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A Review: Formulation of Sunscreen

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Mini Review

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ABSTRACT

Despite being a source of solar energy and life-giving energy, sunlight poses serious health risks by causing conditions such as sunburn, hyperpigmentation, wrinkles, dermatitis, urticaria, aging, immunological suppression, and other skin conditions. The most effective method to prevent sunburn and oedema is topical use of sunscreens (together with avoiding severe sun exposure). This page makes an effort to gather some of the key properties, classifications, formulations, benefits, drawbacks, SPF measurement, and evaluations of sunscreens. Sunglasses and/or sun protection clothing offer an insufficient and less practical solution to eliminating all of these health risks. Customers should effectively use the right items to increase sun protection.

Keywords: Sunscreen; Urticarial; Oedema; Sun protection; SPF

INTRODUCTION

In order to defend against UV rays, sunscreen is increasingly used as a photo protective agent. An item that, when applied topically, shields the treated region from sunburn is known as a sunscreen preparation. Sunscreens work

with the body's built-in defences to bolster skin protection from the sun's harmful UV radiation. The way it can reflect, absorb, or scatter solar radiation determines how it works. By comparing the time, it takes for sunburn to occur on skin protected with sunscreen up until now with the time it takes for sunburn to occur on nonexistent skin covered, a sunscreen's Sun Protection Factor (SPF) is calculated [1]. The ability of sunscreens to prevent UV damage is key to their efficacy in preventing UV-induced sunburns or their capacity to prevent cancer [2].

Spectrum of UV radiation

The portions of Ultraviolet (UV) radiation that are biologically active are UVA and UVB radiation. The primary skin types that UV radiation affects, along with the effects they cause, are given below [3].

UVB (290–320 nm)

- Causing the greatest extensive harm.
- Influence directly on proteins and DNA in cells.
- Sunburn is a severe injury.
- Long-term harm, such as cancer [3].

UVA (320–400 nm)

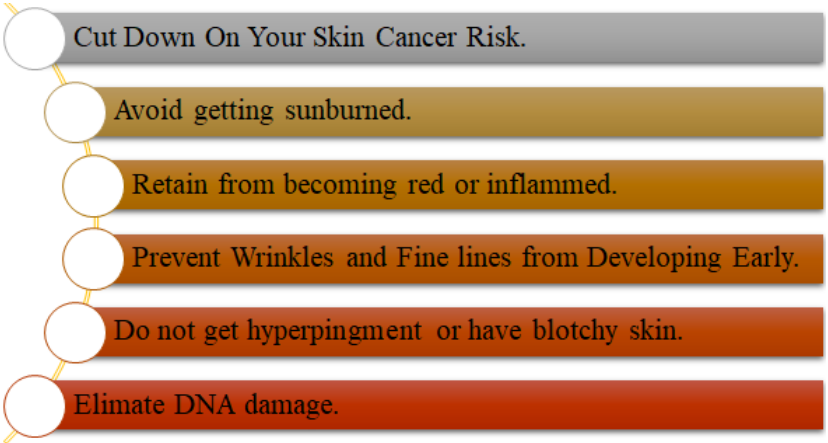
- Not immediately taken up by biological targets.
- Deeper penetration than UVB.
- Reactive oxygen species that are produced have an impact on connective tissue and cause severe immunosuppression.
- Responsible for tanning, photoaging, photocarcinogenesis, external photosensitization, and several idiopathic photodermatoses [4,5].

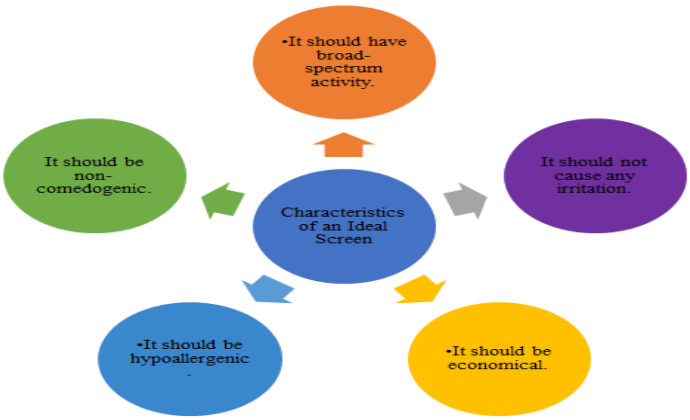
LITERATURE REVIEW

Characteristics of an ideal screen

Advantages of ideal sunscreen is shown in Figure 1

Figure 1. Advantages of an ideal sunscreen.





Disadvantages

Some of the disadvantages of sunscreen in shown in below Figure 2 and classifications of sunscreen is shown in Table 1.

Figure 2. Disadvantages of sunscreen.

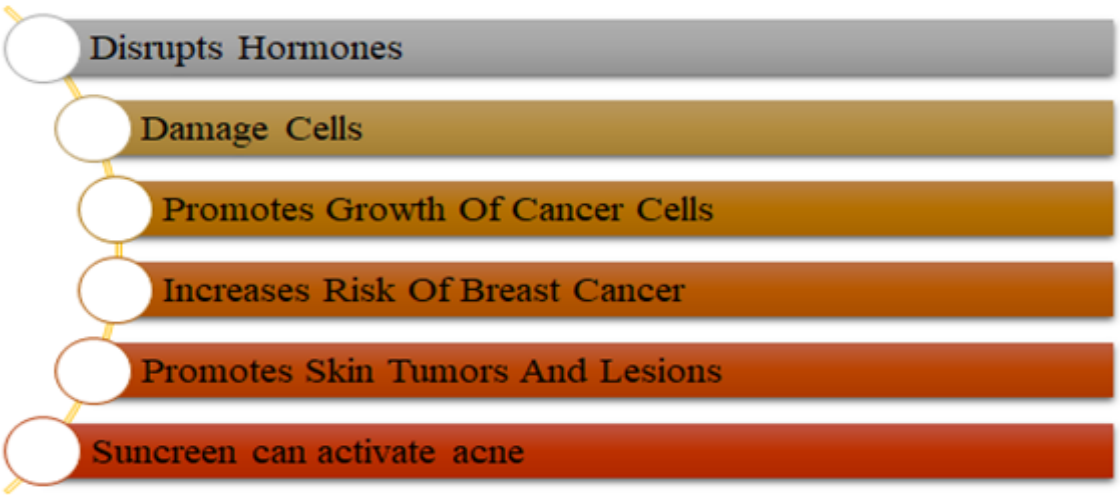


Table 1. Classification of sunscreen [6].

Physical sunscreen	Chemical sunscreen
1. UV-scattering and UV-reflecting particles that return the UV rays to the environment.	1. Absorb UV rays while being excited to a state of greater energy.
2. The following are the top two inorganic UV filters: • (ZnO) Zinc oxide • (TiO_2) Titanium dioxide	2. Categorized into three groups according to the scope of protection: • UVB (290–320 nm) • UVA (310–400 nm) • Sunscreens with a broad spectrum that cover the full spectrum (290-400 nm)
3. Effective immediately.	3. It should be applied 15 minutes before sun exposure.
4. It may be better for reactive skin.	4. It may offer superior UVA protection.

5.Active ingredients • Zinc oxide • Titanium dioxide • Talc • Kaoline • Ferric Chloride • Red Petrolatum	5.Active ingredients • PABA • PABA esters • Benzophenones • Cinnamates • Salicylates • Anthranilates

Formulas/formulation for sunscreen

Formulation of emulsion: Depending on its viscosity, an emulsion is referred to as a lotion or a cream, respectively, below 50,000 and between 150,000 and 500,000 centipoises, offering virtually limitless adaptability [7]. It is often made from W/O and O/W emulsions, two incompatible liquid phases [8]. These compositions have the ability to release liquid from bottles and distribute it more easily on the skin [9]. Sunscreens in the form of emulsions provide another classy option that may leave the skin feeling silky and smooth without being oily. However, stabilizing them is quite challenging, especially at high temperatures [10].

Formulation of gel: Due to its beauty and purity, sunscreen gel appears to be the perfect vehicle from an aesthetic standpoint. It is divided into four primary categories: aqueous formulations, hydro-alcoholic formulations, micro-emulsion formulations, and oil anhydrous formulations water and soluble substances, such as organic substances, phosphate esters, and nonionic surfactants, must be present in the aqueous gel in sufficient quantities to ensure that it will be transparent at all temperatures. Therefore, when exposed to sweat or water, it is readily removed [10]. The majority of lipophilic substances are easily miscible in alcohol; hence, hydro-alcohol gels are made by combining alcohol and water. This is crucial for decreasing extra solutes. The micro emulsion gels have a beautiful feel and a high SPF since they are made of small particles that make them seem smooth, thick, and evenly distributed on the skin.

Formulation of aerosol: To shield skin conditions from damaging sunlight, aerosol sunscreens are topically sprayed. These creams spread quickly across the skin's surface, dispersing active components to create a thin layer of skin film [11].

Formulation of sun stick: The sun stick's small size and light weight make it portable, making it unquestionably one of the most practical goods. Petrolatum and waxes are added to the two primary components of an emulsion, specifically oil and oil-soluble components, to create sun stick [11]. This type is classified into three groups: matte sunscreen, semi-transparent sunscreen, and transparent sunscreen. Only chemical UV filters are used in the transparent composition, whereas both semi-transparent and matte sunscreens are made mostly of chemical and mineral constituents [12]. The flow chart of the sunscreen formulation and method of preparation is shown below (Figures 3 and 4)

Figure 3. Flow chart of the formulation of sunscreen.

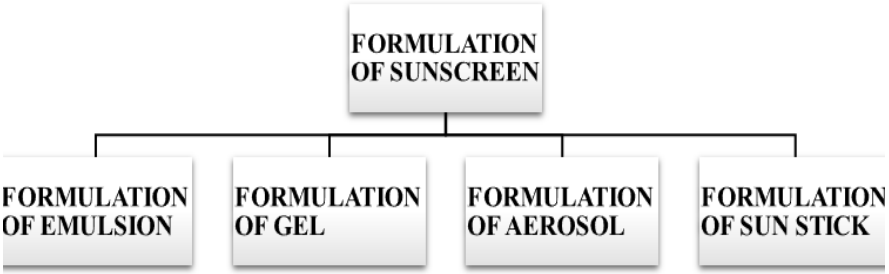
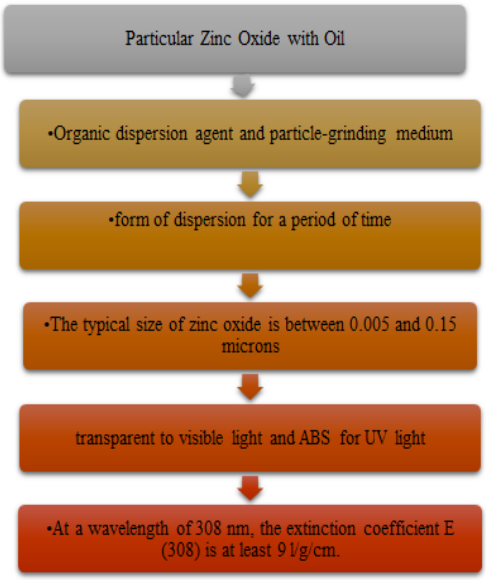


Figure 4. Method for preparation of sunscreen.



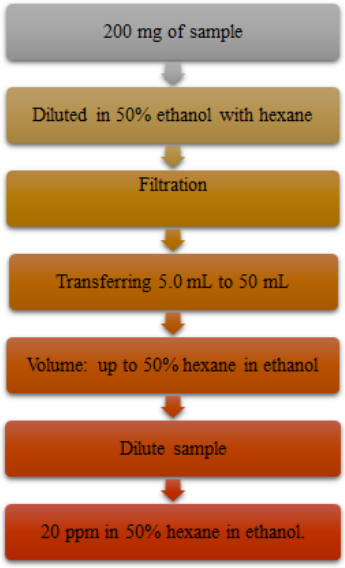
Spf and its measurement

The sun protection factor is known as SPF, and the quantity next to it represents how effectively the sunblock shields sunburned skin. In comparison to comparable products with lower SPF values, a sunscreen with higher SPF protection and broad-spectrum coverage offers superior protection against sunburn and UVA radiation damage under ideal circumstances (such as in a lab) (Figure 5) [13].

Formula for mean spf calculation

$$\text{SPF} = \frac{\text{MINIMAL ERYTHMAL DOSE IN PROTECTED SKIN}}{\text{MINIMAL ERYTHMAL DOSE IN UNPROTECTED SKIN}}$$

Figure 5. Sunscreen sample prepation for spf measurement



Sunscreen evaluation

***In vivo* evaluation of sunscreen:** The SPF rating does not account for the defence against the entire UVR's UVA spectrum since it only considers erythema brought on by UVB and UVA-II. With better knowledge of how UVA

radiation combines with naturally occurring photosensitizers to cause cellular DNA damage, the need for effective UVA protection is evident. High dosages of UVA are needed *in vivo* for testing the UVA protection provided by sunscreen, which raises ethical and financial concerns. For the assessment of *in vivo* UVA protection, three techniques have been suggested [13]:

- (Immediate Pigment Darkening) IPD,
- (Persistent Pigment Darkening) PPD, and
- (UVA Protection Factor) UVA-PF.

***In vitro* evaluation of sunscreen:** If an SPF-created *in vitro* test technique could produce findings more quickly and affordably, it would be useful. It could also sidestep the moral dilemmas raised by testing *in vivo*. Although numerous *in vitro* procedures have been created, there is currently no widely used methodology. In *in vitro* methods, a sunscreen film is often placed on an artificial test substrate, and to determine how much UVR penetrates sunscreen, spectrophotometers are employed. A spectrophotometer is used to measure the quantity of UVR that passes through the sunscreen film. IMS Inc.'s Vitro-Skin is a synthetic skin substrate that has to be utilized after a precise hydration process [14].

CONCLUSION

Sun protection includes the use of sunscreens. UV radiation exposure is linked to a reduced risk of a variety of skin issues and malignancies with regular and adequate use. Additionally, patients should be advised not to rely only on using sunscreen. Because of this, it may be assumed that there is a substantial market for sunscreen ingredients, whether they are synthetic, natural, or combined with the need to protect against harmful UVA and UVB rays.

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