e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

A REVIEW OF HERBAL SUNSCREEN CREAM SPF DETERMINATION BY IN VITRO MODEL

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ABSTRACT

Sunscreen is a chemical substance that aids in UV radiation protection. UV B radiation is what causes sunburn, while UV A may do greater harm to the skin. The optimal sunscreen should obstruct both wavelengths.

The purpose of this study was to create a topical herbal sunscreen formulation using a combination of medicinal herbs and some fixed oils. The development of melanoma, squamous cell carcinoma, and actinic keratosis is decreased by regular use of sunscreen. Chemicals in sunscreen can be either organic or inorganic. Sunblock lotion is another name for sunscreen. The products that absorb or reflect the sun's UV radiation and protect the skin.

The usage of sunscreens, which have been proven to be effective in alleviating symptoms, has grown due to the rising incidence of skin cancer and the photodamaging effects of UV radiation. Sunscreen ingredients should be completely safe, chemically inert, non-irritating, non-toxic, photostable, and capable of shielding the skin from sun harm.

Keywords: Herbal Sunscreen, SPF (Sun Protection Factor), And Skin Burn.

I. INTRODUCTION

A material that aids in shielding the skin from the damaging effects of the sun. Sunscreens offer protection from UVA and UVB rays by reflecting, absorbing, and scattering the radiation. Applying sunscreen-containing lotions, creams, or gels can help shield the skin against damage and early aging, both of which can result in skin cancer. In order to increase the degree of sun protection factor (SPF) and to heal, reduce sunburn, sun tanning, skin melanoma, and early fine lines and wrinkles, sun-block formulations must be developed Sunscreens are regularly used to shield the skin from UV radiation and lower the chance of developing skin conditions brought on by the sun's rays. Research is currently being conducted on broadspectrum sunscreens to lessen the long-term impacts of excessive UV exposure. [2]

Over the past few decades, there has been a major evolution in the usage of sunscreens as photo protectants. As more people become aware of how sunscreens prevent sunburns, aging skin, and melanomas.The need for sunscreen formulations will invariably increase, and there exists a major opportunity for pharmaceutical enterprises to supply this demand by developing excellent, efficacious, safe, and aesthetically appealing sunscreen formulations. [3] A substance called sunscreen lotion blocks the sun's harmful rays by trapping ultraviolet radiation, or UV rays. UV rays are classified into

- UVA: the longest wavelength, 320–400 nm, damages the dermis and inner skin cells, resulting in instantaneous sunburn and tanning.
- UVB: This medium-wavelength light, which ranges from 290 to 320 nm, affects the cells in the epidermis and results in blisters, sunburn, and delayed tanning.
- UVC: The shortest wavelength, ranging from 100 to 290 nm, damages the outermost skin cells, resulting in redness, ulceration, and lesions.

Certain bioactive materials in the surroundings absorb UV radiation, shielding the skin from their damaging effects. Biologically active chemicals have gained popularity in cosmetics formulations recently due to their safety, lack of unpleasant reactions, absence of hazardous chemical components, and environmental integrity. Since manmade photoprotective substances are more likely to be harmful and cancer-causing.

II. SUNSCREEN CLASSIFICATION

Sunscreens fall into the following categories:.

1. They can be categorized as follows based on how they work:

a. Physical sunscreen: Blocks harmful light from the skin.

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Eg. zinc oxide and titanium dioxide.

b. Chemical sunscreen: UV rays are absorbed

For instance, oxybenzone, avobenzone, and microfine titanium dioxide. The combination of both physical and chemical active substances is believed to be a great sunscreen. While the bulk of organic compounds used in sunscreen formulations have not been proven to be safe, physical sun blockers have a scattering effect that causes whitening phenomena.

2. Depending on the use

a. Topical: They shield the skin from harmful radiation by reflecting or absorbing it.

B. Oral: They are taken orally to prevent skin damage. For instance, carotenoids hey are taken orally to prevent skin damage. For instance, carotenoids

Two kinds of topical sunscreens exist according to how they work as protective agents.

- Organic sunscreen
- Inorganic sunscreen
- Organic Sunscreen: This type of sunscreen functions by entering into the skin and producing heat from UV radiation. Because it is thin and perfect for daily use, adding skincare components is simple. Chemically, organic sunscreen actives are based on carbon. Its active ingredient is non-mineral.
- Inorganic sunscreen: These are particles that serve as a physical barrier to absorb ultraviolet and UV light, scattering and reflecting UV rays back to the surrounding environment. Since they encompass the whole UV spectrum, they are regarded as broad spectrum. The sunblock is another name for inorganic sunscreens. [6]

III. SUNSCREEN IMPORTANCE

Because it aids in the intestine absorption of calcium, phosphorus, and vitamin D3, ultraviolet light is vital to human health. However, by directly interacting with proteins, lipids, DNA, and RNA, these radiations also negatively impact human health and may have cancerous effects. Applying any active molecule with UV-absorbing or UV-reflecting qualities topically is the most effective technique to shield skin from damaging UV rays. Because of this, sunscreen has become more important in the current situation. [8]

Using sunscreen is among the greatest and simplest methods to safeguard the health and beauty of your skin at any age. Regular use of sunscreen helps guard against sunburn, skin cancer, and early aging. Dermatologist Anna Chien answers frequently asked questions on how to include sunscreen into your daily regimen.

IV. THE PHOTO PROTECTION MACHANISM

UV radiationmediated photo oxidative damage penetrates the dermal capillaries via epidermis and dermis and causes depletion of enzymatic and non-enzymatic antioxidants in stratum corneum, epidermis, and dermis. Pre-existing melanin and its precursors will undergo photooxidation, which will cause an instantaneous and long-lasting pigment darkening.

It has been shown that wearing sunscreen increases the skin's tolerance to ultraviolet radiation by preventing and reducing the harmful effects of UV radiation. They employ two methods of operation Mineral-based sunscreens that are based on inorganic materials scatter and reflect ultraviolet radiation from the skin's surface, preventing sun rays from passing through the skin. [9]

V. REVIEW OF LITERATURE

- Velasco et al. (2008) researched and examined the creation of sunscreens with broad spectrum anti-UV radiation efficacy and lower chemical UV filter concentrations; bioactive products have been the subject of multiple studies because of environmental concerns (sustainability), low environmental impact, and safe use.
- Aloe vera, basil, green tea, almond, olive, jojoba, and cucumber are the most often used herbs in herbal sunscreen lotions, according to Ashawat et al. (2006).
- Tabrizi & Associates, 2003 Concerned with the development of sunscreen, there is significant interest in the use of natural raw materials that imply UV absorption and skin protection against UVB and UVA radiation. This is because it is linked to the benefits of the goods and customer compliance.

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- F'guyer & associates, 2003 Numerous plant-based chemicals have demonstrated antimutagenic, anticarcinogenic, and nontoxic properties. They can also significantly suppress a wide range of cellular processes at different phases of the carcinogenesis process. Ascorbic acid, ginkgo biloba, apigenin, resveratrol, curcumin, silymarin, tea polyphenols, and beta-carotenoids are a few examples.
- Movileanu & colleagues (2000) Due to their various in vivo action mechanisms, polyphenolic compounds demonstrate a wide range of pharmaceutical activities, including anticancer, antibacterial, antiprotozoa, hepatoprotective, vasoactive, antithrombotic, antiallergic, and antioxidant.
- Robbins (2003) Among the important groups of advantageous phytoconstituents include high molecular weight polypenols, flavonoids, and phenolic acids
- Baby et al. (2006): Movileanu et al. (2000).Because of their various in vivo action mechanisms, polypenolic compounds have a wide range of pharmacological activities, including anti-allergic, anti-inflammatory, hepatoprotective, vasoactive, antithrombotic, antioxidant, free radical scavenging, anticancer, antibacterial, and antiprotozoal effects.

Velasco & Associates (2008) In addition to these bioactive substances' antioxidant and absorbance spectrum profiles, polyphenol compounds like flavonoids and organic UV filters may also have photoprotective effects due to their structural similarities.

VI. MATERIAL AND METHODS

1. Vitellaria paradoxa, or shea butter

It is extracted from the shea nut's fat. The African savannas are the birthplace of the shea tree. It has the ability to quickly soak into the skin at body temperature, melt at body temperature, and produce benefits without leaving the skin feeling greasy. It has anti-oxidant properties and contains vitamins A and E, which promote blood circulation beneath the skin's surface and improve skin cell renewal. The oil offers essential defense against hazardous UV radiation because it includes cinnamic acid

2. Cera alba, or beeswax

It is a naturally occurring wax that comes from Apis honeybees. Beeswax foundation is mostly used as a thickening and emulsifier, though it can also be used to stabilize emulsions. In order to make it easier to heat and mix the components of the water phase, beeswax is employed to melt the solids. Its primary function is to provide a creamy texture.

3. Aloe vera

Aloe vera is a useful active component to include in your sunscreen blend. It has been demonstrated to be effective in treating and preventing skin burns. Aloe vera gel is made from the leaves of Aloe vera and A. Barbadensis. Because of its hydrating and revitalizing properties, aloe vera gel is utilized in cosmetic lotions. It preserves the natural moisture balance of the skin while blocking UVA and UVB rays. It prevents sunburn and activates the immune system. Aloe vera gel can aid in the healing process of sunburns by lowering inflammation, which in turn helps to reduce discomfort and redness. Additionally, the gel promotes collagen synthesis, which aids in the healing process.

4. Rose-flavored water

Rose water has vitamin B, which is frequently found in sun products and sunscreen. It contributes to increasing SPF's efficacy. Rose water is a useful tool for reducing skin discoloration. Rose water unclogs your pores, allowing you to remove debris and oils from your skin. It aids in preserving the pH balance of your skin. Gurbavigal is a moisturizing and nourishing ingredient that shields skin from damaging environmental aggressors. Its antioxidant levels combat free radicals and maintain the health and radiance of the skin.

5. Coconut oil

Coconut oil prevents premature skin aging and maintains the skin smooth and silky. Use coconut oil on your skin to hydrate and exfoliate dead skin cells. Coconut oil moisturizes dry skin, even in those who have eczema or other skin conditions. Its antimicrobial, antifungal, and antiviral qualities aid in wound healing and stop free radicals from damaging the skin. Because of its anti-inflammatory qualities, coconut oil helps to minimize redness on the skin, making it beneficial for both oily and dry skin types.

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6. Capsule of vitamin E

Extra protection against acute UVB damage and against cell mutation brought on by exposure to the sun and pollutants is provided by vitamin E.Vitamin E helps to increase skin suppleness and cleanse the skin by eliminating pollutants. Lemon juice and vitamin E together can help whiten skin. It is most well-known for improving the appearance and condition of skin. It contains anti-inflammatory and antioxidant qualities.

7. Carrot seed oil

This essential oil has high quantities of vitamin A and has a vital role in providing antioxidant, antibacterial, antifungal, and aromatic characteristics. It also offers sun protection. A 2009 study that appeared in "Pharmacognosy Magazine" states that carrot seed oil has a natural SPF of 38 to 40 [7].

8. Sandalwood oil

Sandalwood's high antioxidant concentration is well-known. It is a potent anti-aging component used in skincare solutions. Free radicals are unstable molecules that cause damage to skin cells and accelerate aging. Antioxidants play a critical role in the fight against these molecules. Sandalwood can help minimize wrinkles and fine lines, giving the appearance of a more young, bright complexion when used on a regular basis. It is crucial for sustaining the suppleness and firmness of the skin since it aids in the regeneration and repair of skin cells. Sandalwood, when added to a sunscreen serum, helps to prevent premature aging and preserve the young appearance of the skin in addition to offering sun protection.

METHOD Of PREPARATION

1. Melt coconut oil, shea butter, and beeswax in a double boiler.
2. Stir until smooth and well combined.
3. Remove from heat and add sandalwood oil and coconut oil
4. Stir in zinc oxide powder, vitamin E oil, and aloe vera gel , Rose water.
5. Pour into a glass jar or tin.
6. Allow to cool and solidify before use

VII. EVALUATION OF THE FORMULATION

Several crucial criteria were evaluated in the formulation evaluation of the herbal sunscreen:

• Physical characteristic

This included evaluating uniformity, color, and appearance.

• Viscosity determination

To guarantee consistency, viscosity was measured at five, ten, twenty, fifty, and one hundred rpm using a Brookfield viscometer. Following the dipping of the spindle groove, 50 g of the preparation were added to a 50 ml beaker. After that, screening was done at various speeds, and the outcomes were computed.

• Measurement of Ph

The pH level of the sun protection was measured using a digital pH meter. Following a specified amount's dissolution in distilled water, aim for skin-pH compatibility after a full day of use

• Study of Extrudability

In order to determine application ease, this included figuring out what proportion of the formulation extruded from a collapsible tube in a certain amount of time [21].

Extrudability is equal to area (cm2) / applied weight (gm) for extruding gel from a tube.

• Spreadability Assessment

By measuring the time it took for a specified weight to slide off between two slides, the spreadability Of the sunscreen was evaluated.

$S = M*L/t$,

Where M is the weight fastened to the upper slide.

L is the glass slide's length.

T = amount of time needed to split the slide

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• Testing for Theramal Durability

Ability of the sunscreen to resist oil separation under specific conditions of humidity and temperature Was examined[21].

• SPF Determination

Using a UV visible spectrophotometer, the efficacy of the sunscreens in protecting against UV Radiation was measured [22-23].

SPF = CFΣ (λ) *I(λ)*A(λ)

Whereas, CF = correction factor

EE = erythemogenic effect

I = intensity of solar light of wavelength

A= Absorbance

• Determining Antioxidant Activity

Through the DPPH technique, the antioxidant activity of the sunscreens was tested [24].

Anti-radical activity is calculated as sample absorbance * 100 minus control absorbance.

Regulate the absorbance.

• Study of In vitro Occlusion

A method of measuring water loss was used to assess how well the sunscreen covered and shielded the skin's surface [25].

Water loss without sample (A) = (A-B)/A * 100 is the occlusion factor (F), while water loss with sample (B) = A.

- **Testing for Stability**

The formulations' stability under various conditions was tested using centrifugation and the freeze-thaw method [26].

- **Assessment of Safety via Mutagenicity Assay**

Salmonella typhimurium strain TA 100 was used to evaluate the sunscreen chemicals' potential for mutagenicity.

Every evaluation component helped to guarantee the quality, safety, and efficacy of the herbal sunscreen formulas [26–28].

To ascertain whether alkaloids, phenols, flavonoids, and tannins were present in the test extracts, qualitative tests were carried out.

VIII. IDEAL PROPERTIES OF SUNSCREEN

1. Must be able to absorb a wide spectrum of UV rays that can burn
2. Needs to remain steady when exposed to sunshine
3. Must be capable of providing whole skin protection.
4. It should be low concentration, safe, and chemically inert.
5. Must not be poisonous, irritating, or cause hypersensitivity.
6. Filtering shouldn't be stained.
7. UVA and UVB radiation prevention
8. The ability to scavenge reactive oxygen species and antioxidants
9. Non-mutagenic characteristic
10. The ability to fight cancer
11. Booster effect
12. The active compound's stability and safety[7]

• MERITS

1. Aids in avoiding sunburn and early aging
2. Provides immediate sun protection upon application.

3. Remains intact longer in direct UV light.
4. Better for people whose skin becomes red when heated.
5. Provides defense against UVA and UVB radiation.; immediate sun protection upon application.

• DEMERITS

1. The product is pricey.
2. Has the ability to form an occlusive film that causes sweating.
3. If not applied precisely and liberally, it may be less protective.
4. May result in the skin showing white drops during perspiration.
5. Certain skin types may become sticky after using sunscreen.

• PRECAUTIONS

1. Patch test before use
2. Avoid applying on broken or irritated skin
3. Consult doctor before using on children or pregnant/breastfeeding women
4. Use in moderation (2-3% concentration)

IX. CONCLUSION

Using sunscreen has been standard procedure throughout the years to shield human skin from the sun's damaging UV radiation. Due to the recognized negative effects of synthetic sunscreen, natural sunscreen agents are more in demand these days than synthetic ones.

Compared to synthetic sunscreens, they are far safer, far more affordable, and have several skin-beneficial effects, which is why they are garnering a lot of attention. These phytoconstituents provide them additional qualities that make them ideal for sunscreen compositions. Their UV absorption range is vast, and they offer protection against cancer, inflammation, and a host of other issues.

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