IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, December 2025
Impact Factor: 7.67

Review on Synthetic Sunscreen Cream

Saniya B. Mulani, Dnyaneshwari M. Patil, Sanika S. Mahajan, Vinayak D. Kale
Students, JBVP'S Vidya Niketan Collage of Pharmacy, Lakhewadi
Assistant Professor, JBVP'S Vidya Niketan Collage of Pharmacy, Lakhewadi

Abstract: *Sunscreen is a chemical preparation designed to shield the skin from ultraviolet (UV) radiation. While UV rays cause sunburn, UVA rays can be even more damaging to the skin, so an effective sunblock should ideally protect against both types of wavelengths. Regular use of sunscreen helps reduce the development of actinic keratosis, melanoma, and squamous cell carcinoma. Sunscreens may contain either organic or inorganic chemical agents and are often referred to as sunblock creams. These products work by absorbing or reflecting solar energy to safeguard the skin. Increasing rates of skin cancer and the harmful effects of UV-induced photo damage have contributed to the growing use of sunscreen products, which have shown beneficial effects in reducing symptoms. To be effective, sunscreen ingredients should be non-toxic, non-irritating, chemically stable, photo stable, and capable of providing comprehensive protection against solar radiation.*

Keywords: Sunscreen, Skin Burn, UV Radiation, Sun Protection

I. INTRODUCTION

Cosmetics are defined as products intended to be rubbed, poured, sprinkled, sprayed on, or otherwise applied to the human body for the purposes of cleansing, beautifying, enhancing attractiveness, or altering appearance. The sun radiates various types of radiation, such as infrared (IR), visible light, and ultraviolet (UV) radiation.[1] The sun's extraterrestrial radiation comprises a broad spectrum of electromagnetic energy, including X-rays, ultraviolet (UV) radiation, visible light, infrared (IR) radiation, microwaves, and radio waves. However, the solar spectrum that reaches the Earth's surface is filtered to wavelengths between 290 and 3000 nanometers (nm), encompassing parts of the UV, visible, and IR regions.[2] Nowadays, sunscreen is one of the most popular cosmetic products, and its appeal goes way beyond just looking good. People are loving sunscreens for their added health benefits, like protecting skin from damage, reducing wrinkles, and even helping prevent skin cancer. It's become a must-have in many people's daily routines. [3] UV-induced skin damage is a major global concern. UVA radiation contributes to skin cancer, dryness, photosensitivity, and premature aging by generating reactive oxygen species (ROS) that damage DNA and cause mutations. UVB rays directly harm DNA, forming pyrimidine dimers that can lead to apoptosis, DNA replication errors, and cancer. UVC radiation is the most harmful type, with mutagenic and carcinogenic effects, but it's largely blocked by the atmospheric layer.[4] Sunlight is a continuous electromagnetic radiation spectrum, comprising three main wavelength ranges: Ultraviolet, Visible, and Infrared. The Ultraviolet (UV) radiation is further categorized into three sub-ranges: UV-A (320-400 nm), UV-B (280-320 nm), and UV-C (200-280 nm). Among these, UV-A has the longest wavelength and lowest energy, while UV-C has the shortest wavelength and highest energy, with UV-B falling in between[5]Sunscreens play a crucial role in preventing UV damage, which is essential for preventing sunburns and potentially reducing the risk of skin cancer. Their effectiveness in absorbing or reflecting UV radiation is what makes them a key component in sun protection strategies.[6] Skin the body's largest organ, is directly exposed to the sun, making it prone to photo damage. UV radiation from the sun's electromagnetic spectrum is the primary cause of this damage, posing significant risks to skin health.[7]

II. IDEAL CHARACTERISTICS OF SUNSCREEN:

1. Must absorb a broad range of UV rays causing sunburn
2. Must be stable in the presence of sunlight
3. Should be able to provide complete protection for skin
4. Should not cause irritation, sensitization and toxicity

DOI: 10.48175/568

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, December 2025
Impact Factor: 7.67

5. Should not stain Filtering
6. Activity against UVB and UVA radiation
7. Broad-spectrum UV protection to prevent skin burns
8. Photostability to maintain effectiveness in sunlight
9. Ability to provide complete skin coverage
10. Water resistance to withstand water exposure
11. Non-toxic, chemically inert, and effective at low concentrations
12. No irritation, sensitization, or toxicity
13. Durable sun protection that lasts several hours.[8]
14. Broad-spectrum UV protection, shielding skin from UVA and UVB rays
15. Non-volatile nature, ensuring it doesn't evaporate easily at high temperatures. [1,9]

III. HISTORY OF SUNSCREEN

There is little literature at the manner historical societies used to Guard themselves from the solar. However, sunscreens have been Used to mitigate the damaging consequences of the solar at the pores and skin since Medieval time. In historical Egypt, girls carried out numerous natural Merchandise as sunscreens.1801: Johan Wilhelm Ritter of Germany first discovers UV radiation.1889: Erik Johan Widmark of Stockholm publishes a landmark study that experimentally proves UV radiation can cause skin erythema and burns.These include; times, Yasmeen, zaytoon, Sober, aquatic lotus oil, almond oil, calcite powder and clay, rice bran Extracts amongst many others. Sunscreen containing ultraviolet.[1]In ancient cultures, the sun was revered as a deity, worshiped for its life-giving energy. The ancient Egyptians are notable for being one of the first civilizations to attempt to protect their skin from the sun's harsh rays using topical agents like rice bran and jasmine. These early innovators recognized the importance of shielding their skin from the sun's potent rays, laying the groundwork for modern photoprotection practices. A filters was released in 1980 and the ultraviolet A star rating system developed in German.[10]The Burmese society extensively utilized plant Extracts as cosmetics manner returned in 2000 BCE 10. In East Africa, the Masai network has a protracted tradition of smearing purple ochre on their hair and face for cultured appeal However are oblivious of the safety afforded to their pores and skin.Folklore Has it that the Kikuyu network in Kenya used to smear clay over. Their uncovered frame elements to guard them from the destructive consequences of sunrays as they went approximately their peasantry farming Activities In cutting-edge instances business use of sunscreens turned into first suggested in 1928 within side the USA following the advent of an emulsion containing benzyl cinnamate and benzyl salicylate. Formulations containing phenyl salicylate seemed in Australia within side the Early 1930s. Quinine oleate turned into used with inside the USA within side the mid1930s. P-Amino benzoic acid (PABA) turned into patented in 1943, and Several sunscreens containing PABA accompanied this. The US army Advanced specs for sunscreens within side the 1950s.Three groups of holidaymakers from Łódź, Poland, spent a week in Tenerife (28° N) in March 2011, enjoying cloudless weather with a maximum UV index (UVI) of 9, classified as very high by WHO.[11]Sir Everard Home, President of the Royal College of Surgeons, discovered sunlight's role in skin burn in 1820, sparking research into radiation-absorbing substances. Acidified quinine sulphate was the first substance used to reduce UVB-induced sunburn effects.[12]Sunscreen has been evolving steadily, and new photoprotective ingredients continue to be developed in response to the growing scientific understanding of solar radiation's effects on the skin.[13]

IV. IMPORTANCE OF SUNSCREEN

The importance of sunscreen products has increased current scenario. Synthetic sunscreen creams contain chemical UV filters such as avobenzone, oxybenzone, octocrylene, and octyl methoxycinnamate. UV radiation has a dual role in human health. It's essential for vitamin D3 production and calcium absorption, but it also poses risks like DNA damage and carcinogenic effects. Topical application of UV-absorbing or reflecting molecules is a key way to protect skin from harm, making sunscreen a crucial part of skin care. Wearing sunscreen is a simple yet effective way to protect your skin's health and appearance at any age. Regular use can help prevent sunburn, skin cancer, and premature aging.[14]Dermatologist Anna Chien notes that incorporating sunscreen into your daily routine can be easy, addressing common concerns can help make it a habit.Sunscreens have demonstrated a reduction in skin cancer rates and photodamage. Their efficacy is

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, December 2025
Impact Factor: 7.67

quantified by the Sun Protection Factor (SPF), which is derived from the Minimal Erythema Dose (MED)—the smallest dose of UV radiation that produces minimal skin redness.[15]

Broad-Spectrum Protection: Blocks UVA and UVB radiation, reducing sunburn, premature aging, and skin cancer risk

Cosmetic Elegance: Lightweight, transparent, and easy to apply, improving user adherence

Formulation Flexibility: Enables water-resistant, high SPF products with added skincare benefits

Daily Use: Comfortable and makeup-friendly, ideal for everyday facial use.

Proven Efficacy: Extensive clinical evidence supports UV protection and photo damage prevention.[16]

V. METHODOLOGY OF SUNSCREEN

Here's a structured methodology for preparing a synthetic sunscreen cream, suitable for academic reference or formulation research.In-Vivo Evaluation Methods (Gold Standard). In vivo methods involve clinical testing on human volunteers under controlled UV exposure to measure real biological responses. In-Vitro Evaluation Methods (Lab Testing). In vitro tests avoid human UV exposure and instead rely on physical measurements of UV.ZnO and hydrophilic silica-coated TiO2 NPs widely used in sunscreen products were used together with their mixtures. The emulsification efficiency, the control of droplet size and the stability of o/w Pickering emulsions solely stabilized by NPs were investigated. A ZnO/TiO2 NPs mixture characterized by a theoretical SPF of 45 was finally used as unique emulsifiers to develop a surfactant-free sunscreen emulsion emission through sunscreen films.[17]

Preparation of the Oil Phase

Step 1: Combine 3 g of beeswax with 4 mL of liquid paraffin and heat the mixture on a water bath at 62-65 °C until the beeswax melts completely.

Step 2: Add 2 g of zinc oxide and 0.5 g of methylparaben to the molten mixture.

Step 3: Stir thoroughly to ensure uniform dispersion of zinc oxide and methylparaben throughout the oil phase.[18]

Preparation of Aqueous Phase

Step 1: Dissolve 2 % sodium chloride (NaCl) in distilled water to prepare a 2 % NaCl solution.

Step 2: To the NaCl solution, add 3 mL of glycerin, 2 mL of triethanolamine, and 2 g of borax.

Step 3: Heat the mixture while stirring continuously until it reaches 65-80 °C.

Step 4: Slowly incorporate the pre-prepared oil phase (from Step 3 of "Preparation of the Oil Phase") into the hot aqueous phase, maintaining the temperature between 65-80 °C and stirring continuously.

Step 5: After complete addition of the oil phase, continue stirring until a uniform emulsion forms.

Step 6: Add a suitable amount of perfume to impart fragrance.[18]

Pre-formulation Studies:

The formulation process starts by choosing suitable UV filters based on the desired Sun Protection Factor (SPF) and broad-spectrum coverage. Organic filters work by absorbing UV radiation, whereas inorganic filters (such as TiO_2 and ZnO) protect by reflecting or scattering UV rays.[19]

Emulsification

The heated oil phase is slowly poured into the aqueous phase while stirring continuously at moderate speed to form a preliminary emulsion. This is followed by high-shear homogenization to reduce droplet size and ensure uniform distribution of UV filters, enhancing SPF performance and improving product texture.[20]

Cooling and Final Additions

The emulsion is gradually cooled to below 40 °C, then heat-sensitive ingredients such as antioxidants and fragrances are added to prevent degradation.[21]

Post-Formulation Evaluation

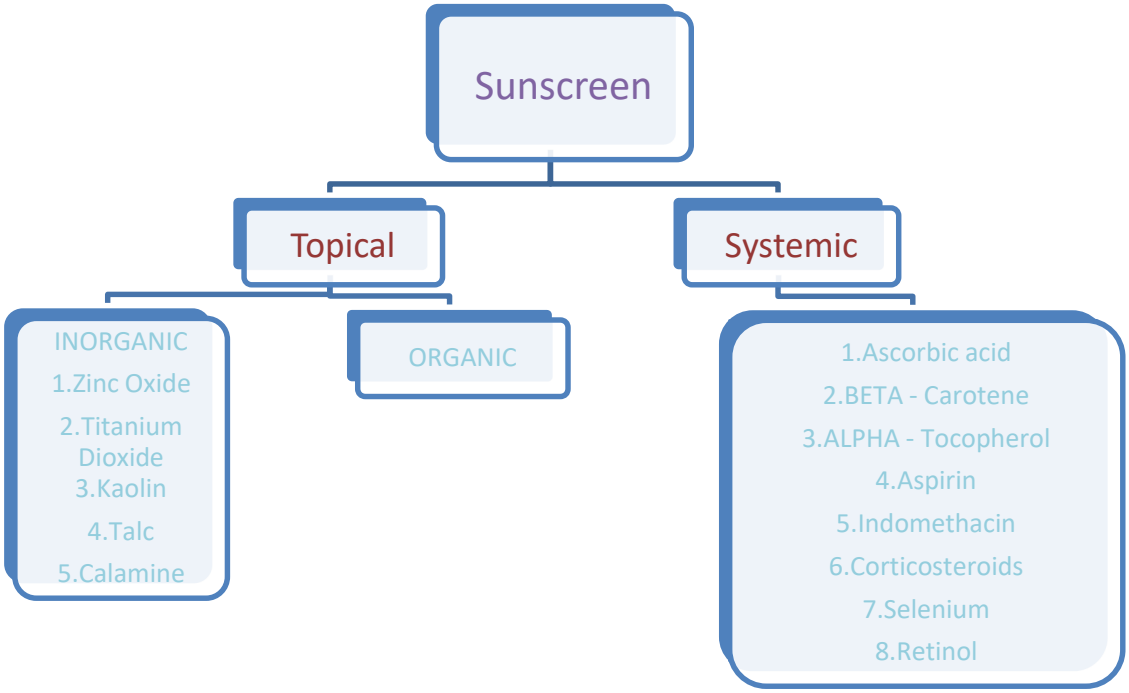
Physical characterization: Assess appearance, viscosity, pH, and phase stability of the final sunscreen cream.

SPF determination: Measure SPF using in vitro spectrophotometric methods or in vivo testing.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, December 2025
Impact Factor: 7.67

Stability studies: Evaluate consistency, efficacy, and safety under varied storage temperatures and perform centrifugation tests to ensure shelf-life reliability.[22]

VII. CLASSIFICATION OF SUNSCREEN:



Inorganic (physical blockers):

Inorganic sunscreens use particles to scatter and reflect UV rays back into the environment, creating a physical barrier against UVA and UVB light. They're considered broad-spectrum, covering the entire UV spectrum, and are often referred to as sunblocks. Ultraviolet and UV light. The two primary inorganic UV pollutants are Zinc oxide (ZnO) and titanium dioxide TiO2) white patches which used in the ornamental and pharmaceutical diligence.[23]

Organic (chemical absorbers):

Organic sunscreens work by absorbing into the skin and converting UV rays into heat. They're lightweight, making them perfect for daily use, and can be easily formulated with other skincare ingredients. Organic sunscreen actives are chemical, carbon-based compounds that don't contain mineral active ingredients.Organic UV pollutants similar as benzophenones, absorb UV radiation with excitation to an advanced energy state. They're astronomically classified into three orders grounded on the range of protection; UVB (290 – 320 nm) and UVA (320 – 400 nm) and broad-diapason sunscreens that cover the entire spectrum (290 – 400 nm). [23]

Natural/ Systemic (chemical absorbers):

Natural chemicals like polyphenols (flavonoids, tannins), carotenoids, anthocyanidins, many vitamins, triglyceride canvases, unpredictable canvases from vegetables, fruits, medicinal factory corridor (leaves, flowers, fruits, berries), algae and lichens are more effective over synthetic chemicals which is due to their long-term salutary goods especially against free radical generated skin damages along with UV- shafts blocking. These are sunscreens that are absorbed into the body and accumulate in the skin swinging protection from the UV shaft.[24]

VIII. EVALUATION PARAMETER OF SUNSCREEN:

Physical parameters:

Colour: Visually inspected and observed manually

Odour: Assessed by smelling the formulation

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, December 2025
Impact Factor: 7.67

Appearance: Examined for overall look and texture

Determination of pH:

- 1 g of cream was weighed and dispersed in 100 ml of filtered waterfor 2 hours.
- pH was measured using a digital pH meter
- Measurements were taken three times, and standard deviation was noted.

Determination of Viscosity:

The Brookfield viscometer was used to test viscosity, with the proper number of spindles Selected. A 50 ml Beaker was used to hold 50 g of preparation until the spindle groove was Dipped, and the rpm was set. Sunscreen viscosity was measured at 5, 10, 20, 50, and 100 Rpm. The viscosity was computed using the factor obtained from the reading.

Spread ability:

- Placed excess sample between two glass slides
- Applied 50 g weight for 3-5 minutes to compress to a uniform thickness
- Measured time taken to separate slides
- Spreadability calculated using the formula:

The formula for calculating it is:

$S = M \times L / t$

Where, M = weight tied to the upper slide

L = length of glass slide

T = time taken to separate the slides

Wash ability:

- Applied a small amount of cream to the hand
- Washed under running water to check washability

Homogeneity:

Checked by visual inspection and touch.

Irritancy Test:

Applied a small amount of sunscreen cream on the dorsal side of the hand; observed for irritation after 5-6 minutes.

Stability Testing:

Stored cream in humidity chamber at 37±1°C and 50-60% RH for 6 hours. Observed for oil separation; no oil separation indicates test pass.[25]

IX. CONCLUSION

Growing awareness about the importance of shielding the skin from harmful UVA and UVB radiation has created a strong market demand for sunscreen ingredients, whether synthetic, natural, or blended. An ideal sunscreen should provide stable, uniform protection across both UVA and UVB wavelengths while offering a high SPF. Natural compounds—such as polyphenols (including flavonoids and tannins), carotenoids, anthocyanidins, various vitamins, fixed and essential oils derived from vegetables, fruits, medicinal plants, algae, and lichens—tend to be especially valuable because they not only absorb UV rays but also deliver long-term skin benefits. With their antioxidant, anti-inflammatory, wound-healing, and other protective properties, sunscreens enriched with these natural ingredients can offer cost-effective, truly broad-spectrum protection along with enhanced overall skin health.

REFERENCES

[1]. Barve CS, Bagade MJ, Bhalke GB, Rode RB. Formulation and evaluation of sunscreen. Int Res J Mod Eng Technol Sci. 2023; 5(12).

[2]. Muthumani T, Sudhahar V, Mukhopadhyay T. Review on sunscreens and sun protection factor. Res J Topical Cosmet Sci. 2015;6(2):55–65. doi:10.5958/2321-5844.2015.00009.6.

[3]. Donglikar MM, Deore SL. Sunscreens: A review. Pharmacogn J. 2016; 8(3): 171–176. Patel N, Patel D, Shrivastava V. A review on formulation and evaluation of sunscreen. Int J Multidiscip Res (IJFMR). 2025;7(2):1. E-ISSN: 2582-2160.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, December 2025
Impact Factor: 7.67

[4]. Bhattacharjee D, Preethi S, Patil AB, Jain V. A comparison of natural and synthetic sunscreen agents: a review. JSS College of Pharmacy, Mysuru. 2020.
[5]. Nikam R, Bachhav P, Pawar M, Sharma Y, Patil D. A review: formulation of sunscreen. Res Rev J Pharm Pharm Sci. 2023;12(3):005. Doi:10.4172/2320-1215.12.3.005
[6]. Pappireddy L, Ratnamala KV. Formulation development and evaluation of sunscreen. Int J Innov Res Technol. 2021 Jun;8(1):86. ISSN: 2349-6002
[7]. Tandi DY, Singh V, Kumar N, Bisai A, Sharma H, Sahu GK. Formulation and evaluation of sunscreen cream. Acta Sci Pharm Sci. 2024;8(6). Doi:10.31080/ASPS.2024.08.1068.
[8]. Patel N, Patel D, Shrivastava V. A review on formulation and evaluation of sunscreen. Int J Multidiscip Res. 2025;7(2):IJFMR250240450.
[9]. Salih H, Psomadakis C, George SMC. Sunscreens: A narrative review. Skin Res Technol. 2024. Doi:10.1002/ski2.432.page no.2,3
[10]. Young AR, Narbutt J, Harrison GI, Lawrence KP, Bell M, O'Connor C, et al. Optimal sunscreen use, during a sun holiday with a very high ultraviolet index, allows vitamin D synthesis without sunburn. Br J Dermatol. 2019. Doi:10.1111/bjd.17888KV
[11]. Ma Y, Yoo J. History of sunscreen: an updated view. J Cosmet Dermatol. 2021. Doi:10.1111/jocd.14004.
[12]. Ma Y, Yoo J. History of sunscreen: an updated view. J CosmetDermatol 2021;20(4):1044–1049. Doi:10.1111/jocd.14004
[13]. Purohit AD, et al. Formulation and evaluation of sunscreen lotion containing natural and synthetic agents. Human Journals. 2023 Jul;27(4).
[14]. Orengo I, Asad U, Elserag L. Sun protection: a comprehensive 2022 dermatologic review. J Fam Med Dis Prev. 2023;9(1):154. doi:10.23937/2469-5793/1510154.
[15]. Guan LL, Lim HW, Mohammad TF. Sunscreens and photoaging: a review of current literature. Am J Clin Dermatol. 2021;22(6):819-828.
[16]. 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. Int J Cosmet Sci. 2021;43(4):432-445.
[17]. Singh S, Kaur R, Bhushan B, Verma S, Kumari S. A summarized review of formulation, in vitro evaluation of sunscreen. Int J Innov Sci Res Technol. 2024;9(4):2458. Doi:10.38124/ijisrt/IJISRT24APR2306.
[18]. Serpone N, Dondi D, Albini A. Inorganic and organic UV filters: their role and efficacy in sunscreens and suncare products. Inorg Chim Acta. 2007;360(3):794-802. Doi:10.1016/j.ica.2005.12.057.
[19]. Santos YR, Andreo-Filho N, Lopes PS, Araujo DR, Sepulveda AF, Sales CC, et al. The influence of complementary processing methods to emulsification on sunscreen emulsion properties: high-shear and high-pressure homogenization effects on particle size distribution and performance. Processes. 2025;13(2):520. Doi:10.3390/pr13020520.
[20]. Chauhan L, Gupta S. Creams: a review on classification, preparation methods, evaluation and its applications. J Drug Deliv Ther. 2020;10(5-S):281–289. Doi:10.22270/jddt.v10i5-s.4430.
[21]. Chavda VP, Patel KK, Patel UK. Sunscreens: a comprehensive review with application to topical formulation evaluation. J Cosmet Dermatol. 2023;22(4):1201–1215. Doi:10.1016/j.jocd.2023.02.014.
[22]. Sahare SB, Ansari AA, Rawat SS, Jaybhaye SS, Ambhure PP. Formulation and evaluation of herbal sunscreen cream. EPRA Int J Multidiscip Res. 2025 Jun;11(6).
[23]. Katiyar SK. Skin photoprotection by natural polyphenols: anti-inflammatory, antioxidant and DNA repair mechanisms. J Nutr. 2007;137(1 Suppl):S213-S221. doi:10.1093/jn/137.1.213.
[24]. Kazi S, Bais S, Dhabekar A. Preparation and evaluation of sunscreen cream. Int J Pharm Sci. 2025;3(6):3545–3554. Doi:10.5281/zenodo.15719679