

## Cosmeceuticals

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INGREDIENT	FUNCTION	MECHANISM	ASSOCIATIONS/SIDE EFFECTS
<b>Vitamin A/ Derivatives (retinal, retinol, retinoic acid, provitamin A, asthaxanthin, lutein)</b>	Antioxidant (reduces free radicals, lowers concentration of matrix metalloproteinases → reduces collagen degradation)	Affects gene transcription → differentiation and growth of cells in the skin  Normalizes follicular epithelial differentiation and keratinization	Comedolysis epidermal thickening, dermal regeneration, pigment lightening  Side effects: Irritation, erythema, desquamation
<b>Vitamin C (L ascorbic acid, tetrahexyldecyl ascorbate)</b>	Secondary endogenous antioxidant in skin  Lightens pigment (affects melanogenesis)  Protects Vitamin E from oxidation  Improves skin texture and hydration  May interrupt melanogenesis by interacting with copper ions	Ascorbic acid: necessary cofactor for prolylhydroxylase and lysyl hydroxylase  L-ascorbic acid: scavenges free oxygen radicals, stimulates collagen synthesis	L-ascorbic acid + alpha-tocopherol (vitamin E) = UVA and UVB protection  Zinc, resveratrol, L-ergothioneine and tyrosine add to vitamin C bioavailability
<b>Vitamin E/ Tocopherols, Tocotrienols</b>	Primary endogenous antioxidant in skin  Inhibits clotting, so do not use on fresh healing wound  Main lipid-soluble antioxidant in humans	Prevents lipid peroxidation; scavenges free oxygen radicals	Alpha tocopherol is the most physiologically active isomer  Alpha tocopherol inhibits cycloprimidine dimer formation via p53 tumor suppressor gene  May reduce skin cancer
<b>Flavonoids: soy, curcumin, silymarin (milk thistle extract), pycnogenol (French maritime bark extract)</b>	Antioxidant	Prevents lipid peroxidation; scavenges free radicals	Soy: contains genestein and diadzein (phytoestrogens → increase skin thickness); UVA/B protection, anticarcinogenic  Silymarin: contains silybin, silydianin and silychristin; UVB protection, anticarcinogenic  Curcumin inhibits NF-kB  Pycnogenol (pine bark extract) contains taxifolin, catechin & procyanidins
<b>Co-Q10 Ubiquinone</b>	Tertiary endogenous antioxidant in skin		
<b>Ellagic Acid</b>	Antioxidant	Inhibits UVA-mediated activation of cellular pathways in keratinocytes	Oral ellagic acid 5% increases sunscreen SPF by 25%
<b>Polyphenols (green tea, pomegranate, resveratrol)</b>	All antioxidants  Resveratrol is also an anti-inflammatory	Reduces lipid peroxidation; scavenges free radicals	Green tea: contains epicatechin, epicatechin-3-gallate, epigallocatechin, and epigallocatechin-3-gallate; UVA/B protection, antiangiogenic, anti-carcinogenic  Pomegranate: contains pantothenic acid, alkaloids, polyphenols and ellagic acid  Resveratrol: phytoestrogen-like effect, found in grapes, cranberries, blueberries, bilberries & peanuts
<b>Aloe Vera</b>	Anti-inflammatory	May decrease the following: cyclooxygenase and lipoxigenase, proinflammatory cytokines and UVB-induced PGE2 release by keratinocytes	Mucilage (active plant ingredient) contains choline and choline salicylate  Active ingredients: salicylic acid, carboxypeptidase, polysaccharides and aloesin  May cause allergic contact dermatitis
<b>Ginkgo</b>	Anti-inflammatory	Not known	Contains bilobalides, ginkgolides, ginkgolic acid

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<b>Licorice Extract (glabridin)</b>	Lightens pigment	Disperses melanin and inhibits tyrosinase	Contains liquiritin and isoliquertin, which disperse melanin and glabridin which inhibits tyrosinase
<b>Kojic Acid</b>	Lightens pigment	Inhibits tyrosinase	Hydrophilic fungal derivative
<b>Aloesin</b>	Lightens pigment	Inhibits tyrosinase	Hydroxymethylchromone inhibits tyrosinase competitively
<b>Arbutin</b>	Lightens pigment	Inhibits tyrosinase; may inhibit melanosome maturation	Gluconopyranoside
<b>Selenium</b>	Antioxidant	Cofactor for glutathione peroxidase and thioredoxin reductase	Protects against UV-induced erythema and skin cancer in mice
<b>Zinc</b>	Antioxidant	May replace harmful redox active elements.  May induce synthesis of free radical scavengers	Reduces UV-induced sunburn in mice
<b>Ferulic Acid (4-hydroxy-3-methoxy-cinnamic acid)</b>	Antioxidant	Reduces lipid peroxidation, scavenges free radicals	UV absorber, synergistic with vitamins C, E and beta-carotene
<b>Arnica</b>	Anti-inflammatory	Not known	Reduces bruising, may help wound healing; may cause allergic contact dermatitis (Compositae family)
<b>Matrikines</b>		Regulatory peptide factors	
<b>Niacinamide</b>	Anti-inflammatory; collagen regulator (affects fibroblast metabolism)  Lightens pigment	Inhibits mast cell histamine release  Increases collagen and ceramide synthesis	Increased collagen synthesis in-vitro and normalization of glycosaminoglycan synthesis
<b>Copper Cofactor</b>	Regulates collagen	Transport protein cofactor; activates collagen synthesis	Functions with zinc → changes dermal fibers (more discrete, less clumped)

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