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A REVIEW ON ROLE OF HERBAL COSMECEUTICALS FOR PHOTOPROTECTION

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ABSTRACT

Many skin problems such as sunburn, pigmentation, ageing, skin cancer, dermatitis, wrinkles and immune suppressions are caused by the extreme exposure to the harmful sun radiations. We can use sunglasses, clothes and other material to cover our skin but this is not a proper way for the protection of our skin or body from the sun rays. For the prevention, sunscreen cream is widely used by the people. The sunscreen cream can be synthetic or natural. This cream is formulated and evaluated by appearance, colour, odour, viscosity, solubility, stability, rancidity, skin irritation test, in vitro evaluation by UV spectroscopy, and sun protection factor (SPF). The SPF is a kind of measure to know about the effectiveness of the product used in the skin for the prevention of the harmful effect of the ultraviolet radiation from the sun. It is important to apply the sunscreen regularly on the skin for continued effectiveness.

Keywords: Sunscreen cream, SPF, UV Radiations

INTRODUCTION:

In order to prevent UV-related skin problems, sunscreen is a cosmetic preparation that is used to actively deflect or absorb sunlight, especially in places with ultraviolet wave emulsion **[1]**. The skin serves as the body's main barrier against environmental contaminants, such as UV rays and toxins found in the environment **[2-6]**. The principal factor causing extrinsic aging, also known as photo aging and mostly brought on by UV light, is oxidative stress. The main consequences of UV radiation on

the skin are immune suppression, inflammation, DNA damage, oxidative stress, and detrimental effects on the extracellular matrix **[7-12]**. Therefore, treating the skin with products that contain functional antioxidant components may be one of the useful techniques to prevent UV-induced damage. The wavelengths of light in sunlight range from ultraviolet to visible light **[12-16]**. The skin of humans is adversely affected by sun exposure. Since plant compounds are more widely accepted and safer for the general population to use, there is currently a lot of research being done on them with the potential to be employed as active components **[16-20]**. Natural sunscreens with significant UV absorptive capacities have lower specific extinction values than artificial sunscreens, and thus are less likely to spread when applied widely in cosmetics. The greatest substitute protection against UV sensitivity is sunscreen. Sunscreen was selected as the dosage form for the cream due to its benefits, which include ease of application, increased skin comfort, non-stickiness, and ease of washing **[21-25]**.

Figure 1: Irritating skin due to UV rays

Figure 2: Skin burn due to sun light

History of Sunscreen –

The exact date that humans started shielding their skin from the sun is unknown. Natural melanin protected our dark-skinned African ancestors from sunburn. As humans migrated to colder climates, they lost their pigmentation to protect themselves from frost. Until the 19th century, Westerners covered their bodies for cultural reasons. Following World War I, tanned bodies were in style. There was no UV protection for the oils utilized. Eugene Schueller, the creator of L'Oreal, created " Ambre Solaire Huiller", the first radiation filtering lotion, in 1935. Benjamin Green created a crimson jelly substance that served as a physical barrier for the men fighting in the Pacific. It was already clear that too much sun exposure may be dangerous. Product sales

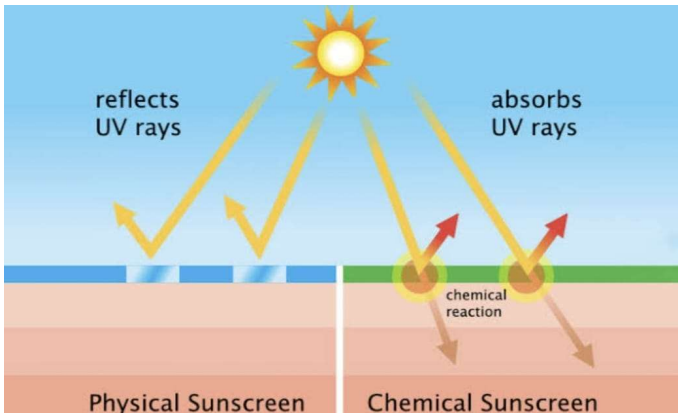
skyrocketed under the Coppertone name, Franz Greiter in 1946.

Ideal properties of sunscreen cream –

- It has to smother a wide spectrum of UV radiation that can burn skin.
- Must remain stable when exposed to sun light.
- It need to be capable of providing whole skin protection**.**
- It ought to be difficult to remove with water.
- It ought to be low concentration, safe, and chemically inert.
- It shouldn't be poisonous, irritating, or sensitising.
- It ought to be able to maintain its sun screening qualities for a number of hours**.**

Types of Sunscreen Cream:

1. Physical Sunscreen – It is commonly known as mineral sunscreen.
2. Chemical Sunscreen – These are synthetic chemical substances.



❖ **Physical Sunscreen-**

In order to protect the skin from the sun's rays, physical sunscreen forms a physical barrier on the skin. These sunscreens work by deflecting UV rays away from your skin to provide broad-spectrum protection. Additionally, they aid in preventing wrinkles and hyper pigmentation caused by UVA rays. Mineral sunscreens can also aid in preventing UVA rays from entering the room through windows, which can lead to pigmentation and collagen deterioration. That's why, even if you have no plans to go outside, it's crucial to use sunscreen every day. The majority of mineral sunscreens are made with zinc oxide and titanium oxide, two substances that the Food and Drug Administration (FDA) Trusted Source has certified as safe and efficient.

❖ ***Chemical Sunscreen-***

Sunscreens with chemicals don't stay on the skin or block UV rays. Rather, they have

active components that absorb UV radiation before your skin has a chance to absorb them. Among these chemical UV filters includes the following-

- Oxybenzone
- Avobenzone
- Octocrylene
- Octisalate
- Octinoxate
- Homosalate

Chemical sunscreens are often easier to apply on a wider variety of skin tones because they don't leave a noticeable film layer on the skin. Due to their ease of application and wear, chemical sunscreens are really preferred by the majority of clients. Chemical sunscreens often apply smoothly, feeling neither oily nor sticky, and leaving no noticeable white cast because they are made to absorbs.

Table 1: Types of skin and SPF

TYPE	DESCRIPTION	SPF	CHARACTER
I	Always burns easily and never tans	More than 8	Sensitive
II	Always burns and tans minimally	6-7	Sensitive
III	Burns moderately and tans gradually	4-5	Normal
IV	Burns minimally and always tans well	2-3	Normal
V	Barely burns and tans profusely	2	Insensitive
VI	Never burns and become deeply pigmented	None	Insensitive

Advantages –

- Sunscreen cream provides UV radiation protection.
- It stops aging too soon.
- It lowers the chance of developing skin cancer.
- It shields against sunburn.
- It stops UVB-induced tanning.

Disadvantages –

- Sunscreen with PABA has a high potential for allergic reactions.
- It might exacerbate acne.
- In places with hair, it could hurt and lead to pus in the hair follicle occasionally.

Requirement of Vitamin E –

A fat-soluble vitamin that is vital to human health is vitamin E. Although there are other forms of vitamin E, alpha – tocopherol is the type that is most physiologically active. This substance functions as a strong antioxidant, preventing free radical damage to the body's cells. A wide variety of foods, such as nuts, seeds, leafy green vegetables, and vegetable oils, contain vitamin E. There are several advantages that vitamin E can offer the skin when applied topically. Because of its emollient qualities, it can assist to increase skin hydration by retaining moisture in the skin. Well-hydrated skin is softer, smoother, and more elastic, all of which can lessen the visibility of wrinkles and fine lines. Apart from its moisturizing qualities, Vitamin E is a potent antioxidant that can aid in diminishing the indications of aging. Vitamin E has the ability to neutralize free radicals and stop their damaging effects,

which can damage skin and cause premature aging. This can enhance the general tone and texture of the skin while lessening the visibility of fine lines and wrinkles. Additionally, vitamin E contains anti-inflammatory qualities, which indicates that it can aid in lowering skin redness and inflammation. Those with rosacea or eczema, or those with sensitive skin, may find this very helpful. Vitamin E can aid to enhance the general well-being and aesthetics of the skin by lowering inflammation. Sunlight-induced UV radiation can lead to a variety of skin issues, including skin cancer, premature aging, and sunburn. Your skin's general health and appearance can be enhanced and your chance of developing these problems can be decreased by using a sunscreen with vitamin E. Apart from its anti-inflammatory, emollient, and antioxidant characteristics, Vitamin E is also involved in numerous other critical physiological processes. It is necessary for the immune system to operate properly and, by thinning the blood, it can help avoid blood clots. Additionally, studies have demonstrated that vitamin E lowers the risk of heart disease by reducing the oxidation of LDL cholesterol, which has the potential to cause plaque to accumulate in the arteries.

Overall vitamin E is a flexible nutrient that offers several advantages to the skin and body. Vitamin E can assist to prevent damage to the body's cells, enhance skin moisture, lessen the appearance of aging, and lessen skin irritation when applied topically or consumed orally. Vitamin E is a great option for anyone trying to protect and improve the health of their skin because it can increase the efficiency of sun protection and offer extra advantages to the skin when used in sunscreens.

Benefits of Vitamin E in Sunscreen –

A topical product like sunscreen can benefit the skin in a number of ways when Vitamin E is added. The following are some of the main advantages of vitamin E-containing sunscreen:

- Improved Sun Protection:-
  Sunlight-induced UV radiation can lead to a variety of skin issues, including skin cancer, premature aging, and sunburn. It has been demonstrated that vitamin E increases sunscreen efficacy and offers extra UV protection. In conjunction with other sun blocking agents such as zinc oxide or titanium dioxide, vitamin E can lessen the likelihood of developing sunburn and other sun-related skin conditions.
- Enhanced Hydration of the Skin:-

Because of its emollient qualities, vitamin E can aid to increase skin hydration by retaining moisture in the skin. Skin that has received enough moisture is softer, smoother and more applicable. This can

enhance the general texture of the skin and lessen the visibility of fine lines and wrinkles.

- Decreased Aging Signs

By scavenging free radicals, vitamin E is a potent antioxidant that can help to lessen the appearance of aging. Unstable chemicals called free radicals have the potential to harm skin tissue and hasten the aging process. In order to counteract these compounds and stop their negative effects, vitamin E can be helpful. This can enhance the general tone and texture of the skin while lessening the visibility of fine lines and wrinkles.

- Decreased Inflammation

Due to its anti-inflammatory qualities, vitamin E may be able to lessen skin irritation and redness. Those with rosacea or eczema, or those with sensitive skin, may find this very helpful. Vitamin E can aid to enhance the general well-being and aesthetics of the skin by lowering inflammation.

Table 2: Ingredients

S. No.	Ingredients	Properties
1.	Vitamin E	Photoprotection
2.	Zinc Oxide	Broad spectrum blocker
3.	Stearic Acid	Softening skin
4.	Glyceryl Monostearate	Prevent dehydration
5.	Sodium Lauryl Sulfate	Cleansing agent
6.	Triethanolamine	Balance pH
7.	Glycerine	Moisturiser
8.	Methyl Parabene	Prevent the growth of bacteria
9.	Propyl Parabene	Extend the shelf life
10.	Bees Wax	Waterproofing power & solid texture
11.	Bentonite	For effectiveness

Formulation of sunscreen cream –

- Adequate sunscreen ingredients are applied.
- A suitable base can be utilized to create an oil, emulsion, fatty cream, or watery lotion as the finished product.
- Emulsifiers are employed in formulation to maintain stability.
- Certain sunscreens contain glycerine as a moisturizer.
- The purpose of the thickening agents is to improve consistency.
- A number of natural oils, including olive, peanut, and coconut oil, can absorb UV rays quite well.
- If a natural oil is being utilized, then an antioxidant should be added to stop rancidity.
- Preservatives such as Sodium propyl paraben and Sodium methyl paraben are utilized.
- Finally, a perfume was applied.

Evaluation of sunscreen cream-

As in any other preparation identification quantitative determination of various ingredients are essential for evaluation and

quality control point of view. Apart from this routine tests some special tests are necessary for this type of product –

- Evaluation of sunscreen protection by measurement of epidermal DNA synthesis*:* To find out how well sunscreens protected the epidermis from the effects of UV light, tests were conducted on various formulations. Sunscreen protection was measured using UV light-induced alterations in the production of epidermal DNA in hairless mice. Additionally, erythema and edema were visually assessed. A recording radiometer was used to measure the UV light exposure. The outcome demonstrated that the sunscreens put to the test could only partially shield the skin against UV light-induced DNA alterations.
- An evaluation of sunscreens in patients with broad action- spectrum photosensitivity: Patients with extreme broad action-spectrum photosensitivity have been investigated in relation to the photo protection provided by three sunscreen prescription options available in the United Kingdom. According to the protection factor provided by each manufacturer, every product under investigation showed good protection against UV-B rays. Conversely, UV- A only varied from fair to poor. Research indicates that using a sunscreen with strong UV-A protection is essential for providing patients with severe broad action-spectrum photosensitivity with satisfactory care.
- Testing sunscreen with a mouse ear model*:* In order to evaluate the efficacy of sunscreen formulation during the development phase, it is preferable to have a straightforward, precise, and reasonably priced biological model. A quantitative, objective response endpoint for assessment is another desired feature. Based on the hairless albino mice's ear swelling response, we have created a test system of this kind. Irradiation times are significantly decreased with this technology; also, the response parameter is metric and may be found non-invasively using a low-cost micrometre. The protection factors derived from the mouse ear model exhibit a strong association with the sun protection factors derived from human participants. This relationship is linear throughout a broad range of values. This innovative approach provides a quick, precise, and affordable way to assess the safety and effectiveness of novel products.

Future Prospective-

Radiation exposure can cause a variety of skin conditions, including skin cancer. The

perfect sunscreen should be less expensive, safe, effective, and have a propensity to block UV radiation. In addition to contact allergies, endocrine disruption, photo allergies, melanoma, reproductive toxicity, skin irritation, and hormone disturbance, the use of synthetic compounds for radiation protection may have other harmful effects. As a result, the use of PABA-free sunscreen is quickly replacing popular sunscreen that has negative consequences. The potential of natural plant ingredients and their protection against UV-induced sunburns, cancer, and other conditions are revealed by the current study. Researchers will need to put in a lot more effort to find newer-derived sunscreen. As a result, the current work may be useful to scientists and researchers in their efforts to find and create novel compounds with sun protection properties that are both highly effective and reasonably priced.

CONCLUSION-

The goal of the current study was to develop a sunscreen cream that is stable and has appropriate UV protection characteristics. The study revealed that sunscreens containing vitamin E exhibited stability, strong antioxidant activity, and high SPF values of 33.43 and 33.50, respectively. It's also been demonstrated that these sunscreens don't cause mutations. It may be said that the current research will hopefully result in better ways to treat sunburns brought on by exposure to UV light. The study also shows that the most effective, reliable, and repeatable method for figuring out how well sunscreens work is UV spectroscopy. The results of this study can therefore be used to establish uniform guidelines for sunscreen cream formulation by manufacturers, scientific associations, and regulatory bodies.

REFERENCES-

[1] Geoffrey K, Mwangi AN, Maru SM. Sunscreen products: Rationale for use, formulation development and regulatory considerations. Saudi Pharmaceutical Journal. 2019 Nov 1;27(7):1009-18.

[2] Pratama G, Yanuarti R, Ilhamdy AF, Suhana MP. Formulation of sunscreen cream from Eucheuma cottonii and Kaempferia galanga (zingiberaceae). InIOP Conference Series: Earth and Environmental Science 2019 May 1 (Vol. 278, No. 1, p. 012062). IOP Publishing.

[3] Soleimani S, Yousefzadi M, Babaei Mahani Nezhad S, Pozharitskaya ON, Shikov AN. Potential of the ethyl acetate fraction of Padina boergesenii as a natural UV filter in sunscreen cream formulation. Life. 2023 Jan 14;13(1):239.

[4] Valverde TM, Soares BN, Nascimento AM, Andrade ÂL, Sousa LR, Vieira PM, Santos VR, Seibert JB, Almeida TC, Rodrigues CF, Oliveira SR. Anti-Inflammatory, Antimicrobial,

Antioxidant and Photoprotective Investigation of Red Propolis Extract as Sunscreen Formulation in Polawax Cream. International Journal of Molecular Sciences. 2023 Mar 7;24(6):5112.

[5] Solai I, Senthilkumar SK, Fernaandus MR, Gandhi M, Shanmugam M, Saravanan M, Selvam P. THE REVIEW ON FORMULATION AND EVALUATION OF SUNSCREEN CREAM.

[6] Jubaidah S, Syamsul ES, Wijaya H, Poddar S. Formulation cream from extract of red pidada leaves (Sonneratia caseolaris L.) as a sunscreen and analysis of active compounds with Liquid Chromatography-High Resolution Mass Spectrometry (LC-HRMS) method. Research Journal of Pharmacy and Technology. 2023;16(2):781-5.

[7] Indarto I, Rahmah GF, Sari W, Kafiana V, Rudini M. Sunscreen cream base on combination of Curcuma longa and Haematococcus Pluvialis extracts: Formulation and in vivo test. InAIP Conference Proceedings 2023 May 15 (Vol. 2595, No. 1). AIP Publishing.

[8] Taniyadukkam V, Jose J, Maliyakkal N, Beeran AA, Almoyad MA, Aleya L, Bandiwadekar A. Development and evaluation of sunscreen cream containing solid lipid nanoparticles of Spinacia oleraceae. Environmental Science and Pollution Research. 2023 Apr;30(18):51782-91.

[9] Barve MC, Bagade MM, Bhalke MG, Rode RB. formulation and evaluation of sunscreen.

[10] Bhide R, Madasu D, Patil P, Dayal N, Koppaka O, Ather S, Thakur M. Formulation, Characterization and In Vitro Evaluation of ProShine MBTMGMIHS Herbal Sunscreen cream containing Flower Extract. Research Journal of Pharmacy and Technology. 2023 Mar 31;16(3):1309-13.

[11] Shah Y, Mewada R. Preparation and evaluation of herbal sunscreen creams.

[12] Pandey P, Sharma A, Sharma H, Vyas GK, Sharma M. Novel Researched Herbal Sunscreen Cream SPF Determination by In-Vitro Model. Asian Journal of Pharmaceutical Research and Development. 2023 Apr 25;11(2):83-90.

[13] Tania BL, Dwiastuti R, Lestari AB, Setyaningsih D. Sunscreen Cream Formulation of Noni Leaf Extract (Morinda citrifolia L.) with Emulsifier Combination of Tween 80 and Lecithin. Pharmacy & Pharmaceutical Sciences Journal/Jurnal Farmasi Dan Ilmu Kefarmasian Indonesia. 2022 Dec 1;9(3).

[14] Poude B, Gurung A, Subedi HP, KC SB, Kalpana Parajuli AT. In Vitro Sun Protection Factor Determination of Selected Medicinal Plants and Formulation of Sunscreen Cream. Systematic Reviews in Pharmacy. 2022 Jul 1;13(7).

[15] Valverde TM, Soares BN, Nascimento AM, Andrade ÂL, Sousa LR, Vieira PM, Santos VR, Seibert JB, Almeida TC, Rodrigues CF, Oliveira SR. Anti-Inflammatory, Antimicrobial, Antioxidant and Photoprotective Investigation of Red Propolis Extract as Sunscreen Formulation in Polawax Cream. International Journal of Molecular Sciences. 2023 Mar 7;24(6):5112.

[16] Darmawan MA, Ramadhani NH, Hubeis NA, Ramadhan MY, Sahlan M, Abd-Aziz S, Gozan M. Natural sunscreen formulation with a high sun protection factor (SPF) from tengkawang butter and lignin. Industrial Crops and Products. 2022 Mar 1;177:114466.

[17] Pratama G, Yanuarti R, Ilhamdy AF, Suhana MP. Formulation of sunscreen cream from Eucheuma cottonii and Kaempferia galanga (zingiberaceae). InIOP Conference Series: Earth and Environmental Science 2019 May 1 (Vol. 278, No. 1, p. 012062). IOP Publishing.

[18] Yanuarti R, Nurfitriyana N, Zuchryanto M, Pratama G, Munandar A, Ilhamdy AF, Jumsurizal J, Kurniawan ID. Formulation and Evaluation of Sunscreen Cream from Moringa oleifera and Turbinaria conoides. InE3S Web of Conferences 2021 (Vol. 324, p. 05001). EDP Sciences.

[19] Gollavilli H, Hegde AR, Managuli RS, Bhaskar KV, Dengale SJ, Reddy MS, Kalthur G, Mutalik S. Naringin nano-ethosomal novel sunscreen creams: Development and performance evaluation. Colloids and Surfaces B: Biointerfaces. 2020 Sep 1;193:111122.

[20] Tania BL, Dwiastuti R, Lestari AB, Setyaningsih D. Sunscreen Cream Formulation of Noni Leaf Extract (Morinda citrifolia L.) with Emulsifier Combination of Tween 80 and Lecithin. Pharmacy & Pharmaceutical Sciences Journal/Jurnal Farmasi Dan Ilmu Kefarmasian Indonesia. 2022 Dec 1;9(3).

[21] Romanhole RC, Fava AL, Tundisi LL, de Macedo LM, Dos Santos ÉM, Ataide JA, Mazzola PG. Unplanned absorption of sunscreen ingredients: Impact of formulation and evaluation methods. International Journal of Pharmaceutics. 2020 Dec 15;591:120013.

[22] Bordes C, Bolzinger MA, El Achak M, Pirot F, Arquier D, Agusti G, Chevalier Y. Formulation of Pickering emulsions

for the development of surfactant-free sunscreen creams. International Journal of Cosmetic Science. 2021 Aug;43(4):432-45.

[23] Suwandi R, Anwar E, Maharany F, Hidayat T. Characterization and formulation of sunscreen from seaweed Padina australis and Euchema cottonii slurry. InIOP Conference Series: Earth and Environmental Science 2020 (Vol. 404, No. 1, p. 012051). IOP Publishing.

[24] Hendrawati TY, Ambarwati H, Nugrahani RA, Hasyim UH. The effects of Aloe Vera gel addition on the effectiveness of sunscreen lotion. Jurnal Rekayasa Proses. 2020;14(1):101-7.

[25] Bhattacharya S, Sherje AP. Development of resveratrol and green tea sunscreen formulation for combined photoprotective and antioxidant properties. Journal of Drug Delivery Science and Technology. 2020 Dec 1;60:102000.