UVB radiation range and the other absorbs strongly in the UVA radiation range.

Preferred members of this class of sunscreening agents are 4-N,N-(2-ethylhexyl)methyl-aminobenzoic acid ester of 2,4-dihydroxybenzophenone; N,N-di-(2-ethylhexyl)-4-aminobenzoic acid ester with 4-hydroxydibenzoylmethane; 4-N,N-(2-ethylhexyl)methyl-aminobenzoic acid ester with 4-hydroxydibenzoylmethane; 4-N, N-(2-ethylhexyl)methyl-aminobenzoic acid ester of 2-hydroxy-4-(2-hydroxyethoxy)benzophenone; 4-N,N-(2-ethylhexyl)-methylaminobenzoic acid ester of 4-(2-hydroxyethoxy)dibenzoylmethane; N,N-di-(2-ethylhexyl)-4-
aminobenzoic acid ester of 2-hydroxy-4-(2-hydroxyethoxy)benzophenone; and N,N-di-(2-ethylhexyl)-4-aminobenzoic acid ester of 4-(2-hydroxyethoxy)dibenzoylmethane and mixtures thereof.

Especially preferred sunscreen actives include 4,4'-t-butylmethoxydibenzoylmethane, 2-ethylhexyl-p-methoxycinnamate, phenyl benzimidazole sulfonic acid, and octocrylene.

A safe and effective amount of the organic sunscreen active is used, typically from about 1% to about 20%, more typically from about 2% to about 10% by weight of the composition. Exact amounts will vary depending upon the sunscreen or sunscreens chosen and the desired Sun Protection Factor (SPF).

Conditioning Agents

The compositions of the present invention may contain a conditioning agent selected from humectants, moisturizers, or skin conditioners. A variety of these materials can be employed and each can be present at a level of from about 0.01% to about 20%, more preferably from about 0.1% to about 10%, and still more preferably from about 0.5% to about 7% by weight of the composition. These materials include, but are not limited to, guanidine; urea; glycolic acid and glycolate salts (e.g., ammonium and quaternary alkyl ammonium); salicylic acid; lactic acid and lactate salts (e.g., ammonium and quaternary alkyl ammonium); aloe vera in any of its variety of forms (e.g., aloe vera gel); starches; sugar and starch derivatives (e.g., alkoxylated glucose, fructose, glucosamine); hyaluronic acid; lactamide monoethanolamine; acetamide monoethanolamine; panthenol; allantoin; and mixtures thereof. Also useful herein are the propoxylated glycerols described in U.S. Pat. No. 4,976,953, to Orr et al., issued Dec. 11, 1990.

Also useful are various C1-C30 monoesters and polyesters of sugars and related materials. These esters are derived from a sugar or polyol moiety and one or more carboxylic acid

Preferably, the conditioning agent is selected from urea, guanidine, sucrose polyester, panthenol, dextranthenol, allantoin, and combinations thereof.

Structuring Agents

The compositions hereof, and especially the emulsions hereof, may contain a structuring agent. Structuring agents are particularly preferred in the oil-in-water emulsions of the present invention. Without being limited by theory, it is believed that the structuring agent assists in providing rheological characteristics to the composition which contribute to the stability of the composition. For example, the structuring agent tends to assist in the formation of the liquid crystalline gel network structures. The structuring agent may also function as an emulsifier or surfactant. Preferred compositions of this invention contain from about 0.1% to about 20%, more preferably from about 0.1% to about 10%, still more preferably from about 0.5% to about 9%, of one or more structuring agents.

Preferred structuring agents are those having an HLB of from about 1 to about 8 and having a melting point of at least about 45°C. Suitable structuring agents are those selected from saturated C14 to C30 fatty alcohols, saturated C16 to C30 fatty alcohols containing from about 1 to about 5 moles of ethylene
oxide, saturated C₁₆ to C₃₀ diols, saturated C₁₆ to C₃₀ monoglycerol ethers, saturated C₁₆ to C₃₀ hydroxy fatty acids, C₁₄ to C₃₀ hydroxylated and nonhydroxylated saturated fatty acids, C₁₄ to C₃₀ saturated ethoxylated fatty acids, amines and alcohols containing from about 1 to about 5 moles of ethylene oxide diols, C₁₄ to C₃₀ saturated glyceryl mono esters with a monoglyceride content of at least 40%, C₁₄ to C₃₀ saturated polyglycerol esters having from about 1 to about 3 alkyl group and from about 2 to about 3 saturated glycerol units, C₁₄ to C₃₀ glyceryl mono ethers, C₁₄ to C₃₀ sorbitan mono/diesters, C₁₄ to C₃₀ saturated ethoxylated sorbitan mono/diesters with about 1 to about 5 moles of ethylene oxide, C₁₄ to C₃₀ saturated methyl glucoside esters, C₁₄ to C₃₀ saturated sucrose mono/diesters, C₁₄ to C₃₀ saturated ethoxylated methyl glucoside esters with about 1 to about 5 moles of ethylene oxide, C₁₄ to C₃₀ saturated polyglucosides having an average of between 1 to 2 glucose units and mixtures thereof, having a melting point of at least about 45°C.

The preferred structuring agents of the present invention are selected from stearic acid, palmitic acid, stearyl alcohol, cetyl alcohol, behenyl alcohol, stearic acid, palmitic acid, the polyethylene glycol ether of stearyl alcohol having an average of about 1 to about 5 ethylene oxide units, the polyethylene glycol ether of cetyl alcohol having an average of about 1 to about 5 ethylene oxide units, and mixtures thereof. More preferred structuring agents of the present invention are selected from stearyl alcohol, cetyl alcohol, behenyl alcohol, the polyethylene glycol ether of stearyl alcohol having an average of about 2 ethylene oxide units (steareth-2), the polyethylene glycol ether of cetyl alcohol having an average of about 2 ethylene oxide units, and mixtures thereof. Even more preferred structuring agents are selected from stearic acid, palmitic acid, stearyl alcohol,
cetyl alcohol, behenyl alcohol, steareth-2, and mixtures thereof.

Thickening Agent (including thickeners and gelling agents)
The compositions of the present invention can contain one or more thickening agents, preferably from about 0.1% to about 5%, more preferably from about 0.1% to about 4%, and still more preferably from about 0.25% to about 3%, by weight of the composition.
Nonlimiting classes of thickening agents include those selected from the following:

Carboxylic Acid Polymers
These polymers are crosslinked compounds containing one or more monomers derived from acrylic acid, substituted acrylic acids, and salts and esters of these acrylic acids and the substituted acrylic acids, wherein the crosslinking agent contains two or more carbon-carbon double bonds and is derived from a polyhydric alcohol. Polymers useful in the present invention are more fully described in U.S. Pat. No. 5,087,445, to Haffey et al., issued Feb. 11, 1992; U.S. Pat. No. 4,509,949, to Huang et al., issued Apr. 5, 1985; U.S. Pat. No. 2,798,053, to Brown, issued Jul. 2, 1957; and in CTFA International Cosmetic Ingredient Dictionary, Fourth Edition, 1991, pp. 12 and 80.
Examples of commercially available carboxylic acid polymers useful herein include the carboxomers, which are homopolymers of acrylic acid crosslinked with allyl ethers of sucrose or pentaerytritol. The carboxomers are available as the Carbopol® 900 series from B.F. Goodrich (e.g., Carbopol® 954). In addition, other suitable carboxylic acid polymeric agents include copolymers of C_{10-30} alkyl acrylates with one or more monomers of acrylic acid, methacrylic acid, or one of their short chain (i.e., C_{1-4} alcohol) esters, wherein the crosslinking agent is an allyl ether of sucrose or pentaerytritol. These copolymers are known as acrylates/C_{10-30}
alkyl acrylate crosspolymers and are commercially available as Carbopol® 1342, Carbopol® 1382, Pemulen TR-1, and Pemulen TR-2, from B.F. Goodrich. In other words, examples of carboxylic acid polymer thickeners useful herein are those selected from carbomers, acrylates/C<sub>10</sub>–C<sub>30</sub> alkyl acrylate crosspolymers, and mixtures thereof. Especially useful are combinations with the ingredient range called LUBRAJELS offered by UNITED GUARDIAN, some of them described in WO 97/47310 of June 12, 1996.

Crosslinked Polyacrylate Polymers

The compositions of the present invention can optionally contain crosslinked polyacrylate polymers useful as thickeners or gelling agents including both cationic and nonionic polymers, with the cationics being generally preferred. Examples of useful crosslinked nonionic polyacrylate polymers and crosslinked cationic polyacrylate polymers are those described in U.S. Pat. No. 5,100,660, to Hawe et al., issued Mar. 31, 1992; U.S. Pat. No. 4,849,484, to Heard, issued Jul. 18, 1989; U.S. Pat. No. 4,835,206, to Farrar et al., issued May 30, 1989; U.S. Pat. No. 4,628,078 to Glover et al. issued Dec. 9, 1986; U.S. Pat. No. 4,599,379 to Flesher et al. issued Jul. 8, 1986; and EP 228,868, to Farrar et al., published Jul. 15, 1987.

Polyacrylamide Polymers

The compositions of the present invention can optionally contain polyacrylamide polymers, especially nonionic polyacrylamide polymers including substituted branched or unbranched polymers. More preferred among these polyacrylamide polymers is the nonionic polymer given the CTFA designation polyacrylamide and isoparaffin and laureth-7, available under the Tradename Sepigel 305 from Seppic Corporation (Fairfield, N.J.).

Other polyacrylamide polymers useful herein include multi-block copolymers of acrylamides and substituted acrylamides
with acrylic acids and substituted acrylic acids. Commercially available examples of these multi-block copolymers include Hypan SR150H, SS500V, SS500W, SSSA100H, from Lipo Chemicals, Inc. (Paterson, N.J.).

Polysaccharides
A wide variety of polysaccharides are useful herein. "Polysaccharides" refer to gelling agents which contain a backbone of repeating sugar (i.e., carbohydrate) units. Nonlimiting examples of polysaccharide gelling agents include those selected from cellulose, carboxymethyl hydroxyethylcellulose, cellulose acetate propionate carboxylate, hydroxyethylcellulose, hydroxyethyl ethylcellulose, hydroxypropylcellulose, hydroxypropyl methylcellulose, methyl hydroxyethylcellulose, microcrystalline cellulose, sodium cellulose sulfate, and mixtures thereof. Also useful herein are the alkyl substituted celluloses. In these polymers, the hydroxy groups of the cellulose polymer is hydroxyalkylated (preferably hydroxyethylated or hydroxypropylated) to form a hydroxyalkylated cellulose which is then further modified with a C_{10}-C_{30} straight chain or branched chain alkyl group through an ether linkage. Typically these polymers are ethers of C_{10}-C_{30} straight or branched chain alcohols with hydroxyalkylcelluloses. Examples of alkyl groups useful herein include those selected from stearyl, isostearyl, lauryl, myristyl, cetyl, isocetyl, cocoyl (i.e. alkyl groups derived from the alcohols of coconut oil), palmityl, oleyl, linoleyl, linolenyl, ricinoleyl, behenyl, and mixtures thereof. Preferred among the alkyl hydroxyalkyl cellulose ethers is the material given the CTFA designation cetyl hydroxyethylcellulose, which is the ether of cetyl alcohol and hydroxyethylcellulose. This material is sold under the tradename Natrosol® CS Plus from Aqualon Corporation (Wilmington, Del.).
Other useful polysaccharides include scleroglucans which are a linear chain of (1-3) linked glucose units with a (1-6) linked glucose every three units, a commercially available example of which is Clearogel™ CS11 from Michel Mercier Products Inc. (Mountainside, N.J.).

Gums

Other thickening and gelling agents useful herein include materials which are primarily derived from natural sources. Nonlimiting examples of these gelling agent gums include acacia, agar, algin, alginic acid, ammonium alginate, amylopectin, calcium alginate, calcium carrageenan, carnitine, carrageenan, dextrin, gelatin, gellan gum, guar gum, guar hydroxypropyltrimonium chloride, hectorite, hyaluronic acid, hydrated silica, hydroxypropyl chitosan, hydroxypropyl guar, karaya gum, kelp, locust bean gum, natto gum, potassium alginate, potassium carrageenan, propylene glycol alginate, sclerotium gum, sodium carboxymethyl dextran, sodium carrageenan, tragacanth gum, xanthan gum, and mixtures thereof.

Preferred compositions of the present invention include a thickening agent selected from carboxylic acid polymers, crosslinked polyacrylate polymers, polyacrylamide polymers, and mixtures thereof, more preferably selected from carboxylic acid polymers, polyacrylamide polymers, and mixtures thereof.

Dermatologically-Acceptable Carrier

The compositions of the invention may be used in various cosmetic and/or personal care products, for example, hair care, such as lotions, gels, sprays, and the like, hair sunscreen compositions, shampoos, hair conditioners, and hair coloring products. Therefore, in addition to any of the above cited skin care or hair care peptides and other actives, the cosmetic compositions described in the present invention may often include as an additional ingredient a dermatologically acceptable carrier. The form of the carrier and the final
product resulting from the combination of the saccharose substitutes with any additional active and with the carrier may be any of the following: liquids, gels, creams, water-in-oil and oil-in-water, and silicone emulsions, foams; they may be clear or opaque; and may be formulated as both aqueous and non-aqueous preparations, including but not limited to topical preparations.

The nature of the dermatologically acceptable carrier, the nature of the final product, and the methods of preparing those need not be described here in detail; many examples can be found in the available literatures, such as PCT application No. WO 00/62743 filed by Larry R. Robinson et al. on April 19, 2000, published on October 26, 2000, or, more generally, in Milady's Standard Textbook of Cosmetology 2000, (Delmar Learning) or in Formulation Technology: Emulsions, Suspensions, Solid Forms by Hans Mollet, Arnold Grubemann and Helen Payne, published by John Wiley & Sons (January 23, 2001), or in Chemistry and Technology of the Cosmetics and Toiletries Industry by Clifford Williams Schmitt, Kluwer Academic Publishers, Dordrecht July 1996, all hereby incorporated. Fiedler's Encyclopedia of Excipients, fifth edition, Edition Cantor Verlag Aulendorf, 2002 is also a useful guide for the formulator skilled in the art of developing cosmetic carriers. All ingredients listed therein may in one way or another be combined to form a dermatologically acceptable carrier and/or used as an additional ingredient for the cosmetic compositions of the invention.

A safe and effective amount of carrier is from about 50% to about 99.99%, preferably from about 80% to about 99.9%, more preferably from about 90% to about 98%, and even more preferably from about 90% to about 95% of the composition. The carrier can be in a wide variety of forms. For example, emulsion carriers, including, but not limited to, oil-in-
water, water-in-oil, water-in-oil-in-water, and oil-in-water-in-silicone emulsions, are useful herein. Preferred carriers contain an emulsion such as oil-in-water emulsions, water-in-oil emulsions, and water-in-silicone emulsions. As will be understood by the skilled artisan, a given component will distribute primarily into either the water or oil/silicone phase, depending on the water solubility/dispersibility of the component in the composition. Oil-in-water emulsions are especially preferred.

Emulsions according to the present invention generally contain a solution as described above and a lipid or oil. Lipids and oils may be derived from animals, plants, or petroleum and may be natural or synthetic (i.e., man-made). Preferred emulsions also contain a humectant, such as glycerin. Emulsions will preferably further contain from about 0.01% to about 10%, more preferably from about 0.1% to about 5%, of an emulsifier, based on the weight of the carrier. Emulsifiers may be nonionic, anionic or cationic. Suitable emulsifiers are disclosed in, for example, U.S. Pat. No. 3,755,560, issued Aug. 28, 1973, Dickert et al.; U.S. Pat. No. 4,421,769, issued Dec. 20, 1983, Dixon et al.; and McCutcheon's Detergents and Emulsifiers, North American Edition, pages 317-324 (1986).

The emulsion may also contain an anti-foaming agent to minimize foaming upon application to the keratinous tissue. Anti-foaming agents include high molecular weight silicones and other materials well known in the art for such use. Suitable emulsions may have a wide range of viscosities, depending on the desired product form. Exemplary low viscosity emulsions, which are preferred, have a viscosity of about 50 centistokes or less, more preferably about 10 centistokes or less, still more preferably about 5 centistokes or less. Preferred water-in-silicone and oil-in-water emulsions are described in greater detail below.
Water-in-silicone Emulsion

Water-in-silicone emulsions contain a continuous silicone phase and a dispersed aqueous phase.

Continuous Silicone Phase

Preferred water-in-silicone emulsions of the present invention contain from about 1% to about 60%, preferably from about 5% to about 40%, more preferably from about 10% to about 20%, by weight of a continuous silicone phase. The continuous silicone phase exists as an external phase that contains or surrounds the discontinuous aqueous phase described hereinafter.

The continuous silicone phase contains a polyorganosiloxane oil. A preferred water-in-silicone emulsion system is formulated to provide an oxidatively stable vehicle for the retinoid. The continuous silicone phase of these preferred emulsions contain between about 50% and about 99.9% by weight of organopolysiloxane oil and less than about 50% by weight of a non-silicone oil. In an especially preferred embodiment, the continuous silicone phase contains at least about 50%, preferably from about 60% to about 99.9%, more preferably from about 70% to about 99.9%, and even more preferably from about 80% to about 99.9%, polyorganosiloxane oil by weight of the continuous silicone phase, and up to about 50% non-silicone oils, preferably less about 40%, more preferably less than about 30%, even more preferably less than about 10%, and even more preferably less than about 2%, by weight of the continuous silicone phase. These preferred emulsion systems provide more oxidative stability to the retinoid over extended periods of time than comparable water-in-oil emulsions containing lower concentrations of the polyorganosiloxane oil. Concentrations of non-silicone oils in the continuous silicone phase are minimized or avoided altogether so as to further enhance oxidative stability of the selected retinoid in the compositions. Water-in-silicone emulsions of this type are

The organopolysiloxane oil for use in the composition may be volatile, non-volatile, or a mixture of volatile and non-volatile silicones. The term "nonvolatile" as used in this context refers to those silicones that are liquid under ambient conditions and have a flash point (under one atmospheric pressure) of or greater than about 100°C. The term "volatile" as used in this context refers to all other silicone oils. Suitable organopolysiloxanes can be selected from a wide variety of silicones spanning a broad range of volatilities and viscosities. Examples of suitable organopolysiloxane oils include polyalkylsiloxanes, cyclic polyalkylsiloxanes, and polyalkylarylsiloxanes.

Polyalkylsiloxanes useful in the composition herein include polyalkylsiloxanes with viscosities of from about 0.5 to about 1,000,000 centistokes at 25°C. Such polyalkylsiloxanes can be represented by the general chemical formula \( R_3SiO[RSiO]_xSiR_3 \) wherein \( R \) is an alkyl group having from one to about 30 carbon atoms (preferably \( R \) is methyl or ethyl, more preferably methyl; also mixed alkyl groups can be used in the same molecule), and \( x \) is an integer from 0 to about 10,000, chosen to achieve the desired molecular weight which can range to over about 10,000,000. Commercially available polyalkylsiloxanes include the polydimethylsiloxanes, which are also known as dimethicones, examples of which include the Vicasil® series sold by General Electric Company and the Dow Corning® 200 series sold by Dow Corning Corporation. Specific examples of suitable polydimethylsiloxanes include Dow Corning® 200 fluid having a viscosity of 0.65 centistokes and a boiling point of 100°C., Dow Corning® 225 fluid having a viscosity of 10 centistokes and a boiling point greater than 200°C., and Dow Corning® 200 fluids having viscosities of 50, 350, and 12,500 centistokes, respectively, and boiling points
greater than 200°C. Suitable dimethicones include those represented by the chemical formula
(CH₃)₃SiO[(CH₃)₂SiO]ₓ[CH₃RSiO]ᵧSi(CH₃)₃, wherein R is straight or branched chain alkyl having from two to about 30 carbon atoms and x and y are each integers of 1 or greater selected to achieve the desired molecular weight which can range to over about 10,000,000. Examples of these alkyl-substituted dimethicones include cetyl dimethicone and lauryl dimethicone. Cyclic polyalkylsilsloxanes suitable for use in the composition include those represented by the chemical formula [SiR₂—O]ₙ, wherein R is an alkyl group (preferably R is methyl or ethyl, more preferably methyl) and n is an integer from about 3 to about 8, more preferably n is an integer from about 3 to about 7, and still more preferably n is an integer from about 4 to about 6. When R is methyl, these materials are typically referred to as cyclomethicones. Commercially available cyclomethicones include Dow Corning® 244 fluid having a viscosity of 2.5 centistokes, and a boiling point of 172°C., which primarily contains the cyclomethicone tetramer (i.e. n=4), Dow Corning® 344 fluid having a viscosity of 2.5 centistokes and a boiling point of 178°C., which primarily contains the cyclomethicone pentamer (i.e. n=5), Dow Corning® 245 fluid having a viscosity of 4.2 centistokes and a boiling point of 205°C., which primarily contains a mixture of the cyclomethicone tetramer and pentamer (i.e. n=4 and 5), and Dow Corning® 345 fluid having a viscosity of 4.5 centistokes and a boiling point of 217°C, which primarily contains a mixture of the cyclomethicone tetramer, pentamer, and hexamer (i.e. n=4, 5, and 6).
Also useful are materials such as trimethylsilsloxysilicate, which is a polymeric material corresponding to the general chemical formula [(CH₂)₃SiO₁/₂]ₓ[SiO₂]ᵧ, wherein x is an integer from about 1 to about 500 and y is an integer from about 1 to
about 500. A commercially available trimethylsiloxy silicate is sold as a mixture with dimethicone as Dow Corning® 593 fluid. Dimethiconols are also suitable for use in the composition. These compounds can be represented by the chemical formulas $R_3SiO[R_2SiO]_xSiR_2OH$ and $HOR_2SiO[R_2SiO]_xSiR_2OH$ wherein $R$ is an alkyl group (preferably $R$ is methyl or ethyl, more preferably methyl) and $x$ is an integer from 0 to about 500, chosen to achieve the desired molecular weight. Commercially available dimethiconols are typically sold as mixtures with dimethicone or cyclomethicone (e.g., Dow Corning® 1401, 1402, and 1403 fluids).

Polyalkylaryl siloxanes are also suitable for use in the composition. Polymethylphenyl siloxanes having viscosities from about 15 to about 65 centistokes at 25°C. are especially useful.

Preferred for use herein are organopolysiloxanes selected from polyalkylsiloxanes, alkyl substituted dimethicones, cyclomethicones, trimethylsiloxy silicates, dimethiconols, polyalkylaryl siloxanes, and mixtures thereof. More preferred for use herein are polyalkylsiloxanes and cyclomethicones. Preferred among the polyalkylsiloxanes are dimethicones.

As stated above, the continuous silicone phase may contain one or more non-silicone oils. Concentrations of non-silicone oils in the continuous silicone phase are preferably minimized or avoided altogether so as to further enhance oxidative stability of the selected retinoid in the compositions. Suitable non-silicone oils have a melting point of about 25°C or less under about one atmosphere of pressure. Examples of non-silicone oils suitable for use in the continuous silicone phase are those well known in the chemical arts in topical personal care products in the form of water-in-oil emulsions, e.g., mineral oil, vegetable oils, synthetic oils, semisynthetic oils, etc.
(2) Dispersed Aqueous Phase
The topical compositions of the present invention contain from about 30% to about 90%, more preferably from about 50% to about 85%, and still more preferably from about 70% to about 80% of a dispersed aqueous phase. In emulsion technology, the term "dispersed phase" is a term well-known to one skilled in the art which means that the phase exists as small particles or droplets that are suspended in and surrounded by a continuous phase. The dispersed phase is also known as the internal or discontinuous phase. The dispersed aqueous phase is a dispersion of small aqueous particles or droplets suspended in and surrounded by the continuous silicone phase described hereinbefore.

The aqueous phase can be water, or a combination of water and one or more water soluble or dispersible ingredients. Nonlimiting examples of such ingredients include thickeners, acids, bases, salts, chelants, gums, water-soluble or dispersible alcohols and polyols, buffers, preservatives, sunscreening agents, colorings, and the like.

The topical compositions of the present invention will typically contain from about 25% to about 90%, preferably from about 40% to about 80%, more preferably from about 60% to about 80%, water in the dispersed aqueous phase by weight of the composition.

(3) Emulsifier for Dispersing the Aqueous Phase
The water-in-silicone emulsions of the present invention preferably contain an emulsifier. In a preferred embodiment, the composition contains from about 0.1% to about 10% emulsifier, more preferably from about 0.5% to about 7.5%, still more preferably from about 1% to about 5%, emulsifier by weight of the composition. The emulsifier helps disperse and suspend the aqueous phase within the continuous silicone phase.
A wide variety of emulsifying agents can be employed herein to form the preferred water-in-silicone emulsion. Known or conventional emulsifying agents can be used in the composition, provided that the selected emulsifying agent is chemically and physically compatible with components of the composition of the present invention, and provides the desired dispersion characteristics. Suitable emulsifiers include silicone emulsifiers, non-silicon-containing emulsifiers, and mixtures thereof, known by those skilled in the art for use in topical personal care products. Preferably these emulsifiers have an HLB value of or less than about 14, more preferably from about 2 to about 14, and still more preferably from about 4 to about 14. Emulsifiers having an HLB value outside of these ranges can be used in combination with other emulsifiers to achieve an effective weighted average HLB for the combination that falls within these ranges.

Silicone emulsifiers are preferred. A wide variety of silicone emulsifiers are useful herein. These silicone emulsifiers are typically organically modified organopolysiloxanes, also known to those skilled in the art as silicone surfactants. Useful silicone emulsifiers include dimethicone copolyols. These materials are polydimethyl siloxanes which have been modified to include polyether side chains such as polyethylene oxide chains, polypropylene oxide chains, mixtures of these chains, and polyether chains containing moieties derived from both ethylene oxide and propylene oxide. Other examples include alkyl-modified dimethicone copolyols, i.e., compounds which contain C2-C30 pendant side chains. Still other useful dimethicone copolyols include materials having various cationic, anionic, amphoteric, and zwitterionic pendant moieties.
The dimethicone copolyol emulsifiers useful herein can be described by the following general structure:

\[
\begin{array}{c}
\text{H}_2\text{C} - \text{Si} - O - (\text{Si} - O)_{x} - (\text{Si} - O)_{y} - \text{Si} - \text{CH}_3 \\
\text{H}_2\text{C} - \text{Si} - O - (\text{Si} - O)_{x} - (\text{Si} - O)_{y} - \text{Si} - \text{CH}_3 \\
\text{H}_2\text{C} - \text{Si} - O - (\text{Si} - O)_{x} - (\text{Si} - O)_{y} - \text{Si} - \text{CH}_3 \\
\text{H}_2\text{C} - \text{Si} - O - (\text{Si} - O)_{x} - (\text{Si} - O)_{y} - \text{Si} - \text{CH}_3
\end{array}
\]

wherein \( R \) is C1-C30 straight, branched, or cyclic alkyl and \( R^2 \) is selected from the group consisting of

\[
\begin{array}{c}
\text{H}_2\text{C} - \text{O} - (\text{C} - \text{H} - \text{O})_{n} - \text{H} \\
\text{H}_2\text{C} - \text{O} - (\text{C} - \text{H} - \text{O})_{n} - \text{C} - \text{H} - \text{O} - \text{H} \\
\text{H}_2\text{C} - \text{O} - (\text{C} - \text{H} - \text{O})_{n} - \text{C} - \text{H} - \text{O} - \text{H} \\
\text{H}_2\text{C} - \text{O} - (\text{C} - \text{H} - \text{O})_{n} - \text{C} - \text{H} - \text{O} - \text{H}
\end{array}
\]

wherein \( n \) is an integer from 3 to about 10; \( R^3 \) and \( R^4 \) are selected from the group consisting of H and C1-C6 straight or branched chain alkyl such that \( R^3 \) and \( R^4 \) are not simultaneously the same; and \( m, o, x, \) and \( y \) are selected such that the molecule has an overall molecular weight from about 200 to about 10,000,000, with \( m, o, x, \) and \( y \) being independently selected from integers of zero or greater such that \( m \) and \( o \) are not both simultaneously zero, and \( z \) being independently selected from integers of 1 or greater. It is recognized that positional isomers of these copolymers can be achieved. The chemical representations depicted above for the \( R^2 \) moieties containing the \( R^3 \) and \( R^4 \) groups are not meant to be limiting but are shown as such for convenience.

Also useful herein, although not strictly classified as dimethicone copolymers, are silicone surfactants as depicted in the structures in the previous paragraph wherein \( R^2 \) is:
\( -(\text{CH}_2)_n-\text{O}-\text{R}^5 \), wherein \( \text{R}^5 \) is a cationic, anionic, amphoteric, or zwitterionic moiety.

Nonlimiting examples of dimethicone copolyols and other silicone surfactants useful as emulsifiers herein include polydimethylsiloxane polyether copolymers with pendant polyethylene oxide sidechains, polydimethylsiloxane polyether copolymers with pendant polypropylene oxide sidechains, polydimethylsiloxane polyether copolymers with pendant mixed polyethylene oxide and polypropylene oxide sidechains, polydimethylsiloxane polyether copolymers with pendant mixed poly(ethylene)(propylene)oxide sidechains, polydimethylsiloxane polyether copolymers with pendant organobetaine sidechains, polydimethylsiloxane polyether copolymers with pendant carboxylate sidechains, polydimethylsiloxane polyether copolymers with pendant quaternary ammonium sidechains; and also further modifications of the preceding copolymers containing pendant C2-C30 straight, branched, or cyclic alkyl moieties. Examples of commercially available dimethicone copolyols useful herein sold by Dow Corning Corporation are Dow Corning® 190, 193, Q2-5220, 2501 Wax, 2-5324 fluid, and 3225C (this later material being sold as a mixture with cyclomethicone). Cetyl dimethicone copolyol is commercially available as a mixture with polyglyceryl-4 isostearate (and) hexyl laurate and is sold under the tradename ABIL® WE-09 (available from Goldschmidt). Cetyl dimethicone copolyol is also commercially available as a mixture with hexyl laurate (and) polyglyceryl-3 oleate (and) cetyl dimethicone and is sold under the tradename ABIL® WS-08 (also available from Goldschmidt). Other nonlimiting examples of dimethicone copolyols also include lauryl dimethicone copolyol, dimethicone copolyol acetate, diethicone copolyol adipate, dimethicone copolyolamine, dimethicone copolyol behenate, dimethicone copolyol butyl ether, dimethicone copolyol hydroxy stearate, dimethicone


Among the non-silicone-containing emulsifiers useful herein are various non-ionic and anionic emulsifying agents such as sugar esters and polyesters, alkoxyated sugar esters and polyesters, C1-C30 fatty acid esters of C1-C30 fatty alcohols, alkoxyated derivatives of C1-C30 fatty acid esters of C1-C30 fatty alcohols, alkoxylated ethers of C1-C30 fatty alcohols, polyglyceryl esters of C1-C30 fatty acids, C1-C30 esters of polyols, C1-C30 ethers of polyols, alkyl phosphates, polyoxymethylene fatty ether phosphates, fatty acid amides, acyl lactylates, soaps, and mixtures thereof. Other suitable emulsifiers are described, for example, in McCutcheon's,

Nonlimiting examples of these non-silicon-containing emulsifiers include: polyethylene glycol 20 sorbitan monolaurate (Polysorbate 20), polyethylene glycol 5 soya sterol, Steareth-20, Ceteareth-20, PPG-2 methyl glucose ether distearate, Ceteth-10, Polysorbate 80, cetyl phosphate, potassium cetyl phosphate, diethanolamine cetyl phosphate, Polysorbate 60, glyceryl stearate, PEG-100 stearate, polyoxyethylene 20 sorbitan trioleate (Polysorbate 85), sorbitan monolaurate, polyoxyethylene 4 lauryl ether sodium stearate, polyglyceryl-4 isostearate, hexyl laurate, steareth-20, ceteareth-20, PPG-2 methyl glucose ether distearate, ceteth-10, diethanolamine cetyl phosphate, glyceryl stearate, PEG-100 stearate, and mixtures thereof.

Oil-in-Water Emulsions


Structuring Agent

A preferred oil-in-water emulsion contains a structuring agent to assist in the formation of a liquid crystalline gel network structure. Without being limited by theory, it is believed that the structuring agent assists in providing rheological
characteristics to the composition which contribute to the stability of the composition. The structuring agent may also function as an emulsifier or surfactant. Preferred compositions of this invention contain from about 0.5% to about 20%, more preferably from about 1% to about 10%, even more preferably from about 1% to about 5%, by weight of the composition, of a structuring agent.

The preferred structuring agents of the present invention include stearic acid, palmitic acid, stearyl alcohol, cetyl alcohol, behenyl alcohol, stearic acid, palmitic acid, the polyethylene glycol ether of stearyl alcohol having an average of about 1 to about 21 ethylene oxide units, the polyethylene glycol ether of cetyl alcohol having an average of about 1 to about 5 ethylene oxide units, and mixtures thereof. More preferred structuring agents of the present invention are selected from stearyl alcohol, cetyl alcohol, behenyl alcohol, the polyethylene glycol ether of stearyl alcohol having an average of about 2 ethylene oxide units (steareth-2), the polyethylene glycol ether of stearyl alcohol having an average of about 21 ethylene oxide units (steareth-21), the polyethylene glycol ether of cetyl alcohol having an average of about 2 ethylene oxide units, and mixtures thereof. Even more preferred structuring agents are selected from stearic acid, palmitic acid, stearyl alcohol, cetyl alcohol, behenyl alcohol, steareth-2, steareth-21, and mixtures thereof.

Hydrophilic Surfactant
The compositions may also contain at least one hydrophilic surfactant. The surfactant, at a minimum, must be hydrophilic enough to disperse in water.

Preferred hydrophilic surfactants are selected from nonionic surfactants. Among the nonionic surfactants that are useful herein are those that can be broadly defined as condensation products of long chain alcohols, e.g. C8-30 alcohols, with sugar or starch polymers, i.e., glycosides. These compounds
can be represented by the formula \((S)_n-O-R\) wherein \(S\) is a sugar moiety such as glucose, fructose, mannose, and galactose; \(n\) is an integer of from about 1 to about 1000, and \(R\) is a C8-30 alkyl group. Examples of long chain alcohols from which the alkyl group can be derived include decyl alcohol, cetyl alcohol, stearyl alcohol, lauryl alcohol, myristyl alcohol, oleyl alcohol, and the like. Preferred examples of these surfactants include those wherein \(S\) is a glucose moiety, \(R\) is a C8-20 alkyl group, and \(n\) is an integer of from about 1 to about 9. Commercially available examples of these surfactants include decyl polyglucoside (available as APG 325 CS from Henkel) and lauryl polyglucoside (available as APG 600 CS and 625 CS from Henkel).

Other useful nonionic surfactants include the condensation products of alkylene oxides with fatty acids (i.e. alkylene oxide esters of fatty acids). These materials have the general formula \(RCO(X)_nOH\) wherein \(R\) is a C10-30 alkyl group, \(X\) is \(\underline{-OCH_2CH_2-}\) (i.e. derived from ethylene glycol or oxide) or \(\underline{-OCH_3CH_3-}\) (i.e. derived from propylene glycol or oxide), and \(n\) is an integer from about 6 to about 200. Other nonionic surfactants are the condensation products of alkylene oxides with 2 moles of fatty acids (i.e. alkylene oxide diesters of fatty acids). These materials have the general formula \(RCO(X)_nOOCR\) wherein \(R\) is a C10-30 alkyl group, \(X\) is \(\underline{-OCH_2CH_2-}\) (i.e. derived from ethylene glycol or oxide) or \(\underline{-OCH_3CH_3-}\) (i.e. derived from propylene glycol or oxide), and \(n\) is an integer from about 6 to about 100. Other nonionic surfactants are the condensation products of alkylene oxides with fatty alcohols (i.e. alkylene oxide ethers of fatty alcohols). These materials have the general formula \(R(X)_n OR'\) wherein \(R\) is a C10-30 alkyl group, \(X\) is \(\underline{-OCH_2CH_2-}\) (i.e., derived from ethylene glycol or oxide) or \(\underline{-OCH_3CH_3-}\) (i.e., derived from propylene glycol or oxide), and \(n\) is an integer from about 6 to about 100 and \(R'\) is \(H\) or a C10-30 alkyl group.
Still other nonionic surfactants are the condensation products of alkylene oxides with both fatty acids and fatty alcohols \( i.e. \) wherein the polyalkylene oxide portion is esterified on one end with a fatty acid and etherified \( i.e. \) connected via an ether linkage) on the other end with a fatty alcohol. These materials have the general formula RCO(X)_n OR' wherein R and R' are C10–30 alkyl groups, X is \( \text{OCH}_2\text{CH}_2 \) \( i.e. \), derived from ethylene glycol or oxide) or \( \text{OCH}_2\text{CH}_3 \) (derived from propylene glycol or oxide), and n is an integer from about 6 to about 100. Nonlimiting examples of these alkylene oxide derived nonionic surfactants include ceteth-6, ceteth-10, ceteth-12, ceteareth-6, ceteareth-10, ceteareth-12, steareth-6, steareth-10, steareth-12, steareth-21, PEG-6 stearate, PEG-10 stearate, PEG-100 stearate, PEG-12 stearate, PEG-20 glyceryl stearate, PEG-80 glyceryl tallowate, PEG-10 glyceryl stearate, PEG-30 glyceryl cocoate, PEG-80 glyceryl cocoate, PEG-200 glyceryl tallowate, PEG-8 dilaurate, PEG-10 distearate, and mixtures thereof.

Still other useful nonionic surfactants include polyhydroxy fatty acid amide surfactants corresponding to the structural formula:

\[
\begin{align*}
R^2 & \quad \text{O} \quad \text{N} \quad \text{Z} \\
\text{C} & \quad \text{R'}
\end{align*}
\]

wherein: \( R^2 \) is H, C1–C4 alkyl, 2-hydroxyethyl, 2-hydroxy-propyl, preferably C1–C4 alkyl, more preferably methyl or ethyl, most preferably methyl; \( R^2 \) is C5–C31 alkyl or alkenyl, preferably C7–C19 alkyl or alkenyl, more preferably C9–C17 alkyl or alkenyl, most preferably C11–C15 alkyl or alkenyl; and Z is a polyhydroxyhydrocarbyl moiety having a linear hydrocarbyl chain with a least 3 hydroxyls directly connected to the chain, or an alkoxylated derivative \( \text{preferably ethoxylated or propoxylated} \) thereof. Z preferably is a sugar moiety selected from the group consisting of glucose, fructose, maltose, lactose, galactose, mannose, xylose, and mixtures thereof. An especially preferred surfactant
corresponding to the above structure is coconut alkyl N-methyl glucoside amide (i.e., wherein the R₂CO— moiety is derived from coconut oil fatty acids). Processes for making compositions containing polyhydroxy fatty acid amides are disclosed, for example, in G.B. Patent Specification 809,060, published Feb. 18, 1959, by Thomas Hedley & Co., Ltd.; U.S. Pat. No. 2,965,576, to E. R. Wilson, issued Dec. 20, 1960; U.S. Pat. No. 2,703,798, to A. M. Schwartz, issued Mar. 8, 1955; and U.S. Pat. No. 1,985,424, to Piggott, issued Dec. 25, 1934; which are incorporated herein by reference in their entirety.

Preferred among the nonionic surfactants are those selected from the group consisting of steareth-21, ceteareth-20, ceteareth-12, sucrose cocoate, steareth-100, PEG-100 stearate, and mixtures thereof.

Other nonionic surfactants suitable for use herein include sugar esters and polyesters, alkoxylated sugar esters and polyesters, C₁₋₃₀ fatty acid esters of C₁₋₃₀ fatty alcohols, alkoxylated derivatives of C₁₋₃₀ fatty acid esters of C₁₋₃₀ fatty alcohols, alkoxylated ethers of C₁₋₃₀ fatty alcohols, polyglyceryl esters of C₁₋₃₀ fatty acids, C₁₋₃₀ esters of polyols, C₁₋₃₀ ethers of polyols, alkyl phosphates, polyoxalkylene fatty ether phosphates, fatty acid amides, acyl lactylates, and mixtures thereof. Nonlimiting examples of these emulsifiers include: polyethylene glycol 20 sorbitan monolaurate (Polysorbate 20), polyethylene glycol 5 soya sterol, Steareth-20, Ceteareth-20, PPG-2 methyl glucose ether distearate, Ceteth-10, Polysorbate 80, cetyl phosphate, potassium cetyl phosphate, diethanolamine cetyl phosphate, Polysorbate 60, glyceryl stearate, polyoxyethylene 20 sorbitan trioleate (Polysorbate 85), sorbitan monolaurate, polyoxyethylene 4 lauryl ether sodium stearate, polyglyceryl-4 isostearate, hexyl laurate, PPG-2 methyl glucose ether distearate, PEG-100 stearate, and mixtures thereof.
Another group of non-ionic surfactants useful herein are fatty acid ester blends based on a mixture of sorbitan or sorbitol fatty acid ester and sucrose fatty acid ester, the fatty acid in each instance being preferably C₆-C₂₄, more preferably C₁₀-C₂₀. The preferred fatty acid ester emulsifier is a blend of sorbitan or sorbitol C₁₆-C₂₀ fatty acid ester with sucrose C₁₀-C₁₆ fatty acid ester, especially sorbitan stearate and sucrose cocoate. This is commercially available from ICI under the trade name Arlatone 2121.

Other suitable surfactants useful herein include a wide variety of cationic, anionic, zwitterionic, and amphoteric surfactants such as are known in the art and discussed more fully below. See, e.g., McCutcheon's, Detergents and Emulsifiers, North American Edition (1986), published by Allured Publishing Corporation; U.S. Pat. No. 5,011,681 to Ciotti et al., issued Apr. 30, 1991; U.S. Pat. No. 4,421,769 to Dixon et al., issued Dec. 20, 1983; and U.S. Pat. No. 3,755,560 to Dickert et al., issued Aug. 28, 1973; these four references are incorporated herein by reference in their entirety. The hydrophilic surfactants useful herein can contain a single surfactant, or any combination of suitable surfactants. The exact surfactant (or surfactants) chosen will depend upon the pH of the composition and the other components present.

Also useful herein are cationic surfactants, especially dialkyl quaternary ammonium compounds or "quats", examples of which are described in U.S. Pat. No. 5,151,209; U.S. Pat. No. 5,151,210; U.S. Pat. No. 5,120,532; U.S. Pat. No. 4,387,090; U.S. Pat. No. 3,155,591; U.S. Pat. No. 3,929,678; U.S. Pat. No. 3,959,461; McCutcheon's Detergents & Emulsifiers, (North American edition 1979) M.C. Publishing Co.; and Schwartz, et al., Surface Active Agents, Their Chemistry and Technology, New York: Interscience Publishers, 1949; which descriptions are incorporated herein by reference. The cationic surfactants
useful herein include cationic ammonium salts such as those having the formula:

\[
\begin{array}{c}
\text{R}^1 \\
\text{N} \\
\text{R}^2 \\
\text{R}^3 \\
\text{X}^- \\
\text{R}^4
\end{array}
\]

wherein \( \text{R}_1 \), is an alkyl group having from about 12 to about 30 carbon atoms, or an aromatic, aryl or alkaryl group having from about 12 to about 30 carbon atoms; \( \text{R}_2, \text{R}_3, \) and \( \text{R}_4 \) are independently selected from hydrogen, an alkyl group having from about 1 to about 22 carbon atoms, or aromatic, aryl or alkaryl groups having from about 12 to about 22 carbon atoms; and \( \text{X}^- \) is any compatible anion, preferably selected from chloride, bromide, iodide, acetate, phosphate, nitrate, sulfate, methyl sulfate, ethyl sulfate, tosylate, lactate, citrate, glycolate, and mixtures thereof. Additionally, the alkyl groups of \( \text{R}_1, \text{R}_2, \text{R}_3, \) and \( \text{R}_4 \) can also contain ester and/or ether linkages, or hydroxy or amino group substituents (e.g., the alkyl groups can contain polyethylene glycol and polypropylene glycol moieties).

More preferably, \( \text{R}_1 \) is an alkyl group having from about 12 to about 22 carbon atoms; \( \text{R}_2 \) is selected from \( \text{H} \) or an alkyl group having from about 1 to about 22 carbon atoms; \( \text{R}_3 \) and \( \text{R}_4 \) are independently selected from \( \text{H} \) or an alkyl group having from about 1 to about 3 carbon atoms; and \( \text{X}^- \) is as described previously.

Still more preferably, \( \text{R}_1 \) is an alkyl group having from about 12 to about 22 carbon atoms; \( \text{R}_2, \text{R}_3, \) and \( \text{R}_4 \) are selected from \( \text{H} \) or an alkyl group having from about 1 to about 3 carbon atoms; and \( \text{X}^- \) is as described previously.

Alternatively, other useful cationic emulsifiers include amino-amides, wherein in the above structure \( \text{R}_1 \) is alternatively \( \text{R}_5 \text{CONH}-(\text{CH}_2)_n \), wherein \( \text{R}_5 \) is an alkyl group.
having from about 12 to about 22 carbon atoms, and n is an integer from about 2 to about 6, more preferably from about 2 to about 4, and still more preferably from about 2 to about 3. Nonlimiting examples of these cationic emulsifiers include stearamidopropyl PG-dimonium chloride phosphate, behenamidopropyl PG dimonium chloride, stearamidopropyl ethylidimonium ethosulfate, stearamidopropyl dimethyl (myristyl acetate) ammonium chloride, stearamidopropyl dimethyl cetearyl ammonium tosylate, stearamidopropyl dimethyl ammonium chloride, stearamidopropyl dimethyl ammonium lactate, and mixtures thereof. Especially preferred is behenamidopropyl PG dimonium chloride.

Nonlimiting examples of quaternary ammonium salt cationic surfactants include those selected from cetyl ammonium chloride, cetyl ammonium bromide, lauryl ammonium chloride, lauryl ammonium bromide, stearyl ammonium chloride, stearyl ammonium bromide, cetyl dimethyl ammonium chloride, cetyl dimethyl ammonium bromide, lauryl dimethyl ammonium chloride, lauryl dimethyl ammonium bromide, stearyl dimethyl ammonium chloride, stearyl dimethyl ammonium bromide, cetyl trimethyl ammonium chloride, cetyl trimethyl ammonium bromide, lauryl trimethyl ammonium chloride, lauryl trimethyl ammonium bromide, stearyl trimethyl ammonium chloride, stearyl trimethyl ammonium bromide, lauryl dimethyl ammonium chloride, stearyl dimethyl cetyl ditallow dimethyl ammonium chloride, dicetyl ammonium chloride, dicetyl ammonium bromide, dilauryl ammonium chloride, dilauryl ammonium bromide, distearyl ammonium chloride, distearyl ammonium bromide, dicetyl methyl ammonium chloride, dicetyl methyl ammonium bromide, dilauryl methyl ammonium chloride, dilauryl methyl ammonium bromide, distearyl methyl ammonium chloride, distearyl methyl ammonium bromide, and mixtures thereof. Additional quaternary ammonium salts include those wherein the C12 to C30 alkyl carbon chain is derived from a tallow fatty acid or from a coconut fatty acid.
The term "tallow" refers to an alkyl group derived from tallow fatty acids (usually hydrogenated tallow fatty acids), which generally have mixtures of alkyl chains in the C₁₆ to C₁₈ range. The term "coconut" refers to an alkyl group derived from a coconut fatty acid, which generally have mixtures of alkyl chains in the C₁₂ to C₁₄ range. Examples of quaternary ammonium salts derived from these tallow and coconut sources include ditallow dimethyl ammonium chloride, ditallow dimethyl ammonium methyl sulfate, di(hydrogenated tallow) dimethyl ammonium chloride, di(hydrogenated tallow) dimethyl ammonium acetate, ditallow dipropyl ammonium phosphate, ditallow dimethyl ammonium nitrate, di(coconutalkyl)dimethyl ammonium chloride, di(coconutalkyl)dimethyl ammonium bromide, tallow ammonium chloride, coconut ammonium chloride, stearamidopropyl PG-dimonium chloride phosphate, stearamidopropyl ethylidimonium ethosulfate, stearamidopropyl dimethyl (myristyl acetate) ammonium chloride, stearamidopropyl dimethyl cetearyl ammonium tosylate, stearamidopropyl dimethyl ammonium chloride, stearamidopropyl dimethyl ammonium lactate, and mixtures thereof. An example of a quaternary ammonium compound having an alkyl group with an ester linkage is ditallowyl oxyethyl dimethyl ammonium chloride.

More preferred cationic surfactants are those selected from behenamidopropyl PG dimonium chloride, dilauryl dimethyl ammonium chloride, distearyl dimethyl ammonium chloride, dimyristyl dimethyl ammonium chloride, dipalmityl dimethyl ammonium chloride, distearyl dimethyl ammonium chloride, stearamidopropyl PG-dimonium chloride phosphate, stearamidopropyl ethylidiammonium ethosulfate, stearamidopropyl dimethyl (myristyl acetate) ammonium chloride, stearamidopropyl dimethyl cetearyl ammonium tosylate, stearamidopropyl dimethyl ammonium chloride, stearamidopropyl dimethyl ammonium lactate, and mixtures thereof.
Still more preferred cationic surfactants are those selected from behenamidopropyl PG dimonium chloride, dilauryl dimethyl ammonium chloride, distearyl dimethyl ammonium chloride, dimyristyl dimethyl ammonium chloride, dipalmityl dimethyl ammonium chloride, and mixtures thereof. A preferred combination of cationic surfactant and structuring agent is behenamidopropyl PG dimonium chloride and/or behenyl alcohol, wherein the ratio is preferably optimized to maintained to enhance physical and chemical stability, especially when such a combination contains ionic and/or highly polar solvents. This combination is especially useful for delivery of sunscreensing agents such as zinc oxide and octyl methoxycinnamate.

A wide variety of anionic surfactants are also useful herein. See, e.g., U.S. Pat. No. 3,929,678, to Laughlin et al., issued Dec. 30, 1975, which is incorporated herein by reference in its entirety. Nonlimiting examples of anionic surfactants include the alkoyl isethionates, and the alkyl and alkyl ether sulfates. The alkoyl isethionates typically have the formula RCO—OCH₂CH₂SO₂M wherein R is alkyl or alkenyl of from about 10 to about 30 carbon atoms, and M is a water-soluble cation such as ammonium, sodium, potassium and triethanolamine. Nonlimiting examples of these isethionates include those alkoyl isethionates selected from ammonium cocooyl isethionate, sodium cocooyl isethionate, sodium lauryl isethionate, sodium stearoyl isethionate, and mixtures thereof.

The alkyl and alkyl ether sulfates typically have the respective formulae ROSO₃M and RO(C₆H₄O)xSO₃M, wherein R is alkyl or alkenyl of from about 10 to about 30 carbon atoms, x is from about 1 to about 10, and M is a water-soluble cation such as ammonium, sodium, potassium and triethanolamine. Another suitable class of anionic surfactants are the watersoluble salts of the organic, sulfuric acid reaction products of the general formula: R₁—SO₃—M, wherein R₁ is chosen from
the group including a straight or branched chain, saturated aliphatic hydrocarbon radical having from about 8 to about 24, preferably about 10 to about 16, carbon atoms; and M is a cation. Still other anionic synthetic surfactants include the class designated as succinamates, olefin sulfonates having about 12 to about 24 carbon atoms, and β-alkyloxy alkane sulfonates. Examples of these materials are sodium lauryl sulfate and ammonium lauryl sulfate. Other anionic materials useful herein are soaps (i.e., alkali metal salts, e.g., sodium or potassium salts) of fatty acids, typically having from about 8 to about 24 carbon atoms, preferably from about 10 to about 20 carbon atoms. The fatty acids used in making the soaps can be obtained from natural sources such as, for instance, plant or animal-derived glycerides (e.g., palm oil, coconut oil, soybean oil, castor oil, tallow, lard, etc.) The fatty acids can also be synthetically prepared. Soaps are described in more detail in U.S. Pat. No. 4,557,853.

Amphoteric and zwitterionic surfactants are also useful herein. Examples of amphoteric and zwitterionic surfactants which can be used in the compositions of the present invention are those which are broadly described as derivatives of aliphatic secondary and tertiary amines in which the aliphatic radical can be straight or branched chain and wherein one of the aliphatic substituents contains from about 8 to about 22 carbon atoms (preferably C₆-C₁₈) and one contains an anionic water solubilizing group, e.g., carboxy, sulfonate, sulfate, phosphate, or phosphonate. Examples are alkyl imino acetates, and iminodiarylalkanoates and aminoalkanoates of the formulas \( RN[CH₂]ₘCO₂M \)₂ and \( RNH(CH₂)ₘCO₂M \) wherein \( m \) is from 1 to 4, \( R \) is a C₆-C₂₂ alkyl or alkenyl, and M is H, alkali metal, alkaline earth metal ammonium, or alkanolammonium. Also included are imidazolinium and ammonium derivatives. Specific examples of suitable amphoteric surfactants include sodium 3-dodecyl-
aminopropionate, sodium 3-dodecylaminopropane sulfonate, N-alkyltaurines such as the one prepared by reacting dodecylamine with sodium isethionate according to the teaching of U.S. Pat. No. 2,658,072 which is incorporated herein by reference in its entirety; N-higher alkyl aspartic acids such as those produced according to the teaching of U.S. Pat. No. 2,438,091 which is incorporated herein by reference in its entirety; and the products sold under the trade name "Miranol" and described in U.S. Pat. No. 2,528,378, which is incorporated herein by reference in its entirety. Other examples of useful amphoteric surfactants include phosphates, such as coamidopropyl PG-dimonium chloride phosphate (commercially available as Monaquat PTC, from Mona Corp.). Other amphoteric or zwitterionic surfactants useful herein include betaines. Examples of betaines include the higher alkyl betaines, such as coco dimethyl carboxymethyl betaine, lauryl dimethyl carboxymethyl betaine, lauryl dimethyl alphacarboxyethyl betaine, cetyl dimethyl carboxymethyl betaine, cetyl dimethyl betaine (available as Lonzaine 16SP from Lonza Corp.), lauryl bis-(2-hydroxyethyl) carboxymethyl betaine, stearyl bis-(2-hydroxypropyl) carboxymethyl betaine, oleyl dimethyl gamma-carboxypropyl betaine, lauryl bis-(2-hydroxypropyl)alpha-carboxyethyl betaine, coco dimethyl sulfopropyl betaine, stearyl dimethyl sulfopropyl betaine, lauryl dimethyl sulfoethyl betaine, lauryl bis-(2-hydroxyethyl) sulfopropyl betaine, and amidobetaines and amidosulfobetaines (wherein the RCONH(CH₂)₃ radical is attached to the nitrogen atom of the betaine), oleyl betaine (available as amphoteric Velvetex OLB-50 from Henkel), and cocamidopropyl betaine (available as Velvetex BK-35 and BA-35 from Henkel). Other useful amphoteric and zwitterionic surfactants include the sultaines and hydroxysultaines such as cocamidopropyl hydroxysultaine (available as Miratine CBS from Rhone-Poulenc), and the alkanoyl sarcosinates corresponding to the
formula RCON(CH₃)₂CH₂CH₂CO₂M wherein R is alkyl or alkenyl of about 10 to about 20 carbon atoms, and M is a water-soluble cation such as ammonium, sodium, potassium and trialkanolamine (e.g., triethanolamine), a preferred example of which is sodium lauroyl sarcosinate.

When the surfactant used is a quaternary nitrogen containing compound ("quat") or indeed when a quat merial is used in compositions or products in accordance with preferred embodiments of the invention, cationic activity may be used as a measure of the amount of quat actually used.

Cationic activity is appropriate for discussion in the context of quats. Cationic activity may be measured by several methods readily understood by those skilled in the art. One such method utilizes a standardized solution of an anionic material, such as sodium lauryl sulfate. This material is added to the solution containing the quat until full complexation of the quat's cations (the end point) has been reached. The end point can be measured potentiometrically or by the use of color indicators.

Typical tests involve titrating a sample of the quat, usually dissolved in a solvent, with the standardized solution of sodium lauryl sulfate until the endpoint is reached. As described in the co-pending and co-assigned U.S. Patent Application No. 09/438,631, incorporated by reference herein in its entirety, once the endpoint is reached, the cationic activity can be calculated according to the following formula:

\[
\% \text{ cationic activity} = \frac{\text{mL} \times N \times \text{MW} \times 100}{\text{S.wt.} \times 1000}
\]

Where:
- mL = the number of mL of anionic material
- N = the normality of the solution used
- MW = the equivalent molecular weight of the quat being analyzed
- S.wt. = the sample weight in grams.

For additional information regarding the methodology for measuring the cationic activity, see W. Schempp and H. T.
Trau, Wochenblatt fur Papierfabrikation 19, 1981, pages 726-732, or J. P. Fischer and K. Lohr, Organic Coatings Science Technology, Volume 8, pages 227-249, Marcel Dekker, Inc. April 1986), both incorporated herein by reference in their entirety. While the use of quat raw materials having a high cationic activity is preferred (activity of at least about 35%, more preferably at least about 50%), use of lower cationic activities are also contemplated, particularly in finished products where the overall cationic activity may be less than 25%, less than 10% and even less than 5%.

Water
The preferred oil-in-water emulsion contains from about 25% to about 98%, preferably from about 65% to about 95%, more preferably from about 70% to about 90% water by weight of the topical carrier.

The hydrophobic phase is dispersed in the continuous aqueous phase. The hydrophobic phase may contain water insoluble or partially soluble materials such as are known in the art, including but not limited to the silicones described herein in reference to silicone-in-water emulsions, and other oils and lipids such as described above in reference to emulsions.

The topical compositions of the subject invention, including but not limited to lotions and creams, may contain a dermatologically acceptable emollient. Such compositions preferably contain from about 1% to about 50% of the emollient. As used herein, "emollient" refers to a material useful for the prevention or relief of dryness, as well as for the protection of the skin. A wide variety of suitable emollients are known and may be used herein. Sagarin, Cosmetics Science and Technology, 2nd Edition, Vol. 1, pp. 32-43 (1972), incorporated herein by reference, contains numerous examples of materials suitable as an emollient. A preferred emollient is glycerin. Glycerin is preferably used in an amount of from or about 0.001 to or about 30%, more preferably
from or about 0.01 to or about 20%, still more preferably from or about 0.1 to or about 10%, e.g., 5%.

Examples of suitable emollients include C₈₋₃₀ alkyl esters of C₈₋₃₀ carboxylic acids; C₁₋₆ diol monoesters and diesters of C₈₋₃₀ carboxylic acids; monoglycerides, diglycerides, and triglycerides of C₈₋₃₀ carboxylic acids, cholesterol esters of C₈₋₃₀ carboxylic acids, cholesterol, and hydrocarbons. Examples of these materials include diisopropyl adipate, isopropyl myristate, isopropyl palmitate, ethylhexyl palmitate, isodecyl neopentanoate, C₁₂₋₁₅ alcohols benzoates, diethylhexyl maleate, PPG-14 butyl ether, PPG-2 myristyl ether propionate, cetyl ricinoleate, cholesterol stearate, cholesterol isostearate, cholesterol acetate, jojoba oil, cocoa butter, shea butter, lanolin, lanolin esters, mineral oil, petrolatum, and straight and branched C₁₂₋₃₀ hydrocarbons.

Also useful are straight and branched chain fatty C₈₋₃₀ alcohols, for example, stearyl alcohol, isostearyl alcohol, ethenyl alcohol, cetyl alcohol, isocetyl alcohol, and mixtures thereof. Examples of other suitable emollients are disclosed in U.S. Patent No. 4,919,934; which is incorporated herein by reference in its entirety.

glycol ether, PPG-10 1,2,6-hexanetriol ether, PPG-15 1,2,6-hexanetriol ether, and mixtures thereof.
Examples of alkoxylated diethers include PPG-10 1,4-butanediol diether, PPG-12 1,4-butanediol diether, PPG-14 1,4-butanediol diether, PPG-2 butanediol diether, PPG-10 1,6-hexanediol diether, PPG-12 1,6-hexanediol diether, PPG-14 hexanediol diether, PPG-20 hexanediol diether, and mixtures thereof. Preferred are those selected from the group consisting of PPG-10 1,4-butanediol diether, PPG-12 1,4-butanediol diether, PPG-10 1,6-hexanediol diether, and PPG-12 hexanediol diether, and mixtures thereof.
Examples of suitable alkoxylated diesters and trimesters are disclosed in U.S. Patent Nos. 5,382,377, 5,455,025 and 5,597,555, assigned to Croda Inc., and incorporated herein by reference.
Suitable lipids include C₈-C₂₀ alcohol monosorbitan esters, C₈-C₂₀ alcohol sorbitan diesters, C₈-C₂₀ alcohol sorbitan triesters, C₈-C₂₀ alcohol sucrose monoesters, C₈-C₂₀ alcohol sucrose diesters, C₈-C₂₀ alcohol sucrose triesters, and C₈-C₂₀ fatty alcohol esters of C₂ -C₆₂ -hydroxy acids. Examples of specific suitable lipids are sorbitan diostearate, sorbitan dioleate, sorbitan distearate, sorbitan isostearate, sorbitan laurate, sorbitan oleate, sorbitan palmitate, sorbitan sesquioleate, sorbitan esquistearte, sorbitan stearate, sorbitan triostearte, sorbitan trioleate, orbitan tristeate, sucrose cocoate, sucrodilaurate, sucrose distearate, sucrose laurate, sucrose myristate, sucrose oleate, sucrose palmitate, sucrose ricinoleate, sucrose stearate, sucrose tribehenate, sucrose tristearate, myristyl lactate, stearyl lactate, isostearyl lactate, cetyl lactate, palmityl lactate, cocoyl lactate, and mixtures thereof.
Other suitable emollients include mineral oil, petrolatum, cholesterol, dimethicone, dimethiconol, stearyl alcohol, cetyl alcohol, behenyl alcohol, diisopropyl adipate, isopropyl
myristate, myristyl myristate, cetyl ricinoleate, sorbitan distearte, sorbitan dilaurate, sorbitan stearate, sorbitan laurate, sucrose laurate, sucrose dilaurate, sodium isostearyl lactylate, lauryl pidolate, sorbitan stearate, stearyl alcohol, cetyl alcohol, behenyl alcohol, PPG-14 butyl ether, PPG-15 stearyl ether, and mixtures thereof.

Lotions and creams according to the present invention generally contain a solution carrier system and one or more emollients. Lotions and creams typically contain from about 1% to about 50%, preferably from about 1% to about 20%, of emollient; from about 50% to about 90%, preferably from about 60% to about 80%, water; and the saccharose substitutes and the additional skin care active (or actives) in the above described amounts. Creams are generally thicker than lotions due to higher levels of emollients or higher levels of thickeners.

Ointments of the present invention may contain a simple carrier base of animal or vegetable oils or semi-solid hydrocarbons (oleaginous); absorption ointment bases which absorb water to form emulsions; or water soluble carriers, e.g., a water soluble solution carrier. Ointments may further contain a thickening agent, such as described in Sagarin, Cosmetics, Science and Technology, 2nd Edition, Vol. 1, pp. 72-73 (1972), incorporated herein by reference, and/or an emollient. For example, an ointment may contain from about 2% to about 10% of an emollient; from about 0.1% to about 2% of a thickening agent; and the saccharose substitutes and the additional skin care active (or actives) in the above described amounts.

Compositions of this invention useful for cleansing ("cleansers") are formulated with a suitable carrier, e.g., as described above, and preferably contain, in addition to the saccharose substitutes and the additional skin care active (or actives) in the above described amounts, from about 1% to
about 90%, more preferably from about 5% to about 10%, of a dermatologically acceptable surfactant. The surfactant is suitably selected from anionic, nonionic, zwitterionic, amphoteric and ampholytic surfactants, as well as mixtures of these surfactants. Such surfactants are well known to those skilled in the detergency art. Nonlimiting examples of possible surfactants include isoceteth-20, sodium methyl cocoyle taurate, sodium methyl oleoyl taurate, and sodium lauryl sulfate. See U.S. Pat. No. 4,800,197, to Kowcz et al., issued Jan. 24, 1989, which is incorporated herein by reference in its entirety, for exemplary surfactants useful herein. Examples of a broad variety of additional surfactants useful herein are described in McCutcheon's Detergents and Emulsifiers, North American Edition (1986), published by Allured Publishing Corporation. The cleansing compositions can optionally contain, at their art-established levels, other materials which are conventionally used in cleansing compositions.

The physical form of the cleansing compositions is not critical. The compositions can be, for example, formulated as toilet bars, liquids, shampoos, bath gels, hair conditioners, hair tonics, pastes, or mousses. Rinse-off cleansing compositions, such as shampoos, require a delivery system adequate to deposit sufficient levels of actives on the skin and scalp. A preferred delivery system involves the use of insoluble complexes. For a more complete disclosure of such delivery systems, see U.S. Pat. No. 4,835,148, Barford et al., issued May 30, 1989.

The compositions of the invention may also include a hair setting agent to impart styling benefits upon application to hair. The hair setting polymers may be homopolymers, copolymers, terpolymers, etc. For convenience in describing the polymers hereof, monomeric units present in the polymers may be referred to as the monomers from which they can be
derived. The monomers can be ionic (e.g., anionic, cationic, amphoteric, zwitterionic) or nonionic. Examples of anionic monomers include unsaturated carboxylic acid monomers such as acrylic acid, methacrylic acid, maleic acid, maleic acid half ester, itaconic acid, fumeric acid, and crotonic acid; half esters of an unsaturated polybasic acid anhydride such as succinic anhydride, phthalic anhydride or the like with a hydroxyl group-containing acrylate and/or methacrylate such as hydroxyethyl acrylate and, hydroxyethyl methacrylate, hydroxypropyl acrylate and the like; monomers having a sulfonic acid group such as styrenesulfonic acid, sulfoethyl acrylate and methacrylate, and the like; and monomers having a phosphoric acid group such as acid phosphooxyethyl acrylate and methacrylate, 3-chloro-2-acid phosphooxypropyl acrylate and methacrylate, and the like. Examples of cationic monomers include monomers derived from acrylic acid or methacrylic acid, and a quaternized epihalohydrin product of a trialkylamine having 1 to 5 carbon atoms in the alkyl such as (meth)acryloxypropyltrimethylammonium chloride and (meth)acryloxypropyl-triethylammonium bromide; amine derivatives of methacrylic acid or amine derivatives of methacrylamide derived from methacrylic acid or methacrylamide and a dialkylalkanolamine having C\textsubscript{1}-C\textsubscript{6} alkyl groups such as dimethylaminoethyl (meth)acrylate, diethylaminoethyl (meth)acrylate, dimethylaminopropyl (meth)acrylate, or dimethylaminopropyl (meth)acrylamide. Examples of the amphoteric monomers include zwitterionized derivatives of the aforementioned amine derivatives of (meth)acrylic acids or the amine derivatives of (meth)acrylamide such as dimethylaminoethyl (meth)acrylate, dimethylaminopropyl(meth)acrylamide by a halogenated fatty acid salt such as potassium monochloroacetate, sodium monobromopropionate, aminomethylpropanol salt of
monochloroacetic acid, triethanolamine salts of monochloroacetic acid and the like; and amine derivatives of (meth)acrylic acid or (meth)acrylamide, as discussed above, modified with propanesultone.

Examples of nonionic monomers are acrylic or methacrylic acid esters of C₁₋₉ alkyl alcohols, such as methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, 2-methyl-1-propanol, 1-pentanol, 2-pentanol, 3-pentanol, 2-methyl-1-butanol, 1-methyl-1-butanol, 3-methyl-1-butanol, 1-methyl-1-pentanol, 2-methyl-1-pentanol, 3-methyl-1-pentanol, t-butanol, cyclohexanol, 2-ethyl-1-butanol, 3-heptanol, benzyl alcohol, 2-octanol, 6-methyl-1-heptanol, 2-ethyl-1-hexanol, 3,5-dimethyl-1-hexanol, 3,5,5-trimethyl-1-hexanol, 1-decanol, 1-dodecanol, 1-hexadecanol, 1-octadecanol, styrene; chlorostyrene; vinyl esters such as vinyl acetate; vinyl chloride; vinylidene chloride; acrylonitrile; alpha-methylstyrene; t-butylstyrene; butadiene; cyclohexadiene; ethylene; propylene; vinyl toluene; alkoxyalkyl (meth)acrylate, methoxy ethyl (meth)acrylate, butoxyethyl (meth)acrylate; allyl acrylate, allyl methacrylate, cyclohexyl acrylate and methacrylate, oleyl acrylate and methacrylate, benzyl acrylate and methacrylate, tetrahydrofurfuryl acrylate and methacrylate, ethylene glycol di-acrylate and -methacrylate, 1,3-butanediol di-acrylate and -methacrylate, diacetoneacrylamide, isobornyl (meth)acrylate, n-butyl methacrylate, isobutyl methacrylate, 2-ethylhexyl methacrylate, methyl methacrylate, t-butylacrylate, t-butylmethacrylate, and mixtures thereof.

Examples of anionic hair styling polymers are copolymers of vinyl acetate and crotonic acid, terpolymers of vinyl acetate, crotonic acid and a vinyl ester of an alpha-branched saturated aliphatic monocarboxylic acid such as vinyl neodecanoate; and copolymers of methyl vinyl ether and maleic anhydride, acrylic
copolymers and terpolymers containing acrylic acid or methacrylic acid.
Examples of cationic hair styling polymers are copolymers of amino-functional acrylate monomers such as lower alkylamino alkyl acrylate or methacrylate monomers such as dimethyl aminoethylmethacrylate with compatible monomers such as N-vinylpyrrolidone or alkyl methacrylates such as methyl methacrylate and ethyl methacrylate and alkyl acrylates such as methyl acrylate and butyl acrylate.
The compositions of the invention may also include a wide range of miscellaneous ingredients. Some suitable miscellaneous ingredients commonly used in the cosmetic and personal care industry are described in The CTFA Cosmetic Ingredient Handbook, (10th Ed., 2004), which is incorporated by reference herein. These ingredients will be used in amounts which are conventional.
Compositions
The physical form of the compositions according to the invention is not important: creams, lotions, gels, emulsions, sprays, dispersions, solutions, milks, suspensions, cleansers, and washes, shampoos and scalp treatment lotions can all incorporate the saccharose substitutes or mixtures thereof, as well as combinations of these compounds with other additional ingredients.
Use to make a personal care product
The use of scalp care compositions containing an active ingredient as described in the present application to make a medicament for reducing the visible signs of irritations, dryness, increased transepidermal water loss, itching and scaly appearance of the skin on the head (scalp) is contemplated.
The scalp care compositions therefore can be used to make a medicament for reducing the visible signs of irritations, dryness, increased transepidermal water loss, itching and
scaly appearance of the skin on the head (scalp) by topical application of said medicament to the skin of the human needing such treatment.

Methods for Improving Scalp Condition

The compositions of the present invention are useful for preventing and/or reducing the visible signs of irritations, dryness, increased transepidermal water loss, itching and scaly appearance of the skin on the head (scalp) and for improving the state of human skin or hair and its appearance. This includes preventive and curative treatment of the skin. For example, such methods are intended to thicken the various skin layers and tissues, repairing the cutaneous barrier of the stratum corneum, preventing the thinning of the skin, preventing and/or retarding the appearance of dryness, decreasing transepidermal waterloss, preventing and/or relieving itch, diminishing dandruff and scaling.

This method of improving scalp skin appearance involves topically applying to the skin or hair an effective amount of a composition of the present invention. The amount of the composition which is needed, the frequency of application and the duration period of use will depend on the amount of saccharose substitute, analogs or derivatives thereof contained in the composition and on the specific combination with other additional ingredients, which can include, for example, pharmaceutically active agents, vitamins, alphahydroxy acids and the like, and the strength of the cosmetic effect desired.

Most advantageously, the compositions of the invention are applied to the skin or hair, once or twice a day, over an extended period of time, at least one week, preferably one month, even more preferably 3 months, even more preferably for at least about six months, and more preferably still for at least about one year.
Amounts of the composition applied to the skin are, per application, in the range of about 0.1 mg/cm² to about 10 mg/cm². In the cosmetic compositions of the invention the saccharose substitute is often provided in a concentration ranging from 0.01% (m/m) and 10% (m/m).

To practice the method, a composition in the form of a skin lotion, cream, gel, foam, ointment, paste, emulsion, spray, conditioner, tonic, or the like, is applied to the scalp skin and/or hair and intended to stay there (leave-on). The composition can be applied manually. In other formulations, such as a shampoo, it is applied for a period of time, usually a number of minutes, and then rinsed.

A shampoo as discussed above will have two purposes. First it will provide scalp and hair cleansing. In accordance with the present invention, however, it should also provide benefit in terms of reducing TEWL and/or increasing retained scalp moisture. Of course, other advantages may also be realized depending upon the shampoo formulation. For example, it may reduce, by the selection of the ingredients used, irritation, dandruff, provide additional substantivity and the like. Instead of or in addition to a shampoo, formulations in accordance with the present invention can be produced as a conditioner. Of course, the use of a conditioner following a shampoo both produced using a saccharose substitute in accordance with the present invention can provide cumulative advantages. Active constituents of the present invention are in contact with the scalp, the greater the degree of TEWL reduction and/or moisture retention (measured moisture content) that can be accomplished. By using both a shampoo and a conditioner, the total exposure time is increased. Moreover, some percentage of, in particular, the conditioner, may remain on the hair or scalp following rinsing, prolonging the effect.
For this reason, leave on conditioners, lotions, tonics, and the like are particularly useful as they maximize the contact between the scalp the saccharose substitutes in accordance with the present invention. Kits or hair care systems employing both the shampoo and a conditioner or a combination of leave on and rinse off conditioners is also particularly useful in accordance with the present invention and such systems are specifically contemplated. These may be used alone or in combination with other products which may or may not contain saccharose substitutes. However, preferably, they will be used in combination with other products which will not negatively or adversely impact the ability of the formulations of the present invention to achieve the desired results.

The use of the saccharose substitutes of the present invention and most preferably the saccharose substitutes of the present invention alone or in combination with other ingredients are particularly advantageous for skin care products designed to reduce visible signs of irritations, dryness, increased transepidermal water loss, itching and scaly appearance of the skin on the head (scalp), either in a transitory or extended fashion. Thus, the preferred compositions are hair care/scalp care products for topical application to the head. However, any of the saccharose substitutes described herein, may be used in products such as shampoo, conditioners and cleansers for many reasons. They may be used in these products to supplement the anti-itch treatment obtained by use of more traditional anti-itch products. They may also be the primary means of applying these anti-itch agents. However, because these saccharose substitutes and mixtures may have other desirable properties, they may be used in shampoos, conditioners, UV-protecting products, styling gels and the other types of products described herein for reasons completely unassociated with its anti-itch and moisturising properties. All of these products and uses are contemplated.
All publications cited herein are hereby incorporated by reference in their entirety.

**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.

As an illustration of the invention, several cosmetic formulae will be cited. The formulae are representative of, but do not restrict, the invention:

**Example 1: Shampoo**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>INCI Name</th>
<th>Supplier</th>
<th>PLACEBO %</th>
<th>HAIRSPA® %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase 1</strong></td>
<td>Water (Aqua)</td>
<td>qsp 100</td>
<td>0.24</td>
<td>qsp 100</td>
</tr>
<tr>
<td></td>
<td>Citric acid</td>
<td>1.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Citrate</td>
<td>qs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>trisodique Conservateur</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phase 2</strong></td>
<td>Sodium Laureth Sulfate</td>
<td>Albright</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td></td>
<td>Sodium Lauroyl Sarcosinate</td>
<td>Croda</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td></td>
<td>Cocamidopropyl Betaine</td>
<td>Croda</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td></td>
<td>PEG-150 Pentaerythrityl Tetrastearate (and) PEG-6 Capryl/Capric Glycerides (and) Water</td>
<td>Croda</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>Phase 3</strong></td>
<td>Glycerin-40%, Lactitol-30%, Xylitol-30%</td>
<td>SEDERMA</td>
<td>-</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Phase 4</strong></td>
<td>Perfume</td>
<td>qs</td>
<td></td>
<td>qs</td>
</tr>
</tbody>
</table>
HAIRSPA®: Glycerin (qsp 100%), Lactitol (30%), Xylitol (30%)
This shampoo, freshly obtained, may be used for daily application to the head, in particular to reduce irritations, dryness, increased transepidermal water loss, itching and scaly appearance of the skin on the head (scalp).

Example 2: Conditioner

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>INCI Name</th>
<th>Supplier</th>
<th>Placebo %</th>
<th>HAIRSPA™ %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eau déminéralisée</td>
<td>Water (Aqua)</td>
<td></td>
<td>qsp 100</td>
<td>qsp 100</td>
</tr>
<tr>
<td>Sorbate de potassium</td>
<td></td>
<td></td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td><strong>Phase 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crodamol CS90</td>
<td>Quaternium 91 and Cetrimonium Methosulfate and Cetearyl Alcohol</td>
<td>Croda</td>
<td>3.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Crillet 3</td>
<td>Cetearyl Alcohol</td>
<td>Croda</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td></td>
<td>Polysorbate 60</td>
<td>Croda</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Phase 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volpo G26</td>
<td>Glycereth 26</td>
<td>Croda</td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td>Conservateur</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phase 4</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HAIRSPA®</strong></td>
<td>Glycerin-40%, Lactitol-30%, Xylitol-30%</td>
<td>SEDERMA</td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td><strong>Phase 5</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NaOH 30%</td>
<td></td>
<td></td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Phase 6</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crillet 1</td>
<td>Polysorbate 20</td>
<td>Croda</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Parfum</td>
<td></td>
<td></td>
<td>qs</td>
<td>qs</td>
</tr>
</tbody>
</table>

This emulsion is used to moisturize, restructure and soothe the scalp skin.
Example 3: Leave-on conditioner

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>INCI Name</th>
<th>Supplier</th>
<th>Placebo %</th>
<th>HAIRSPA™ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>Water (Aqua)</td>
<td></td>
<td>qsp 100</td>
<td>qsp 100</td>
</tr>
<tr>
<td>Potassium Sorbate</td>
<td></td>
<td></td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Acide Citrique</td>
<td>Citrimonium Trisodique</td>
<td></td>
<td>0.22</td>
<td>0.22</td>
</tr>
<tr>
<td>Incroquat CTC 30</td>
<td>Chloride</td>
<td></td>
<td>1.20</td>
<td>1.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Phase 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procetyl AWS Preservative</td>
<td>PPG-5 Ceteth-20</td>
<td>Croda</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Phase 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HAIRSPA®</td>
<td>Glycerin-40%, Lactitol-30%, Xylitol-30%</td>
<td>SEDERMA</td>
<td>-</td>
<td>2%</td>
</tr>
<tr>
<td>Phase 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crillett 1 Perfume</td>
<td>Polysorbate 20</td>
<td>Croda</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

This leave-on product is used to moisturize, restructure and soothe the scalp skin.

Example 4: Scalp treatment study: 15 days clinical study versus PLACEBO.

Principle
In order to study hydration, two complementary parameters have been considered: scalp moisture measured thanks to a special DermaLab instrument and moisturising of epidermic retention measured by TEWL (trans epidermal water loss).
The median part on the side, halfway between face and ear, presenting an average value in hydration, has been chosen like representative of the whole scalp and like evaluation site with the new DermaLab equipment.
The vertex part of the scalp was selected for a measurement of TEWL, because this zone is usually most fragile and is dehydrated, and the TEWL is a significant parameter, modified even after only one washing.

Protocol
Inclusion criteria: study was led on a 28 subject group, consisted of 16 women and 12 men, self-qualifying like having a desiccated scalp, sometimes prone to itchings.

Special non-inclusion
Fatty hair, thick and crisp hair (incompatible with the probe of measurement).

The 10 day-treatment sequence for each volunteer includes 3 applications of: a shampoo containing 1% HAIRSPA™ or placebo, then a conditioner containing 1% HAIRSPA™ or placebo, ending with a leave-on containing 2% HAIRSPA™ or placebo.

For the two periods previous to the test with the PLACEBO or HAIRSPA®, the volunteers use their usual shampoo with, the day before measurement, a shampoo provided by Sederma (standard shampoo) and identical for all. Each subject thus constitutes its own control for comparison of HAIRSPA® against placebo.

The average age of the 16 women is of 36±9 years, the average age of the 12 men is of 28±5 years.

Shampoo, conditioner, leave-on formulas are the ones of respectively examples 1, 2, and 3.

For each volunteer the recorded data is the average of 8 values measured successively.

Results
Measurements were carried out at T0 before the sequence shampoo/conditioner/leave-on, then 2h30 after drying of the hair.

The T0-T2.5h difference represents the benefit obtained immediately by the treatment. The difference T0-Day 0 to T0-Day 10 represents the long lasting profit obtained after 3 treatment sequences. A variance analysis was carried out to
the measures made at T0 and T2.5h on Day 0 and Day 10. On TEWL: vertex zone of the scalp was the point of application.

Table 2: Immediate effect, 2.5 hours after treatment

<table>
<thead>
<tr>
<th>TEWL</th>
<th>Immediate effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D0</td>
</tr>
<tr>
<td></td>
<td>T0</td>
</tr>
<tr>
<td></td>
<td>T0</td>
</tr>
<tr>
<td>HAIRSPA®</td>
<td>15.7</td>
</tr>
<tr>
<td>Change %</td>
<td>No change</td>
</tr>
<tr>
<td>PLACEB0</td>
<td>12.4</td>
</tr>
<tr>
<td>Change %</td>
<td>+23.4%</td>
</tr>
</tbody>
</table>

The results show that the immediate effect of the treatment with HAIRSPA® is without consequence on the TEWL, whereas the treatment with the PLACEB0 significantly increases the TEWL and this in a reproducible way, with more than 23%.

Table 3: Long lasting effect, Day 10, after several treatments

<table>
<thead>
<tr>
<th>TEWL</th>
<th>LONG LASTING EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T0 at D0</td>
</tr>
<tr>
<td>HAIRSPA®</td>
<td>15.7</td>
</tr>
<tr>
<td>Change %</td>
<td>-12.7%</td>
</tr>
<tr>
<td>PLACEB0</td>
<td>12.4</td>
</tr>
<tr>
<td>Change %</td>
<td>+4.8% (non significant)</td>
</tr>
</tbody>
</table>

The results obtained at D0 and D10 indicate a clear improvement of the TEWL after several treatments with HAIRSPA®: -12.7%. We are thus in presence of a continuous improvement, treatment after treatment. On the contrary, treatment repeated with the PLACEB0 led to a deterioration of the situation with an increase of 5% of the TEWL. For surface moisturizing: median zone side of the scalp was the point of application.

Table 4: Immediate effect, 2.5 hours after treatment
The results indicate an immediate improvement of the moisturizing for the PLACEBO treatment as for HAIRSPA® treatment with however a clear difference in favour of HAIRSPA® since an immediate profit from 21 to 27% is obtained. Note, the test on D0 – day one – illustrates that the use of xylitol and lactitol, in a system, can provide improvement in moisturization of about 25% or more at T 2.5, in this case 27%. T 2.5 refers to 2.5 hours after application of the leave-on conditioner, in this case.

Table 5: Long lasting effect, Day 10, after several treatments

<table>
<thead>
<tr>
<th>Moisturizing power</th>
<th>LONG LASTING EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T0 at D0</td>
</tr>
<tr>
<td>HAIRSPA®</td>
<td>83.6</td>
</tr>
<tr>
<td>Change %</td>
<td>+17%</td>
</tr>
<tr>
<td>PLACEBO</td>
<td>76.8</td>
</tr>
<tr>
<td>Change %</td>
<td>-3.3% (non significant)</td>
</tr>
</tbody>
</table>

One observes a clear improvement of long lasting moisturizing from + 17% after three treatments with HAIRSPA®, whereas the repetitive treatment with the PLACEBO leads to a beginning of dryness with -3% in hydration.

The treatment by HAIRSPA® significantly improves the scalp moisturizing with an immediate effect from 21 to 27% and one progressive and durable improvement with a profit of +17% after a series of three treatments.

Visual observations in video-microscopy

By a progressive and durable increase in moisturizing on the surface and in-depth thanks to the use of HAIRSPA®, shampoo after shampoo, an improvement of the scalp quality is observed.
Example 5: BLINDED STUDY on 3 volunteers DURING 5H

OBJECTIVE OF THE STUDY

This study was performed to evaluate the moisturizing effect of HAIRSPA Leave on in comparison with Adonitol Leave on (1.2% adonitol + 0.8% glycerin). For this, 3 volunteers were recruited.

The evaluation was performed on the scalp by the mean of non-invasive method based on electrical conductance using a Dermalab device as described herein.

TESTED PRODUCTS

- HAIRSPA™ leave on (Table I)
- Adonitol leave on (Table I)

SCHEDULE AND PROTOCOL OF THE STUDY

Subjects were tested at 15 minutes before application, at application “T0”, 1 hour following application “T1”, two hours following application, “T2”, and five hours following application “T5”. Measurement was with a DERMA-LAB device from CORTEX.TECHNOLOGIES. With an eight pin probe using the manufacturer's directions. The products were applied in equal amounts without drying. Testing was undertaken along the median side of the scalp between the ear and the vertex of the scalp.

RESULTS

Hydration of the scalp before product application (T0) and after one (T1), two (T2) or five hours (T5) are shown in Figure 1. Each value is the mean of 8 measurements. Values are in μsiemens (conductance unit). Looking at Table 6, the variation compared with T0 is the measure of the moisturizing power or the improved moisture retention obtained by use of test formulation. In this particular test, there was no reading taken at T2.5. However, looking at the data in Table 6 and Figure 1, it is clear that at T2.5, adonitol in this concentration and in this test leave on format, had a percent increase in moisturizing power of between 16.1 and 21.4 %, and
more particularly, under 20%. It would not be considered as having appreciable scalp conditioning properties. Therefore, adonitol is not a saccharose substitute in accordance with the present invention. Yet, an otherwise identical formulation with xylitol and lactitol instead of adonitol provided between 31.0 and 36.2% moisturizing power. It does have appreciable scalp conditioning properties and they are saccharide substitute in accordance with the present invention.

Table 6: HAIRSPA leave on

Hydration of the scalp before product application (T0) and after one (T1), two (T2) or five hours (T5). Each value is the mean of 8 measurements. Values are in µsiemens (conductance unit).

<table>
<thead>
<tr>
<th>HAIRSPA™ Leave on</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vol 1</td>
<td>21.3</td>
<td>26.3</td>
<td>22.5</td>
<td>28.8</td>
</tr>
<tr>
<td>Vol 2</td>
<td>25.0</td>
<td>32.5</td>
<td>30.0</td>
<td>26.3</td>
</tr>
<tr>
<td>Vol 3</td>
<td>26.3</td>
<td>51.3</td>
<td>46.3</td>
<td>40.0</td>
</tr>
<tr>
<td>Mean</td>
<td>24.2</td>
<td>36.7</td>
<td>32.9</td>
<td>31.7</td>
</tr>
<tr>
<td>Standard-Deviation of the mean</td>
<td>2.6</td>
<td>13.0</td>
<td>12.1</td>
<td>7.3</td>
</tr>
<tr>
<td>Variation compared with T0 (%)</td>
<td>51.7%</td>
<td>36.2%</td>
<td>31.0%</td>
<td></td>
</tr>
</tbody>
</table>

Table 7: Adonitol Leave on

<table>
<thead>
<tr>
<th>Adonitol Leave on</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vol 1</td>
<td>21.3</td>
<td>25.0</td>
<td>25.0</td>
<td>22.5</td>
</tr>
<tr>
<td>Vol 2</td>
<td>22.5</td>
<td>28.8</td>
<td>23.8</td>
<td>21.3</td>
</tr>
<tr>
<td>Vol 3</td>
<td>26.3</td>
<td>33.8</td>
<td>32.5</td>
<td>41.3</td>
</tr>
<tr>
<td>Mean</td>
<td>23.3</td>
<td>29.2</td>
<td>27.1</td>
<td>28.3</td>
</tr>
<tr>
<td>Standard-Deviation of the mean</td>
<td>2.6</td>
<td>4.4</td>
<td>4.7</td>
<td>11.2</td>
</tr>
<tr>
<td>Variation compared with T0 (%)</td>
<td>25.0%</td>
<td>16.1%</td>
<td>21.4%</td>
<td></td>
</tr>
</tbody>
</table>
We claim:

1. A personal care composition comprising: at least one saccharose substitute exhibiting appreciable scalp conditioning, in an amount of about 0.01 to about 10 % by weight of said composition, and at least one additional ingredient, said composition having a pH of about 7 or less.

2. The personal care composition of claim 1 wherein said saccharose substitute being provided in an amount of about 0.05 to about 5 % by weight of said composition.

3. The personal care composition of claim 1 wherein said saccharose substitute includes erythritol, butanediol, butanetriol, arabitol, arabinol, pentaerythritol, pentitol, xylitol, pentanediols, pentanetriols, galactitol, hexanetriol, hexylene glycol, mannitol, sorbitol, hexanediols, isomalt, lactitol, maltitol, xylulose, fructose, melibiose, sucrose, maltose.

4. The personal care composition of claim 3 wherein said saccharose substitute is xylitol, xylose, sorbitol, lactitol, and mixtures of any thereof.

5. The personal care composition of claim 1 having a pH of about 3.5 to about 7.

6. The personal care composition of claim 5 having a pH of about 3.5 to about 6.5.

7. The personal care composition of claim 1 wherein said saccharose substitute provides an increase in scalp moisturization of at least about 30 % 2.5 hours after application of said composition.

8. The personal care composition of claim 1 wherein said additional ingredient is a surfactant, detergent, skin conditioner, hair conditioner, pH adjuster, quat, protein, polypeptide, viscosity modifier, salt, gel former or water.

9. A scalp treatment kit comprising: a shampoo and a conditioner, wherein each of said shampoo and said conditioner includes at least one saccharose substitute exhibiting
appreciable scalp conditioning, in an amount of about 0.01 to about 10% by weight of each of said shampoo and said conditioner, and each of said shampoo and said conditioner include at least one additional ingredient, said shampoo having a pH of about 4.5 to about 7 and said conditioner having a pH of about 3.5 to about 6.5.

10. The scalp treatment kit of claim 9 wherein said saccharose substitute in each of said shampoo and said conditioner are provided in an amount of about 0.05 to about 5% by weight thereof.

11. The scalp treatment kit of claim 9 wherein said saccharose substitute includes erythritol, butanediol, butanetriol, arabitol, arabinol, pentaerythritol, pentitol, xylitol, pentanediols, pentanetriols, galactitol, hexanetriol, hexylene glycol, mannitol, sorbitol, hexanediols, isomalt, lactitol, maltitol, xylulose, fructose, melibiose, sucrose, maltose.

12. The scalp treatment kit of claim 11 wherein said saccharose substitute is xylitol, xylose, sorbitol, lactitol, and mixtures of any thereof.

13. The scalp treatment kit of claim 1 wherein said saccharose substitute provides an increase in scalp moisturization of at least about 30% 2.5 hours after application of said composition.

14. The scalp treatment kit of claim 9 wherein said conditioner is a leave on conditioner.

15. The scalp treatment kit of claim 9 further comprising a second conditioner and wherein one of said conditioners is a rinse off conditioner and one of said conditioners is a leave on conditioner.

16. A method of improving the moisturization of the scalp of a subject in need thereof, comprising the steps of: providing a personal care composition comprising: at least one saccharose substitute exhibiting appreciable scalp
conditioning, in an amount of about 0.01 to about 10 % by weight of said composition, and at least one additional ingredient, said composition having a pH of about 7 or less and applying an amount of said composition sufficient to cover a desired area of said scalp.
Figure 1:
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 7 A61K7/48

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data, EMBASE, BIOSIS

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>WO 95/15149 A (SEDERMA S.A.; GREFF, DANIEL) 8 June 1995 (1995-06-08) cited in the application page 4, lines 8-10; claims</td>
<td>1-16</td>
</tr>
<tr>
<td>X</td>
<td>DE 101 14 641 A1 (DIEITIC DR. WIDMANN PHARMA + DIAET GMBH) 10 October 2002 (2002-10-10) paragraph ‘0023‘; claims 1-3; examples</td>
<td>1-16</td>
</tr>
<tr>
<td>X</td>
<td>EP 1 050 300 A (SHISEIDO COMPANY LIMITED) 8 November 2000 (2000-11-08) paragraphs ‘0007‘, ‘0009‘ - ‘0011‘, ‘0017‘, ‘0018‘; examples test,2-9,12-14 claims 1,3-5; examples working,1,2,4,5</td>
<td>1-16</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of box C.

Patient family members are listed in annex.

* Special categories of cited documents:
  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier document but published on or after the international filing date
  - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  - "O" document referring to an oral disclosure, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority date claimed

* Other documents:
  - "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  - "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  - "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  - "Z" document member of the same patent family

**Date of the actual completion of the international search**

8 August 2005

**Date of mailing of the international search report**

23/08/2005

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patent attest 2
NL - 2280 HT The Hague
Tel. (31-70) 340-2040, Tx. 31 651 epp nl, Fax (31-70) 340-3016

Authorized officer

Mitchell, G
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>
| X        | WO 2004/084849 A (SHIN, SUK-BONG)  
7 October 2004 (2004-10-07)  
page 6, lines 18-29  
page 7, lines 10-16  
page 7, line 27—page 8, line 23  
claims 3, 4; examples 1-3 | 1-16 |
| X        | EP 1 129 693 A (KABUSHIKI KAISHA  
HAYASHIBARA SEIBUTSU KAGAKU KENKYUJO)  
5 September 2001 (2001-09-05)  
page 5, lines 47-49, paragraphs 13-15, 28  
page 7, lines 3-6; examples 1, 2, 5-7 | 1-16 |
| X        | PATENT ABSTRACTS OF JAPAN  
v. 1996, no. 05,  
31 May 1996 (1996-05-31)  
& JP 08 026947 A (SHISEIDO CO LTD),  
abstract | 1-16 |
| X        | GB 1 408 036 A (TREUHANDVEREINIGUNG AG)  
1 October 1975 (1975-10-01)  
page 1, lines 26-56  
page 2, lines 13-24  
page 3, lines 38-41; examples 2, 3 | 1-16 |
| X        | PATENT ABSTRACTS OF JAPAN  
v. 2003, no. 12,  
5 December 2003 (2003-12-05)  
& JP 2004 250332 A (POLA CHEM IND INC),  
9 September 2004 (2004-09-09)  
abstract | 1-16 |
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AU 7188594 A</td>
<td>19-06-1995</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 9515149 A1</td>
<td>08-06-1995</td>
</tr>
<tr>
<td>DE 10114641 A1</td>
<td>10-10-2002</td>
<td>DE 10291166 D2</td>
<td>01-07-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 02076415 A1</td>
<td>03-10-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2000302674 A</td>
<td>31-10-2000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AT 272397 T</td>
<td>15-08-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 1272362 A ,C</td>
<td>08-11-2000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 60012610 D1</td>
<td>09-09-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 60012610 T2</td>
<td>04-08-2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1050300 A2</td>
<td>08-11-2000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TW 565443 B</td>
<td>11-12-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6328984 B1</td>
<td>11-12-2001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1129693 A2</td>
<td>05-09-2001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2001031249 A1</td>
<td>18-10-2001</td>
</tr>
<tr>
<td>JP 08026947 A</td>
<td>30-01-1996</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>GB 1408036 A</td>
<td>01-10-1975</td>
<td>FI 48532 B</td>
<td>31-07-1974</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FI 47450 B</td>
<td>31-08-1973</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AR 193130 A1</td>
<td>30-03-1973</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 4666672 A</td>
<td>21-03-1974</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BE 788788 A1</td>
<td>13-03-1973</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 986413 A1</td>
<td>30-03-1976</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH 581467 A5</td>
<td>15-11-1976</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DD 102914 A5</td>
<td>05-01-1974</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 2244830 A1</td>
<td>26-04-1973</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FR 2152935 A1</td>
<td>27-04-1973</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IE 36929 B1</td>
<td>30-03-1977</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IT 1048260 B</td>
<td>20-11-1980</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 1090769 C</td>
<td>31-03-1982</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 48096735 A</td>
<td>10-12-1973</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 56032962 B</td>
<td>31-07-1981</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LU 66043 A1</td>
<td>14-03-1974</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NL 7212424 A ,B</td>
<td>15-03-1973</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NO 140965 B</td>
<td>10-09-1979</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PH 15692 A</td>
<td>11-03-1983</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RO 67290 A1</td>
<td>15-03-1980</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AT 331989 B</td>
<td>10-09-1976</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AT 766772 A</td>
<td>15-12-1975</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SU 554802 A3</td>
<td>15-04-1977</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ZA 7206247 A</td>
<td>29-05-1974</td>
</tr>
</tbody>
</table>