Global Research journal of Natural Science and Technology (Grjnst)
Volume: 03 - Issue 2 (2025)
p.ISSN: 2790-7643 e.ISSN: 2790-7651
www.grjnst.com

# Review Article on the role of Aloe vera in Cosmeceutical as a Natural drug

**Saira Faraz**
*Department of Pharmacognosy, Faculty of Pharmacy, Nazeer Hussain University, Karachi, Pakistan*
saira.faraz@nhu.edu.pk
**Tuba Sahar**
*Department of Pharmaceutics, Faculty of Pharmacy, Nazeer Hussain University, Karachi, Pakistan*
tuba.sahar@nhu.edu.pk
**Amna Shaikh**
*Department of Pharmacology, Faculty of Pharmacy, Nazeer Hussain University, Karachi, Pakistan*
amna.shaikh@nhu.edu.pk

## Abstract

Aloe vera is one of the most well-known herbal agents used in skincare, particularly in sunscreen formulations. Due to the drawbacks of synthetic chemicals, the field of cosmeceuticals has evolved to combine cosmetic and pharmaceutical benefits using natural ingredients. This assignment focuses on the pharmacological roles of Aloe vera in protecting the skin from ultraviolet (UV) damage. It includes a comparative overview of natural vs. synthetic Aloe vera sources, the phytochemical composition of Aloe vera, and the scientific basis for its incorporation into sunscreen products.

**Keywords:** Aloe vera, Sunscreen, UV Protection, Cosmeceuticals, Phytochemicals

### Introduction

Sun exposure has both beneficial and harmful effects on human health. Excessive exposure to ultraviolet (UV) rays can lead to photoaging, sunburn, and increased risk of skin cancer. Sunscreens are essential topical agents used to block or absorb UV radiation. While chemical sunscreens dominate the market, they have side effects and environmental concerns. As a

result, attention has shifted toward natural ingredients such as Aloe vera due to their soothing, protective, and healing effects on the skin.


## 2. Cosmeceuticals

Cosmeceuticals is a hybrid term derived from “cosmetics” and “pharmaceuticals.” It refers to products that lie between traditional cosmetics and medicinal drugs. These are topical formulations (like creams, lotions, gels, and serums) that are applied to the skin to enhance appearance and provide therapeutic benefits backed by bioactive compounds.

## Key Characteristics of Cosmeceuticals:

**Aspect Description**

- ✓ **Function:** Improve appearance and offer therapeutic effects
- ✓ **Form:** Topical creams, lotions, gels, masks, serums
- ✓ **Ingredients:** Contain active substances like antioxidants, peptides, botanical extracts
- ✓ **Action:** Penetrate skin to act at cellular or biochemical levels
- ✓ **Regulation:** Not fully regulated as drugs, but more than regular cosmetics

**Examples of Cosmeceuticals:**

- ✓ Sunscreens with Aloe vera, green tea, or zinc oxide (protects and repairs skin)
- ✓ Anti-aging creams with retinoid or peptides (reduce wrinkles, stimulate collagen)
- ✓ Moisturizers with hyaluronic acid or niacin amide (improve hydration and tone)
- ✓ Whitening creams with kojic acid or vitamin C (lighten pigmentation)

**3.Importance of Natural vs Artificial Sources of Aloe Vera**

| **Aspect** | **Natural Aloe Vera** | **Artificial/Synthetic Aloe Vera** |
|---|---|---|
| **Source** | Direct plant extract | Chemically synthesized or processed gel |
| **Phytochemical Content** | Full spectrum (aloesin, | May lack full range of |

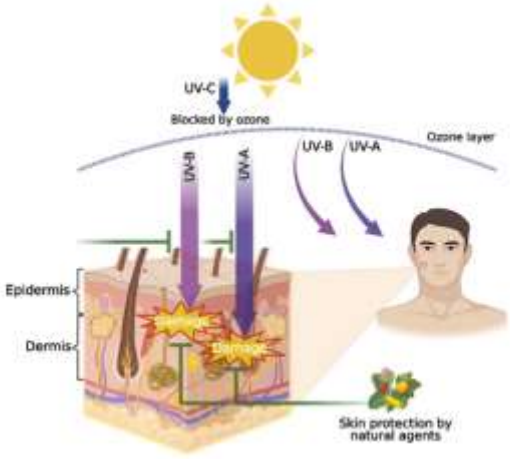
| | | |
|---|---|---|
| | acemannan, vitamins) | active compounds |
| **Skin Compatibility** | High – minimal allergic reactions | Variable – depends on additives |
| **Environmental Impact** | Biodegradable and eco-friendly | May involve chemicals harmful to nature |
| **Therapeutic Benefits** | Superior wound healing, anti-inflammatory action | May be limited or purely cosmetic |
| **Cost** | Economical in large scale | Can be costly due to processing |

## 4. Botanical Profile of Aloe Vera

Aloe barbadensis Miller is a succulent plant whose gel is used in skin care and pharmaceutical preparations. The gel contains over 75 active compounds, making it suitable for dermatological use.

## 5. Skin and UV Radiation

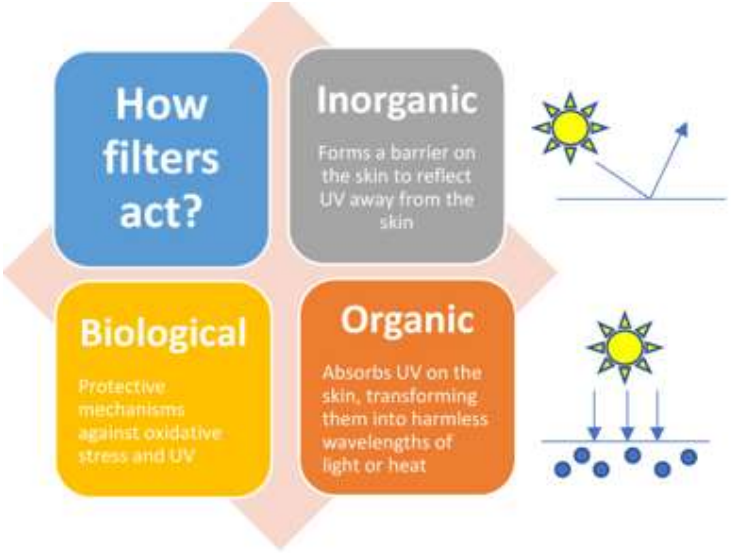
UV radiation is divided into UVA (320–400 nm), UVB (290–320 nm), and UVC (200–290 nm). UVB causes direct DNA damage, erythema, and sunburn, while UVA contributes to long-term damage like photoaging and wrinkles. Both forms can cause oxidative stress through the generation of reactive oxygen species (ROS). Sunscreens are designed to mitigate these effects by either absorbing or reflecting UV rays.




## 6. Conventional vs. Herbal Sunscreens

Conventional sunscreens often contain synthetic agents like oxybenzone, avobenzone, and octinoxate. While effective, these agents may cause irritation and have been linked to coral reef damage. Herbal sunscreens, in contrast, use plant-based agents like Aloe vera, green tea,

and cucumber, which are considered safer, biodegradable, and multifunctional (i.e., photoprotection plus skin nourishment).




## 7.Aloe Vera Phytochemicals & Pharmacological Actions

| Phytochemical | Action | Pharmacological Benefit |
|---|---|---|
| Aloin, Aloesin | UV absorption | Photoprotection |
| Acemannan | Boosts collagen, skin regeneration | Wound healing, anti-aging |
| Polysaccharides | Retain moisture, form a barrier | Moisturizing, soothing |
| Vitamins C & E | Antioxidants | Reduce oxidative stress from UV |
| Saponins | Antimicrobial | Prevent skin infections |
| Salicylic acid | Mild exfoliant | Removes dead skin |

## 8. Role of Aloe Vera in Cosmeceuticals

In cosmeceuticals, Aloe vera is used for its dual action:

- **Cosmetic:** Enhances appearance, soothes, and hydrates.
- **Pharmaceutical:** Heals UV damage, fights inflammation, and provides protection at the cellular level.
- It bridges the gap between traditional skincare and therapeutic treatments.

## 9. UV Protective Mechanism of Aloe Vera

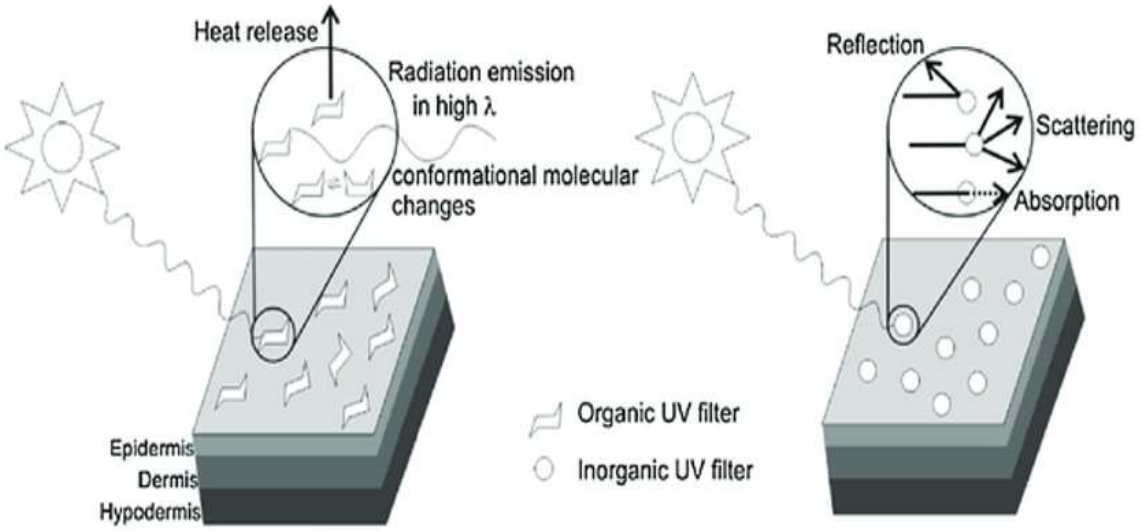
Aloe vera acts via multiple pathways:

- ✓ **UV Absorption:** Aloin and aloesin absorb UVB rays.
- ✓ **Free Radical Neutralization:** Antioxidants in Aloe vera prevent oxidative stress.
- ✓ **Cellular Repair:** Acemannan helps in the regeneration of skin cells and collagen.
- ✓ **Barrier Function:** Polysaccharides form a protective film on the skin.

## 10. Pharmacological Actions in Sunscreen

- ✓ **Anti-inflammatory:** Reduces erythema and swelling post-UV exposure.

- ✓ **Moisturizing:** Prevents skin dryness associated with sun exposure.
- ✓ **Wound Healing:** Accelerates recovery from UV-induced damage.
- ✓ **Antimicrobial:** Prevents secondary infections in sunburned skin.
- ✓ **Anti-aging:** Reduces photoaging signs by promoting elasticit




## 11. Formulation of Aloe-Based Sunscreens

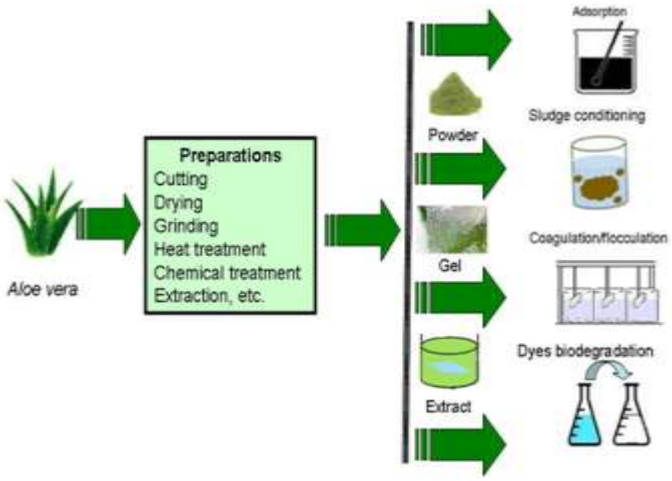
Aloe vera is typically added in gel or extract form to cream-based sunscreen formulations. A typical formula includes:

**Aloe extract**

- ✓ Emulsifying agents (Cetyl alcohol, stearic acid)
- ✓ Preservatives (Methyl paraben)
- ✓ UV filters (zinc oxide, titanium dioxide)
- ✓ Stabilizers (Carbopol, triethanolamine)


**Preparation Steps:**

- ✓ Separate oil and aqueous phases.
- ✓ Heat both to ~80°C.
- ✓ Mix and homogenize under controlled conditions.
- ✓ Cool and store.




## 12.Advantages Over Conventional Sunscreens

- ✓ Safer for sensitive skin
- ✓ No harmful chemical residues

- ✓ Provides skin benefits like hydration and healing
- ✓ Suitable for daily and long-term use

## 13. Comparative Studies with Other Herbal Agents

When compared to other herbal agents like green tea, turmeric, or cucumber:

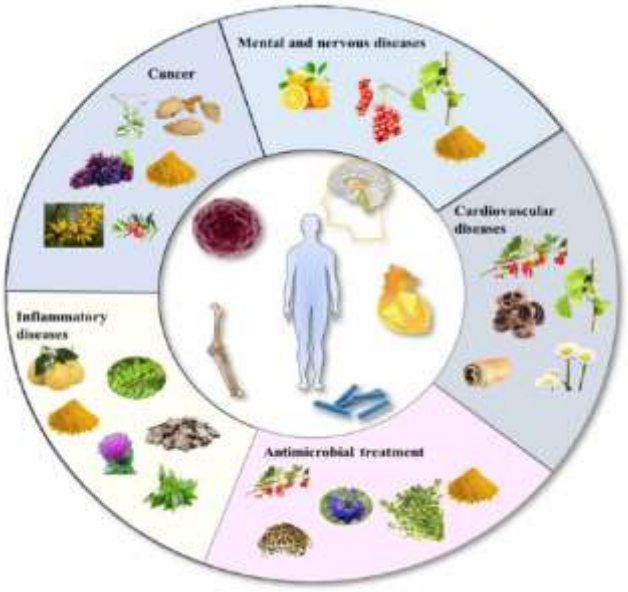
- ✓ Aloe vera has superior moisturizing and wound healing properties.
- ✓ Tomato (lycopene) may offer higher antioxidant strength.
- ✓ Cucumber excels in cooling effect.

  However, Aloe vera offers a balanced combination of UV protection, hydration, and healing—making it a leading candidate.

## 14. Stability and Storage Considerations

Aloe-based sunscreens can degrade due to:

- ✓ Light and oxygen exposure
- ✓ Microbial contamination
- ✓ Stabilization techniques include:
- ✓ Use of natural preservatives (e.g., parabens, vitamin E)
- ✓ Packaging in opaque tubes
- ✓ Storage below 25°C




## 15. Advantages and Limitations

### Advantages:

- ✓ Natural and safe for sensitive skin
- ✓ Eco-friendly and biodegradable
- ✓ Offers multi-level protection (UV, hydration, healing)

### Limitations:

- ✓ Lower SPF compared to chemical sunscreens
- ✓ Potential for allergic reactions in rare cases
- ✓ Requires refrigeration or stabilization

## 16. Market Trends and Consumer Preference

The global herbal sunscreen market is projected to grow significantly.

- ✓ Consumers prefer:
- ✓ Clean-label products
- ✓ Vegan, cruelty-free ingredients
- ✓ Products with skin benefits beyond sun protection
- ✓ Aloe vera is prominently featured in brands like Himalaya, Patanjali, and Biotique.

- ✓ **17. Regulatory and Safety Aspects**

- ✓ Aloe vera is classified as "Generally Recognized As Safe (GRAS)" by FDA. Patch testing is recommended before widespread use. Regulatory bodies require SPF testing, stability testing, and microbial analysis before herbal sunscreens can be marketed.

## 18. Recent Research and Innovations

- ✓ Studies in journals such as Molecules and AJBSR have confirmed
- ✓ Aloe vera increases SPF value of creams when combined with zinc oxide.
- ✓ Nanoformulations and liposomal delivery are under research to improve skin penetration andSPF.
- ✓ Combining Aloe vera with other herbal extracts enhances efficacy.

## 19. Future Scope of Aloe-Based Sunscreens

- ✓ In vivo clinical trials for SPF validation
- ✓ Bioencapsulation for enhanced delivery
- ✓ Customized sunscreen products for different skin types
- ✓ AI-powered formulation using dermatological databases
- ✓ Eco-labeling and green certifications to increase trust

## 20. Conclusion

The present assignment is a comprehensive review and research-based study on the role of Aloe vera in sunscreen formulations. By thoroughly analyzing multiple review articles, research publications, and scientific databases, we have identified the pharmacological, chemical, and protective potential of Aloe vera as a natural cosmeceutical agent. The data collected through this literature strongly support Aloe vera's UV-protective, anti-inflammatory, moisturizing, wound-healing, and antioxidant actions, making it a powerful alternative to synthetic sunscreens.

This review not only highlights current developments in herbal sunscreen technology but also lays the groundwork for future experimental studies, such as in vivo SPF testing, nanoformulation development, and patient-specific skincare applications. With growing interest in plant-based and safe cosmetic products, further clinical and industrial research can significantly enhance the efficacy, stability, and acceptance of Aloe vera-based sunscreens in global markets.

**References**


- **References**
- **1.Aloe vera-based Sunscreen Formulation and Evaluation**
  https://ajbsr.net/data/uploads/4760.pdf
- **2. Aloe vera: A Review of Its Use in Cosmetics and Dermatology – MDPI Molecules**
  https://www.mdpi.com/1420-3049/25/6/1324
- **3. Recent Trends in Herbal Cosmetics – The Pharma Innovation Journal**
  https://www.thepharmajournal.com/archives/2012/vol1issue7/PartA/1-7-1.pdf
- **4. Aloe vera: A Valuable Ingredient – Critical Reviews in Food Science and Nutrition**
  https://www.tandfonline.com/doi/abs/10.1080/10408690490468486
- **5. Formulation and Evaluation of Sunscreen Creams Containing Natural Antioxidant Extracts – IJPR**
  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3931204/
- **6. Medicinal Properties of Aloe vera – J Clin Pharm Ther**
  https://onlinelibrary.wiley.com/doi/10.1111/j.1365-2710.2005.00626.x
- **7. Aloe vera: A Short Review – Indian Journal of Dermatology**
  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2763764/
- **8. Aloe vera Gel: Applications and Effectiveness – J HerbMed Pharmacol**
  https://herbmedpharmacol.com/Article/jhp-10057
- **9. Composition and Applications of Aloe vera Leaf Gel – Molecules**

https://www.mdpi.com/1420-3049/13/8/1599

- **10. Herbal Sunscreens: Review and Advances – JPSR**

  http://www.jpsr.pharmainfo.in/Documents/Volumes/vol14Issue05/jpsr14052203.pdf

- **11. Preparation and Evaluation of Herbal Sunscreen Creams – Pharmacognosy Research**

  https://www.phcogres.com/article.asp?issn=0974-8490;year=2013;volume=5;issue=1;spage=50;epage=56;aulast=Sahu

- **12. Aloe vera: A Plant for Health and Beauty – Indian Journal of Dermatology**

  https://www.ijdvl.com/article.asp?issn=0378-6323;year=2016;volume=61;issue=1;spage=63;epage=67;aulast=Gupta

- **13. Advances in Cosmeceuticals: Plant Extracts – Frontiers in Pharmacology**

  https://www.frontiersin.org/articles/10.3389/fphar.2020.01224/full

- **14. Herbal Cosmeceuticals: Current Trends and Prospects – RJPT**

  https://www.rjptonline.org/AbstractView.aspx?PID=2021-14-2-67

- **15. Aloe vera in Skincare and Sunscreen – AJBSR**

  https://www.ajbsr.com/pdf/ajbsr-id4760.pdf1), 45–56.