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(54) **COMPOSITIONS FOR THE TREATMENT OF SIGNS OF AGING**

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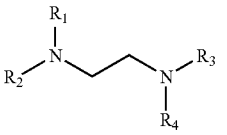
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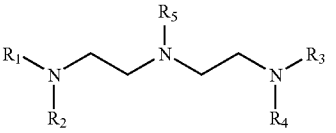
(57) **ABSTRACT**

The present invention features a method of treating at least one sign of aging on the skin selected from the group consisting of enhancing the elasticity of said skin, enhancing the firmness of said skin, and reducing the appearance of wrinkles or cellulite on the skin, by administering to skin in need of such treatment a composition comprising at least one compound of the formula I or formula II:

(I)



(II)



wherein R1, R2, R3, R4, and R5 independently, are selected from the group consisting of hydrogen, C_1-C_6 alkyl, C_1-C_6 hydroxyalkyl, or a cosmetically acceptable salt thereof.

COMPOSITIONS FOR THE TREATMENT OF SIGNS OF AGING

BACKGROUND OF THE INVENTION

[0001] Aging of the skin is a complex phenomenon resulting from the interaction of several intrinsic and extrinsic factors. Intrinsic aging is an inevitable, genetically programmed process. Among extrinsic influences (e.g., wind, heat, cigarette smoke, chemicals, etc.), ultraviolet radiation appears to be the single most important factor associated with aging of the skin.

[0002] N,N,N',N'-tetrakis (2-hydroxypropyl) ethylenediamine has been disclosed for use as a catalytic agent. For example, PCT Patent Application No. WO/0170132 describes the use of N,N,N',N'-tetrakis(2-hydroxypropyl) ethylenediamine as catalytic agent to polymerize micropsheres prior to injection into the skin. Injection of microspheres into the skin acts to augment skin contour deficiencies such as wrinkles. The use of tertiary amines, such as N,N,N',N'-tetrakis (2-hydroxypropyl) ethylenediamine, as chelating agents to prevent the reduction of the salicylic acid is described in U.S. Pat. No. 4,822,604.

[0003] The application of N,N,N',N'-tetrakis (2-hydroxypropyl) ethylenediamine in cosmetic products has been described in European Patent No. 0023978 whereby the development of carcinogenic nitrosamines in cosmetic and toiletry products which contain triethanolamine is avoided by using N,N',N',N'-tetrakis (2-hydroxypropyl) ethylenediamine to neutralize acidic formulations. U.S. Pat. No 4,749,507 describes the use of N,N,N',N'-tetrakis (2-hydroxypropyl) ethylenediamine, for removing hair dyes from hair and skin and U.S. Pat. No 3,916,008 describes the use of esters of ethylene diamine are useful as hypocholesterolaemic agents in animals and man. Bhide MV et al. (Immunopharmacol. 1985;7(3):303-312) reported that treating macrophages in culture with N,N,N',N'-tetrakis(2-hydroxypropyl-)ethylenediamine resulted in an increase macrophage phagocytosis.

[0004] The present invention relates to the unexpected discovery that certain ethanediamine compounds are effective for treating the sign of aging.

SUMMARY OF THE INVENTION

[0005] In one aspect, the present invention features a method of treating at least one sign of aging on the skin selected from the group consisting of enhancing the elasticity of said skin, enhancing the firmness of said skin, and reducing the appearance of wrinkles or cellulite on the skin, by administering to skin in need of such treatment a composition comprising at least one compound of the formula I or formula II described below.

[0006] In another aspect, the present invention features a product containing (a) a composition including at least one compound of the formula I or formula II described below and (b) instructions directing the user to apply said composition to skin in order to treat at least one sign of aging on the skin selected from the group consisting of enhancing the elasticity of said skin, enhancing the firmness of said skin, and reducing the appearance of wrinkles on the skin.

[0007] In another aspect, the present invention also features a method of promoting a composition including at least one compound of the formula I or formula II described below, wherein said method comprises directing the user to apply said composition to skin in order to treat at least one sign of aging on the skin selected from the group consisting of enhancing the elasticity of said skin, enhancing the firmness of said skin, and reducing the appearance of wrinkles on the skin.

[0008] Other features and advantages of the present invention will be apparent from the detailed description of the invention and from the claims.

DETAILED DESCRIPTION OF THE INVENTION

[0009] It is believed that one skilled in the art can, based upon the description herein, utilize the present invention to its fullest extent. The following specific embodiments are to be construed as merely illustrative, and not limitative of the remainder of the disclosure in any way whatsoever.

[0010] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the invention belongs. Also, all publications, patent applications, patents, and other references mentioned herein are incorporated by reference. Unless otherwise indicated, a percentage refers to a percentage by weight (i.e., %(W/W)).

Definitions

[0011] What is meant by "treat or treating a sign of aging on the skin" is reducing the appearance of wrinkles on the skin and/or enhancing the firmness or elasticity of the skin, including but not limited to, treating sagging, lax and loose skin or tightening skin.

[0012] What is meant by a "product" is a product in finished packaged form. In one embodiment, the package is a container such as a plastic, metal or glass tube or jar containing the composition. The product may further contain additional packaging such as a plastic or cardboard box for storing such container. In one embodiment, the product contains instructions directing the user to administer the composition to the tissue to enhance its firmness or elasticity. Such instructions may be printed on the container, label insert, or on any additional packaging.

[0013] What is meant by "contract a skin cell" is to reduce the length of at least one dimension of the skin cell. Examples of skin cells include, but are not limited to, keratinocytes.

[0014] What is meant by "promoting" is promoting, advertising, or marketing. Examples of promoting include, but are not limited to, written, visual, or verbal statements made on the product or in stores, magazines, newspaper, radio, television, internet, and the like.

[0015] For promoting the contraction of skin cells, examples of such statements include, but are not limited to, "contracts skin cells,""contracts keratinocytes,""shrinks skin cells," and "shrinks keratinocytes". Examples of such visual statements include digital images, pictures, drawings, or movies of skin cells depicting contracted cells and/or the contraction of cells (e.g., showing a reduction in the length of at least one dimension of the skin cell). In one embodiment, the skin cells are of the of the upper epidermis.

[0016] For promoting the treatment of signs of aging, examples of such statements include, but are not limited to, "enhances skin elasticity,""improving visible and tactilely perceptible manifestations of the skin,""increases skin elasticity or firmness,""restores skin elasticity,""treats sagging or lax skin,""reduces the appearance of cellulite,""lifts the skin," and "lifts the face,""firms the skin,""firms the face, ""younger skin,""restores youthful firmness", "improves facial contours," and "makes skin look younger."

[0017] As used herein, the term "wrinkle" includes fine line, fine wrinkles, coarse wrinkles, cellulite, scars, and stretch marks. Examples of wrinkles include, but are not limited to, fine lines around the eyes (e.g., "crow's feet"), forehead and cheek wrinkles, frown-lines, and laugh-lines around the mouth.

[0018] As used herein, "administering to skin in need of such treatment" means contacting (e.g., by use of the hands or an applicator such, but not limited to, a wipe, tube, roller, spray, or patch) the area of skin in need such treatment or an area of skin proximate to the area of skin in need of such treatment (e.g., to contract an area of skin proximate to the area of need of treatment, thereby tightening the area of skin in need of such treatment).

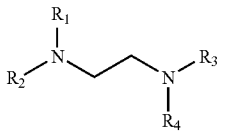
[0019] As used herein, "composition" means a composition suitable for administration to the skin.

[0020] As used herein, "cosmetically-acceptable" means that the ingredients which the term describes are suitable for use in contact with the skin without undue toxicity, incompatibility, instability, irritation, allergic response, and the like.

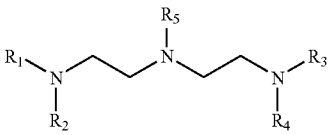
[0021] As used herein, "safe and effective amount" means an amount of the compound, carrier, or of the composition sufficient to induce an enhancement in tissue elasticity, but low enough to avoid serious side effects. The safe and effective amount of the compounds or composition will vary with the area being treated, the age, health and skin type of the end user, the duration and nature of the treatment, the specific compound or composition employed, the particular cosmetically-acceptable carrier utilized, and like factors.

Compounds

[0022] The compositions of the present invention contain at least one compound of the formula I or formula II:



(I)

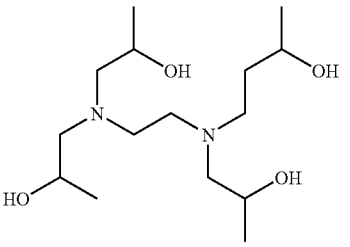


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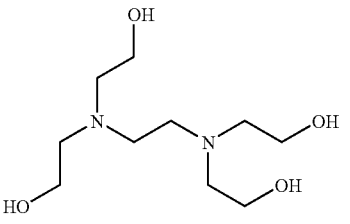
wherein R1, R2, R3, R4, and R5 independently, are selected from the group consisting of hydrogen, C_1-C_6 alkyl, and C_1-C_6 hydroxyalkyl; or a cosmetically-acceptable salt thereof.

[0023] In one embodiment, the compositions of the present invention contain at least one compound of the formula I and R1, R2, R3, and R4 are selected from the group consisting of C_1-C_3 alkyl and C_1-C_3 alkanol. In a further embodiment, at least one of R1, R2, R3, and R4 of formula I is a C_2-C_3 alkanol group bearing at least one hydroxyl group.

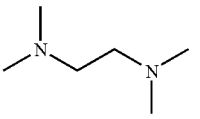
[0024] Examples of compounds of formula I include, but are not limited to, N,N,N',N'-Tetrakis(2-hydroxypropyl)ethylenediamine (THPED), N, N, N', N'-Tetrakis (2-hydroxyethyl) ethylene diamine (THEED), N, N, N', N'-tetramethylethylene diamine (TEMED) (the structures of which are set forth below), enantiomers thereof, or diastereoisomers thereof, or cosmetically-acceptable salts thereof.



(THPED)



(THEED)



(TEMED)

[0025] The synthesis of N,N,N',N'-tetrakis (2-hydroxypropyl) ethylenediamine from the reaction of ethylenediamine with of propylene oxide is described in U.S. Pat. No. 2,697,118.

[0026] The compounds of the present invention may also be present in the form of cosmetically acceptable salts. For use in medicine, the salts of the compounds of this invention refer to non-toxic "cosmetically acceptable salts," cosmetically acceptable acidic/anionic or basic/cationic salts. Cosmetically acceptable acidic/anionic salts include, and are not limited to acetate, benzenesulfonate, benzoate, bicarbonate, bitartrate, bromide, calcium edetate, camsylate, carbonate, chloride, citrate, dihydrochloride, edetate, edisylate, estolate, esylate, fumarate, glyceptate, gluconate, glutamate, glycollylarsanilate, hexylresorcinate, hydrabamine, hydrobromide, hydrochloride, hydroxynaphthoate, iodide, isethionate, lactate, lactobionate, malate, maleate, mandelate, mesylate, methylbromide, methylnitrate, methylsulfate, mucate, napsylate, nitrate, pamoate, pantothenate, phosphate/diphospate, polygalacturonate, salicylate, stearate,

subacetate, succinate, sulfate, tannate, tartrate, teoclate, tosylate and triethiodide. Cosmetically acceptable basic/cationic salts include, and are not limited to aluminum, benzathine, calcium, chloroprocaine, choline, diethanolamine, ethylenediamine, lithium, magnesium, meglumine, potassium, procaine, sodium and zinc. Other salts may, however, be useful in the preparation of compounds according to this invention or of their cosmetically acceptable salts. Organic or inorganic acids also include, and are not limited to, hydriodic, perchloric, sulfuric, phosphoric, propionic, glycolic, methanesulfonic, hydroxyethanesulfonic, oxalic, 2-naphthalenesulfonic, p-toluenesulfonic, cyclohexanesulfamic, saccharinic or trifluoroacetic acid.

Compositions

[0027] The compositions useful in the present invention involve formulations suitable for administering to the target tissues. In one embodiment, the composition contains a safe and effective amount of (i) compounds of the present invention and (ii) a cosmetically-acceptable carrier. In one embodiment, the cosmetically-acceptable carrier is from about 50% to abut 99.99%, by weight, of the composition (e.g., from about 80% to about 99%, by weight, of the composition).

[0028] The compositions may be made into a wide variety of product types that include but are not limited to solutions, suspensions, lotions, creams, gels, sticks, sprays, ointments, cleansing liquid washes and solid bars, shampoos and hair conditioners, pastes, foams, powders, mousses, shaving creams, wipes, patches, nail lacquers, wound dressing and adhesive bandages, hydrogels, film-forming products, facial and skin masks, make-up such as foundations, mascaras, and lipsticks, and the like. These product types may contain several types of cosmetically- acceptable carriers including, but not limited to solutions, suspensions, emulsions such as microemulsions and nanoemulsions, gels, solids and liposomes. The following are non-limitative examples of such carriers. Other carriers can be formulated by those of ordinary skill in the art.

[0029] The compositions useful in the present invention can be formulated as solutions. Solutions typically include an aqueous or organic solvent (e.g., from about 50% to about 99.99% or from about 90% to about 99% of a cosmetically acceptable aqueous or organic solvent). Examples of suitable organic solvents include: propylene glycol, polyethylene glycol (200-600), polypropylene glycol (425-2025), glycerol, 1,2,4-butanetriol, sorbitol esters, 1,2,6-hexanetriol, ethanol, and mixtures thereof.

[0030] A lotion can be made from such a solution. Lotions typically contain from about 1% to about 20% (e.g., from about 5% to about 10%) of an emollient(s) and from about 50% to about 90% (e.g., from about 60% to about 80%) of water. As used herein, "emollients" refer to materials used for the prevention or relief of dryness, as well as for the protection of the skin or hair. Examples of emollients include, but are not limited to, those set forth in the International Cosmetic Ingredient Dictionary and Handbook, eds. Wenninger and McEwen, pp. 1656-61, 1626, and 1654-55 (The Cosmetic, Toiletry, and Fragrance Assoc., Washington, D.C., 7th Edition, 1997) (hereinafter "ICI Handbook").

[0031] Another type of product that may be formulated from a solution is a cream. A cream typically contains from about 5% to about 50% (e.g., from about 10% to about 20%) of an emollient(s) and from about 45% to about 85% (e.g., from about 50% to about 75%) of water.

[0032] Yet another type of product that may be formulated from a solution is an ointment. An ointment may contain a simple base of animal, vegetable, or synthetic oils or semi-solid hydrocarbons. An ointment may contain from about 2% to about 10% of an emollient(s) plus from about 0.1% to about 2% of a thickening agent(s). Examples of thickening agents include, but are not limited to, those set forth in the ICI Handbook pp. 1693-1697.

[0033] The compositions useful in the present invention can also be formulated as emulsions. If the carrier is an emulsion, from about 1% to about 10% (e.g., from about 2% to about 5%) of the carrier contains an emulsifier(s). Emulsifiers may be nonionic, anionic or cationic. Examples of emulsifiers include, but are not limited to, those set forth in the ICI Handbook, pp. 1673-1686.

[0034] Lotions and creams can be formulated as emulsions. Typically such lotions contain from 0.5% to about 5% of an emulsifier(s), while such creams would typically contain from about 1% to about 20% (e.g., from about 5% to about 10%) of an emollient(s); from about 20% to about 80% (e.g., from 30% to about 70%) of water; and from about 1% to about 10% (e.g., from about 2% to about 5%) of an emulsifier(s).

[0035] Single emulsion skin care preparations, such as lotions and creams, of the oil-in-water type and water-in-oil type are well-known in the art and are useful in the subject invention. Multiphase emulsion compositions, such as the water-in-oil-in-water type or the oil-in-water-in-oil type, are also useful in the subject invention. In general, such single or multiphase emulsions contain water, emollients, and emulsifiers as essential ingredients.

[0036] The compositions of this invention can also be formulated as a gel (e.g., an aqueous, alcohol, alcohol/water, or oil gel using a suitable gelling agent(s)). Suitable gelling agents for aqueous and/or alcoholic gels include, but are not limited to, natural gums, acrylic acid and acrylate polymers and copolymers, and cellulose derivatives (e.g., hydroxymethyl cellulose and hydroxypropyl cellulose). Suitable gelling agents for oils (such as mineral oil) include, but are not limited to, hydrogenated butylene/ethylene/styrene copolymer and hydrogenated ethylene/propylene/styrene copolymer. Such gels typically contains between about 0.1% and 5%, by weight, of such gelling agents.

[0037] The compositions of the present invention can also be formulated into a solid formulation (e.g., a wax-based stick, soap bar composition, powder, and wipe containing powder).

[0038] The compositions useful in the subject invention may contain, in addition to the aforementioned components, a wide variety of additional oil-soluble materials and/or water-soluble materials conventionally used in compositions for use on skin at their art-established levels.

Additional Cosmetically Active Agents

[0039] In one embodiment, the composition further contains another cosmetically active agent in addition to the above compounds. What is meant by a "cosmetically active agent" is a compound (e.g., a synthetic compound or a

compound isolated from a natural source, or a natural extract containing a mixture of compounds) that has a cosmetic or therapeutic effect on the tissue, including, but not limiting to, lightening agents, darkening agents such as self-tanning agents, anti-acne agents, shine control agents, anti-microbial agents such as anti-yeast agents, anti-fungal, and anti-bacterial agents, anti-inflammatory agents, anti-parasite agents, external analgesics, sunscreens, photoprotectors, antioxidants, keratolytic agents, detergents/surfactants, moisturizers, nutrients, vitamins, energy enhancers, anti-perspiration agents, astringents, deodorants, hair removers, hair growth enhancing agents, hair growth delaying agents, firming agents, anti-callous agents, agents for skin conditioning, anti-cellulite agents, fluorides, teeth whitening agents, anti-plaque agents, and plaque-dissolving agents, and odor-control agents such as odor masking or pH-changing agents.

[0040] In one embodiment, the agent is selected from, but not limited to, the group consisting of hydroxy acids, benzoyl peroxide, D-panthenol, octyl methoxycinnimate, titanium dioxide, octyl salicylate, homosalate, avobenzone, carotenoids, free radical scavengers, spin traps, retinoids and retinoid precursors such as retinol and retinyl palmitate, ceramides, polyunsaturated fatty acids, essential fatty acids, enzymes, enzyme inhibitors, minerals, hormones such as estrogens, steroids such as hydrocortisone, 2-dimethylaminoethanol, copper salts such as copper chloride, peptides containing copper such as Cu:Gly-His-Lys, coenzyme Q10, amino acids such a proline, vitamins, lactobionic acid, acetyl-coenzyme A, niacin, riboflavin, thiamin, ribose, electron transporters such as NADH and FADH2, and other botanical extracts such as aloe vera, Feverfew, and Soy, and derivatives and mixtures thereof. The cosmetically active agent will typically be present in the composition of the invention in an amount of from about 0.001% to about 20% by weight of the composition, e.g., about 0.005% to about 10% such as about 0.01% to about 5%.

[0041] Examples of vitamins include, but are not limited to, vitamin A, vitamin Bs such as vitamin B3, vitamin B5, and vitamin B12, vitamin C, vitamin K, vitamin E such as alpha, gamma or delta-tocopherol, and derivatives and mixtures thereof.

[0042] Examples of hydroxy acids include, but are not limited, to glycolic acid, lactic acid, malic acid, salicylic acid, citric acid, and tartaric acid.

[0043] Examples of antioxidants include, but are not limited to, water-soluble antioxidants such as sulfhydryl compounds and their derivatives (e.g., sodium metabisulfite and N-acetyl-cysteine), lipoic acid and dihydrolipoic acid, resveratrol, lactoferrin, and ascorbic acid and ascorbic acid derivatives (e.g., ascorbyl palmitate and ascorbyl polypeptide). Oil-soluble antioxidants suitable for use in the compositions of this invention include, but are not limited to, butylated hydroxytoluene, retinoids (e.g., retinol and retinyl palmitate), different types of tocopherols (e.g., alpha-, gamma-, and delta-tocopherols and their esters such as acetate) and their mixtures, tocotrienols, and ubiquinone. Natural extracts containing antioxidants suitable for use in the compositions of this invention, include, but not limited to, extracts containing flavonoids, isoflavonoids, and their derivatives such as genistein and diadzein (e.g., such as Soy and Clover extracts, extracts containing resveratrol and the like. Examples of such natural extracts include grape seed, green tea, pine bark, and propolis.

Other Materials

[0044] Various other materials may also be present in the compositions useful in the subject invention. These include humectants, proteins and polypeptides, preservatives and an alkaline agent. Examples of such agents are disclosed in the ICI Handbook, pp. 1650-1667. The compositions of the present invention may also contain chelating agents (e.g., EDTA) and preservatives (e.g., parabens). Examples of suitable preservatives and chelating agents are listed in pp. 1626 and 1654-55 of the ICI Handbook. In addition, the compositions useful herein can contain conventional cosmetic adjuvants, such as colorants such as dyes and pigments, opacifiers (e.g., titanium dioxide), and fragrances.

Mineral Water

[0045] The compositions of the present invention may be prepared using a mineral water, for example mineral water that has been naturally mineralized such as Evian® Mineral Water (Evian, France). In one embodiment, the mineral water has a mineralization of at least about 200 mg/L (e.g., from about 300 mg/L to about 1000 mg/L). In one embodiment, the mineral water contains at least about 10 mg/L of calcium and/or at least about 5 mg/L of magnesium.

[0046] The composition and formulations containing such compositions of the present invention may be prepared using methodology that is well known by an artisan of ordinary skill.

EXAMPLE 1

Electric Cell-Substrate Impedance Detection

[0047] Electrical changes due to the presence of a cell layer can be used to calculate cell morphological parameters including the barrier function of the cell layer (the spacing between the ventral side of the cell and the substratum) and the cell membrane capacitance (Giaever and Keese, Proceedings of National Academy of Sciences 88, 7896, 1991).

[0048] Current flowing between a reference electrode, onto which cells or cell cultures may be attached, and a larger counter electrode using normal culture medium as the electrolyte can be used to detect changes in cell morphological parameters. In the absence of cells on the electrode, the current flows unrestrained from the surface of the electrodes. In the presence of cells attached and spread upon the electrode, the current must now flow in the spaces under and between the cells, as the cell membrane act as insulators.

[0049] The electrical changes of living, viable cells can be sampled rapidly, in real time, over an extended period of time, and the measurements are the measurement is non-invasive. An example of this technology is the Electric Cell-substrate Impedance Sensing System (ECIS) available from Applied Biophysics (Troy, N.Y.). Electrical changes in keratinocyte morphological parameters can be used to identify novel compounds for anti-aging benefits.

[0050] Human keratinocytes and Epilife culture media (Cascade Biologics, Portland, Oreg.) were cultured at 37° C. in a humidified atmospheres of 5% CO_2/95% air. Electric Cell-substrate Impedance Sensing System (ECIS) electrode arrays (Applied Biophysics, Troy, N.Y.) were coated with

0.01 mg/ml Laminin V (Sigma Aldirch, St Louis, Mo.) in sterile Phosphate Buffered Saline (Gibco Life Sciences, San Diego, Calif.). Human keratinocytes were prepared at a density of 0.125×10^6 cells/mL in Epilife culture media. Human keratinocytes were plated at 5.0×10^4 cells/electrode well and cultured at 37° C. in a humidified atmospheres of 5% CO_2/95% O_2 for 24-48 hrs. Capacitance changes (in nanofarads, nF) of keratinocytes were measured using a Electric Cell-substrate Impedance Sensing System (ECIS) Model 1600R (Applied Biophysics, Troy, N.Y.) using the method of Wegener and co-workers (Wegener J, Keese C R, Giaever I, Exp Cell Res. 259:158-166, 2000) at a frequency of 40,000 Hz. Capacitance readings are inversely related to the contact area of a cell onto the ECIS electrode array, the greater the cell area contacting the electrode the smaller the capacitance readings (Wegener J, Keese C R, Giaever I, Exp Cell Res. 259:158-166, 2000). Conversely as a cell contracts or shrinks, the contact area of the cell onto the ECIS electrode array decreases, resulting in an increase in the capacitance readings. The change in capacitance readings for each treatment groups was integrated over 5 hrs as a function of area-under-the-curve (AUC) analysis from approximately 1000 keratinocyte cells. These calculations are based on the trapezoid theorem. The AUC of the media curve was subtracted from the compound treated group. A positive AUC difference indicates keratinocyte contraction, the greater the AUC difference the greater the amount of keratinocyte contraction. The following compounds were used in the example: N,N,N',N'-Tetrakis(2-hydroxypropyl-)ethylenediamine (THPED, available from BASF under the tradename "Quadrol" or "Neutrol") and 2-(dimethylamino-)ethanol (available from BASF under the tradename "DMAE"). DMAE is a known skin-firming agent. The compounds were diluted into Hank's Buffered Salt Solution (HBSS; Gibco Life Sciences, San Diego, Calif.) and the pH of the solution adjusted to between pH 7.2-7.3. The pH of the HBSS without compounds ("Media Alone") was also adjusted to pH 7.2-7.3.

[0051] Based on this example, it can be seen from the results on table I, that DMAE and THPED induces a dose-dependent contraction or shrinkage of keratinocyte cell area compared to media treatment alone as measured by keratinocyte capacitance.

TABLE I

Quantitation of Electrical Capacitance Contraction of Human Keratinocytes (Mean ± Std Dev)

	Concentration (% V/V)			
Treatment	0%	0.01%	0.05%	0.1%
Media Alone	15.8 ± .8			
Media + THPED		29.2 ± 3.2**	35.1 ± 5.3*	44.5 ± 9.1*
Media + DMAE		22.82 ± 4.1**	28.8 ± 5.6**	36.1 ± 5.9*

*= P < 0.05 compared to AUC for Media Alone treated group using a paired t-Test.
**= P < 0.1 compared to AUC for Media Alone treated group using a paired t-Test

EXAMPLE 2

Contraction of Human Keratinocytes with THPED Using Real Time Visual Microscopy

[0052] Human keratinocytes and Epilife culture media (Cascade Biologics, Portland, Oreg.) were cultured at 37° C. in a humidified atmospheres of 5% CO_2 /95% air. Glass Cover Slides (Applied Biophysics, Troy, N.Y.) were coated with 0.01 mg/ml Laminin V (Sigma Aldirch, St Louis, Mo.) in sterile Phosphate Buffered Saline, (Gibco Life Sciences, San Diego, Calif.). Human keratinocytes were prepared at a density of 0.125×10^6 cells/mL in Epilife culture media. Human keratinocytes were plated at 3.75×10^4 cells/well on a 6 well plate containing Laminin coated coverslips and cultured at 37° C. in a humidified atmospheres of 5% CO_2/95% O_2 for 48 hrs. Individual coverslips were transferred to a open bath imaging chamber (Warner Instruments, Hamden, Conn.) mounted on a Leica inverted microscope (Leitz DM1L) with an attached CCD camera. Cells were perfused with Hank's Buffered Salt Solution (HBSS; Gibco Life Sciences, San Diego, Calif.) at flow rate of 1 ml/min using a peristaltic pump (Cole Parmer, Vernon Hills, Ill.). DMAE or THPED was diluted into Hank's Buffered Salt Solution and the pH of the solution adjusted to between pH 7.2-7.3. The pH of the HBSS without DMAE or THPED ("Media Alone") was also adjusted to pH 7.2-7.3. Human keratinocytes were perfused for 10 minutes with buffer alone to establish basal conditions at which time, buffer containing various concentrations of DMAE or THPED were perfused onto keratinocytes. Images were collected of a field of keratinocytes containing 10-20 cells at 0, 10 and 20 minutes of treatment using ImagePro software. Cell area was determined using Scion Image software (Version 4.0.2), and reductions in cell area were reported as the ratio of cell area after treatment to cell area prior to treatment

[0053] Based on this example, it was found (as shown in Table II) that DMAE and THPED induces a dose-dependent contraction or shrinkage of keratinocyte cell area as determined by keratinocyte surface area.

TABLE II

Quantitation of Visual Contraction of Human Keratinocytes with THPED and DMAE (Mean ± Std Dev) Concentration (% V/V)

Treatment	2 Min	10 Min	20 Min
Media Alone			2.1% ± 3.2%
Media + DMAE (0.01%)		4.82% ± 0.68%*	6.22% ± 0.95%*
Media + DMAE (0.05%)		16.40% ± 2.58%*	18.04% ± 3.09%*
Media + DMAE (0.1%)		23.61% ± 3.03%*	33.83% ± 2.96%*
Media + THPED (0.1%)	32.9% ± 11.3%*	37.9% ± 10.7%*	47.3% ± 12.7%*

*= P < 0.05 compared to cell area of keratinocytes prior to treatment with THPED using a paired t-Test.

[0054] Based on this example, it can be seen that DMAE and THPED are able to significantly induce a rapid contraction or shrinkage of keratinocyte cell area.

EXAMPLE 4

Reviscometer® RVM 600 Reading in the Upper Inner Arm

[0055] The Reviscometer® RVM 600 (Courage and Khazaka, Cologne, Germany) measures the propagation time of an elastic shear pulse in viscoelastic materials. As the preferred disposition of the collagen fibers corresponds to the skin's cleavage line (Lange's lines), the speed of propagation of elastic disturbances on the skin will depend strongly on its orientation. Skin sites on the body where the skin is the loosest would present the strongest orientation effects, e.g. on the upper inner arm, the neck, the thighs and the abdomen based on collagen fiber orientation.

[0056] In this study we chose an instrument that allows the determination of directional tension along the surface of the skin. The velocity of sound depends on the density and tension of the material through which it is propagating, for example sound travels faster in water than it does in air and faster yet in a solid. Mechanical vibrations propagate faster the higher the tension, like a guitar string the higher the tension the higher the frequency of oscillation after plucking. The probe that comes in contact with the skin of the instrument in question is composed of two transducers placed 1.5-2 mm apart and mounted on two independent supports. Then one transducer generates a motion of small amplitude (<1 mm) and the second transducer determines when the disturbance generated by the first transducer arrives at its location. From this time, we can calculate the velocity of propagation and, therefore, the tension along the skin. In the limit where the motion of the transducer is less than 100 microns, the instrument would probably probe the tension in the epidermis and as the motion becomes larger the motion would include the dermis. The instrument used in this study generates a motion that probes the epidermis and the superficial dermis. The time that it takes the acoustic pulse to go from transmitter to receiver is the measured parameter called Resonance Running Time (RRT). The RRT depends on the directional orientation of the collagen bundles. Readings must be performed in different angles: 0°, 45°, 90° and 135°. In this study readings as function of the angle were taken in increments of 3°; covering an angular field of 100° range. The anisotropy (A) of the measured parameter, RRTmax/RRTmin, and the full width at half maximum (FWHM) obtained from a Gaussian fit of the RRT as a function of the measured angle are two new mechanical parameter that change with age. Its ratio A/FWHM is a new mechanical parameter that we can use to predict the subjects age since we obtained a p value of <0.001 for this ratio as a function of age. In this study we will express the skin firming as a ratio of the Anisotropy before and after product application.

[0057] Skin viscoelastical measurements were performed as a function the direction with a Reviscometer® (Model RVM 600, Courage Khazaka, Cologne, Germany). The probe is held perpendicular to the skin surface by a hollow cylindrical holder that is attached to the surface of the skin with double stick tape (positioning top). The holder has marks along its periphery at angular intervals of 45°. In our instrument we modified the probe-holder assembly by placing a mm scale on the probe and another on the holder. Then we carried out measurements by rotating the probe within the holder so that the mm lines of the scale would align with each other, this corresponded to making measurements every 3° for a total interval of 100°.

[0058] The skin viscoelastical measurements were taken on the upper inner arm of 30 subject. Two sites were chosen in each arm, readings were taken as described above before and 45 minutes after product application. In one of the sites was applied a placebo formulation (no THPED) and in the second site a formulation containing 2.5% of THPED (as described in Example 4), was applied. After the gaussian fit, the Anisotropy ratio, before and after product application, was calculated.

[0059] It was found that the THPED formulation decreases the skin anisotropy 3 fold, as compared to 1.5 fold for the placebo formulation. Using a Minitab® software for the statistical analysis comparing THPED formulation against placebo, we obtained a $p<0.001$. This shows that THPED treated sites can tight and firm the skin and this effect is statistically significant.

[0060] Compositions containing DMAE were also tested in the same methodology as described above. The upper inner arms of subjects were treated with products that contained either 0% DMAE (placebo), 0.5% DMAE, 1% DMAE, 2% DMAE, or 3% DMAE. The anisotropy was measured both before and 35 minutes after product application. The anisotropy ratio shows a dose response for DMAE indicating that the contraction of the keratinocytes, as seen in the Confocal Microscopy example (example 3), can firm and tight the skin as well deliver anti-aging benefits to the skin. Table V shows the firming effect (anisotropy ratio) for the DMAE as a function of DMAE concentration in percentage.

TABLE V

DMAE Concentration (%)	Firming (A_{before}/A_{after})
Placebo	1.1 ± 1.1
0.5	6.5 ± 5.8
1	9.5 ± 6.3
2	14.5 ± 4.8
3	20.9 ± 5.0

EXAMPLE 4

Topical Composition

[0061] The following is a description of the manufacture of a topical lotion composition containing THPED. Into a primary glass beaker, 545.60 g of deionized water was weighed and heated to 78-80° C. While mixing at moderate speed, 15.0 g of PVM/MA Decadiene Crosspolymer available from International Specialty Products (Wayne, N.J.) under the tradename "Stabileze QM" was added and mixed until homogenous at 78-80° C. The beaker was removed from heat, and 1.0 g of Disodium EDTA available from Dow Chemical (Midland, Mich.) under the tradename "Versene NA", 7.5 g of Sucrose Cocoate available from Croda (Edison, N.J.) under the tradename "Crodesta SL-40", 7.5 g of PEG-6 Capric/Caprylic Glycerides available from Croda under the tradename "Glycerox 767," and 10.0 g of Hexylene Glycol available from Pfaltz & Bauer Chemicals (Waterbury, Conn.) under the tradename "Hexylene Glycol" were added and mixed until uniform.

[0062] In a secondary beaker, 305.0 g of deionized water were weighed into a glass beaker. 25.0 g of N,N,N',N'-Tetrakis(2-hydroxypropyl)ethylenediamine available from BASF under the tradename "Quadrol" or "Neutrol" was added and mixed until uniform. When the temperature of the primary beaker was cooled to 40° C. or below, the contents of the second beaker were added to the primary beaker and mixed until uniform.

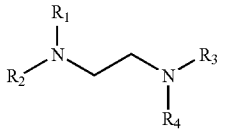
[0063] A buffering solution was prepared in a tertiary beaker by first weighing 12.4 g of deionized water into a glass beaker. 8.0 g of Anhydrous Citric Acid "Citric Acid" and 23.0 g of Glycolic Acid (70%) available from DuPont Chemical under the tradename "Glypure" were then added and mixed until uniform. The pH of the mixture in the primary beaker was adjusted to between 7.0-7.5 with Glycolic/Citric/Water mixture added from the tertiary beaker.

[0064] Then, 5.0 g of Talc available from Luzenac (Denver, Colo.) under the tradename "Windsor Talc 66" was added to the primary beaker and mixed until uniform. 10.0 g of Nylon 12 available from Kobo Products, Inc (South Plainfield, N.J.) under the tradename "SP-10" was added to the primary beaker and mixed until uniform. 10.0 g of Silicone Quaternium-13 available from Biosil Technologies, Inc. (Paterson, N.J.) under the tradename "Biosil Basics SPQ" was added to the primary beaker and mixed until uniform. 10.0 g of Parabens available from Nipa Laboratories, Inc. (Wilmington, Del.) under the tradename "Phenonip" was added to the primary beaker and mixed until uniform. Finally, the mixture was homogenized for 5 minutes and cooled to 25° C.

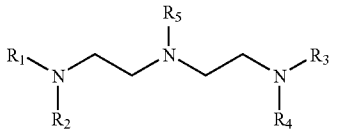
What is claimed is:

1. A method of treating at least one sign of aging on the skin selected from the group consisting of enhancing the elasticity of said skin, enhancing the firmness of said skin, and reducing the appearance of wrinkles or cellulite on the skin, said method comprising administering to skin in need of such treatment a composition comprising at least one compound of the formula I or formula II:

(I)



(II)



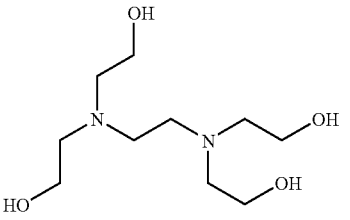
wherein R1, R2, R3, R4, and R5 independently, are selected from the group consisting of hydrogen, C_1-C_6 alkyl, C_1-C_6 hydroxyalkyl, or a cosmetically acceptable salt thereof.

2. A method of claim 1, wherein said method comprises enhancing the elasticity of said skin.

3. A method of claim 1, wherein said method comprises enhancing the firmness of said skin.

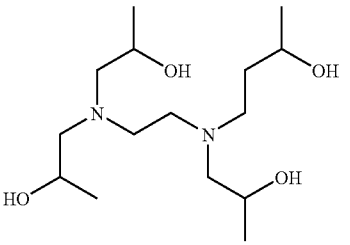
4. A method of claim 1, wherein said method comprises reducing the appearance of wrinkles on the skin.

5. A method of claim 1, wherein said composition comprises a compound is of the formula



or a cosmetically acceptable salt thereof.

6. A method of claim 1, wherein said composition comprises a compound is of the formula

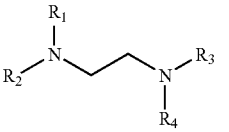


an enantiomer thereof, or a diastereoisomer thereof, or a cosmetically acceptable salt thereof.

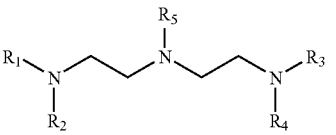
7. A product comprising:

(a) a composition comprising at least one compound of the formula I or formula II:

(I)



(II)



wherein R1, R2, R3, R4, and R5 independently, are selected from the group consisting of hydrogen, C_1-C_6 alkyl, C_1-C_6 hydroxyalkyl, or a cosmetically acceptable salt thereof; and

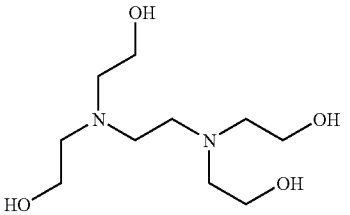
(b) instructions directing the user to apply said composition to skin in order to treat at least one sign of aging on the skin selected from the group consisting of enhancing the elasticity of said skin, enhancing the firmness of said skin, and reducing the appearance of wrinkles on the skin.

8. A product of claim 7, wherein said instructions direct the user to apply said composition to skin in order to enhance the elasticity of said skin.

9. A product of claim 7, wherein said instructions direct the user to apply said composition to skin in order to enhance the firmness of said skin.

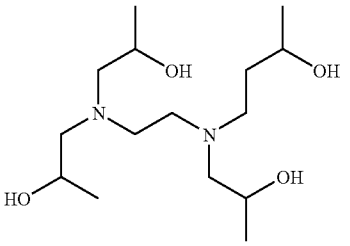
10. A product of claim 7, wherein said instructions direct the user to apply said composition to skin in order to reduce the appearance of wrinkles on the skin.

11. A product of claim 7, wherein said compound is of the formula



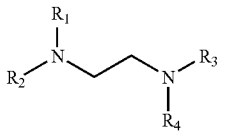
or a cosmetically acceptable salt thereof.

12. A product of claim 7, wherein said compound is of the formula

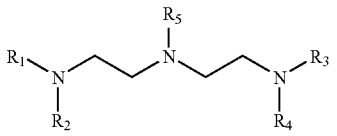


an enantiomer thereof, or a diastereoisomer thereof, or a cosmetically acceptable salt thereof.

13. A method of promoting a composition comprising at least one compound of the formula I or formula II:



(I)



(II)

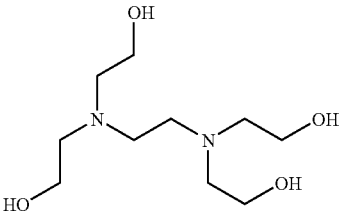
wherein R1, R2, R3, R4, and R5 independently, are selected from the group consisting of hydrogen, C_1-C6 alkyl, C_1-C_6 hydroxyalkyl, or a cosmetically acceptable salt thereof, wherein said method comprises directing the user to apply said composition to skin in order to treat at least one sign of aging on the skin selected from the group consisting of enhancing the elasticity of said skin, enhancing the firmness of said skin, and reducing the appearance of wrinkles on the skin.

14. A method of claim 13, wherein said method comprises directing the user to apply said composition to enhance the elasticity of the skin.

15. A method of claim 13, wherein said method comprises directing the user to apply said composition to enhance the firmness of the skin.

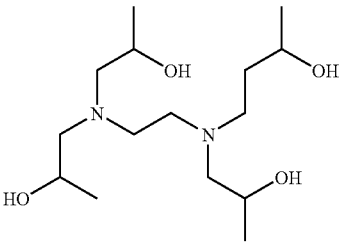
16. A method of claim 13, wherein said method comprises directing the user to apply said composition to reduce the appearance of wrinkles on the skin.

17. A method of claim 13, wherein said compound is of the formula



or a cosmetically acceptable salt thereof.

18. A method of claim 13, wherein said compound is of the formula



an enantiomer thereof, or a diastereoisomer thereof, or a cosmetically acceptable salt thereof.

* * * * *