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Review Article

Herbal Plant in Photo Protection and Sunscreen Action: A Review

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ABSTRACT

When pollution and harsh synthetic chemicals have such an impact on today's world, nature has bestowed onto us its timeless resource of herbal ingredients. The review primarily highlights a number of herbal compounds that may offer photoprotective properties. Sunburn is primarily caused by ultraviolet radiation, which also increases the risk of developing serious skin cancer. Herbal compounds with sun screening properties can be used to prevent the penetration of UV radiation. Herbal remedies are more widely available, less expensive, and have fewer adverse effects than synthetic ones. They are also effective in treating chronic diseases. Basically, since they have antioxidant properties, herbs that contain vitamins A, C, and E, flavonoids, polyphenols, carotenoids (lycopene, β carotene), and phenolic acids improve photoprotection. In addition to neutralizing reactive oxygen species (ROS) and preventing the production of free radicals, these herbal components also improve skin protection against damaging UV radiation. Several herbs with active ingredients that provide photoprotection are the subject of this review. The examination of the chemical components found in different herbal remedies that have a UV shielding effect is concluded in this article, along with the detrimental and dangerous effects of UV rays and the forms of UV radiation.

INTRODUCTION

The formulation of sunscreen is applied topically with the intention of increasing the Sun Protection Factor (SPF) and healing, preventing, or resisting the unpleasant or harmful consequences of sunburn, suntan, sun cancer, and premature skin aging (1). Sun screens are typically used to shield skin from the harmful effects of sunlight. Herbal

sunscreens don't cause any comedogenic effects and are environmentally friendly (2).

Mechanisms of Photoprotection from Herbal Plants

1. Physical protection

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Herbal sunscreens use inorganic or mineral-based substances to create a protective layer on the skin's surface in their physical mode of action. By reflecting and dispersing incoming UV light, this layer serves as a physical barrier that keeps it from reaching the epidermis and harming cells.

Key minerals used for physical protection include:

- Zinc oxide (ZnO)
- Titanium dioxide (TiO₂)

2. Chemical Absorption

The chemical absorption of UV light is the second main process. High-energy UV photons can be absorbed by specific chemical compounds found in herbal extracts, and the absorbed energy can be safely released as low-energy heat. This change stops the radiation from generating oxidative stress, DNA damage, or inflammatory reactions by penetrating deeper into the skin's layers. Natural UV absorbers are herbal compounds that are high in flavonoids, phenolic acids, tannins, and polyphenols. These substances effectively absorb UV light in the UVA and UVB bands thanks to their conjugated double bond structures.

Example of effective phytochemical includes:

- Flavonoids
- Phenolic compounds
- Tannins (3)

Types of UV radiation

UV. A Radiation

The wavelength range of radiation is 320–400 nm. The primary cause of the skin's instant tanning or darkening is UV-A radiation.

UV. B Radiation

The wavelength of radiation is between 280 and 320 nm. Burning rays are the name given to UV-B radiation. UV-B radiation is more genotoxic than UV-A radiation, however it primarily affects the skin's epidermal basal cell layer. One of the main causes of sunburn is ultraviolet B (UVB) radiation, which varies with the season. Sunburned skin is a prominent risk factor for skin cancer.

UV.C Radiation

Radiation has a wavelength of 200–280 nm. Because ozone layers block UV-C rays, they are less dangerous and effective (4).

The sunscreen can work in different ways

Skin can develop a protective layer that either absorbs or reflects UV radiation to keep them from reaching the skin. Both zinc oxide and titanium dioxide possess this characteristic. However, the drawbacks of this preparation include the removal of both dangerous and good rays. It is possible to reduce inflammatory symptoms with biologically useful medicines without lowering tanning. Because sunburn causes cells to break down, histamine is released into the tissue (5).

What is SPF

Sun protection factor, or SPF for short, is a measure of how well a sunscreen protects you from ultraviolet (UV) radiation throughout the duration of its effectiveness. On the other hand, the darker skin tone indicates dermal cell injury. SPF ratings typically only cover UVB rays, however some sunscreens can also block UVA rays. The SPF rating indicates how much sunburn protection the sunscreen lotion provides (5).

Skin

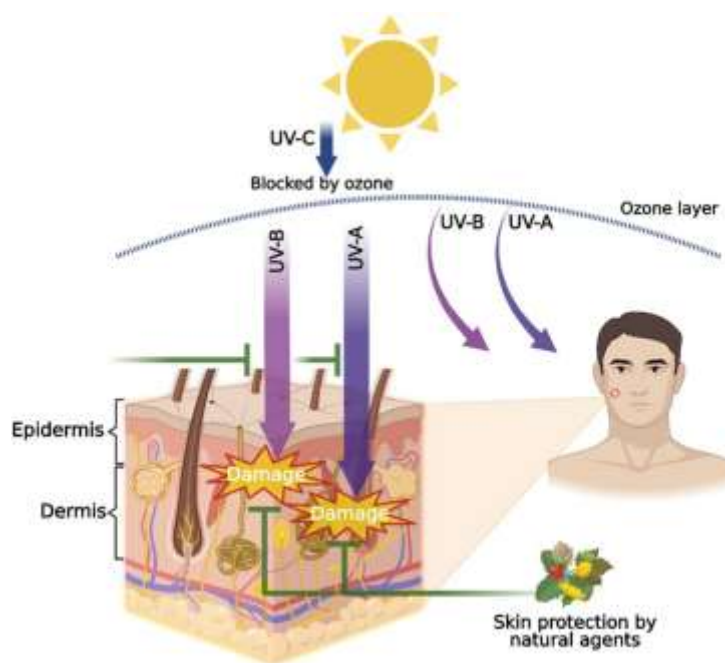
The largest organ is the human skin. The organ is special because it controls the body's loss of heat



and water and shields it from toxins and microbes. The medicinal substance that is applied topically has both local and systemic effects. One physical barrier is thought to be the skin's membrane. The

pores in the skin tissues are mostly where the medication is transported (6)

Effect of UV on skin



Advantages

- UV radiation protection is offered by sunscreen cream.
- It prevents premature ageing and reduces the risk of skin cancer.
- It provides protection from sunburn.
- It prevents tanning caused by UVB rays. (7)

Disadvantages

- Taste and colour are hard to conceal.
- The manufacturing process is difficult and time-consuming.
- Herbal medications require long-term therapy and have slower effects than allopathetic dose forms. (8)

Some Important Photoprotective Agents

1. Luffa cylindrica

- **Kingdom:** Plantae
- **Division:** Mangoliophyta
- **Class:** Mangoliosida
- **Order:** Cucurbitales
- **Genus:** Luffa
- **Species :** Cylindrica(9)



Figure :1 Luffa cylindrica

Luffa cylindrica contains flavonoids that function as secondary metabolites and UV protectants, providing protection from UV radiation that might cause mutations (Helfrich et al., 2008). The components of *Luffa cylindrica*, ascorbic acid and carotenoids, act as photoprotective agents when applied topically to the skin before being exposed to ultraviolet (UV) light (10).

2. Aloe vera

- **Kingdom:** Plantae
- **Clade:** Angiosperms
- **Clade:** Monocots
- **Order:** Asparagales
- **Family:** Asphodelaceae
- **Subfamily:** Asphodeloideae
- **Genus:** Aloe
- **Species :** A Vera (11)



Figure 2: Aloe vera

Skin damage from radiation has been claimed to be prevented by aloe vera gel. The precise function is unknown, but after aloe vera gel is administered, the skin produces metallothionein, an antioxidant protein that scavenges free radicals and keeps superoxide from being suppressed. 8)Antioxidants, which are abundant in it, counteract free radicals. Thus, aloe vera prevents wrinkles and aging-related changes. It improves circulation, which nourishes the skin. Psoriasis and other skin conditions like dermatitis can be

effectively treated with aloe vera. It treats minor second-degree burns as well as cuts, wounds, blisters, and burns, including sunburns. Dark spots and skin imperfections, as well as acne and skin allergies, are all cleared up by aloe vera (12).

3. Embilca officinalis

- **Kingdom:** Plantae
- **Division:** Angiospermae
- **Class:** Dicotyledonae
- **Order:** Geraniales
- **Family:** Euphorbiaceae
- **Genus:** Emblic
- **Species:** Officinalis Gearth (13)



Figure 3: Embilca officinalis

In the Indian ayurveda system, Indian gooseberry is a significant medicinal plant. Indian gooseberry is used for both medical and nutritional purposes. Its antioxidant qualities make it a popular ingredient in cosmetics. Amla contains a lot of ascorbic acid. An important factor in the effectiveness of photoprotection is β -glucogallin. β -glucogallin by demonstrating a ROS inhibitory impact, you can increase your resistance to UV B stress. Additionally, it stops UV-induced melanogenesis and sun exposure-induced skin tanning (4).

4. Crocus Stivus

- **Kingdom:** Plantae
- **Division:** Magonoliophyta
- **Class:** Liliopsida
- **Order:** Asparagales
- **Family:** Iridaceae
- **Genus:** Crocus
- **Species:** C.Sativus (14)



Figure 4: Crocus stivus

The anti-sun properties of saffron are well known for shielding the skin from damaging UV radiation because of its antioxidant qualities, saffron not only has antisolar and moisturizing qualities but also helps prevent skin cancer. It is well known that saffron lowers the pigment known as melanin. Consequently, it works incredibly well as a skin-lightening agent. On human skin, the formulation containing C. sativus extract significantly depigmented the skin and had an antirhythmic effect. Saffron can be soaked with a few basil leaves to heal imperfections like acne in traditional herbal cosmetics (15).

Table 1: Plants with antioxidant potential as well as anti- wrinkling and anti-aging properties and are commonly used in diet.

Plant Name	Part preferentially Used	Responsible Constituent	Reference
Solanum lycopersicum (Tomato)	Fruits	Lycopene	16
Camellia Sinensis (Green tea)	Leaves	Epigallocatechin gallate	17
Malus domestica (Apple)	Fruits	Quercetin, Epicatechin	18
Citrus limon (Lemon)	Fruits	Ascorbic acid	19
Butyrospermumparkii	fruits	Stearic and oleic acids	20
Anthemis nobills (Roman comomile)	Leaves	2-methyl butanoic acid ester	21
Actostaphylos uva-ursi (Bearberry)	Leaves	Hydroquinone mono-glycoside, myricetin, quercetin, Vitamin C	22
Helianthus annuus (Sun Flower)	Flower	Vitamin E	23
Punica granatum (Pomegranate)	Fruit	Vitamin B5, Potassium, polyphenols and Vitamin C	24
Daucus corota (Carrot)	Root	Vitamin A, Sitosterol, Laserine, Epilaserine	25
Brassica oleracea (Cabbage)	Leaves	Vitamin C Indole-3-carbinol	26
Curcuma longa (Turmeric)	Rhizomes	Curcumin, Zingiberine	27
Annona squamosa (Sugar-apple)	Fruit and seed	Lirideninemoupinamide, a-Pinene	28
Cocos nucifera (Coconut)	Fruits and all parts	Vitamin B Vitamin C etc.	29

Allium sativum (Garlic)	Plants bulb	Homocysteine, allicin (diallylthiosulfinate or diallyl disulfide)	30
Glycyrrhiza glabra (Liquorice)	Root	Glycyrrhetic acid Stearyl glycyrrhetinate	31
Morinda officinalis (Indian mulberry)	Root	Constituent not reported	32
Curcuma aromatica (wild turmeric)	Rhizome	Constituent not reported	33
Gmelina arborea (Gambha)	Bark	Constituent not reported	34
Ginkgo biloba (Maidenhair tree)	Leaf	Ginkgolides and Bilobalide	35

Table 2: Some branded herbal cosmeceuticals for photoprotection of skin from harmful UVB radiation
(36)

Branded product	Herbal constituent	Manufacturer	Purpose
Tomato Sun Cream SPF 36PA++	Tomato	Skin food Cosmetics South Korea	Anti-wrinkle and Sunscreen Cream
Natural Sun SPF 25	Green Tea, Aloe vera	Aubrey Organics, United States	Sunscreen cream
Sunscreen SPF+80	Apple	Greeno, Syria	Sunscreen cream
Power Light intensive Fairness Moisturizer SPF 15	Lemon, Long Dan	Garnier, England	Sun protecting fairness cream
SPF 30 natural mineral sunscreen	Shea butter, Jojoba	John Masters TM Organics, New York	Sunscreen cream
Aroma sun tanning gel cream SPF 10	Roman chamomile, Geranium, Jasmine	Declore, Paris	Sunscreen gel
Saffron and bearberry fairness cream	Saffron, Bearberry	Joves, India	Fair complexion cream
Body lotion	Sun flower oil	Cosmetics Bakery, Singapore	Body lotion
Hydra Light moisture-infusing lotion	Pomegranate, Oat, Cranberry	Paula's Choice, Canada	Antioxidant, anti-aging, moisturizer lotion
Bio-pro carrot protective cream SPF 30	Carrot oil	Biotique Botanical Herbal Extracts, India	Sunscreen cream
Even out face cream SPF 20	Liquorice	Oriflame Cosmetics, Sweden	Sunscreen cream
Antiwrinkle Moisturizing lotion SPF 30	Emblica	S B Cosmetics Inc, Florida	Anti-wrinkle lotion
Resist Super antioxidant concentrate serum	Turmeric	Paula's Choice, Canada	Antioxidant serum
Biovera SPF 75	Aloe vera	Biotique Botanical Herbal Extracts, India	Protective body lotion
Save face and body sunscreen SPF 15	Bitter orange	Arbonne Cosmetics. U.S.A.	Sunscreen lotion

CONCLUSION

Herbal plants offer a promising avenue for natural sun protection through their antioxidant, anti-



inflammatory, and UV-absorbing properties. Although they rarely match the SPF performance of conventional sunscreen filters on their own, they play an important role as photoprotective adjuncts and SPF boosters. Ongoing research and improved formulation technologies may enhance the stability, absorption, and efficacy of plant-based sunscreens, making them viable alternatives for consumers seeking natural skincare solutions. Therefore, herbal plants are a great choice for healthy and natural sun protection

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