Research Journal of Medicinal Plant

ISSN 1819-3455

Academic Journals Inc.

www.academicjournals.com

Research Journal of Medicinal Plant 7 (1): 1-22, 2013
ISSN 1819-3455 / DOI: 10.3923/rjmp.2013.1.22

Review on Skin Aging and Compilation of Scientific Validated Medicinal Plants, Prominence to Flourish a Better Research Reconnoiters in Herbal Cosmetic

[1]Ram Kumar Sahu, [1]Amit Roy, [1]Munglu Matlam, [1]Vinay Kumar Deshmukh, [2]Jaya Dwivedi and [3]Arvind Kumar Jha

[1]Department of Pharmaceutical Sciences, Columbia Institute of Pharmacy, Raipur (C.G.), India
[2]Department of Pharmaceutical Chemistry, Banasthali University, Banasthali (R.J.), India
[3]Department of Pharmaceutical Sciences, Shri Shankaracharya Institute of Pharmaceutical Science, Bhilai (C.G.), India

Corresponding Author: Ram Kumar Sahu, Department of Pharmaceutical Sciences, Columbia Institute of Pharmacy, Tekari, Raipur (C.G.)-493111, India Tel: +91-9893577279 Fax: 0771-4004681

ABSTRACT

As skin ages it deprives its charming youthful expression. Aging may be simple chronological passing of the years or photoaging induced by exposure to the sun. The free radical fabricated in the body commenced response of receptors of nuclear signaling, mitochondrial damage, protein oxidation, telomere based DNA damage, genetic mutations and decrease of many hormone levels. Due to this aging skin displays variable epidermal thickness, dermal elastosis, reduced collagen, increased matrix degrading metalloproteinases, severe atrophy, telangiectases, inflammatory infiltrates and vessel ectasia. The secondary metabolites such as quercetin, polyphenol, flavonoid and flavonol, ellagic acids are obtained from plant extracts, provokes the free-radical scavenging activity, antagonize the UV signaling pathway, inhibition of elastase activity and matrix metalloproteinase expression and increase of expression of procollagen type I. Herbal cosmetics play a leading role in impeding and reversing aging of skin. The botanical ingredients present in herbal cosmetic impact biological functions of skin and contribute nutrients required for the healthy skin. The imperative efforts are constrained to associate the medicinal plants with possible mechanism based on scientifically validated, leading to the emergence of novel cosmeceuticals for prevention of sagging. The information of present review assists the cosmetics scholar for development of novel herbal antiaging formulation producing the reduction of wrinkles, redness and abnormal discolorations that result from aging. The combination of listed medicinal plant can be produced immensely efficient, low toxicity and cost impressive product compared to synthetic antiaging formulation. This review can put forward revolt in the field of cosmetic market.

Key words: Aging, collagen, elastase, chronological, photoaging

INTRODUCTION

Skin forms a remarkable protective barrier against the external environment (Costin and Hearing, 2007), helping to regulate temperature and fluid balance, keeping out harmful microbes and chemicals and offering some protection against sunlight (Svobodova *et al*., 2006; Palm and O'Donoghue, 2007; Hussein, 2005). Due to external and internal causes, the collagen fibers and

elastic fibers present in dermal tissue of the skin is modified or damaged which leads to wrinkles formation and sagging on the skin because the elasticity of the skin is reduced, it is one of the measure causes for the skin aging (Kuno and Matsumoto, 2004).

There are two distinct types of skin aging, one of the aging caused due to the passage of time or by the inherited gene is called chronological or intrinsic (internal aging). The chronological aging is regulated mainly by androgens and other hormones. The other type of aging is known as photoaging or extrinsic (external) aging and is caused by environmental factors, such as exposure to the sun's rays, repetitive facial expressions, gravity, sleeping positions and smoking (Mukherjee *et al*., 2011). Almost 90% of skin changes due to chronic sun exposure (Zouboulis and Boschnakow, 2001). Extrinsic aging is caused by chronic exposure to UV light so it is also known as photo aging.

MECHANISM OF SKIN AGING

Extrinsic skin aging: Extrinsic skin aging is a collective process and depends mostly on the degree of sun exposure and skin pigment. With chronic skin exposure to UV rays, the stratum corneum thickens, the epidermis becomes acanthotic and there is progressive dysplasia with cellular atypia and anaplasia, reduction in collagen and degeneration of elastic fibers (Yaar and Gilchrest, 2007). The following aspects are integrated with photodamaged aging.

Membrane/nuclear signaling: UV irradiation provokes Reactive Oxygen Species (ROS) which repress the activity of enzyme protein-tyrosine phosphatase κ. This enzyme maintains cell-surface receptors of skin, including receptors for Epidermal Growth Factor (EGF), interleukin (IL)-1, keratinocyte growth factor and Tumour Necrosis Factor (TNF)-α in an inactive (hypophosphorylated) state (Xu *et al*., 2006). Activated receptors impel to intracellular signaling through stimulation of the stress-associated Mitogen-activated Protein (MAP) kinases p38 and c-Jun amino terminal kinase (JNK) (Fisher *et al*., 1998). Kinase activation induces the transcription of the nuclear transcription complex AP-1(composed of the proteins c-Jun and c-Fos) (Fisher *et al*., 2002). Moreover, singlet oxygen breaks lipid membrane resulting to activation of AP-1 through ceramide release and leads to the formation of carbonyl groups (C = O) and accumulation of oxidized damaged dermal proteins. Arachidonic acid unleashed by oxidized membrane lipids is turned by cyclooxygenase enzymes into prostaglandins recruiting inflammatory cells to the area (Yaar and Gilchrest, 2007).

AP-1 increases transcription of MMPs (matrix metalloproteinase) and decreases expression of the procollagen I and III genes and TGF-β (transforming growth factor-β) receptors, with a final outcome of reduced dermal matrix formation and Hence, it reduces the synthesis of collegen (Fisher *et al*., 2000).

UV-induced collagen degradation is generally incomplete, leading to the agglomeration of partially depraved collagen fragments in the dermis and these are conceived to reduce the structural integrity of the skin. UV also stimulates the Nuclear Factor (NF) κB transcription factor and through neutrophil recruitment and MMP-8 release further intensifies matrix degradation. The disabled proteins incorporating carbonyl groups assemble in the upper portions of the dermis. In addition, mitochondria betray large DNA deletions and compromised function (Yaar and Gilchrest, 2007).

Mitochondrial damage: Mitochondria are cellular organelles that generate energy (ATP) by compelling oxygen. UV effect on the mitochondria electron transport chain produces abundant ROS

that can damage mitochondrial DNA (mtDNA). The mitochondrial genome encodes 13 components of the electron transport chain (Graeber *et al*., 1998) and oxidative damage may be foremost to deletions or rearrangements of the DNA, most likely due to double-strand breaks (Prado *et al*., 2003; Srivastava and Moraes, 2005) which may affect mitochondrial ability to generate energy for the cell. It is inferred that the consequent decrease in mitochondrial function in photodamaged skin leads to additional accumulation of ROS and further compromises the cell's ability to initiate energy.

Protein oxidation: Oxidative damage can also affect proteins and photodamaged skin exhibits accumulation of ROS-induced devastation in upper dermal proteins (Sander *et al*., 2002). Oxidative protein impair may result in loss or gain of activity (i.e., enzymes), loss of structural protein function and increased/decreased susceptibility to degradation (Shacter, 2000). While epidermal proteins are routinely hastily degraded by epidermal methionine sulfoxide reductases, oxidized dermal proteins persist longer (Garmyn and Yarosh, 2006).

Telomeres: Telomeres are tandem repeats of a short sequence TTAGGG. It exists in a loop configuration. Telomeres become critically short when these loop is disrupted by cell division or UV irradiation. During cell division telomeres cap (the terminal portion of chromosomes, preventing the fusion of telomeres with each other.) cannot be replicated, so the bases of the telomeres caps are lost with each cell division and finally enters a state of senescence or apoptosis (Blackburn, 2001). When telomeres are damaged by UV irradiation the loops configuration becomes disclosed and through interaction with the Werner protein activates the tumour suppressor protein p53 and other proteins which responsible for DNA damage and also induces senescence or apoptosis (Yaar and Gilchrest, 2007).

Intrinsic skin aging: Intrinsic skin aging also known as natural aging mostly found in sunprotected area. Basically the molecular mechanisms of both the type of skin aging (extrinsic and intrinsic) are similar, for example shortening of telomeres, mutations of mitochondrial DNA, oxidative stress genetic mutations and decrease of many hormone levels. According to the free-radical theory of aging, ROS, chiefly commencing from oxidative cell metabolism, play a notable role in both chronological aging and photoaging (Fisher *et al*., 2002). In spite of several antioxidative mechanisms, which decline with increasing age, abound with ROS damage composed of cell's components. This damage induces to increasing ROS and decreasing antioxidative capacities and finally to cellular aging (Makrantonak and Zouboulis, 2007). ROS influence the transcription factor c-Jun via MAPK (mitogen-activated protein kinases) in extrinsic and intrinsic skin aging. This induction triggers transcription factor called activator protein 1(AP-1), which leads to the expression of matrix metalloproteinases MMP-1 (interstitial collagenase), MMP-3 (stromelysin 1) and MMP-9 (gelatinase b) (Chung *et al*., 2000). In tendering with these outcomes elevated levels of partially degraded collagen are present in intrinsically aged skin similar to photoaged skin. In intrinsically aged skin expression of the Connective Tissue Growth Factor (CTGF) and Transforming Growth Factor (TGF)-β/Smad signalling are reduced due to which expression of type I procollagen also become less (Quan *et al*., 2009; Kohl *et al*., 2011).

Hormonal changes can also alter intrinsic skin aging. The exhibition of sex hormones in the gonads, the pituitary and adrenal glands already gradually decline in the mid-twenties. The

hormone oestrogens and progesterone start dwindling during menopause. In particular, the imperfection in oestrogens and androgens cause dryness, wrinkling, epidermal atrophy, collagen breakdown and loss of elasticity (Kohl *et al*., 2011).

HERBAL COSMETIC PREVENTING SKIN AGING

Herbal cosmetics play a leading role in impeding and reversing aging of skin. Ingredients present in herbal cosmetic impact biological functions of skin and it also provide required nutrition for the healthy skin. The application of herbal antiaging products has been proliferated to many folds in personal-care practice and over, there is a noteworthy demand for the herbal cosmetics. All this occurred due to the extravagant use of synthetic based products in the last one and half century; their production and usage cause human health imperiled with several adverse effects leading to innumerable. It also incited substantial pollution and disturbed our eco-system. Now a day Personal care industry is more focalize on herbal based cosmetics as it is a fast growing segment in the world. Herbal cosmetics are not pondered under the preview of Drugs and Regulations of Food and Drug Administration's (Kapoor, 2005). The imperative efforts are constrained to associate the medicinal plants with possible mechanism based on scientifically validated, leading towards the emergence of novel cosmeceuticals for prevention of sagging. Medicinal plants restraining skin aging are listed in Table 1.

DISCUSSION

In the field of cosmetic antiaging are mostly demarcated as an agent who preventing and eliminating the wrinkles and sags of the skin (Kuno and Matsumoto, 2004). Over the years, many various compounds and formulations have been used in eradication of skin aging (Farooqi *et al*., 2002).

The compositions of synthetic antiaging formulations include ingredients that are not always eco-friendly and are for that reason economically unviable. Some of the prior art antiaging formulations also contain components that are ultimately harmful to the skin (Farooqi *et al*., 2002). The natural skin-care products are quickly absorbed by the superficial layers in the skin and are hypo-allergenic in nature. However, the active ingredients of synthetic skin care product produce an adverse effect on skin such as allergic contact dermatitis, irritant contact dermatitis, phototoxic and photo-allergic reactions (Mukherjee *et al*., 2011). Additionally, the natural herbs have despicable mammalian toxicity and can be handled safely. This makes the use of natural formulation by manufacture of skin-care products attractive and is becoming common (Farooqi *et al*., 2002). Manifold herbs, notably fruits, vegetables and whole grains comprise antioxidants, polyphenols scavenging free radicals and eradicate byproducts of metabolism. Today, herbal cosmetics are in demand in whole world due to its significant impact on skin aging.

The over exposure of UV radiation to skin cause's DNA damage and reducing cellular DNA repair capacity, are sources of photoaging. It has been proclaimed that paeoniflorin obtained from *Paeonia lactiflora* produces protective effects on UV-induced DNA damage (Lee *et al*., 2006a). This suggests that topical application of *Paeoniae lactiflora* extracts could improve the ability of the skin to repair DNA damage and prevent from photoaging.

The anthocyanins like cyanidin-3-glucoside, petunidin-3-glucoside, malvidin-3-glucoside and delphinidin-3-glucoside obtained from the berries of *Vaccinium uliginosum* diminished UV-induced augmented-release of IL-6 and IL-8 by suppressing the function of enzyme protein-tyrosine phosphatase κ. The inhibition of secretion of IL may validate to be a worthwhile means to achieve protection against UV irradiation.

Table 1: List of antiaging plants manifests chemical constituents and possible mechanism of action

Botanical name (Family)	Part used	Chemical constituents	Possible mechanism of action	Reference
Acanthopanax koreanum (Araliaceae)	Leaves, root, stem	Acanthopanic acid, rutin and saponins	Free radical scavenging activity	Kim *et al*. (2007b)
Aesculas hippocastanum (Hippocastanaceae/ Sapindeceae)	Leaves	Aescin, coumarin-aesculin and flavonoids	It induces contraction force by the formation of stress fibres accompanied by actin polymerization. It has been reported that force generation by thrombin or LPA is due to phosphorylation of the myosin light chain	Fujimura *et al*. (2006), Wilkinson and Browna, (1999)
Alnus formosana (Betulaceae)	Leaves	Phenolic compounds	Free radical scavenging activity and inhibit matix-metalloproteinase in human skin fibroblast	Hou *et al*. (2003), Lee *et al*. (2009a)
Aloe vera (Liliaceae)	Gel	Anthraquinone glycosidealoin	By increasing type I procollagen and it decreasing the MMP-1 gene expressions	Barrantes and Guinea (2003), Cho *et al*. (2009a), Jain *et al*. (2010)
Alpinia katsumadai (Zingiberaceae)	Seed	Chalcone, flavonoids, sesquiterpenoids	Inhibitory effect on leukocyte, elastase, hyaluronidase and lipid peroxidation	Lee *et al*. (1999)
Ananus comosus (Bromeliaceae)	Peel	β-carotene, citronic, ascorbic acid	Free radical scavenging activity	Reddy *et al*. (2011)
Angelica archangelica L. (Apiaceae)	Root	Furanocoumarins	Inhibit elastase and collagenase	Thring *et al*. (2009)
Arctium lappa L. (Asteraceae)	Root	Sulfur containing polyacetylenes in roots (including artinal and lappaphens)	Inhibit elastase	Thring *et al*. (2009)
Areca catechu (Arecaceae)	Seeds	Tannins, polyphenols	By inhibition of enzyme elastase	Lee and Choi (1999), Lee *et al*. (1999, 2001)
Aster spathulifolius (Asteraceae)	Leaves and twigs	Terpenoids	Free radical scavenging activity.	Kim *et al*. (2007c)
Berberis aristata (Berberidaceae)	Berries	Berberine	Regulating MMP-1 and type procollagen expression in human dermal fibroblasts by inhibiting MMP-9 and IL-6	Kim and Chung (2008), Kim *et al*. (2008b)
Boswellia serrata (Burseraceae)	Gum resin	Boswellic acids α-and β-amyrins	Skin barrier functioning; prevent moisture loss through epidermis	Majeed and Prakash (2005), Osborne *et al*. (2005) Pardhy and Bhattacharyya, (1978a, b), Mahajan *et al*. (1995)
Brassica campestris (Cruciferae/Brassicaceae)	Stem, flower, root	Flavonoids, hydroxycinnamic acids derivatives	Free radical scavenging activity	Kim *et al*. (2007d)
Caesalpinia pulcherrima (Caesalpiniaceae)	Flower	Gallic acid, catechin, rutin and ellagic acid	DPPH radical scavenging and ABTS cation radical scavenging activity	Samee and Vorarat (2007), Soisuwan *et al*. (2010)
Calendula officinalis (Asteraceae)	Flower	Triterpenes, sterols, flavonoids, carotenes	Inhibiting activity/secretion of MMP-2 and MMP-9 Decrease transepidermal water loss	Fonseca *et al*. (2010), Akhtar *et al*. (2011), Reddy *et al*. (2011)

Table 1: Continue

Botanical name (Family)	Part used	Chemical constituents	Possible mechanism of action	Reference
Callistemon lanceolatus (Myrtaceae)	Stem	Betulinic acid, pyracrenic acid, arjunolic acid, catechin	Elastase inhibition and free radical scavenging activities	Kim *et al*. (2009a)
Camellia japonica (Theaceae)	Leaves, Oil	Phenolics and flavonol glycoside	Free radical scavenging activity, inhibition of elastase activity and MMP-1 expression. Inhibiting MMP-1 activity and induced human type I procollagen synthesis.	Kim *et al*. (2007a), Jung *et al*. (2007)
Camellia sinensis (Theaceae)	Leaves	Quercetin, kaempferol, caffeic acid	Inhibition of UV-induced erythema and Antioxidant effect. Inhibit the activity of collagenase and increases collagen iosynthesis rate of human fibroblasts Inhibit sebum production Inhibit elastase and collagenase Tyrosinase inhibition by chelating copper at the site, Decrease MITF production 4	Katiyar *et al*. (2000) Shimogaki *et al*. (2000), Pinnell (2003), Kim *et al*. (2004), Hsu (2005) Yoshimura *et al*. (2005) Gao *et al*. (2008) Thring *et al*. (2009) Reddy *et al*. (2011) Kumar *et al*. (2012)
Capsicum annum (Solanaceae)	Whole plant	Carotenoids, ascorbic acid	Free radical scavenging activity, inhibition of elastase activity and MMP-1 expression	Kim *et al*. (2007b)
Carica papaya (Caricaceae)	Fruit pulp	Vitamins A, E and C, beta-carotene enzymes	Antioxidant activity	Reddy *et al*. (2011)
Centella asiatica (Umbelliferae)	Whole plant	Brahmoside, asiaticoside	Stimulating collagen I synthesis induces collagen I synthesis through TGF beta receptor I kinase-independent Smad signaling. By induce collagen expression	Bonte *et al*. (1994), Lee *et al*. (2006b), Haftek *et al*. (2008), Reddy *et al*. (2011)
Cimicifuga acerina (Ranunculaceae)	Root	Actein, Epi-Actein, Deoxyactein, Deoxycimifigoside,	Free radical scavenging activity	Kim *et al*. (2007c)
Cinnamonum cassia (Lauraceae)	Bark	Phenols, isoeugenol, cinnamic aldehyde, coumarin	Inhibitory effect on leukocyte elastase, hyaluronidase and lipid peroxidation	Lee *et al*. (1999)
Citrus grandis (Rutaceae)	Stem, leaves	Flavone, coumarin phenolic acids (cinnamic acid)	Free radical scavenging activity	Kim *et al*. (2007d)
Citrus limonum (Rutaceae)	Fresh fruit	α-pinene, camphene, ß-pinene, limonene	Inhibiting free radical-mediated reactions	Calabrese *et al*. (1999)
Citrus sinensis (Rutaceae)	Fruit	Phenolic compounds (anthocyanins, flavanones and hydroxycinnamic acids) and ascorbic acid	NF-B and AP-1 translocation and procaspase-3 cleavage	Cimino *et al*. (2007) Mukherjee *et al*. (2011)
Citrus unshiu Marcow (Rutaceae)	Leaves, stem	Phenolics, carotenoids and flavonoids	Free radical scavenging activity	Kim *et al*. (2007a)

Table 1: Continue

Botanical name (Family)	Part used	Chemical constituents	Possible mechanism of action	Reference
Clematis terniflora (Ranunculaceae)	Leaves and twigs	Triterpenes, flavonoids, coumarins	Free radical scavenging activity	Kim *et al*. (2007b)
Commelina communis (Commelinaceae)	Whole plant	Polyphenol, flavonoid and flavonol	Free radical scavenging activity	Kim *et al*. (2007c)
Coriandrum sativum (Umbelliferae)	Seeds	Petroselinic acid triglycerides	Skin barrier functioning; prevent moisture loss through epidermis.	Majeed and Prakash (2005)
Cornus kousa or *Benthamidia kousa* (Cornaceae)	Stem	Triterpenoids, flavanoids, ellagic acid derivative	Free radical scavenging activity and elastase inhibition activity	Sultana and Lee (2007)
Cornus macrophylla (Cornaceae)	Fruits, leaves, stem	Terpenoids, flavonoids, tannins	Free radical-scavenging and inhibit elastase	Kim *et al*. (2007d)
Crataeva nurvula (Capparidaceae)	Stem bark	Lupeol	Antioxidant action and keratinocyte proliferation	Majeed and Prakash (2005)
Cucumis sativus (Cucurbitaceae)	Fruit juice	Ascorbic acid	Antioxidant activity and inhibitory effect on hyaluronidase and elastase activity	Nema *et al*. (2011)
Curculigo orchioides (Hypoxidaceae)	Rhizome	Two phenolic glycosides, curculigoside, orcinol-beta-D-glucoside and two cycloartane saponins, curculigosaponin G, curculigosaponin I	Inhibitory activity against MMP-1	Lee *et al*. (2009b), Mukherjee *et al*. (2011)
Curcuma longa (Zingiberacease)	Rhizome	Curcumin, Demethoxy-curcumin and bisdemethoxy-curcumin	Inhibition of increases in MMP-2 expression Inhibitory effect on leukocyte elastase, hyaluronidase and lipid peroxidation	Sumiyoshi and Kimura (2009), Lee *et al*. (1999), Mukherjee *et al*. (2011)
Curcuma xanthorrhiza (Zingiberaceae)	Rhizome	Curcuminoids, xanthorrhizol	Inhibiting MMP-1 expression and type-1 procollagen-inducing effect	Oh *et al*. (2009) Mukherjee *et al*. (2011)
Daphniphyllum macropodum (Daphniphyllaceae)	Leaves, stem	Flavonoids	Free radical scavenging activity.	Kim *et al*. (2007a)
Daucus carota (Apiaceae)	Leaves	Anthocyanins, caffeic acid, carotenoids, ferulic acid and cinnamic acid derivatives.	Free radical scavenging activity	Kim *et al*. (2007b)
Diospyros discolour (Ebenaceae)	Leaves	Phenolic compounds	Inhibit matix-metalloproteinase in human skin fibroblast	An *et al*. (2005), Lee *et al*. (2009c)
Diospyros kaki folium (Ebenaceae)	Fruits, leaves and stem	Polyphenols like isoquercitrin, trifolin, astragalin, chrysontemin, quercetin, kaempferol	By inhibiting tyrosinase, collagenase and elastase	An *et al*. (2005), Kim *et al*. (2007c) Xue *et al*. (2011)
Distylium racemosum (Hamamelidaceae)	Leaves, stem	Catechin derivatives, gallic acid derivatives, tyrosol, flavonoids, lupeol	Free radical-scavenging and inhibit elastase	Kim *et al*. (2007d), Ko *et al*. (2011)

Table 1:Continue

Botanical name (Family)	Part used	Chemical constituents	Possible mechanism of action	Reference
Dryopteris cassirrhizoma (Dryopteridaceae)	Entire plant	Dryopteroside, (+)-catechin-6-C-beta-D-glucopyranoside	Inhibitory effect on leukocyte elastase, hyaluronidase, lipid peroxidation and free radical scavenging activity	Lee *et al*. (1999), Kim *et al*. (2007a)
Eclipta alba (Composite/Asteraceae)	Whole plant	Phenolics and flavonoids like wedelolactone and demethylwedelolactone	Free radical scavenging activity	Reddy *et al*. (2011)
Emblica officinalis (Euphorbiaceae)	Fruit	Ascorbic acid, tannins and polyphenolic compounds	By promoting procollagen production and inhibiting MMP-1 in human skin fibroblasts	Scartezzini *et al*. (2006), Fujii *et al*. (2008) Adil *et al*. (2010) Mukherjee *et al*. (2011)
Eriobotrya deflex (Rosaceae)	Dried leaves	Phenolic compounds	Free radical scavenging activity and inhibit MMP in human skin fibroblast	Hou *et al*. (2003) Lee *et al*. (2009a)
Euonymus fortunei (Celastraceae)	Fruits	Flagelignanins A, lupoel, B-sitosterol glycoside	Inhibit elastase	Kim *et al*. (2007a)
Euphorbia esula (Euphorbiaceae)	Whole plant	Diterpenoids and flavonoids	Free radical scavenging activity	Kim *et al*. (2007b)
Farfugium japonicum (Asteraceae/Compositae)	Whole plant	Sesquiterpenoid, triterpenoids, sterols	Free radical scavenging activity	Kim *et al*. (2007c)
Filipendula glaberrima (Rosaceae)	Root	Hydrolysable tannins and polyphenols like ß-farnesol l-α-terpineol benzenemethanol	Free radical scavenging activity, inhibition of elastase activity and MMP-1 expression	Kim *et al*. (2007d)
Fraxinus chinensis (Oleaceae)	Bark	Coumarins like esculin and esculetin	Free radical scavenging activity and a decreased the MMP-1 mRNA expression	Lee *et al*. (2007), Cho *et al*. (2007), Mukherjee *et al*. (2011)
Fucus vesiculosus (Fucaceae)	Thallus	Alginic acid, alginates, volatile oils	Inhibit elastase and collagenase	Fujimura *et al*. (2002), Thring *et al*. (2009)
Galium aparine L. (Rubiaceae)	Leaves, stem	Tannins, phenolic acids, flavonoids, iridoid glycosides	Inhibit elastase and collagenase	Thring *et al*. (2009)
Garcinia indica (Clusiaceae/Guttiferae)	Fruits	Garcinol, isogarcinol, cyancidin, 3-glycoside, cyanidin, coumarins, 3-sambubioside cambogiol	By inhibiting hyaluronidase and elastase enzyme	Sahasrabudhe and Deodhar (2010), Reddy *et al*. (2011)
Ginkgo biloba (Ginkgoaceae)	Leaves	Flaavonoids (kaempferol and quercetin), terpenoids, catechins	Antioxidant and free radical-scavenging activity	Tiedtke and Marks (2005)
Glycine max (Fabaceae/Leguminoceae)	Seeds (bean)	Isoflavones, anthocyanins	Enhance collagen and elastin synthesis Anti-oxidant activity and preventing caspase-3 pathway activation	Tsoyi *et al*. (2008), Jain *et al*. (2010), Seiberg (2011), Reddy *et al*. (2011) Mukherjee *et al*. (2011)
Hibiscus abelmoschus (Malvaceae)	Seed	Farnesol, ambrettolide, ambrettolic acid, dihydroambrettolic acid	Maintaining the FGF-2 content in the skin and increasing sulphated GAG neo-synthesis.	Rival *et al*. (2009)

Table 1: Continue

Botanical name (Family)	Part used	Chemical constituents	Possible mechanism of action	Reference
Hibiscus furcellatus (Malvaceae)	Leaves, stem and aerial part	Anthocyanins	Anti-free radical action.	Pauly and Fleury (2002)
Illicium anisatum (Illiciaceae)	Leaves	1-allyl-2-me-thoxy-4,5-methylenedioxybenzene, 4-allyl-2,6-dimethoxyphenol, 1-allyl-3-methoxy-4-(3--methylbut-2-enyloxy) benzene and 1-allyl-3,5-dimethoxy-4-(3-methylbut -2-enyloxy) benzene	Anti-oxidant and anti-elastase activity	Kim *et al*. (2009b)
Illicium verum (Illiaceae)	Fruit	Essential oil consisting of trans-anethole, anisaldehyde, methylchavicol and other monoterpenoids	Inhibit elastase and collagenase	Thring *et al*. (2009)
Kaempferia pandurata (Zingiberaceae)	Rhizome	Panduratin A, isopanduratin and 5-hydroxypanduratin	Reduced the expression of MMP-1 and induced the expression of type-1 procollagen	Shim *et al*. (2008), Hwang *et al*. (2012)
Labisia pumila (Blume) (Myrsinaceae)	Root	Alkenyl resorcinols, triterpenoids, ascorbic acid, ß-carotene, anthocyanins and flavonoids	Free radical scavenging activity and inhibition of TNF-alpha, COX-2, MMP-1 and MMP-9 expression	Choi *et al*. (2010), Mukherjee *et al*. (2011)
Lastrea japonica (Filicales)	Entire plant	Phenolic compound	Inhibit elastase	Kim *et al*. (2007a)
Lavendula vera (Labiatae/lamiaceae)	Aerial parts or flowers oil	Essential oil-linalool, linalyl acetate, camphor, lavandulyl, caryophyllene, Limonene	Antioxidant activity	Reddy *et al*. (2011)
Maackia fauriei (Fabaceae)	Stem	Flavonoid constituents, formononetin genistein, daidzein,	Free radical scavenging activity	Kim *et al*. (2007b)
Machilus japonica (Lauraceae)	Leaves	Phenolic compounds	Free radical scavenging activity and Inhibit MMP in human skin fibroblast	Hou *et al*. (2003), Lee *et al*. 2009b
Machilus thunbergii (Lauraceae)	Stem bark	Meso-dihydroguaiaretic acid and licarin A	Inhibition of MMP-1	Moon and Jung (2006) Mukherjee *et al*. (2011)
Magnolia ovovata (Magnoliaceae)	Bark	Magnolol and honokiol	Inhibition of nuclear factor kappa-B dependent-transcription	Tanaka *et al*. (2007) Mukherjee *et al*. (2011)
Malus doumeri (Rosaceae)	Leaves	Chrysin-5-glucoside,3-hydroxyphloridzin, phloridzin, chrysin, phloretin, 3-hydroxyphloretin and quercetin	Through free radical-scavenging activities, anti-elastase and anti-MMP-1 activity in human skin fibroblast cells	Leu *et al*. (2006)
Mangifera indica (Anacardiaceae)	Fruits	Citric and ascorbic acids, carotenoids, phenolic compounds, flavonoids, β-amyrins, gallotannin, glucogallin, indicol, taraxerol, friedelin, lupeol	Anti-oxidant activity	Reddy *et al*. (2011)

Table 1: Continue

Botanical name (Family)	Part used	Chemical constituents	Possible mechanism of action	Reference
Maprounea guianesis (Euphorbiaceae)	Leaves and aerial part of plant	Flavonoids	Anti-free radical action, anti-elastase, anti-collagenase, anti-UVA and anti-UVB	Pauly and Fleury (2002, 2003)
Melothria heterophylla (Cucurbitaceae)	Roots	1,2,4,6-tetra-O-galloyl-beta-(D)-glucopyranose and 3,4,5-trihydroxybenzoic acid	Antioxidant activity and inhibitory effect on expression of MMP-1	Cho *et al*. (2006) Mukherjee *et al*. (2011)
Mentha arvensis (Labiatae/Lamiaceae)	Whole plant	Menthol, menthone αandβ-pinene, α-thujene, l-limonene, flavonoids	Anti-oxidant activity and reduces free radical damage.	Reddy *et al*. (2011)
Mimusops elengi (Sapotaceae)	Bark, fruit, flower, leaves	Quercetin, saponins	Free radical scavenging (antioxidant) activity and inhibiting tyrosinase enzyme	Misra and Mitra (1967, 1968), Sahu (1996), Boonyuen *et al*. (2009), Narayanaswamy *et al*. (2011)
Miscanthus sinensis (Poaceae)	Flower, root, stem	Phenolic acids (e.g. ferulic acid, caffeic acid, p-hydroxybenzoic acid) flavonoids, triterpenes and saponins	Free radical scavenging activity	Kim *et al*. (2007c)
Molus domestica (Rosaceae)	Furits	Malic, citric, lactic and succinic acid, vitamins, minerals, flavones	Free radical-scavenging and antioxidant activity.	Reddy *et al*. (2011) Jelodarian *et al*. (2012)
Myristica fragrans (Myristicaceae)	Seed kernels	Volatile oil, myristicin and myristic, epicatechin and cyaniding.	Inhibitory effect on leukocyte elastase, hyaluronidase and lipid peroxidation.	Lee *et al*. (1999)
Narcissus tazetta (Amaryllidaceae)	Leaves and twigs	Ascorbic acid	Free radical scavenging activity	Kim *et al*. (2007d)
Nelumbo nucifera (Nelumbonaceae)	Leaves, seed and flower	Kaempferol, glucopyranose, sitosterol flavonoids	By free radical scavenging activity and elastase inhibition	Wanauppathamkul *et al*. (2004), Samee and Vorarat (2007), Kim *et al*. (2011)
Nymphaea tetragona (Nymphaeaceae)	Rhizome	Flavonoids and anthocyanins	Free radical scavenging activity, inhibition of elastase activity and MMP-1 expression	Kim *et al*. (2007d)
Ocimum basilicum (Lamiaceae)	Leaves and flowers	Phenolics and favonoids	By antioxidant properties.	Rasul and Akhtar (2011)
Paeoniae lactiflora (Paeoniaceae)	Root	Paeoniflorin	Anti-oxidant activity and protective effects on UV-induced DNA damage	Lee *et al*. (2006a)
Panax ginseng (Araliaceae)	Leaves, root	Oleanolic acid, saponins, ginsenosides	By Scavenges free radical and protects unsaturated fatty acids. By potoprotection Type-I procollagen gene and protein expression, prevent MMP-9 gene induction and elongated the fibrillin-1 fiber length. Increase of expression of procollagen type I and decrease MMP-1 Antioxidant activity and free radical scavenging activity.	Zhang *et al*. (1996) Aburjai and Natsheh (2003), Lee *et al*. (2009c); Cho *et al*. (2009b), Jain *et al*. (2010) Reddy *et al*. (2011), Lee *et al*. (2010) Kang *et al*. (2009)

Table 1: Continue

Botanical name (Family)	Part used	Chemical constituents	Possible mechanism of action	Reference
Persicaria hydropiper (Polygonaceae)	Whole plant	Flavonoids (Isoquercitrin and isorhamnetin) flavonoid glycosides and phenylpropanoid glycosides	Free radical scavenging activity, inhibition of elastase activity and MMP-1 expression.	Kim *et al*. (2007a)
Persicaria dissitiflora (Polygonaceae)	Entire plant	Terpenoid, Cineol	Free radical-scavenging and inhibit elastase	Kim *et al*. (2007b)
Phoenix dactylifera (Arecaceae)	Fruits and seeds	Flavonoids, cinnamic acids, phenolic acids vitamin C, E and A, β-carotene	Free radical scavenging activity.	Bauza *et al*. (2002) Vyawahare *et al*. (2009)
Pistia stratiotes (Araceae)	Leaves	2-di-c-glycosylflavones and lucenin, anthocyanincynidin 3-glucoside, liteolin 7-glycoside	Free radical scavenging activity	Reddy *et al*. (2011) Jha *et al*. (2010)
Platycarya strobilacea (Juglandaceae)	Fruits	Ellagic acid	Free-radical scavenging activity, elastase inhibitory activity, the expression of MMP-1 and type I collagen synthesis	Kim *et al*. (2010a)
Prunus armeniace (Rosaceae)	Fruits	Chlorogenic, vanillic acids, quecertin, rutin and kaempferol	Free radical scavenging power and lipid peroxidation inhibition activity	Kole *et al*. (2005), Yigit *et al*. (2009) Reddy *et al*. (2011)
Prunus dulcis Mill. (Rosaceae)	Nut	Polyphenols, flavonol, flavanone aglycones and glycosides	Antioxidant and free radical scavenging activity	Sultana *et al*. (2007) Mukherjee *et al*. (2011)
Psidium guajava (Myrtaceae)	Leaves	Phenolic compounds caffeic acid, ferulic acid, rutin trihydrate; quercetin dehydrate	Inhibit elastase enzyme activity	Kim *et al*. (2007c)
Pterocarpus santalinus (Fabaceae)	Bark	Terpenoids, pigments-santalin, erthyrodiol	By inhibiting the activity and expression of collagenase (MMP-1) and gelatinase (MMP-2) and have tyrosinase inhibition activity.	Kole *et al*. (2005), Kim *et al*. (2007a), Reddy *et al*. (2011)
Punica granatum (Lythraceae)	Fruits	Gallotannins and ellagitannins (punicalin and punicalagen).	Promote proliferation and procollagen synthesis and inhibit matrix metalloproteinase-1 production Inhibit elastase and collagenase	Aslam *et al*. (2006) Thring *et al*. (2009)
Pyracantha angustifolia (Rosaceae)	Fruits, leaves and stem	Flavonoids, rutin	Free radical-scavenging and inhibit elastase	Kim *et al*. (2007d)
Pyrrosia hastata (Polypodiaceae)	Leaves, root and twigs	Phenolic or poly-phenolic compounds.	Free radical scavenging activity, inhibition of elastase activity and MMP-1 expression.	Kim *et al*. (2007a)
Pyrrosia polydactylis (Polypodiaceae)	Leaves	Phenolic compounds	Free radical scavenging activity and inhibit MMP in human skin fibroblast	Hou *et al*. (2003), Lee *et al*. (2009a)
Pyrus taiwanensis (Rosaceae)	Leaves	Phenolic compounds	Free radical scavenging activity and Inhibit MMP in human skin fibroblast	Hou *et al*. (2003), Lee *et al*. 2009b
Randia armata (Rubiaceae)	Leaves and aerial part of plant	Phenolic compounds	Anti-free radical action, anti-collagenase and anti-UVB.	Pauly and Fleury (2002, 2003)

Table 1: Continue

Botanical name (Family)	Part used	Chemical constituents	Possible mechanism of action	Reference
Rhus javanica (Anacardiaceae)	Entire plant	Phenolics, flavanoids, aromatics, steroids and triterpenes	Free radical-scavenging and inhibit elastase	Kim *et al*. (2007b)
Rosa centifolia (Rosaceae)	Flowers	Tannins, ascorbic acid, carotenoids, pectins, flavonoids, tannins	Inhibit elastase and collagenase	Thring *et al*. (2009)
Rosmarinus officinalis (Labiatae/Lamiaceae)	Leaves	Mainly carnosic acid and rosmarinic acid and other camphor, caffeic acid, ursolic acid, betulinic acid, rosmaridiphenol and rosmanol	By protect from free radicals	Calabrese *et al*. (2000)
Salvia officinalis (Labiatae/Lamiaceae)	Flower, leaves, stem	Carnosolic acid, flavonoids, diterpene quinonesroyleanone cirsiliol, linalool and α-terpineol	Free radical scavenging activity	EL-Agbara *et al*. (2008) Reddy *et al*. (2011)
Sanguisorba officinalis (Rosaceae)	Root	Ziyuglycoside I	Free radical scavenging activity, elastase inhibitory activity, expression of MMP-1 *in vitro* and type I collagen synthesis in normal human fibroblast cells	Kim *et al*. (2008a)
Silybum marianum (Compositae)	Seeds, fruits	Flavolignans	By free radicals scavenging and antioxidant activity.	Singh and Agarwal (2009), Feher *et al*. (2011), Rasul and Akhtar (2012)
Spondias mombin (Anacardiaceae)	Leaves and aerial part of plant	Phenols, tannins, anthraquinone and flavonoids	Anti-free radical, anti-elastase, anti-collagenase, anti-UVA and anti-UVB	Pauly and Fleury (2002, 2003)
Tagetes erecta (Asteraceae)	Flowers	Syringic acid and β-amyrin	Inhibit elastase, hyaluronidase and MMP-1	Maity *et al*. (2011) Mukherjee *et al*. (2011)
Tamarindus indica (Fabaceae)	Seeds	polyphenolics (catechin, epicatechin and procyanidin), flavonoids	Radical scavenging and lipid peroxidation reducing activity	Gediya *et al*. (2011)
Terminali arjuna (Combretaceae)	Bark	Tannins like Catechol, Gallocatechin, epigallocatechin and flavonoids and also phenolics like gallic acid and ellagic acid	Hyaluronidase, elastase inhibition and collagen synthesis	Satardekar and Deodhar (2010), Rahman *et al*. (2004)
Terminalia chebula (Combretaceae)	Fruits	Hydrolysable tannins like Chebulinic acid, Gallotannins, casuarinin, chebulanin, corilagin, neochebulinic acid, terchebulin, gallic acid, phenolics like ellagic acid, chebulic acid	Hyaluronidase, elastase inhibition and collagen synthesis, anti-oxidative and MMP-2 inhibition.	Juang *et al*. (2004), Satardekar and Deodhar (2010), Manosroi *et al*. (2010), Kim *et al*. (2010b) Mukherjee *et al*. (2011)
Theobroma cacao (Sterculiaceae)	Bean	Methylxanthine, anandamide	Reduced total hydroxyproline and pepsin-resistant hydroxyproline content	Mitani *et al*. (2007) Mukherjee *et al*. (2011) Reddy *et al*. (2011)
Thymus quinquecostatus (Lamiaceae/Labiatae)	Whole plant	2(*S*)-5,7,3',5'-tetrahydroxyflavanone, (+)-taxifolin, (+)-aromadendrin, rosmarinic acid, caffeic acid	Free radical scavenging activity	Kim *et al*. (2007c)

Table 1: Continue

Botanical name (Family)	Part used	Chemical constituents	Possible mechanism of action	Reference
Torreya nucifera (Taxaceae)	Stem, leaves	Sesquiterpenoids, labdane and abietane diterpenoids and flavonoids	Free radical scavenging activity	Kim *et al*. (2007d)
Typha orientalis (Typhaceae)	Seed	Polyphenol, flavonoid and flavonol	Free radical scavenging activity, inhibition of elastase activity and MMP-1 expression.	Kim *et al*. (2007a)
Vaccinium uliginosum (Ericaceae)	Berries	Anthocyanins like cyanidin-3-glucoside, petunidin-3-glucoside, malvidin-3-glucoside and delphinidin-3-glucoside	Removal of reactive oxygen species, diminished UV-B augmented-release of IL-6 and IL-8	Bae *et al*. (2009) Mukherjee *et al*. (2011)
Viburnum awabuki (Caprifoliaceae)	Leaves, stem	Terpenoids	Inhibit elastase	Kim *et al*. (2007b)
Viola hondoensis (Violaceae)	Whole plant	Quercetin-3-O-beta-d-(6''-feruloyl)-galactopyranoside	Inhibition of MMP-1 expression	Moon *et al*. (2005) Mukherjee *et al*. (2011)
Vitis adstricta, *Vitis thunbergii* and *Vitis vinifera* (Vitaceae)	Leaves, seed, shoot	Phenolic compounds, proanthocyanidins and resveratrol	Free radical scavenging activity and inhibit matix-metalloproteinase in human skin fibroblast	Hou *et al*. (2003), Lee *et al*. (2009c), Baxter (2008) Mukherjee *et al*. (2011)
Waltheria indica (Sterculiacae)	Leaves, buds and aerial part of plant	Polyphenols, flavonoids, sterols, tannins	Anti-free radical action, anti-elastase, anti-collagenase, anti-UVA and anti-UVB	Pauly and Fleury (2002, 2003)
Zingiber officinale (L.) (zingiberaceae)	Rhizome	beta-sitosterol palmitate, isovanillin, glycol monopalmitate, hexacosanoic acid 2,3 dihydroxypropyl ester, maleimide-5-oxime, p-hydroxybenzaldehyde, adenine, 6-gingerol	Inhibit elastase enzyme activity	Tsukahara *et al*. (2006), Mukherjee *et al*. (2011)

Botanical antioxidants have been notified to have a good potential as antiaging agents. For example, dietary grape seed proanthocyanidins arose in inhibition of the expressions of Proliferating Cell Nuclear Antigen (PCNA) and cyclooxygenase-2 (COX-2) in the skin. Flavonoids are the largest group among plants with active properties; more than, 5000 flavonoids have been extracted and identified (Chiu *et al*., 2009), decrease the early activation of signaling pathway in response to UV induced injury.

The quercetin, polyphenol, flavonoid and flavonol, ellagic acids are obtained from natural resources, produces the free radical scavenging activity, inhibition of elastase activity and MMP expression and increase of expression of procollagen type I (Kim *et al*., 2007a, 2008a; Maity *et al*., 2011; Moon *et al*., 2005). Moreover, active constituents having antioxidant properties obtained from plant extracts, inhibit elastase, hyaluronidase, collagen synthesis, lipid peroxidation activity, protein expression of procollagen and prevent MMP gene induction and due to this fibrillin fibre length elongated to maintain elasticity of skin (Satardekar and Deodhar, 2010; Aslam *et al*., 2006). The above characters of ingredients help to minimize the environmental effects and stress to the skin. Moreover, it also improve texture, firmness and elasticity, counteract dryness, smooth out wrinkles, minimize age spots, improve color and increase moisture content of the skin.

CONCLUSION

Skin aging may be categorized as intrinsic and extrinsic. The anti-aging cream must include a unique composition with DNA repair and cellular repair molecules. The bioactive components such as flavonoids, polyphenols, tannins, quercetin etc from a variety of plant sources are combined actively to reduce wrinkles, reverse sun damage, diminish redness and abnormal pigment and improve the signs in the various categories of skin aging. The information of present review assists the cosmetics scientists for development of novel herbal antiaging formulation producing the reduction of wrinkles, redness and abnormal discolorations that result from aging. The combination of listed medicinal plant can be produced immensely efficient, low toxicity and cost impressive product compared to synthetic antiaging formulation.

The provision of such high-pitched information will authenticate the scholar for further development of herbal cosmetic, in order that more societal people can benefit from a more widely available, safer and more certified practice of herbal cosmetics in the future. This review can put forward revolt in the field of cosmetic market.

ACKNOWLEDGMENT

Authors pay indebtedness to Columbia Institute of Pharmacy, Raipur for providing library and online journal facilities.

REFERENCES

Aburjai, T. and F.M. Natsheh, 2003. Plants used in cosmetics. Phytother. Res., 17: 987-1000.

Adil, M.D., P. Kaiser, N.K. Satti, A.M. Zargar, R.A. Vishwakarma and S.A. Tasduq, 2010. Effect of *Emblica officinalis* (fruit) against UVB-induced photo-aging in human skin fibroblasts. J. Ethnopharmacol., 132: 109-114.

Akhtar, N., Shahiq-uz-zaman, B.A. Khan, M. Haji and S. Khan *et al*., 2011. Evaluation of various functional skin parameters using a topical cream of *Calendula officinalis* extract. African J. Pharm. Pharmacol., 5: 199-206.

An, B.J., J.H. Kwak, J.M. Park, J.Y. Lee and T.S. Park *et al*., 2005. Inhibition of enzyme activities and the antiwrinkle effect of polyphenol isolated from the persimmon leaf (*Diospyros kaki folium*) on human skin. Dermatol. Surg., 31: 848-854.

Aslam, M.N., E.P. Lansky and J. Varani, 2006. Pomegranate as a cosmeceutical source: Pomegranate fractions promote proliferation and procollagen synthesis and inhibit matrix metallo proteinases-1 production in human skin cells. J. Ethnopharmacol., 103: 311-318.

Bae, J.Y., S.S. Lim, S.J. Kim, J.S. Choi and J. Park *et al*., 2009. Bog blueberry anthocyanins alleviate photoaging in ultraviolet-B irradiation-induced human dermal fibroblasts. Mol. Nutr. Food Res., 53: 726-738.

Barrantes, E. and M. Guinea, 2003. Inhibition of collagenase and metalloproteinases by aloins and aloe gel. Life Sci., 72: 843-850.

Bauza, E., C. Dal Farra, A. Berghi, G. Oberto, D. Peyronel and N. Domloge, 2002. Date palm kernel exhibits antiaging properties and significantly reduces skin wrinkles. Int. J. Tissue React., 24: 131-136.

Baxter, R.A., 2008. Anti-aging properties of resveratrol: Review and report of a potent new antioxidant skin care formulation. J. Cosmetic Dermatol., 7: 2-7.

Blackburn, E.H., 2001. Switching and signaling at the telomere. Cell, 106: 661-673.

Bonte, F., M. Dumas, C. Chaudagne and A. Meybeck, 1994. Influence of asiatic acid, madecassic acid and asiaticoside on human collagen I synthesis. Planta Med., 60: 133-135.

Boonyuen, C., S. Wangkarn, O. Suntornwat and R. Chaisuksant, 2009. Antioxidant capacity and phenolic content of *Mimusops elengi* fruit extract. Kasetsart J. (Nat. Sci.), 43: 21-27.

Calabrese, V., S.D. Randazzo, C. Catalano and V. Rizza, 1999. Biochemical studies on a novel antioxidant from lemon oil and its biotechnological application in cosmetic dermatology. Drugs Exp. Clin. Res., 25: 219-225.

Calabrese, V., G. Scapagnini, C. Catalano, F. Dinotta, D. Geraci and P. Morganti, 2000. Biochemical studies of a natural antioxidant isolated from rosemary and its application in cosmetic dermatology. Int. J. Tissue React., 22: 5-13.

Chiu, T.M., C.C. Huang, T.J. Lin, J.Y. Fang, N.L. Wu and C.F. Hung, 2009. *In vitro* and *in vivo* anti-photoaging effects of an isoflavone extract from soybean cake. J. Ethnopharmacol., 126: 108-113.

Cho, Y.H., J.H. Kim, G.S. Sim, B.C. Lee, H.B. Pyo and H.D. Park, 2006. Inhibitory effects of antioxidant constituents from *Melothria heterophylla* on matrix metalloproteinase-1 expression in UVA-irradiated human dermal fibroblasts. J. Cosmetic Sci., 57: 279-289.

Cho, Y.H., J.H. Kim, B.C. Lee and H.B. Pyo, 2007. Cosmetic composition comprising extract of *Fraxinus chinensis* having skin damage inhibition effect. Korea Patent 1020050076942. http://patent.ipexl.com/KR/1020050076942.html

Cho, S., C.H. Won, D.H. Lee, M.J. Lee and S. Lee *et al*., 2009a. Red ginseng root extract mixed with Torilus fructus and Corni fructus improves facial wrinkles and increases type I procollagen synthesis in human skin: A randomized, double-blind, placebo-controlled study. J. Med. Food, 12: 1252-1259.

Cho, S., S. Lee, M.J. Lee, D.H. Lee, C.H. Won, S.M. Kim and J.H. Chung, 2009b. Dietary *Aloe vera* supplementation improves facial wrinkles and elasticity and it increases the type I procollagen gene expression in human skin *in vivo*. Ann. Dermatol., 21: 6-11.

Choi, H.K., D.H. Kim, J.W. Kim, S. Ngadiran, M.R. Sarmidi and C.S. Park, 2010. *Labisia pumila* extract protects skin cells from photoaging caused by UVB irradiation. J. Biosci. Bioeng., 109: 291-296.

Chung, J.H., S. Kang, J. Varani, J. Lin, G.J. Fisher and J.J. Voorhees, 2000. Decreased extracellular-signal-regulated kinase and increased stress-activated MAP kinase activities in aged human skin *in vivo*. J. Invest. Dermatol., 115: 177-182.

Cimino, F., M. Cristani, A. Saija, F.P. Bonina and F. Virgili, 2007. Protective effects of a red orange extract on UVB-induced damage in human keratinocytes. BioFactors, 30: 129-138.

Costin, G.E. and V.J. Hearing, 2007. Human skin pigmentation: Melanocytes modulate skin color in response to stress. FASEB J., 21: 976-994.

EL-Agbara, Z.A., K. Shakya, N.A. Khalaf and M. AL-haroon, 2008. Comparative antioxidant activity of some edible plants. Turk. J. Biol., 32: 193-196.

Farooqi, A.H.A., S. Sharma and S. Kumar, 2002. Herbal skin care formulation and a process for the preparation thereof. U.S. Patent 6368639. http://patent.ipexl.com/US/6368639.html

Feher, P., M. Vecsernyes, F. Fenyvesi, J. Varadi and T. Kiss *et al*., 2011. Topical application of *Silybum marianum* extract. J. Med. Aradean (Arad Med. J.), 14: 5-8.

Fisher, G.J., H.S. Talwar, J. Lin, P. Lin and P. McPhillips *et al*., 1998. Retinoic acid inhibits induction of c-Jun protein by ultraviolet radiation that occurs subsequent to activation of mitogen-activated protein kinase pathways in human skin *in vivo*. J. Clin. Invest., 101: 1432-1440.

Fisher, G.J., S. Datta, Z. Wang, X.Y. Li and T. Quan *et al*., 2000. c-Jun-dependent inhibition of cutaneous procollagen transcription following ultraviolet irradiation is reversed by all-trans retinoic acid. J. Clin. Invest., 106: 663-670.

Fisher, G.J., S. Kang, J. Varani, Z. Bata-Csorgo, Y. Wan, S. Datta and J.J. Voorhees, 2002. Mechanisms of photoaging and chronological skin aging. Arch. Dermatol., 138: 1462-1470.

Fonseca, Y.M., C.D. Catini, F.T. Vicentini, A. Nomizo, R.F. Gerlach and M.J. Fonseca, 2010. Protective effect of *Calendula officinalis* extract against UVB-induced oxidative stress in skin: Evaluation of reduced glutathione levels and matrix metalloproteinase secretion. J. Ethnopharmacol., 127: 596-601.

Fujii, T., M. Wakaizumi, T. Ikami and M. Saito, 2008. Amla (*Emblica officinalis* Gaertn.) extract promotes procollagen production and inhibits matrix metalloproteinase-1 in human skin fibroblasts. J. Ethnopharmacol., 119: 53-57.

Fujimura, T., K. Tsukahara, S. Moriwaki, T. Kitahara, T. Sano and Y. Takema, 2002. Treatment of human skin with an extract of *Fucus vesiculosus* changes its thickness and mechanical properties. J. Cosmetic Sci., 53: 1-9.

Fujimura, T., K. Tsukahara, S. Moriwaki, M. Hotta, T. Kitahara and Y. Takema, 2006. A horse chestnut extract, which induces contraction forces in fibroblasts, is a potent anti-aging ingredient. J. Cosmetic Sci., 57: 369-376.

Gao, X.H., L. Zhang, H. Wei and H.D. Chen, 2008. Efficacy and safety of innovative cosmeceuticals. Clin. Dermatol., 26: 367-374.

Garmyn, M. and D.B. Yarosh, 2006. The Molecular and Genetic Effects of Ultraviolet Radiation Exposure on Skin Cells. In: Photodermatology, Lim, H.W., H. Honigsman and J.L.M. Hawk (Eds.). Informa Healthcare, New York, USA., pp: 41-50.

Gediya, S.K., B.R. Mistry, K.U. Patel, M. Blessy and N.H. Jain, 2011. Herbal Plants: Used as a cosmetics. J. Nat. Prod. Plant Resour., 1: 24-32.

Graeber, M.B., E. Grasbon-Frodl, U.V. Eitzen and S. Kosel, 1998. Neurodegeneration and aging: Role of the second genome. J. Neurosci. Res., 52: 1-6.

Haftek, M., S. Mac-Mary, M.A. Le Bitoux, P. Creidi, S. Seite, A. Rougier and P. Humbert, 2008. Clinical, biometric and structural evaluation of the long-term effects of a topical treatment with ascorbic acid and madecassoside in photoaged human skin. Exp. Dermatol., 17: 946-952.

Hou, W.C., R.D. Lin, K.T. Cheng, Y.T. Hung and C.H. Cho *et al*., 2003. Free radical-scavenging activity of Taiwanese native plants. Phytomedicine, 10: 170-175.

Hsu, S., 2005. Green tea and the skin. J. Am. Acad. Dermatol., 52: 1049-1059.

Hussein, M.R., 2005. Ultraviolet radiation and skin cancer: Molecular mechanisms. J. Cutaneous Pathol., 32: 191-205.

Hwang, J.K., J.S. Shim, S.H. Gwon, Y.Y. Kwon and H.I. Oh *et al*., 2012. Novel use of Panduratin derivatives or extract of *Kaempferia pandurata* comprising the same. U.S. Patent 0065272A1. http://www.specialchem4cosmetics.com/patents-applications/patent.aspx?id=1356831andq=cosmetics%20market

Jain, A., S. Dubey, A. Gupta, P. Kannojia and V. Tomar, 2010. Potential of herbs as cosmaceuticals. Int. J. Res. Ayurveda Pharm., 1: 71-77.

Jelodarian, S., A.H. Ebrahimabadi, A. Khalighi and H. Batooli, 2012. Evaluation of antioxidant activity of *Malus domestica* fruit extract from Kashan area. Avicenna J. Phytomedicine, 2: 139-145.

Jha, M., N. Ganesh and V. Sharma, 2010. *In vitro* evaluation of free radical scavenging activity of *Pistia stratiotes*. Int. J. Chem. Tech. Res., 2: 180-184.

Juang, L.J., S.J. Sheu and T.C. Lin, 2004. Determination of hydrolyzable tannins in the fruit of *Terminalia chebula* Retz. by high-performance liquid chromatography and capillary electrophoresis. J. Sep. Sci., 27: 718-724.

Jung, E., J. Lee, J. Baek, K. Jung and J. Lee *et al*., 2007. Effect of *Camellia japonica* oil on human type I procollagen production and skin barrier function. J. Ethnopharmacol., 112: 127-131.

Kang, T.H., H.M. Park, Y.B. Kim, H. Kim and N. Kim *et al*., 2009. Effects of red ginseng extract on UVB irradiation-induced skin aging in hairless mice. J. Ethnopharmacol., 123: 446-451.

Kapoor, V.P., 2005. Herbal cosmetics for skin and hair care. Nat. Prod. Radiance, 4: 306-314.

Katiyar, S.K., N. Ahmad and H. Mukhtar, 2000. Green tea and skin. Arch. Dermatol., 136: 989-994.

Kim, D.S., S.H. Park, S.B. Kwon, K. Li, S.W. Youn and K.C. Park, 2004. Epigallocatechin-3-gallate and hinokitiol reduce melanin synthesis via decreased MITF production. Arch. Pharm. Res., 27: 334-339.

Kim, J.H., Y.H. Cho, B.C. Lee and H.B. Pyo, 2007a. Cosmetic composition comprising extracts of *Pterocarpus santalinus* capable of inhibiting activity. Korea Patent. http://patent.ipexl.com/KR/1020050076940.html

Kim, J.Y., H.J. Yang, K.H. Lee, S.M. Jeon, Y.J. Ahn, B.R. Won and S.N. Park, 2007b. Antioxidative and antiaging effects of Jeju Native Plant Extracts (II). J.Soc. Cosmet. Sci. Korea, 33: 165-173.

Kim, S.S., C.G. Hyun, J. Lee, J. Lim, J.Y. Kim and D. Park, 2007c. *In vitro* screening of jeju medicinal plants for Cosmeceutical materials. J. Appl. Biol. Chem., 50: 215-220.

Kim, Y.H., K.S. Kim, C.S. Han, H.C. Yang and S.H. Park *et al*., 2007d. Inhibitory effects of natural plants of Jeju Island on elastase and MMP-1 expression. Int. J. Cosmet. Sci., 29: 487-488.

Kim, S. and J.H. Chung, 2008. Berberine prevents UV-induced MMP-1 and reduction of type I procollagen expression in human dermal fibroblasts. Phytomedicine, 15: 749-753.

Kim, S., Y. Kim, J.E. Kim, K.H. Cho and J.H. Chung, 2008a. Berberine inhibits TPA-induced MMP-9 and IL-6 expression in normal human Keratinocytes. Phytomedicine, 15: 340-347.

Kim, Y.H., C.B. Chung, J.G. Kim, K.I. Ko and S.H. Park *et al*., 2008b. Anti-wrinkle activity of ziyuglycoside I isolated from a *Sanguisorba officinalis* root extract and its application as a cosmeceutical ingredient. Biosci. Biotechnol. Biochem., 72: 303-311.

Kim, J.H., J.C. Byun, A.K.R. Bandi, C.G. Hyun and N.H. Lee, 2009a. Compounds with elastase inhibition and free radical scavenging activities from *Callistemon lanceolatus*. J. Med. Plant. Res., 3: 914-920.

Kim, J.Y., S.S. Kim, T.H. Oh, J. Baik, G. Song, N. Lee and C.G. Hyun, 2009b. Chemical composition antioxidant anti-elastase and anti-inflammatory activities of Illicium anisatum essential oil. Acta Pharm., 59: 289-300.

Kim, S.J., S.A. Sancheti, S.S. Sancheti, B.H. Um, S.M. Yu and S.Y. Seo, 2010a. Effect of 1, 2, 3, 4, 6-penta-O galloyl-beta-d-glucose on elastase and hyaluronidase activities and its type II collagen expression. Acta Polon. Pharm. Drug Res., 67: 145-150.

Kim, Y.H., K.H. Kim, C.S. Han, H.C. Yang and S.H. Park *et al*., 2010b. Anti-wrinkle activity of *Platycarya strobilacea* extract and its application as a cosmeceutical ingredient. J. Cosmet. Sci., 61: 211-224.

Kim, T., H.J. Kim, S.K. Cho, W.Y. Kang and H. Baek *et al*., 2011. *Nelumbo nucifera* extracts as whitening and anti-wrinkle cosmetic agent. Korean J. Chem. Eng., 28: 424-427.

Ko R.K., G.O. Kim, C.G. Hyun, D.S. Jung and N.H. Lee, 2011. Compounds with tyrosinase inhibition, elastase inhibition and DPPH radical scavenging activities from the branches of *Distylium racemosum* Sieb. Et Zucc. Phytotherapy Res., 25: 1451-1456.

Kohl, E., J. Steinbauer, M. Landthaler and R.M. Szeimies, 2011. Skin aging. J. Eur. Acad. Dermatol. Venereol., 25: 873-884.

Kole, P.L., H.R. Jadhav, P. Thakurdesai and A.N. Nagappa, 2005. Cosmetics potential of herbal extracts. Nat. Prod. Radiance, 4: 315-321.

Kumar, S., N. Singh and S. Archana, 2012. Green tea polyphenols: Versatile cosmetic ingredient. IJARPB, 1: 348-362.

Kuno, N. and M. Matsumoto, 2004. Skin beautifying agent, antiaging agent for skin, whitening agent and external agent for the skin. US Patent No. 6682763 B2

Lee, K.K. and J. Choi, 1999. The effects of *Areca catechu* L. extracts on anti ageing. Int. J. Cosmet. Sci., 21: 285-295.

Lee, K.K., J.H. Kim, J.J. Cho and J.D. Choi, 1999. Inhibitory effects of 150 plant extracts on elastase activity and their anti-inflammatory effects. Int. J. Cosmet. Sci., 21: 71-82.

Lee, K.K., J.J. Cho, E.J. Park and J.D. Choi, 2001. Anti-elastase and anti-hyaluronidase of phenolic substance from *Areca catechu* as a new anti-ageing agent. Int. J. Cosmetic Sci., 23: 341-346.

Lee, J., E. Jung, Y. Kim, J. Park and J. Park *et al*., 2006a. Asiaticoside induces human collagen I synthesis through TGF? receptor I kinase (T'RI kinase)-independent Smad signaling. Planta Medica, 72: 324-328.

Lee, S., J.M. Lim, M.H. Jin, H.K. Park and E.J. Lee *et al*., 2006b. Partially purified paeoniflorin exerts protective effects on UV-induced DNA damage and reduces facial wrinkles in human skin. J. Cosmet. Sci., 57: 57-64.

Lee, B.C., S.Y. Lee, H.J. Lee, G.S. Sim and J.H. Kim *et al*., 2007. Anti-oxidative and photo-protective effects of coumarins isolated from *Fraxinus chinensis*. Arch. Pharm. Res., 30: 1293-1301.

Lee, H.J., J.S. Kim, M.S. Song, H.S. Seo and C. Moon *et al.*, 2009a. Photoprotective effect of red ginseng against ultraviolet radiation-induced chronic skin damage in the hairless mouse. Phytother. Res., 23: 399-403.

Lee, S.Y., M.R. Kim, H.S. Choi, H.I. Moon, J.H. Chung, D.G. Lee and E.R. Woo, 2009b. The effect of curculigoside on the expression of matrix metalloproteinase-1 in cultured human skin fibroblasts. Arch. Pharm. Res., 32: 1433-1439.

Lee, Y.L., M.H. Lee, H.J. Chang, P.Y. Huang, I.J. Huang, K.T. Cheng and S.J. Leu, 2009c. Taiwanese native plants inhibit matrix metalloproteinase-9 activity after ultraviolet B irradiation. Molecules, 14: 1062-1071.

Lee, H.S., H.J. Lee, H.J. Cho, S.S. Park, J.M. Kim and H.J. Suh, 2010. Cosmetic potential of enzymatic treated ginseng leaf. J. Ginseng Res., 34: 227-236.

Leu, S.J., Y.P. Lin, R.D. Lin, C.L. Wen, K.T. Cheng, F.L. Hsu and M.H. Lee, 2006. Phenolic constituents of *Malus doumeri* var. formosana in the field of skin care. Biol. Pharm. Bull., 29: 740-745.

Mahajan, B., S.C. Taneja, V.K. Sethi and K.L. Dhar, 1995. Two triterpenoids from *Boswellia serrata* gum resin. Phytochemistry, 39: 453-455.

Maity, N., N.K. Nema, M.K. Abedy, B.K. Sarkar and P.K. Mukherjee, 2011. Exploring *Tagetes erecta* Linn flower for the elastase, hyaluronidase and MMP-1 inhibitory activity. J. Ethnopharmacol., 137: 1300-1305.

Majeed, M. and L. Prakash, 2005. Novel natural approaches to anti-aging skin care. Cosmetic and Toiletries Manufacture Worldwide, Sabinsa Corporation, pp: 11-15. http://www.drmajeed.com/articles/2005NovelNaturalApproaches.pdf

Makrantonak, E. and C.C. Zouboulis, 2007. Characteristics and pathomechanisms of endogenously aged skin. Dermatology, 214: 352-360.

Manosroi, A., P. Jantrawut, T. Akihisa, W. Manosroi and J. Manosroi, 2010. *In vitro* anti-aging activities of *Terminalia chebula* gall extract. Pharm. Biol., 48: 469-481.

Misra, G. and C.R. Mitra, 1967. Constituents of fruit and seeds of *Mimusops elengi*. Phytochemistry, 6: 453-453.

Misra, G. and C.R. Mitra, 1968. Constituents of leaves, hard wood and root of *Mimusops elengi*. Phytochemistry, 7: 501-502.

Mitani, H., A. Ryu, T. Suzuki, M. Yamashita, K. Arakane and C. Koide, 2007. Topical application of plant extracts containing xanthine derivatives can prevent UV induced wrinkle formation in hairless mice. Photodermatol. Photoimmunol. Photomed., 23: 86-94.

Moon, H.I., J. Lee, P.Z. Ok and J.H. Chung, 2005. The effect of flavonol glycoside on the expressions of matrix metalloproteinase-1 in ultraviolet-irradiated cultured human skin fibroblasts. J. Ethnopharmacol., 101: 176-179.

Moon, H.I and J.C. Jung, 2006. Effect of Meso-dihydroguaiaretic acid from *Machilus thunbergii* Sieb et Zucc on MMP-1 expression in heat shock-induced cultured primary human fibroblasts. Phytother. Res., 20: 714-716.

Mukherjee, P.K., N. Maity, N.K. Nema and B.K. Sarkar, 2011. Bioactive compounds from natural resources against skin aging. Phytomedicine, 19: 64-73.

Narayanaswamy, N., S. Rohini, A. Duraisamy and K.P. Balakrishnan, 2011. Antityrosinase and antioxidant activities of various parts of *Mimusops elengi*: A comparative study. Int. J. Res. Cosmetic Sci., 1: 17-22.

Nema, N.K., N. Maity, B. Sarkar and P.K. Mukherjee, 2011. *Cucumis sativus* fruit-potential antioxidant, anti-hyaluronidase and anti-elastase agent. Arch. Dermatol. Res., 303: 247-252.

Oh, H.I., J.S. Shim, S.H. Gwon, H.J. Kwon and J.K. Hwang, 2009. The effect of xanthorrhizol on the expression of matrix metalloproteinase-1 and type-I procollagen in ultraviolet-irradiated human skin fibroblasts. Phytother. Res., 23: 1299-1302.

Osborne, R., L.R. Robinson, L. Mullins and P. Raleigh, 2005. Use of a facial moisturizer containing palmitoyl pentapeptide improves the appearance of aging skin. J. Am. Acad. Dermatol., 52: P96-P96.

Palm, M.D. and M.N. O'Donoghue, 2007. Update on photoprotection. Dermatol. Ther., 20: 360-376.

Pardhy, R.S. and S.C. Bhattacharyya, 1978a. β-Boswellic acid, acetyl-β-boswellic acid, acetyl-11-keto-β-boswellic acid and 11-keto-β-boswellic acid, four pentacyclic triterpenic acids from the resin of *Boswellia serrata*. Indian J. Chem., 16B: 176-178.

Pardhy, R.S. and S.C. Bhattacharyya, 1978b. Tetracyclic triterpene acids from the resin of *Boswellia serrata* Roxb. Indian J. Chem., 16B: 174-175.

Pauly, G. and N.M. Fleury, 2002. Cosmetic containing plant extracts, particularly with a depigmenting, anti-radical and anti-aging action. U.S. Patent No. 0076450 A1. http://www.google.com.pk/patents/US20020076450?utm_source=gb-gplus-sharePatent

Pauly, G. and N.M. Fleury, 2003. Cosmetic containing plant extracts. U.S. Patent 0072820 A1. http://www.google.com.pk/patents/US20030072820?utm_source=gb-gplus-sharePatent

Pinnell, S.R., 2003. Cutaneous photodamage, oxidative stress and topical antioxidant protection. J. Am. Acad. Dermatol., 48: 1-19.

Prado, F., F. Cortes-Ledesma, P. Huertas and A. Aguilera, 2003. Mitotic recombination in *Saccharomyces cerevisiae*. Curr. Genet., 42: 185-198.

Quan, T., Y. Shao, T. He, J.J. Voorhees and G.J. Fisher, 2009. Reduced expression of connective tissue growth factor (CTGF/CCN2) mediates collagen loss in chronologically aged human skin. J. Invest. Dermatol., 130: 415-424.

Rahman, Z., K. Kohli, R.K. Khar, H.S. Lamba, A. Rathour and R. Pahwa, 2004. An overview of *Terminalia arjuna*: Chemistry and pharmacological profile. Indian Drugs, 41: 641-649.

Rasul, A. and N. Akhtar, 2011. Formulation and *in vivo* evaluation for anti-aging effects of an emulsion containing basil extract using non-invasive biophysical techniques. DARU, 19: 344-350.

Rasul, A. and N. Akhtar, 2012. Anti-aging potential of a cream containing milk thistle extract: Formulation and *in vivo* evaluation. Afr. J. Biotechnol., 11: 1509-1515.

Reddy, P.M., M. Gobinath, M.K. Rao, P. Venugopalaiah and N. Reena, 2011. A Review on importance of herbal drugs in cosmetics. Int. J. Adv. Pharm. Nanotechnol., 1: 121-139.

Rival, D., S. Bonnet, B. Sohm and E. Perrier, 2009. A *Hibiscus abelmoschus* seed extract as a protective active ingredient to favour FGF-2 activity in skin. Int. J. Cosmetic Sci., 31: 419-426.

Sahasrabudhe, A. and M. Deodhar, 2010. Anti-hyaluronidase, anti-elastase activity of *Garcinia indica*. Int. J. Bot., 6: 299-303.

Sahu, N.P., 1996. Triterpenoid saponins of *Mimusops elengi*. Phytochemistry, 41: 883-886.

Samee, W. and S. Vorarat, 2007. Simultaneous determination of gallic acid, catechin, rutin, ellagic acid and quercetin in flower extracts of *Michelia alba*, *Caesalpinia pulcherrima* and *Nelumbo nucifera* by HPLC. Thai Pharm. Health Sci. J., 2: 131-137.

Sander, C.S., H. Chang, S. Salzmann, C.S. Muller, S. Ekanayake-Mudiyanselage, P. Elsner and J.J. Thiele, 2002. Photoaging is associated with protein oxidation in human skin *in vivo*. J. Invest. Dermatol., 118: 618-625.

Satardekar, K.V. and M.A. Deodhar, 2010. Anti-ageing ability of *Terminalia* species with special reference to hyaluronidase, elastase inhibition and collagen synthesis *in vitro*. Int. J. Pharmacogn. Phytochem. Res., 2: 30-34.

Scartezzini, P., F. Antogoni, M.A. Raggi, F. Poli and C. Sabbioni, 2006. Vitamin C content and antioxidant activity of the fruit and of the ayuravedic preparation of *Emblica officinalis* gaertn. J. Ethnopharmacol., 104: 113-118.

Seiberg, M., 2011. Non-denatured Soybean Extracts in Skin Care: Multiple Anti-Aging Effects. In: Soybean-Biochemistry, Chemistry and Physiology, Ng T.B. (Ed.). InTech Publishers, New York, USA., pp: 119-136.

Shacter, E., 2000. Protein oxidative damage. Methods Enzymol., 319: 428-436.

Shim, J.S., Y.Y. Kwon and J.K. Hwang, 2008. The effects of panduratin a isolated from *Kaempferia pandurata* on the expression of matrix metalloproteinase-1 and type-1 procollagen in human skin fibroblasts. Planta Med., 74: 239-244.

Shimogaki, H., Y. Tanaka, H. Tamai and M. Masuda, 2000. *In vitro* and *in vivo* evaluation of ellagic acid on melanogenesis inhibition. Int. J. Cosmet. Sci., 22: 291-303.

Singh, R.P. and R. Agarwal, 2009. Cosmeceuticals and silibinin. Clin. Dermatol., 27: 479-484.

Soisuwan, S., W. Mapaisansin, W. Samee, A.H. Brantner and N. Kamkaen, 2010. Development of peacock flower extract as anti-wrinkle formulation. J. Health Res., 24: 29-34.

Srivastava, S. and C.T. Moraes, 2005. Double-strand breaks of mouse muscle mtDNA promote large deletions similar to multiple mtDNA deletions in humans. Hum. Mol. Genet., 14: 893-902.

Sultana, N. and N.H. Lee, 2007. Antielastase and free radical scavenging activities of compounds from the stems of *Cornus kousa*. Phytother. Res., 21: 1171-1176.

Sultana, Y., K. Kohli, M. Athar, R.K. Khar and M. Aqil, 2007. Effect of pre-treatment of almond oil on ultraviolet B-induced cutaneous photoaging in mice. J. Cosmet. Dermatol., 6: 14-19.

Sumiyoshi, M. and Y. Kimura, 2009. Effects of a turmeric extract (*Curcuma longa*) on chronic ultraviolet B irradiation-induced skin damage in melanin-possessing hairless mice. Phytomedicine, 16: 1137-1143.

Svobodova, A., D. Walterova and J. Vostalova, 2006. Ultraviolet light induced alteration to the skin. Biomed. Pap. Med. Fac. Univ. Palacky Olomouc Czech. Repub., 150: 25-38.

Tanaka, K., J. Hasegawa, K. Asamitsu and T. Okamoto, 2007. *Magnolia ovovata* extract and its active component magnolol prevent skin photoaging via inhibition of nuclear factor κB. Eur. J. Pharmacol., 565: 212-219.

Thring, T.S.A., P. Hili and D.P. Naughton, 2009. Anti-collagenase, anti-elastase and anti-oxidant activities of extracts from 21 plants. BMC Complementary Altern. Med., Vol. 9.

Tiedtke, J. and O.A. Marks, 2005. Multi-functional botanical active based on ginko for anti-aging. Cosmetic Sci. Technol., 2005: 18-25.

Tsoyi, K., H.B. Park, Y.M. Kim, J.I. Chung and S.C. Shin *et al*., 2008. Protective effect of anthocyanins from black soybean seed coats on UVB-induced apoptotic cell death *in vivo* and *in vivo*. J. Agric. Food Chem., 55: 10600-10605.

Tsukahara, K., H. Nakagawa, S. Moriwaki, Y. Takema, T. Fujimura and G. Imokawa, 2006. Inhibition of ultraviolet-B-induced wrinkle formation by an elastase-inhibiting herbal extract: Implication for the mechanism underlying elastase-associated wrinkles. Int. J. Dermatol., 45: 460-468.

Vyawahare, N., R. Pujari, A. Khsirsagar, D. Ingawale, M. Patil and V. Kagathara, 2009. *Phoenix dactylifera*: An update of its indegenous uses, phytochemistry and pharmacology. Int. J. Pharmacol., Vol. 7, No. 1. 10.5580/164b

Wanauppathamkul, S., S. Chaturonratsamee and W. Chusattayanond, 2004. The use of sacred lotus stamen extract as antioxidant in drugs, food supplements and cosmetics. Inventors: International Laboratories Corp., Ltd., Assignee, Thai Petty Patent, 1610.

Wilkinson, J.A. and M.G. Browna, 1999. Horse chestnut-*Aesculus hippocastanum*: Potential applications in cosmetic skin-care products. Int. J. Cosmetic Sci., 21: 437-447.

Xu, Y., Y. Shao, J.J. Voorhees and G.J. Fisher, 2006. Oxidative inhibition of receptor-type protein-tyrosine phosphatase kappa by ultraviolet irradiation activates epidermal growth factor receptor in human keratinocytes. J. Biol. Chem., 281: 27389-27397.

Xue, Y.L., T. Miyakawa, Y. Hayashi, K. Okamoto and F. Hu *et al*., 2011. Isolation and tyrosinase inhibitory effects of polyphenols from the leaves of persimmon, *Diospyros kaki*. J. Agric. Food. Chem., 59: 6011-6017.

Yaar, M. and B.A. Gilchrest, 2007. Photoaging: Mechanism, prevention and therapy. Br. J. Dermatol., 157: 874-887.

Yigit, D., N. Yigit and A. Mavi, 2009. Antioxidant and antimicrobial activities of bitter and sweet apricot (*Prunus armeniaca* L.) kernels. Braz. J. Med. Biol. Res., 42: 346-352.

Yoshimura, M., Y. Watanabe, K. Kasai, J. Yamakoshi and T. Koga, 2005. Inhibitory effect of an ellagic acid-rich pomegranate extract on tyrosinase activity and ultraviolet-induced pigmentation. Biosci. Biotechnol. Biochem., 69: 2368-2373.

Zhang, D., T. Yasuda, Y. Yu, P. Zheng, T. Kawabata, Y. Ma and S. Okada, 1996. Ginseng extract scavenges hydroxyl radical and protects unsaturated fatty acids from decomposition caused by iron-mediated lipid peroxidation Free Radic. Biol. Med., 20: 145-150.

Zouboulis, C.C. and A. Boschnakow, 2001. Chronological ageing and photoageing of the human sebaceous gland. Clin. Exp. Dermatol., 26: 600-607.