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A review on Medicinal plants as potential source of sun screening agents

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ABSTRACT

The severe exposure to dangerous sun radiations causes several skin illnesses such as sunburn, pigmentation, wrinkles, dermatitis, urticaria, ageing, skin malignancies, and immunological suppression. The severe exposure to damaging solar radiations causes cancer and immunological suppression. strategies to prevent skin ageing, sunburn, and other problems caused by the sun UV (ultraviolet) radiation is a type of radiation that is emitted by the sun. Sunscreens work by shielding the skin from the sun's rays. UV and visible solar rays are absorbed. Herbs have mostly used in medicine and cosmetics, and their ability to heal a variety of skin problems, as well as decorate and improve the appearance of the skin, is well recognised. The topic of discussion in this review article is numerous plant-derived compounds that act as sunscreen agents, such as Aloe Vera Green tea etc.

INTRODUCTION

In cosmetics herbs have ability to improve skin related problems.(**Kawther T. Khalaf et.all 2021**). Herbal cosmetic preparation is a ointment, spray or additional topical products which care for the skin from the sun's ultraviolet (UV) radiation, or reduces sunburn and other skin problems, with the aim of decreasing the threat of skin cancer with the help of natural constituents **(Rajendra Jangde* and S. J. Daharwal 2011).** Ultraviolet (UV) radiation is distinct as that part of the electromagnetic spectrum between X rays and visible light, A Sunscreen preparation used as photo protecting agents for UV protection, and is defined as a formulation which applied topically, for protection against sunburn. **(Priyanka Kantivan Goswami et. all 2013)** Sunscreen products serve as the body's natural defence mechanisms to guard against dangerous UV radiation by the sun to absorbing, reflecting, or scattering the sun's rays.

The Benefits of Herbal Sunscreens

- Easily available.
- No adverse effect
- There is no need for any specific equipment.
- Natural constituents are easily available
- Cheap (Rajendra Jangde et.all 2015)
- The specification of ideal sunscreen compounds
- It should absorb or filter off the rays that cause sunburn, which are in the 2900-3300 Angstrom range.
- It must have stable against of light, air, and moisture, or if it is decomposed in the presence of air and light, the decomposition products must exhibit similar absorption to the previously decomposed compound in the 2900 to 3300Angstrom area.
- It should have extremely little absorption for long UV radiation beyond 3400 Angstroms, which are thought to cause tanning without causing erythema.
- Nontoxic and nonirritating compounds and breakdown products should be used..
- On the skin, the presence of acid or base. It should be approximately neutral to avoid unfavourable consequences.
- They have good solubility in the ointment base or vehicle
- It must have less water solubility to prevent immediate removal by perspiration.
- Have relatively nonvolatile so it will not evaporate under conditions of use.
- It must not be quickly absorbed through the skin.**(Priyanka Kantivan Goswami et.al2013)**

Photo protection -Sunscreens products provide inadequate protection to UVR and function against sunburn from UV-B radiation. They provide more degree of protection from UV-A radiation The only reliance on sunscreens can

have the unintended consequence of lengthening outdoor exposure times, especially in those who burn quickly and then suffer from the consequences. **(S. J. Daharwal et.all 2011)**

There are three forms of ultraviolet rays

I. ultraviolet A (UVA),
II. ultraviolet B (UVB),
III. ultraviolet C (UVC)

I. UVA rays
It has a longer wavelength than other types of UV light, but has less energy, so it has a better ability to penetrate the skin and affect deep cells. It causes visual effects such as wrinkles, and its effect is associated with some skin cancers because of indirect DNA damage, rash skin aging. UVA is one of the different types of UV rays that reaches the earth and is not absorbed by the ozone layer It produces an immediate tan and may result in sunburn. In tanning beds, UVA rays are the primary source of light.

II. UVB rays
Energy levels are upper but Wavelength is lower than UVA rays. The outer layers of skin injure by UVB rays and directly destroy DNA and most skin cancers are caused by UVB rays, they can also show the way to premature skin aging. The cappotential partly absorbed through the ozone layer, 5% of UVB rays attain the earth. Excessive exposure to UVB rays leads to sunburn. frequently, the effects of UV rays are late, or appear a few hours after sun exposure.

III. UVC rays
Of the three types of ultraviolet rays, they have the highest energy levels and the shortest wavelength. As a result, they do harm to all living things. UVC rays never reach the ground because they are totally absorbed by the ozone layer. They are represented by human sources of ultraviolet radiation, such as specific bacteria-killing lamps, welding lamps, and mercury lamps, and while they do not cause skin cancer, they do cause eye and skin damage.Based on wavelength it is measured in nanometers (nm = 0.000000001 meters or 1 x 10-9 meters) (**Kawther T. Khalaf et.all 2021**)

Mechanism of action of skin damage by UV radiation

(A) Direct DNA damage

(Amaro-Ortiz A, Yan B et.all 2014).

(B) Indirect DNA damage

UV-B rays are more risky than type UV- A because UV –A rays are not active enough to damage or alter the DNA directly. However, it may aid in the formation of dangerous oxygen radicals, Its directly attack DNA, adding to it by altering proteins and fats in such a way that they are harmful to DNA. This damage is attention to cause cancer. This type of damage is caused by ultraviolet rays (UVA) used in tanning beds and booths, so continuing exposure to this raises the risk of developing skin cancer (**Kawther T. Khalaf et.all 2021**).

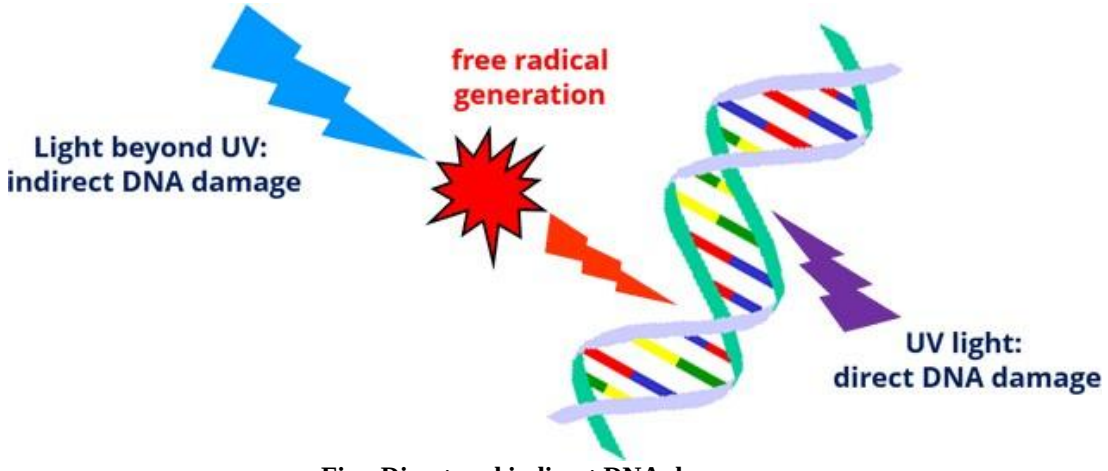

Fig.- Direct and indirect DNA damage

UV-absorption and UV-induced oxidative stress

Oxidation events originate and often perpetuate skin damaging actions. Antioxidants are frequently utilised to protect skin against UV damage via intrinsic routes. In fact, natural chemicals' antioxidant effects are weak and are linked to their photochemical characteristics. Phototoxic or photoprotective effects occur when a natural substance absorbs UV light. When photon energy is absorbed by phytochemical ingredients, electrons can be translocated from occupied (ground state) to unoccupied (S1, S2) orbitals, resulting in the production of excited botanic species. This excitation starts in the singlet state and progresses to the excited triplet state by spin inversion caused by inter system crossing of absorbed energy.

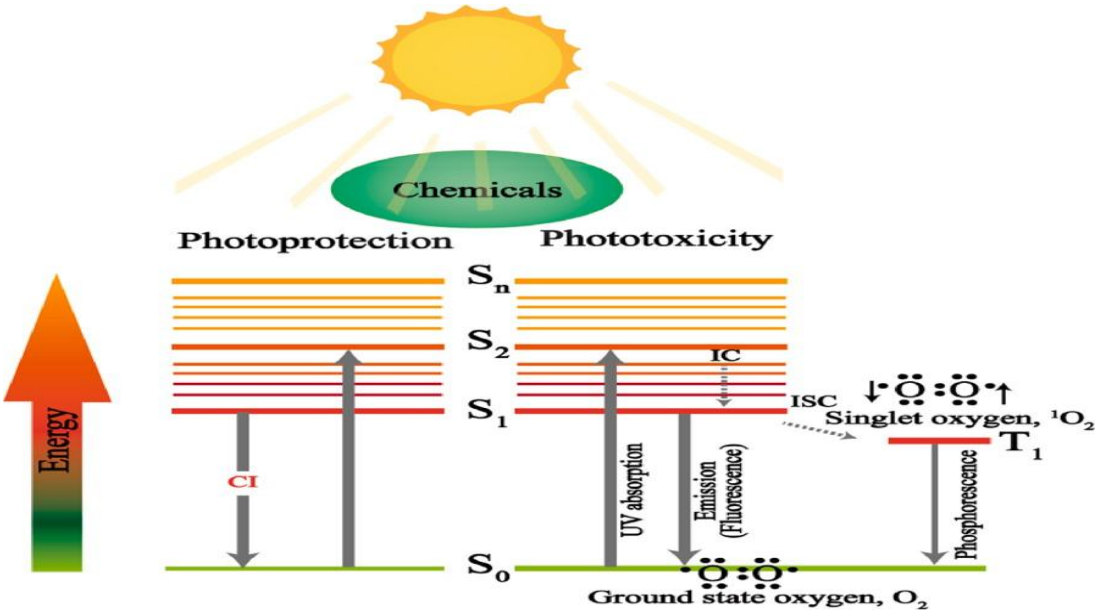

Fig.-Photoprotection

Energy transfer from an excited triplet photosensitizer to an oXygen atom (type II photochemical reaction) could result in an excited singlet oXygen, which could be implicated in the oxidation of proteins and membrane lipids, as well as the induction of DNA impairment. Free radical species can develop as a result of hydrogen or electron exchanges (type I photochemical reaction). These effects promote biomolecule production or, in the presence of oxygen, the formation of secondary free radicals such highly reactive hydroxyl or peroxyl radicals, which are known intermediates in the oxidative destruction of DNA and other biomolecules.

These photochemical responses of excited photosensitizers may result in;

I. Photoirritation by oXidative damage to proteins and cellular lipids,
II. Photogenotoxicity through DNA damage,
III. Photo allergy by formation of photoantigens

Phyto-photoprotection

Phytoconstituents are highly popular in cosmetics these days since they not only protect you from damaging endogenous toxins, but they also help you seem younger.Not only does it defend against endogenous and external agents, but it also protects against a variety of skin illnesses.**(Saraf S, Kaur C.et.al2010)**

Overexposure to the sun can lead to skin cancer and photoaging. As a result, fine lines, wrinkles, and elasticity loss develop. Hyperpigmentation marks can form on the skin. Herbal extracts have the capacity to heals and softens the skin while also acting as a sunscreen.**(Ichihashi M, Ando H, Yoshida M,et.al 2009)**

Phytoconstituents such as resveratrol, quercetin, and silymarin were chosen. Vitamin C,which is not only helpful for skin conditioning but also for hair growth. It is thought to be beneficial to the creation of herbal beauty formulations. This can help to reduce the risk of skin cancer and the ageing process.**(Stallings AF, Lupo MP 2009)**

Flavonoids

These are secondary metabolites found in plants that have the ability to absorb sunlight and hence block damaging radiation. UV rays have antioxidant properties and regulate the immune system. a number of signalling routes The presence of floral pigments is a sign of quality.**(Nunes AR, Vieira ÍG,et al 2018)**

Flavonoid has a distinct property in most angiosperm groups .They are, however, not only found in flowers, but in all living things. plant components Flavanols are one of the most essential types of antioxidants. It is also the foundation for flavonoids that have a ketone group proanthocyanin. It can be divided into several divisions based on its purpose**. (Harborne JB. Flavonoids 1977)**

The degree of unsaturation, the oxidation, and the carbon of the ring C the ring B is joined here. Isoflavones are flavonoids with a ring structure.

Terpenoids

Terpenoids, also known as isoprenoids, are a group of chemicals made up of isoprene units (a five-carbon compound) with a variety of basic skeletons as well as functional groups. The terms "terpene" and "terpenoid" are frequently used interchangeably **(Yermakov AI, Khlaif et.al 2010)**

Terpenoids" are sometimes included in the term "terpene," and They're referred to as modified terpenes somewhere. Terpenoids Both terms should not be used in the same sentence. Terpenes are the types of terpanoids are chemical components with 10-15 carbon atoms.are terpenes that have had the methyl group removed in their place.

Topical Sunscreen agents- On the basis of their mechanism of action, topical sunscreens can be generally divided into two groups, chemical absorbers and physical blockers.

I. Chemical Absorber
II. Physical Blocker
III. Natural sunscreen blocker **(Cameron GS, et al.2015)**

Chemical absorber -Chemical absorbers act as absorbing ultraviolet (UV) radiation and another can be differentiated by the type of radiation they absorb, UVA or UVB, or both UVA and UVB.

Physical absorber- Physical blockers work by reflecting or scattering the UV radiation. **(Boyd AS, Naylor M, et.al 2015)**

List of some of the common chemical absorbers available and they provide protection against the UV range. Chemical absorbing sunscreens frequently contain a mixture of ingredients to get treatment against both UVB and UVA radiation. Some are also combined with physical blockers.

Table1. Herbs commonly used in Herbal sunscreen preparation

Common name	Latin name	Principle constituents
Aloe Vera	Aloe barbidensis	Barbiloin,aloe emodin
Bavchi	Psoralea corylifoliya	Psorelea, corylifolin
Turmeric	Curcuma longa linn	Curcumin, curcuminoid
Neem	Azandirachta indica	Azandirachtin,,nimbin nimbidin
Lemmon	Citrus lamonis burn	Limonene,citral,geranyl acetate
Papaya	Carica papaya	Papain,chymopapain,polypeptide
Sandal wood	Santalum album linn.	Alfa-santalol,beta-santalol

(Goswami PK et al 2013)

Natural sunscreens

Aloe Vera

The source of Aloe vera and Aloe barbadensisare leaves is the Aloe vera gel. Aloe vera gel is generally used in cosmetics and toiletries for its moisturizing and revitalizing action. It ability to maintain skin natural moisture balance and blocks both UVA and UVB rays. The sunburns and motivate immune system involvement stop by enzyme bradykinase in aloes (**Goswami PK et al 2013**).

Aloe vera inappropriate for burns caused by radiation or by sunlight. This is for its calming and cooling effect. But studies confirm that its beneficial effect is by using it at a rate of 100%

The main Properties of aloe vera is that it contains poly-saccharides, mannose-6-phosphate, and complex anthraquinones. In addition to enzymes, salicylic acid, minerals, lignin, saponins, sterols, and vitamins **(Zainab Tuama Al-Dallee et al 2021)**

The spectrophoto metric peaks have at about 297 nm of Aloe extracts and aloin from the plant so can act as a sunscreen for skin as well as hair. The photo protective activity of Aloe vera juice on Asian hair namely Black, grey which are chemically colored was determine by this study. Tryptophan content of hair treated with aloe vera juice before and after exposure to UV radiation

Tomato

The tomato fruit (Lycopersiconesculentum) is a major source of lycopene and studied for its incosmtic antioxidant activity and pharmaceutical domain. Tomatoes are rich in lycopene, a highly studied antioxidant and an anti-carcinogenic carotenoid with a strong reduction capacity. Lycopene is a carotenoid that provides red color to tomatoes. **(Priyanka Kantivan Goswami1, Mayuri Samant 2013)** It is not just a pigment, but also a powerful antioxidant, neutralizes free radicals in particular those derived from oxygen found beneath the lipid membrane and skin. Lycopene retrieves fat radicals, reduces lipid peroxidation and prevents erythema caused by UV radiation on

the skin. Lycopene can reduce the damaging effect that UV light can have on the skin and can enhance protection against short-term sunburn (sun) and cumulation effects of sun exposure (cancer).
It is effective in reducing DNA damage from exposure to ultraviolet radiation, and studies have shown that lycopene enhances skiing.(Daud FS et al 2011).

Green Tea
Green tea is made from the leaves of the Camellia sinensis plant. Polyphenols are regarded to be the most important anti-cancer mediators. (-)-epicatechin (EC), (-)-epicatechin-3-gallate (ECG), (-)-epigallocatechin (EGC), and (-)-epigallocatechin-3-gallate (EGCG) are the four primary polyphenols found in green tea (EGCG). Caffeine, flavonoids, phenolic acids, and the alkaloids obromine and theophylline are among the other ingredients. Wang et al. found that green tea administered in the drinking water to SKH-1 hairless mice had a dose-dependent prolongation in the mean time of tumour development when they were subjected to a photo carcinogenesis protocol, which was the first evidence that green tea polyphenols might have a protective role in UV-induced skin cancer. Green tea has very little UVB or UVA absorption; it is effective when administered systemically; and it protects against at least some of the biological effects of ultraviolet radiation when delivered soon after exposure.

(Goswami PK et al.2013)
Topical green tea extract dramatically enhanced the minimum erythema dose of UV on healthy human skin while also reducing UV damage indicators. The most active components were reported to be (-)-epigallocatechin-3-gallate (EGCG) and (-)-epicatechin-3-gallate (ECG). Topical application of green tea, as well as oral ingestion, has been found to protect against chemical and UVB-induced carcinogenesis and inflammatory responses in multiple mouse skin models. Topical application of (-) epigallocatechin-3- gallate (EGCG), the primary polyphenolic ingredient in green tea, was tested on human skin. UVB-induced infiltration of leukocytes (macrophage/neutrophils), which is a possible source of reactive oxygen species (ROS) and prostaglandin (PG) metabolites, was prevented. Humans were exposed to UVB irradiation at four times their minimum erythema dosage (MED) on sun-protected skin, and skin biopsies or keratomes were taken 24 or 48 hours later**.(Kawther T. Khalaf et.al 2021)**

Grapes
Grapes (Vitisvinifera) have the highest concentration of polyphenols (60 percent -70 percent). Resveratrol (trans-3, 5, 4-trihydroxystilbene) is a polyphenolicphytoalexin found in the skin and seeds of grapes. It's a powerful antioxidant with anti-inflammatory and anti-proliferative properties. .**(Stallings AF, Lupo MP 2009)**

Proanthocyanidin is found in grape seeds (Vitis vinifera) (OPC). OPC is a type of antioxidant that protects DNA against genetic alterations. Furthermore, OPC inhibits elastase, ensuring the safety of the elastin found in the skin and functioning in tandem with Vitamin C and E to protect and regenerate the skin. Grape OPCs operate by assisting in the recycling of inactive Vitamin E, converting it to the active form and therefore acting as a default Vitamin E extender. GSPs (proanthocyanidins) are potent antioxidants and free radical scavengers **(Nabiha Y, Cynthia I et al 2007)**

Cucumber
They are high in water, fibre, and essential minerals, and they relieve skin irritations and prevent water retention. Cucumber also includes ascorbic acid (vitamin C) and caffeic acid, both of which are anti-inflammatory and alleviate skin irritations. Cucumbers applied topically can aid with puffy eyes, burns, and dermatitis because these two acid components prevent water retention. Beech Tree in India The sunscreen activity of several solvent extracts of Pongamiap innata leaves (Aq, methanol, and acetone) was compared to the conventional sunscreen medication p-aminobenzoic acid.

Indian Beech Tree
The sunscreen activity of various solvent (Aq, methanol and acetone) extracts of leaves of *Pongamiap innata* was compared with the standard sunscreen drug *p*-aminobenzoic acid. Using a UV-visible spectrophotometer, the absorption spectra of several solvent extracts of this plant were measured. In the UVB zone, aqueous and methanol extracts were found to be extremely efficient, whereas in the UVA region, they were only moderately effective. Acetone extract was discovered to absorb primarily in the UVA spectrum. The extracts of this plant's leaves have a high absorption across the UV spectrum, including UVA. As a result, P. Pinnata extract can be used to create highly effective sunscreens.

Almonds
Almonds are the commercial name for almonds.Polyphenolic chemicals, particularly flavonoids and phenolic acids, are abundant in seeds. UVB protection is available.The skin extract of this plant was put to the test. The UVB radiation was used to expose mice, and the results were examined.lipid peroxidation and glutathione levels have changed.Mice were given a prepared lotion to apply to their skin after they had been skilled. The effects of irradiation as well as the effects of 2 hours before to irradiation were observed. Glutathione levels are high, with

higher levels of lipid peroxidation and lower levels of lipid peroxidation. The findings revealed that current events are important.The use of a cream formulation has a considerable impact.qualities that are anti-oxidant and anti-photo ageing.

Saffron

Saffron was tested for anti-solar action by Golmohammadzadeh SH et al. Saffron (Crocus sativus) pollen was dried and ground in a blender. Lotions containing 2, 4, and 8% grinded saffron, and a control lotion base not including saffron were among the experimental compositions. According to FDA, the saffron lotions were made in the same way as homosalate lotions. The sun protection factors of the formulations were measured using an in vitro spectrophotometry method (SPFs). According to the findings of this study, saffron can be utilised as a natural UV absorbent.

Shea butter

Shea butter is a kind of butter made from shea .The fat from the shea nut is used to make shea butter (Vitellariaparadoxa). The shea tree is indigenous to Africa's savannahs. Shea butter melts at room temperature and absorbs quickly without leaving a greasy residue. It contains vitamins A and E as a antioxidants , which encourage skin cell regeneration and blood circulation beneath the skin's surface. The oil's cinnamic acid provides important UV protection.

Shea butter

Jojoba Oil

The desert shrub jojoba (Simmondsiachinensis) is used to treat eczema, psoriasis, and dry skin. Jojoba oil is a good moisturiser for dry skin, and it also includes myristic acid, a natural plant component that gives some UV protection.

Jojoba

Carrot seed oil

Carrot (Daucuscarota) seed oil could be a powerful antioxidant, antibacterial, antifungal, and aromatic volatile oil with a high fat-soluble vitamin content .When applied locally to the skin as a diluted resolution, Carrot seed oil, a carrier oil, also give natural sun protection. According to a research paper released in 2009, "Pharmacognosy Magazine" published a list of products Carrot seed oil-based sunscreens include a natural SPF of 38 and40.

Carrot seed

Soybean Oil

Soybeans (Glycine Max) are a healthy and cost-effective sunscreen ingredient. Soybeans are a good source of important fatty acids, protein, lecithin, iron, and calcium in the diet. They are originally from China. Soybean oil is a cost-effective moisturiser when used topically on the skin as compared to other oils, and it has a natural SPF of 10.

Soybean seed

Evening primrose oil

Evening primrose (Oenothera spp.)oil has a high γ-Linolenic acid content that promotes healthy skin and skin rejuvenation Its colour is usually yellow. It relieves skin irritation and inflammation, making it an excellent choice for anyone suffering from eczema, psoriasis, or any sort of dermatitis. Evening primrose skin oil helps to prevent dry skin and premature skin ageing.

Evening primrose

Perspective on the future

Harmful radiation can cause a variety of skin problems, including skin cancer. The ultimate solar protection should be affordable, effective, and easy to use. It should be safe and have a tendency to block UV rays, With the usage of synthetic materials,(oxybenzone, octinoxate, homosalate, nanoparticles, and amino acids)For example, benzoic acid, Oxylisadimate, Padimate O, Roxadimate, and others)

Other harmful effects, such as contact, may occur as a result of radiation shielding.allergic reactions, endocrine disruption, photoallergies, melanoma, and reproductive problemstoxicology, skin irritation, hormonal disruption, and other issues As a result, nowadays Herbal sunscreen formulations are progressively displacing chemical sunscreen formulations.Sunscreen that is fashionable but has negative side effects. As a result, we'll go on.the concept of using natural substances and plant metabolites becauseThey have the ability to shield themselves from UV rays because of their pigmentation.

CONCLUSION

Days with sunscreen correlated not with days without risk behavior, but with days "sunbathing with the intention to tan," indicating that sunscreens were used as tanning aids to avoid sunburn. Herbs have long been used in medicine and cosmetics, and their ability to heal a variety of skin problems, as well as decorate and improve the appearance of the skin, is well recognised. The topic of discussion in this review article is numerous plant-derived compounds that act as sunscreen agents, such as Aloe Vera, Green tea etc.

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