



Preparation And Evaluation Of Herbal Sunscreens: A Review

Hritik¹ Meenu Sharma² Sacchindanand yadav³ Dr(Prof.)kshitij Agarwal⁴

1 Student Hari college of pharmacy Saharnpur India 2 Assistant professor Hari College of pharmacy Saharanpur India 3 Associate professor Hari College of pharmacy Saharanpur India 4 Director Hari College of pharmacy Saharanpur India

Abstract

The increasing concern about the adverse effects associated with synthetic sunscreens has led to growing interest in herbal alternatives. Herbal sunscreens are topical preparations that contain plant-based ingredients capable of protecting the skin from harmful ultraviolet (UV) radiation. In addition to photoprotection, these herbal formulations often provide added benefits such as antioxidant, anti-inflammatory, and moisturizing effects. This review discusses the commonly used herbal ingredients, preparation techniques, evaluation parameters, and challenges involved in developing effective herbal sunscreens.

Keywords: Herbal sunscreen, photoprotection, ultraviolet radiation, plant extracts, antioxidant, SPF, formulation, skin care, natural cosmetics

I. Introduction

Ultraviolet radiation from the sun, primarily UVA (320–400 nm) and UVB (290–320 nm), is a significant environmental factor contributing to skin aging, sunburn, pigmentation disorders, and even skin cancers. Conventional sunscreens use chemical and physical agents to block or absorb UV rays. However, these agents are often linked to allergic reactions, skin irritation, and environmental harm, particularly to aquatic ecosystems. Consequently, there is an increasing demand for natural, safer alternatives such as herbal sunscreens. Herbal sunscreens rely on plant extracts that are rich in polyphenols, flavonoids, tannins, and essential oils. These natural compounds absorb UV radiation and neutralize free radicals generated by sun exposure. This review focuses on the preparation, formulation strategies, and testing of herbal sunscreens.

II. Common Herbal Ingredients with Photoprotective Properties

Many herbs are known to possess natural sun-protective and antioxidant properties. Some of the most widely used herbs in sunscreen formulations are listed below:

2.1 Aloe vera (*Aloe barbadensis*): Known for its soothing, hydrating, and anti-inflammatory properties. It contains anthraquinones, which may help absorb UV radiation.

2.2 Green tea (*Camellia sinensis*): Rich in polyphenolic catechins that have antioxidant, anti-inflammatory, and photoprotective effects.

2.3 Licorice (*Glycyrrhiza glabra*): Contains a compound called glabridin, which has skin-lightening properties and helps protect against UVB-induced pigmentation.

2.4 Turmeric (*Curcuma longa*): The active compound curcumin provides strong antioxidant and anti-inflammatory protection and may reduce UV damage.

2.5 Sandalwood (*Santalum album*): Offers anti-inflammatory and astringent properties, and is traditionally used in skin care to cool and soothe the skin.

2.6 Cucumber (*Cucumis sativus*): Contains a high percentage of water and vitamin C. It helps cool the skin and may provide mild protection against UV rays.

III. Preparation of Herbal Sunscreens

The development of herbal sunscreens generally involves a few key stages:

3.1 Extraction of herbal actives: The active compounds are extracted from plant materials using solvents such as water, ethanol, or methanol. Techniques such as maceration, percolation, and Soxhlet extraction are commonly employed.

3.2 Formulation: The herbal extracts are mixed into a suitable base, such as a cream, lotion, or gel. The base also includes emulsifiers, thickeners, humectants, and stabilizing agents to ensure a smooth and stable product.

3.3 Mixing and homogenization: The formulation is thoroughly mixed to ensure even distribution of herbal ingredients and proper texture.

3.4 Preservation: Natural or mild synthetic preservatives are added to prevent microbial contamination and improve the shelf life of the product.

IV Evaluation of Herbal Sunscreens

To ensure the safety and efficacy of herbal sunscreens, they must undergo a series of evaluations, which can include the following tests:

4.1 Sun Protection Factor (SPF) testing: SPF is a measure of how well a sunscreen protects the skin from UVB rays. This can be tested using spectrophotometric analysis or in vivo methods on human volunteers.

4.2 Stability testing: The sunscreen is stored under various conditions (temperature, humidity, and light exposure) to assess physical and chemical stability over time.

4.3 Skin irritation and allergy testing: In vivo or in vitro tests are performed to determine whether the formulation causes any irritation or allergic response.

4.4 Antioxidant activity tests: Methods such as DPPH, ABTS, or FRAP assays are used to evaluate the antioxidant capacity of the formulation.

4.5 Sensory evaluation: Parameters such as spreadability, absorption rate, greasiness, and skin feel are evaluated by users or trained panels to determine acceptability.

V Advantages of Herbal Sunscreens

There are several benefits associated with the use of herbal sunscreens:

They are generally safe for all skin types due to their biocompatibility and minimal side effects.

Many herbal ingredients offer additional skincare benefits such as moisturization, anti-aging effects, and healing properties.

Herbal sunscreens are environmentally friendly and biodegradable.

They provide multiple functions in one product, such as protection from UV rays, hydration, and antioxidant defense.

VI Challenges and Limitations

6.1 Despite the promising advantages, herbal sunscreens face certain challenges:

The composition of plant extracts can vary due to differences in cultivation, harvest time, and extraction methods, making standardization difficult the SPF values of herbal sunscreens may be lower than those of synthetic sunscreens unless highly concentrated or combined with physical blockers.

Some herbal ingredients are unstable and degrade when exposed to light, heat, or air.

Regulatory approval can be challenging due to the complexity of herbal formulations and lack of extensive clinical data.

6.2 Future Perspectives

Future developments in herbal sunscreens may involve advanced delivery systems such as nanoemulsions, liposomes, and microspheres to improve the stability and skin penetration of herbal actives. Standardization of extracts and development of novel herbal UV filters will also enhance product reliability and market acceptance. Collaborative efforts between herbal medicine and modern cosmetic science are essential to meet both consumer expectations and regulatory standards.

Conclusion

Herbal sunscreens represent a natural, safe, and multifunctional alternative to conventional sunscreens. While they may not yet fully replace synthetic UV filters, especially in terms of high SPF protection, they offer valuable skin care benefits and reduce the risk of adverse effects. With continued research and innovation, herbal sunscreens are expected to play a more significant role in the cosmetic industry.

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