

An Overview on Sunscreen

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ABSTRACT

The review basically emphasis on various herbal ingredients which have potential for photoprotection. Ultraviolet rays are the major cause of sunburn which further leads to dangerous skin cancer. This review focuses on various herbs with active constituent responsible for photoprotection. Human beings are daily exposed to ultraviolet (UV) radiation from the sun; being situated at the interface between the body and its environment. the skin directly suffers from the deleterious effects of UV radiation. UVB (280–320 nm), regarded as “the burning rays”, makes up 4% to 5% of UV light but is also the most active constituent of solar light. The depletion of the ozone layer has increased our risk of sun damage from harmful UV rays. It Helps Maintain an Even Skin Tone: Sunscreen helps prevent discoloration and dark spots from sun damage, helping you maintain a smoother and more even skin tone. SPF is determined by the UV spectroscopy, In vitro SPF, Mansur equation. Sunscreen is defined as substance that protects the skin from excessive exposure to the ultraviolet radiation of the sun. Sunscreen use is often proposed for sun protection because of their ability to block UV-induced sunburns (the sun protection factor –SPF). Sunscreens are found in cream, lotion, gel, stick, spray, and lip balm type’s forms. They are for external use only.

KEYWORDS

SPF, Sunscreen, protein factor, UV light, Epidermis, Dermis, Hypodermis, Carrot seed oil, Aloe vera, Bees wax, Coconut oil, Green tea, Vitamin E, etc.

I. INTRODUCTION

A sunscreen preparation is defined as a formulation which, when applied topically, protects the treated area from sunburn. Sunscreens are used to aid the body's natural defence mechanisms to protect against harmful UV radiation from the sun. UVA and UVB rays cause skin melanoma,

sunburn, photo ageing, skin pigmentation and various painful effects. Solar ultraviolet radiations (UVR) is divided into three categories: UV-C (200- 280 nm), UV-B (280-320 nm) and UV-A (320- 400 nm). UV-C is the most biologically damaging radiation, but it is filtered out by ozone layer. Currently UV-B radiation and to a lesser extent UV-A radiation are responsible for inducing skin cancer. Preparations containing herbal ingredients or extracts can be prepared as they are safe to use because they contain natural substances having less side effects, are renewable sources, are under GRAS (Generally Regarded as Safe) category, and are less expensive. Sunscreen works by filtering (not blocking) UV radiation with a chemical barrier that absorbs and/or reflects the UV rays away from your skin. Ability of sunscreen to protect against sunburns depends upon optimising water resistance capacity and its SPF rating. SPF stands for ‘sun protection factor’. The SPF protects against UVB radiation. A sunscreen is given an SPF number (of between 4 and 30+) after strict laboratory testing. Herbal sunscreens are eco-friendly with no comedogenic and side effects. Sunscreen known as sun blocker, sunburn cream etc. It is a topical product that absorbs or reflects some of the ultraviolet radiations on the skin exposed to sunlight and thus shows protection against sunburn. Long-time phytoconstituents have been used in cosmetics, have proven potential in various skin-based therapy including moisturising, anti-aging, antioxidant and sunscreen. Use of natural phytochemicals and herbal extracts in the field of skin care cosmetics and UV protection represents a new trend in the cosmetic industry.

ANATOMY OF SKIN SKIN:

The skin is the outermost layer of the body, which acts as a barrier to protect from the external environment. The purpose of sunscreen preparation is to resist skin from painful effects of sunburn and skin cancer. The skin has up to seven layers of ectodermal tissue and monitors the

fundamental muscles, bones, tendons and inside organs. Human skin is like the majority of the warm-blooded creature's skin, and very much like pig's skin.

The skin is the cutaneous membrane that covers all body which is the largest organ of the body about 10% of body weight on average, having an area of about 1.7 square metres and weighs 4.5-5 kg, it is 0.5 – 4 mm thick, thinnest on the eyelids.

ANATOMY OF SKIN:

Commonly skin is composed of 3 layers. Each layer has certain functions:

- 1.Epidermis
- 2.Dermis
- 3.Subcutaneous fat layer (hypodermis)

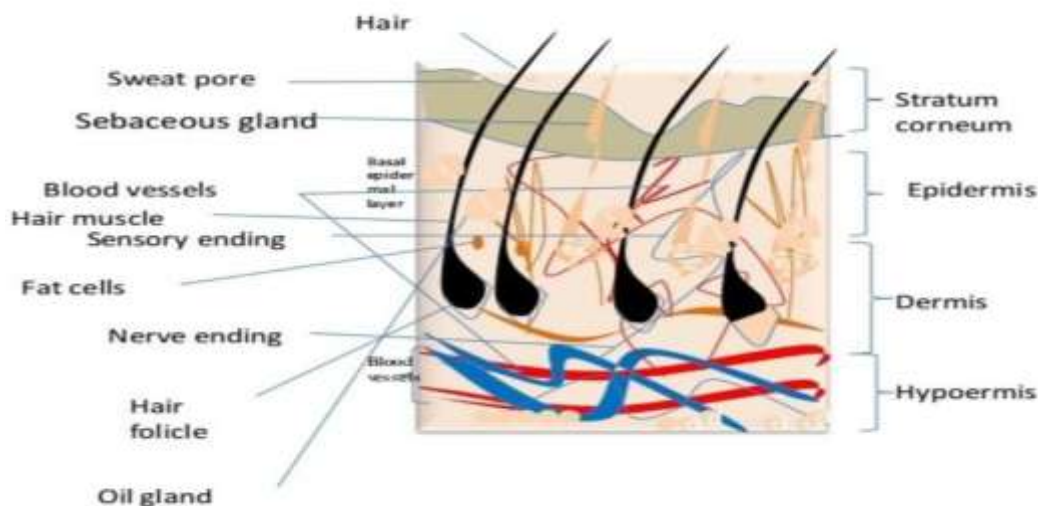


Fig. Anatomy of skin

A.EPIDERMIS:

Epidermal layer is the outermost layer of the skin act as a physical and biological barrier to the external environment, prevents the loss of water and maintains internal homeostasis, preventing penetration by irritants and allergens, stratified squamous epithelium mainly composed of keratinocytes, produces the protein keratin and are the major building blocks of the epidermis. The epidermis is divided into four layers according to keratinocyte morphology and the degree of differentiation into cornified cells (the outermost layer is called the stratum corneum). The epidermis is the outer layer, formed by a stratified, squamous epithelium composed mainly of keratinocytes and also dendritic cells (melanocytes, Merkel cells, and Langerhans cells).

B. DERMIS:

The dermis is the middle layer basically made up of collagen and amorphous connective tissue containing nerve and vascular networks, epidermal appendages, fibroblasts, macrophages, and mast cells. Dermis consists of about 15-20 %

of total body. Dermis composed of mast cells and fibroblasts, ground substances, blood vessels, lymphatics, sweat glands and nerves. The dermis was found to have three fibrous components: a papillary layer, a reticular layer and a cordovan-leather tissue layer.

C. SUBCUTANEOUS FAT LAYER:

This layer contains subcutaneous tissues lying below the dermis. It consists of mainly fats and provides insulation to the body from the cold, aiding shock absorption and provides main structural support for the skin. It is composed of blood vessels and nerves.

D.SKIN TYPES AND THEIR CARE:

a NORMAL:

Features: Has even tone, soft, smooth texture, no visible pores or blemishes and no greasy patches or flaky areas.

Herbs: Pomegranate leaves juice, Herbal Face Pack, Gingili Oil.

Essential oil: Chamomile, Fennel, Geranium, Lavender, Lemon, Rose, Sandal Wood, Patchouli.

b DRY :-

Features: Low level of sebum and prone to sensitivity. Has a parched look, feels “tight”? Chapping and cracking are signs of extremely dry, dehydrated skin.

Herbs: Aloe Vera, Olive Oil, Calendula Comfrey
Essential oil: Chamomile, Fennel, Geranium, Lavender, Lemon, Rose, Sandal Wood, Patchouli, Almond, Avocado

c. OILY:-

Features: Shiny, thick and dull coloured
Chronically oily skin has coarse pores and pimples and other embarrassing blemishes. Prone to black heads

Herbs: Aloe Vera, Burdock Root chamomile Horsetail, Oat Straw, Thyme, Lavender, Lemon Grass, Liquorice, Rose Buds, Witch Hazel
Essential oil: Bergamot, Cypress Frankincense Geranium, juniper, Lavender, Lemon, Sage Evening Primrose.

d. COMBINATION

Features: Some parts of your face are dry or flaky, while the centre part of your face, nose, chin, and forehead (called the T- zone) is oily.

Herbs: Witch Hazel, Menthol, Aloe Vera, Turmeric, Wheat Germ, Sweet Flag
Essential oil: Citrus Oils, Jasmine Oil, SandalWood Oil.

F. FUNCTION OF THE SKIN:

1.It acts as a protective barrier and protects the body from harmful agents, mechanical, thermal and other physical injury.

- 2.Protect from harmful effects of UV radiation
- 3.Prevent excessive loss of moisture and protein.
- 4.Acts as a sensory organ (touch, detects temperature).
- 5.Helps regulate temperature.
- 6.An immune organ to detect infections etc.
- 7.The skin and accessory structures perform a variety of essential functions, such as protecting the body from invasion by microorganisms, chemicals, and other environmental factors.

WHAT IS SPF?

SPF stands for sun protection factor, a relative indicator to shield you from ultraviolet (UV) rays for the period of time the sunscreen can protect you. The darker colour of the skin, however, is a sign of cell damage in the dermis. Usually, SPF numbers apply to UVB rays only, but certain sunscreens can also protect against UVA. The SPF value shows the amount of protection for sunburn offered by the sunscreen product. According to some guidelines there are certain standards of SPF values such as according to ANVISA (Agencia Nacional de Vigilancia Sanitaria) a SPF value greater than or equal to 6 is beneficial, where as in USFDA and FDA a SPF value greater than 2 and 15 respectively is allowed. A sunscreen with a SPF of 15 provides >93% protection against UVB. Protection against UVB is increased to 97% with SPF of 30+.SPF can be determined by in vivo or in vitro methods, but the in-vivo method is expensive and introduces the ethical testing on humans and animals. So, mostly the in- vitro method that is rapid cost effective is used.

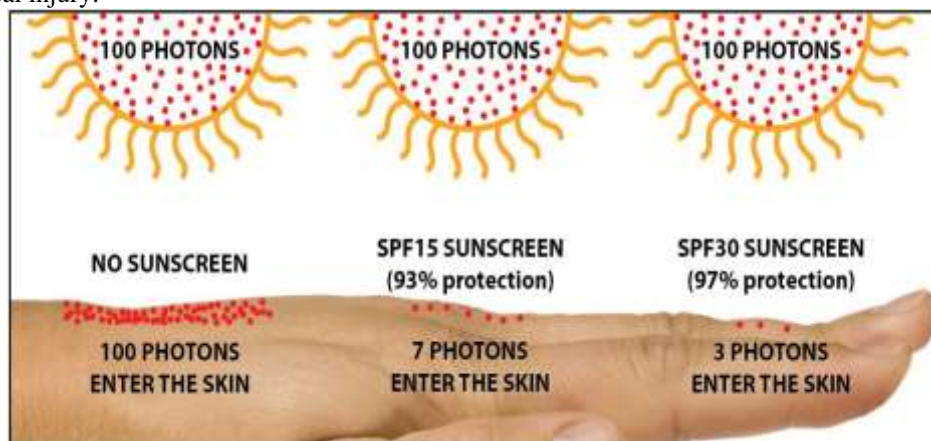


Fig.Sunscreen Level of Protection

EFFECT OF UV RAYS ON SKIN:

Chronic exposure to U.V radiation leads to damaging effects to skin. It causes sunburn and photo aging. Intermittent sunburn is a major factor for malignant melanoma. However existing chemical sunscreens are comparatively less efficient and show more side effects and toxicities.

Chronic sun exposure causes squamous cell and basal carcinomas which shows damaging effects on skin. Acute exposure to sun rays leads to redness and pigmentation which may further aggravate erythema and sunburn.



Fig.Damaging of UV Radiation

UVB is the principal cause for tanning and acute sunburn and also being immunosuppressive, carcinogenic and mutagenic. Meanwhile, the importance of the UVA biologically has been recognized. UVA causes significant photo biological reactions, mostly of indirect to the nature

and requires oxygen such as delayed and immediate tanning reactions and formation of new melanin. Exposure to sun rays causes premature skin aging called as photoaging, associated with freckling, fine wrinkling, dilation of capillaries, irregular pigmentation, and loss of elasticity.

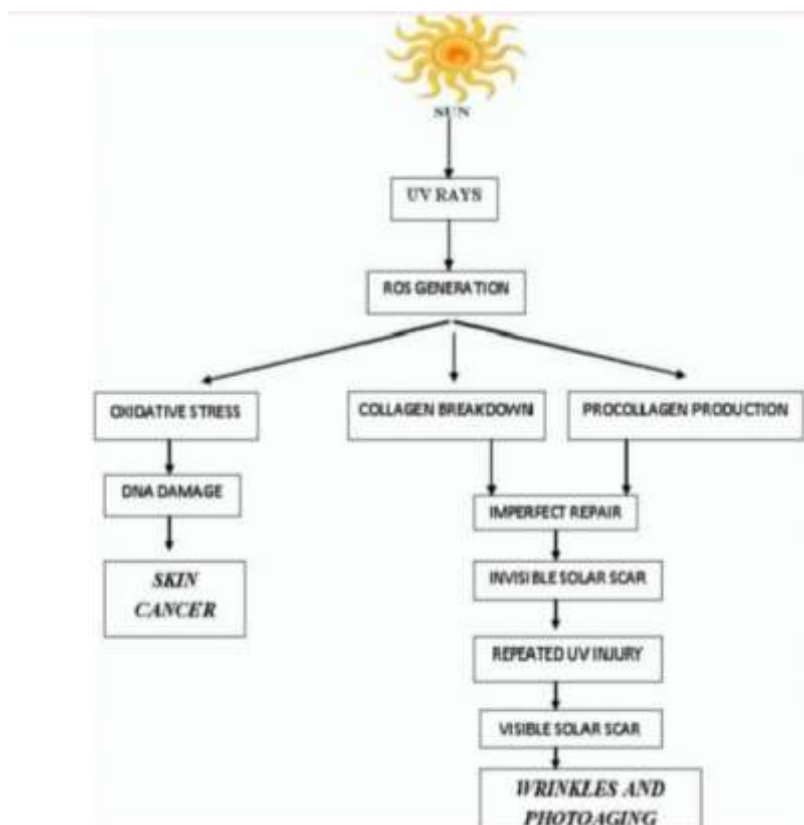


Fig. Effect of ros on skin

Reactive oxygen species (ROS) are chemically reactive species which contains oxygen. Eg -include peroxides, superoxide, radical, and singlet oxygen. ROS are natural byproduct of normal metabolism of oxygen and have major roles in cell homeostasis and signaling.

HERBAL SUNSCREEN:

Sunscreen are also known as Suntan lotion or sun block; the purpose of Sunscreen preparation is to resist skin from painful effects of sunburn and skin cancer. UV radiations shows damaging and harmful effects on skin. It is beneficial to use herbal ingredient as they do not provoke allergic reactions, do not show any negative side effects, do not show any comedogenic effect. Herbal constituents can be easily incorporated in formulation. They are more effective, rich with its stability safety, purity, cost effectiveness, easily available and found in large variety of plants. Because of all above benefits several plants compounds have gained considerable attention as skin protective agent. The next move was to look into other cultural treatments and to dissect countries around the world's ethno pharmacy and use our skills to assign chemicals that may be responsible for the benefits of the skin. There have been many new active molecules found and many more to be discovered. As it has been shown that topical antioxidant supplementation has an effect on the skin's antioxidant network, the application of antioxidant-rich aromatherapy formulations provides interesting avenues for future study. There are several different types of sunscreen products that can be found on the global market (oils, sticks, gels, creams, lotions). Generally, sunscreen is used to protect skin from damaging effects of sunrays. Diligent use of sunscreen can also help to slow or temporarily prevent the development of wrinkles, dark spot, sagging skin.

BENEFITS OF HERBAL SUNSCREEN:

- Easily available.
- No side effects.
- Absorbs radiation preferentially in the range of 280-320 nm.
- Are stable to heat, light and perspiration.
- They are more effective, rich with its stability safety, purity,
- Cost effectiveness, easily available and found in large variety of plants.
- They should be non-toxic.
- No irritation should be caused on skin.

- They should not be readily absorbed by the skin.
- These products should be readily soluble in suitable vehicle used in the preparation.
- Be neutral.

A number of people with sensitive skin, such as those suffering from hypersensitivity of skin will not mostly prefer chemical sunscreens due to concern about skin exposure to unknown chemicals. Even though many hypoallergic cosmetics were released in market for sensitive skin, there are still limited options in sunscreens. Hence it is better to use the sunscreens containing herbal ingredients which are more suited for sensitive.

THE SUNSCREEN CAN WORK IN DIFFERENT WAYS:

A protective layer can be formed on skin that prevent the UV rays to reach the skin either by absorbing or by reflecting them. Zinc oxide and titanium dioxide both have such property. But this preparation has disadvantages of eliminating the beneficial rays along with the harmful ones.

To incorporate substances in preparations to filter the sun rays by absorbing medium range UV rays (280nm-320nm) but allowing rays of higher wavelength to pass. All modern suntan preparations are based on this principle and contains such substances.

Biologically effective substances can be used effectively to prevent symptoms of inflammation without reduction of tanning. Because the damage of cells by sunburn liberates histamine in tissue.

COMPONENTS OF SUNSCREEN

- 1.Green tea
- 2.Aloe vera
- 3.Vitamin E
- 4.Carrot seed oil
- 5.Coconut oil
- 6.Bees wax.

1.GREEN TEA

Botanical name: *Thea viridis*

Family: Theaceae

Part used: Leaves

Active chemical constituents: (-)-Epigallocatechin-3-O gallate (EGCG)

Green tea extract contains several polyphenolic components with antioxidant properties, but the predominant active components are the flavanol

monomers known as catechins, where epigallocatechin-3-gallate and epicatechin-3-gallate are the most effective antioxidant compounds. Topical administration likewise provides great benefits, including protecting against damage that can contribute to skin cancer and skin aging. EGCG, a prime component of green tea, provides broad-spectrum protection against UV light induced DNA damage and immune system dysfunction of the skin. Leaves of these plant are popular nutraceutical used as antioxidant. Antioxidants protect the cells from lethal effects of

ROS such as singlet oxygen, superoxide, hydroxyl radicals. These radicals are produced due to uv ray's penetration. Chemical constituents are Vit-E, tocopherols, catechins, polyphenols & carotenoids which shows antioxidant property so, it is used as herbal sunscreen agent.

Uses:

Reduces Risk of Cancer. Sunscreen helps protect you from the sun's harmful ultraviolet rays – even on cloudy days. Minimizes Skin Disorders. Age Defense. Healthy Skin and Tone. Antioxidants



Image. Green tea

2.ALOE VERA:

Botanical name: Aloe barbadensis.

Family: Xanthorrhoeaceae

Part used: Leaves

Active chemical constituents: Barbaloin, isobarbaloin anthraquinones.

Chemical constituents are glucoside and isobarbaloin and barbaloin, free anthraquinones like emodin, iso-emodin, quercetin, rutin and chrysophanic. This plant mainly known for its cooling & soothing effect but it is ineffective when used in less than 50% & is very effective if used in 100% pure form. It has scientifically evident to

treat all type of burns be it radiation or thermal & all wound healings also. It is mostly used as sunscreens, moisturizers, suntan agent & also acts immune enhancer due to its high levels of antioxidant. The photo protective activity of Aloe vera juice on hair was studied by measuring the content of tryptophan in the hair before and after treatment with Aloe vera, and exhibited that the hair untreated with aloe had higher level of chemical damage than that treated with Aloe vera juice, hence it can offer Protection from UV damage. SPF value: 0.0995

Uses :- Soothing, moisturizing, healing and used against sun burn.



Image. Alo vera

3. VITAMIN E:

Synonym: alpha-tocopherol, tocopherol, tocotrienol.

Alpha-tocopherol is the major lipophilic antioxidant in plasma membranes and tissues. The term vitamin E collectively refers to 30 naturally occurring molecules (4 tocopherols and 4 tocotrienols), all exhibit vitamin E activity. Its major role is generally considered to be the arrest of chain propagation and lipid peroxidation by scavenging lipid peroxy radicals, hence protecting the cell membrane from destruct. Both plants and animals serve as a source of vitamin E. It has been

found beneficial against certain types of cancer & cardiac problems. It is known as 'scavenger of free radicals'. Vitamin E is mainly present in nuts, whole cereal grains, almonds, vegetable oils etc.

Uses:

Vitamin E helps maintain healthy skin and eyes, and strengthen the body's natural defense against illness and infection (the immune system). Vitamin E also has antioxidant properties. There is insufficient evidence on whether vitamin E oil can remove dark spots. The only evidence is that it can protect from the damaging effects of the sun and reduce depigmentation in melasma.



Image. Vitamin c

4. Botanical name: *Daucus carota*.

Family: Apiaceae.

Active chemical constituents: β -carotene, ascorbic acid and tocopherol.

It is a valuable herb since ages as it is rich natural source of Vitamin A along with other essential vitamins. Carrot seed oil is indicated for anti-aging, revitalizing and rejuvenating. As it promotes the formation of new cells and helps in reducing wrinkles. The main active constituent responsible for sunscreen and antioxidant activity

is beta carotene. This material is also known as provitamin A and is often used in UV sunscreen preparations as a boost to the efficacy of the product. It has long been known that this material is also a powerful antioxidant. SPF value: 38 to 40. Up to 5% oil tincture is used in sun preparations to achieve desirable activity against sunburns. Carrot oil clears the complexion; it gradually dissolves the hardened (cornified) cores of blackheads.

Uses:

Carrot seed oil is safe to use as a sunscreen.



Image. Carrot seed oil

5.COCONUT OIL:

Botanical name: *Cocos nucifera*.

Family: Arecaceae.

Active chemical constituents: Lauric acid.

The melting point of coconut oil is 24 to 25 °C (75-76 °F) and thus it can be used easily in both liquid or solid forms and is often used in cooking and baking. Coconut oil is excellent as a skin moisturizer and softener. A study shows that

extra virgin coconut oil is effective and safe when used as a moisturizer, with absence of adverse reactions.

Uses: Moisturizing dry skin, including in people with conditions such as eczema. Reducing inflammation, which may result from UVB rays. Promoting wound healing. Antibacterial, antifungal, and antiviral properties.



Image. Coconut oil

6.BEES WAX

Botanical name: *Cera alba*.

Family: Apidae

Active chemical constituents: Carbon (73.3%), hydrogen (13.2%) and oxygen (7.5%).

Beeswax can create a protective layer on the skin. It's also a humectant, which means that it attracts water. Both of these qualities can help the skin stay hydrated. Beeswax is also a natural exfoliator, ideal for sloughing away dead skin cells. It also has antibacterial, anti-inflammatory and antiviral properties, which can help protect the skin as well," Hadley adds. It repairs damage, promotes the skin's regeneration, diminishes the appearance

of the signs of aging, soothes itchiness and irritation, and creates a hydrating, long-lasting protective barrier against environmental pollutants. Beeswax contains vitamin A which has been proven in multiple studies to reduce wrinkles and age spots. Beeswax protects lips and retains lip moisture. Beeswax has lubricating, softening activities and reduces trans-epidermal water loss from skin. This means it helps protect lips from becoming dry or chapped.

Uses:

Beeswax will not clog pores and it creates a barrier for your skin that helps heal, protect, and hydrate.



Image. Bees wax

NEED TO STUDY:

There is evidence from regulatory agencies that though synthetic sun blocker have fast sun protective action but simultaneously it have potential risk associated with it. Results from CDC held in 2007 reported that mothers with high levels of oxybenzone (Benzophenon-3) in their bodies were more likely to give birth to underweight baby girls.

It is beneficial to use herbal ingredient as they do not provoke allergic reactions, do not show any negative side effects, do not show any comedogenic effect. Herbal constituents can be easily incorporated in formulation. They should not be readily absorbed by the skin. These products should be readily soluble in suitable vehicle used in the preparation. Quantities of ordinary and novel natural makeup are valuable to treat harmed skin. Herbal sunscreens are quickly supplanting the advanced sunscreen containing UV-channels because of related results with UV channels. Numerous natural sunscreens are accessible in

market as creams, moisturizer, and gel having named SPF. Also, there are plants accessible that have given signs of shielding themselves from extreme warmth and UV radiation from the sun and they are fascinating.

II. CONCLUSION:

UV radiation causes many skins related problems like premature aging, wrinkles, sunburn, suntan, skin cancer. So, everybody need protection from this harmful radiation. There are many options or different ways to protect our skin from radiation one of the better options is to prevent direct exposure to sunlight but this is impossible mainly during summer because of this reason we need to use sunscreens. The ingredients used in the cream are easily available and the evaluation parameters performed showed better results. The present study reveals that UV spectrometry is a acceptable, economic, reproducible and rapid method for the evaluation of herbal sunscreen.

Product name	Photo	SPF Reported	Key Ingredient
Mama earth		SPF 50 PA+++	Carrot seed and turmeric
Lotus		SPF 40 PA+++	Birch
Patanjali		SPF 30	Coconut oil Turmeric Aloe vera
Biotique		SPF 50+	Sandalwood honey

Fig. Marketed products of sunscreen

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