



# FORMULATION AND EVALUATION OF HERBAL SUNSCREEN CREAM

Mr. Jain Prajwal Jitendra<sup>1</sup>, Miss.Smrutigandha R. Kamble<sup>2</sup> (Ass. Prof. [M Pharm.]),  
Mr. Singare Pawan Vitthal<sup>3</sup>, Mr. Khandebharad Pavan Shahadev<sup>4</sup>,  
Mr. Bhumber Pavankumar Dnyaneshwar<sup>5</sup>, Dr. Gulshan Rathi<sup>6</sup> (Principal [M. Pharm.]).

VSS Institute of Pharmacy Badnapur, Tal-Badnapur, Dist-Jalna, Jalna - Chhatrapati Sambhajinagar Highway  
Pin: - 431202.

## Abstract:

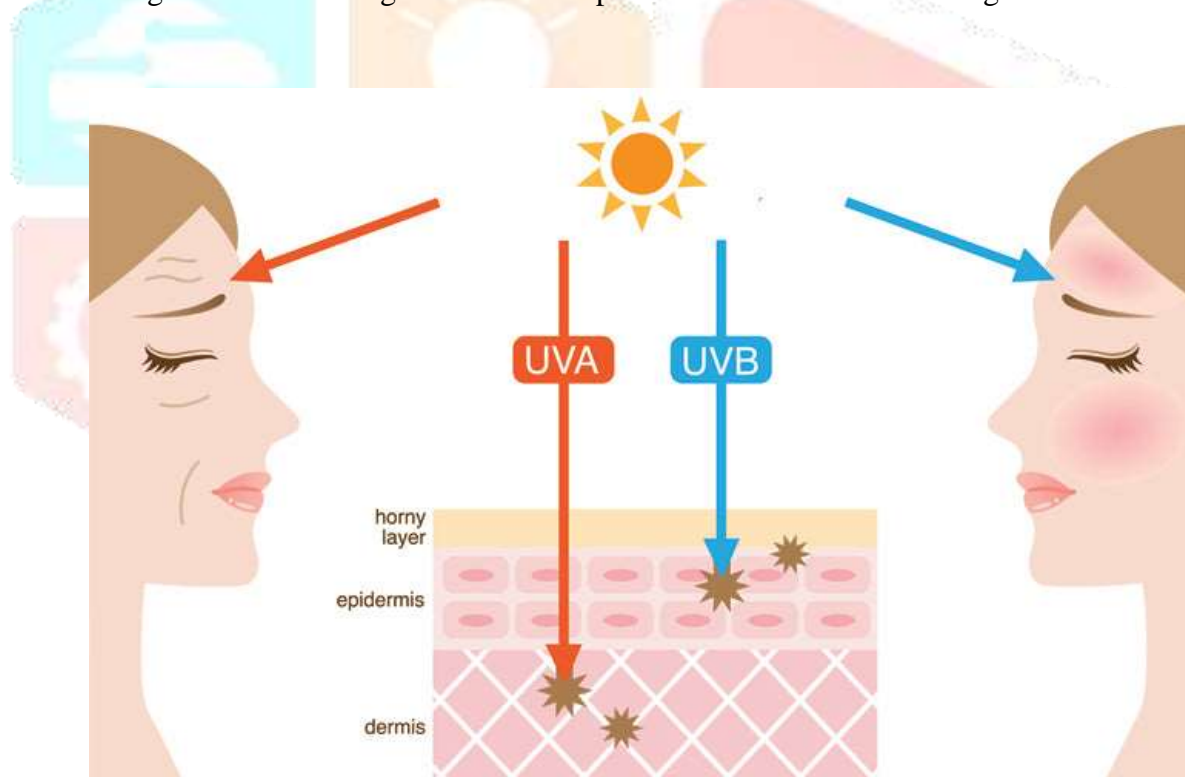
Aloe vera is a medicinal plant heavily used in the pharmaceutical industry, especially in cosmetics. The aloe plant cultivated in Indonesia to supply this industry is *Aloe chinensis* Baker. This research aims to determine the effects of Aloe vera gel extract on the effectiveness of sunscreen lotion. The steps included Aloe vera gel extraction, flavonoid absorption test, sun protection factor (SPF) value measurement, pH test, viscosity test, homogeneity test, and organoleptic evaluation. The extract was added to the base sunscreen formulation at five different concentrations. UV-Vis spectrophotometry at 290 – 320 nm was performed on the preparations to determine their SPF values. The highest SPF value of 10.21 was found in the 20% Aloe vera gel extract preparation. This value falls within the national industrial standard for sunscreen SPF value range of 2 – 60. The research showed that a higher Aloe vera gel extract concentration increased the pH, with the most elevated pH at 7.0 for the preparation containing 20% Aloe gel vera extract. This value also falls within the national pH standard for sunscreen of 4.5 – 8.0. The higher concentration of Aloe vera gel extract also increased the dispersive amount of the sunscreen preparation, with the highest value of 5 cm resulting from a 20% Aloe vera gel extract addition. This research showed that the increased addition of Aloe vera gel extract resulted in higher SPF value.

**Key Words:** Sunscreens, Aloe Vera, Coconut Oil, Vitamin E Capsule, SPF.

## Introduction:

### SUNSCREEN:

Sunscreens are used to protect the skin from the harmful effects of the sun. <sup>(1)</sup> They help to prevent sunburn and premature aging (such as wrinkles, and leathery skin). Sunscreens also help to decrease the risk of skin cancer and sunburn-like skin reactions (sun sensitivity) caused by some medications (including tetracyclines, sulfa drugs, and phenothiazines such as chlorpromazine). The active ingredients in sunscreens work either by absorbing the sun's ultraviolet (UV) radiation, preventing it from reaching the deeper layers of the skin, or by reflecting the radiation. Mineral sunscreen (inorganic or physical sunscreen) sits on top of the skin and acts as a barrier to the sun's rays. You may see the words zinc or titanium on the label. These can be a bit hard to rub in because they are designed to stay on the skin's surface, so they might leave the skin a little whitish. Some even come in fun colors that kids enjoy. Mineral sunscreen starts to work as soon as it is applied, but it can come off easily with water or sweat. Chemical sunscreen (also called organic sunscreen) protects the skin by absorbing the sun's rays like a sponge. It converts the rays into heat and then releases that heat from the skin. Because it absorbs into the top layer of the skin, it doesn't leave the whitish coating on the skin that minerals do and it doesn't wash off as easily either. But it can take 15-30 minutes to start working. <sup>(1)</sup> Seeking shade, wearing protective clothing including a lightweight and long-sleeved shirt, pants, a wide-brimmed hat, and sunglasses with UV protection, and using sunscreen are all important behaviors to reduce your risk of skin cancer. The U.S. Food and Drug Administration regulates sunscreen products as over-the-counter drugs. <sup>(1)</sup>



**Fig 1. UV Rays and Their Effect on Skin**

Scientific evidence supports the benefits of using sunscreen to minimize short-term and long-term damage to the skin from the sun's rays. Sunlight consists of two types of harmful rays that reach the earth UVA rays and UVB rays. Overexposure to either can lead to skin cancer. In addition to causing skin cancer, here's what each of these rays does UVA rays (or aging rays) can prematurely age your skin, causing wrinkles and age spots, and can pass through window glass. UVB rays (or burning rays) are the primary cause of sunburn and are blocked by window glass The United States Department of Health & Human Services and the World Health Organization's International Agency of Research on Cancer have declared UV radiation from the sun and artificial sources, such as tanning beds and sun lamps, a known carcinogen (cancer-causing substance).

Herbal sunscreen is also known as herbal sunblock. Herbal suntan lotion is a lotion, spray, or other topical product that helps protect the skin from the sun's UV radiation and reduces sunburn and other skin.

### **Sunscreen classified into two types:**

#### **Physical sunscreen:**

Those that reflect the sunlight.

#### **Chemical sunscreen:**

#### **Physical sunscreen:**

Sunscreen agents are for external use only. the use of sunscreen as photo protecting agent for UV protection. the sunscreen formulations which when applied topically protect the treated area from sunburn sunscreen depends on its ability to protect against UV-induced sunburn and its chemopreventive activity. Excessive solar ultraviolet radiation is responsible for various skin damage such as sunburn, skin pigmentation premature aging, and photocarcinogenesis. The main mechanism of skin damage by UV radiation is the formation of Reactive Oxygen Species (ROS) that interact with proteins and lipids and subsequently alter them. UVB and to a lesser extent UVA are responsible for inducing skin damage. Sunscreen should contain antioxidant agents in addition to sunblock agents to be effective in the prevention of photoaging and skin cancer. Plants due to their antioxidant potential are known as an attractive option to be used in Sunscreen formulations for the prevention of skin damage due to solar radiation. sunscreen is a topical product that protects the skin against the harmful effects of the sun. <sup>(2)</sup>

### **Classification of sunscreen and the mechanism of photoprotection:**

sunscreen is classified as either topical or systemic based on the route of administration topical sunscreens are divided into two classes on their mechanism of protection Organic sunscreen and Inorganic sunscreen

#### **Organic Sunscreen:**

Organic sunscreen works by absorbing into the skin and converting UV rays into heat. it is thin and ideal for everyday use allowing for skincare ingredients to be added easily. Organic sunscreen actives a chemical carbon-based compound and contains non-mineral active ingredients. <sup>(3)</sup>

#### **Inorganic sunscreen:**

These are particles that scatter and reflect UV rays to the environment they act as physical barriers to indent ultraviolet and UV light They are considered broad spectrum as they cover the entire ultraviolet spectrum. Inorganic sunscreens are also referred to as sunblock. <sup>(3)</sup>

### **Mechanism of photoprotection:**

Sunscreen acts by preventing and minimizing the damaging effects of the ultraviolet sun rays following exposure to the sunscreen have been demonstrated to increase the tolerance of skin to UV exposure. <sup>(4)</sup> They work on two mechanisms Scattering and reflection of UV energy from the skin surface mineral based on inorganic sunscreen work on this mechanism they provide a coating that blocks sun rays from penetrating through the skin. Absorption of the UV energy by converting it to heat energy thus reducing its harmful effects and

reducing the depth that can penetrate the skin organic sunscreen works on this mechanism. <sup>(4)</sup>

### The main role of ingredients used in formulation:

#### Aloe vera:



**Fig.2. Aloe Vera Gel**

Aloe vera is a good active ingredient to reach in the Sunscreen arsenal. it has been proven to both treat and prevent burns on your skin. the leaves of aloe vera and *A. Barbadensis* are the source of aloe vera gel. aloe vera gel is used in cosmetics lotion for its moisturizing and revitalization. it blocks UVA and UVB rays and maintains the skin's natural moisture balance. It stops the sunburn and stimulates immune system intervention. aloe vera gel can be used to help with the healing process of sunburn it helps relieve pain and redness by reducing inflammation. the gel also stimulates the production of collagen which helps the healing process. <sup>(5)</sup>

**Butterfly pea flower:****Packed with antioxidants:**

Butterfly pea flowers contain many antioxidants such as flavonoids anthocyanins and polyphenols. your skin needs antioxidants to improve general health and elasticity. antioxidants help to minimize fine lines and improve your skin and appearance. <sup>(6)</sup>

**Soothes minor skin irritation:**

Butterfly pea flowers helped calm itching and general irritation. The butterfly pea flower is used for use in rejuvenating the skin.

**Reduce redness:**

Because of the butterfly pea flower's ability to soothe irritated skin, it also minimizes redness caused by acne, dryness, and general irritation. these nourishing properties are further enhanced when combined with other nutrients that benefit skin health.

**Improve moisture retention:**

This helps increase skin turnover to naturally restore itself Moisture retention helps stop dryness and promote lipid balance.

**Improve the skin barrier:**

Because butterfly pea flowers contain plant-based antioxidants and antioxidants vitamin such as vitamins, they help improve the skin barrier

**Suitable for all skin types:**

Butterfly pea flower is a hidden skin care rockstar. It is gentle enough for use on all skin types, no matter what time of year it is.

**Coconut oil:****Fig.4. Coconut Oil**

Coconut oil keeps the skin soft and smooth while preventing premature aging of the skin. coconut oil for skin use as a moisturizer removes dead skin cells. Coconut oil moisturizes dry skin including in people with conditions such as eczema. promoting wound healing it has antibacterial, antifungal, and antiviral properties which prevent free radicals from causing damage to the skin. coconut oil has anti-inflammatory properties which reduce redness on the skin this can be helpful for both dry and oily skin conditions by reducing inflammation of the skin. <sup>(7)</sup>

**Rose water:****Fig.5. Rose Water**

Rose water contains vitamin B which is often used in Sunscreen and sun products .it helps to bolster the effectiveness of SPF Rose water can be used to lighten skin pigmentation. Rose water can remove oils and dirt from your skin by unclogging your pores. It helps maintain the pH level of your skin. It is a hydrating and nourishing agent for the skin and protects skin against harmful environmental aggressors, gulabjal has antioxidant levels that tackle free radicals and keep skin healthy and glowing. <sup>(7)</sup>

### **Vitamin E Capsule:**



**Fig.6. Vitamin E Capsule**

Vitamin E provides extra protection against acute UVB damage and protects against cell mutation caused by sun and pollution exposure. vitamin E helps cleanse your skin remove the impurities and help improve skin elasticity Vitamin E combination with lemon juice helps to whiten the skin.it is most commonly known for its benefits of skin health and appearance. it has antioxidant and anti-inflammatory properties. <sup>(8)</sup>

### **Formulation of sunscreen cream:**

### **Formulation of butterfly pea flower extract:**

To make an extract of butterfly pea flower for herbal sunscreen, steep about a dozen fresh or dried flower leaves in a cup of boiling water. After about 15 minutes, strain the liquid and discard the leaves. The deep blue water is then ready to be used in Sunscreen cream. <sup>(9)</sup>

**Table No.1. Butterfly pea flowers contain**

Soluble minerals:	8.94mg
Ash. :	0.9mg
Crude protein:	41.27mg
Soluble carbohydrates:	29.18mg

**Formulation of sunscreen cream was prepared by the following procedure: -**

1. I have to take butterfly pea flower extract.
2. then I have taken aloe vera gel because it has proven to both treat and prevent burns on the skin.
3. Then add rose water in a mixture of rose water to provide a cooling effect.
4. then gradually add coconut oil and vitamin E.
5. All the ingredients were mixed vigorously using a spatula for about 20-30min and placed. List of ingredients used in the formulation.

**Formulation of sunscreen cream was prepared by following the procedure -**

1. I have to take butterfly pea flower extract.
2. then I have to take aloe vera gel because it has proven to both treat and prevent burns on the skin.
3. Then add rose water in a mixture of rose water to provide a cooling effect.
4. Then gradually add coconut oil and vitamin E.
5. All the ingredients were mixed vigorously using a spatula for about 20-30min and placed.

**Table No.2. List of ingredients used in the formulation**

Aloe vera.	5 gm
Rose water.	2 ml
Butterfly pea flower Extract.	4 gm
vitamin E.	2 gm
coconut oil.	2 ml

**Final Product:****Fig.7. Final Product****Evaluation of sunscreen cream for sun screening activity****Effectiveness of sunscreen:**

The effectiveness of sunscreen is usually expressed by the sunscreen protection factor (SPF), which is the ratio of UV energy required to produce a minimal erythral dose in protected skin to unprotected skin. A simple, rapid, and reliable in vitro method of calculating the spf is to screen the absorbance of the product between 290-320nm at every interval.SPF can be calculated by applying the following formula known as the Mansur equation.

- **SPF spectrophotometric**=CF×EEF (wavelength)×I(wavelength)×Abs(wavelength)

Where CF=correction factor (10), EE=erythmogenic effect of radiation with wavelength, Abs=spectrophotometric absorbance values at wavelength. <sup>(10)</sup>

The value of EE×I constants.

#### **PH of the cream:**

The pH meter was calibrated using a standard buffer solution. about 0.5 of the cream was weighed and dissolved in 50.0ml of distilled water and its pH was measured

#### **Homogeneity:**

The formulations were tested for homogeneity by visual appearance and by touch. <sup>(11)</sup>

#### **Appearance:**

The appearance of the cream was judged by its color, pearlescence, roughness, and grade.

#### **Removal:**

The ease of removal of the cream applied was examined by washing the applied part with tap water.

#### **Irritancy test:**

The cream was applied to the specified area and time was noted. Irritancy, erythema, and edema were checked if any for regular intervals up to 24 hours and reported. <sup>(11)</sup>

#### **After feel:**

Emolliency, slipperiness, and amount of residue left after the application of the fixed amount of cream was checked.

#### **Type of smear:**

After the application of the cream, the type of film or smear formed on the skin was checked.

**Table No.3.Types of skin and SPF**

Types.	Description	SPF.	Character
1	Always burn easily. And never Tans	More than 8.	Sensitive
2	Always burn and tan. Minimally	6-7.	Sensitive
3	Burn moderator and Tan gradually	4-5	Normal
4	Burn minimal and. Always tan well	2-3	Normal
5	Barely burn and tan Profusely	2	
6	Never burn and Become deeply Pigment	None	Insensitive

**Research Methodology:****Materials:**

The main ingredient in this trial is Aloe vera gel extract that had been obtained from the cleaning and peeling of Aloe vera leaves and followed by water removal. Aloe vera was purchased from farmers around West Java with a type of Aloe vera Chinensis Baker. The sunscreen lotion base was made from Part A, containing stearic acid, cetyl alcohol, and liquid paraffin, and Part B, containing triethanolamine (TEA), glycerin, methylparaben, and distilled water. <sup>(12)</sup>

**Procedures:****Production of Aloe vera gel extract:**

Aloe vera leaves were washed and cleaned. The gel was obtained by removing the rind of the Aloe vera. The gel was then put in the blender, and the resulting puree was filtered to collect the extract.

**Sunscreen base preparation:**

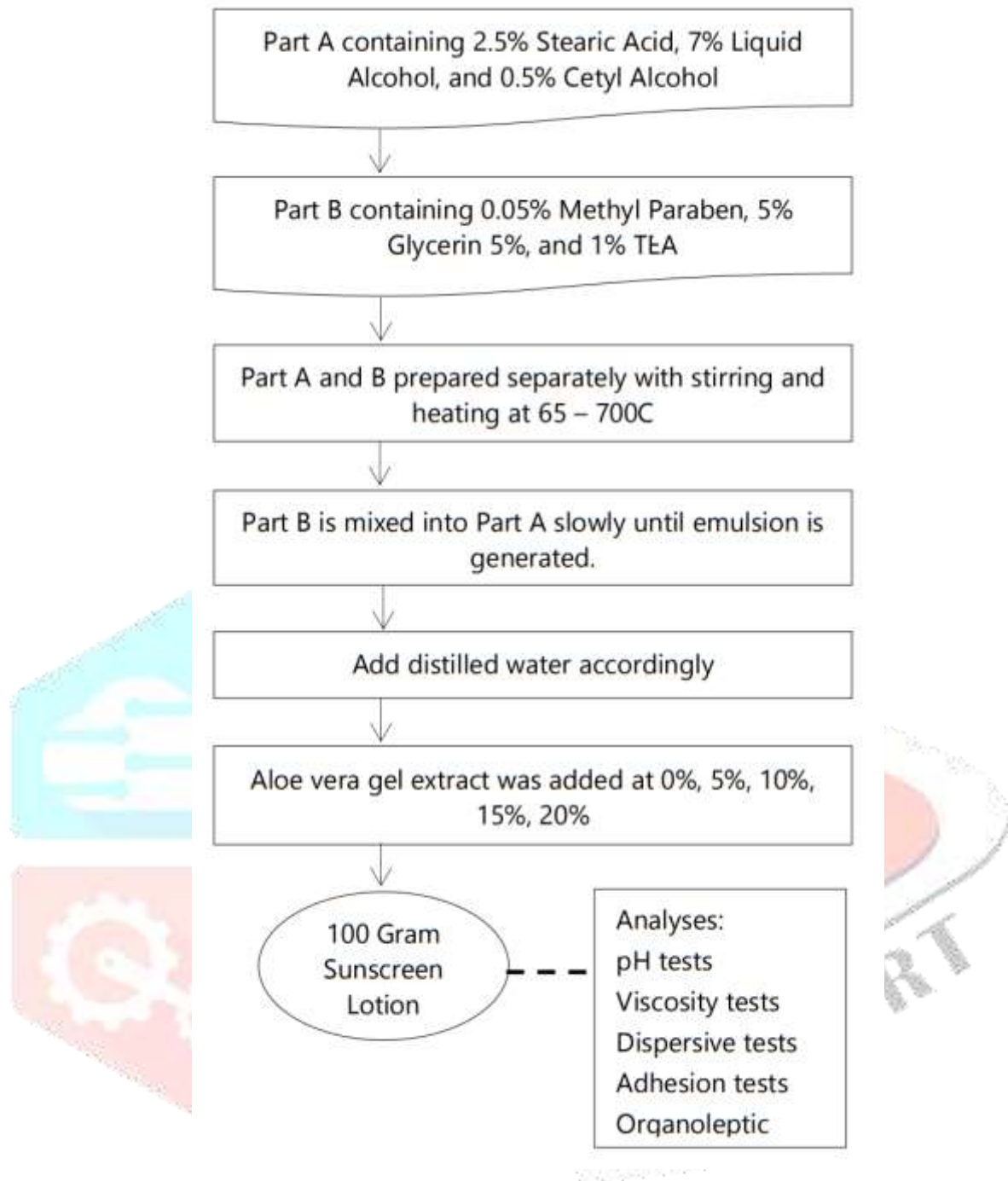
Part A was prepared by mixing stearic acid, cetyl alcohol, and liquid paraffin on a hotplate set at 65-70<sup>0</sup>C. Part B was prepared by mixing methylparaben, glycerin, and TEA in distilled water on a hotplate at 65-70<sup>0</sup>C. After complete mixing, Part B was slowly added to Part A to form an emulsion. Aloe vera gel extract was added to the emulsion. <sup>(13)</sup>

**Table No.4. The compositions of the tested sunscreens**

Ingredient	Formula (%)				
	FA	FB	FC	FD	FE
Stearic Acid	2.5	2.5	2.5	2.5	2.5
Liquid Paraffin	7	7	7	7	7
Cetyl Alcohol	0.5	0.5	0.5	0.5	0.5
Glycerin	5	5	5	5	5
Methyl Paraben	0.05	0.05	0.05	0.05	0.05
TEA	1	1	1	1	1
Distilled Water	83.95	78.95	73.95	68.95	63.95
<i>Aloe vera</i> gel	0	5	10	15	20

**Table No.5. Observation Table**

Sr.No.	Parameters	Observation
1	Color	Light Blue
2	Odor	Characteristics
3	Spreadability	Good and uniform
4	PH	6.5
5	Test for irritancy	No.irritation reaction



**Fig 8. Flow Chart for Sunscreen Preparation**

**Benefits of sunscreen:** <sup>(14)</sup>

- Reduce risk of skin cancer
  - Protect against sunburn
  - Avoid inflammation and redness
  - Avoid blotchy skin and hyperpigmentation
  - Stop DNA damage
  - Prevent the early onset of wrinkles and fine lines
  - Lower skin cancer risk
  - Shields from harmful UV rays
  - Maintain the brightness of your natural complexion
  - Maintain the look and texture of your skin
  - Delays premature signs of aging
  - Reflects UVA and UVB rays
- Works immediately when applied on the skin.

**Advantages:** <sup>(15)</sup>

- Easily available
- No side effects
- No special equipment is needed for the preparation
- They are inexpensive
- Ingredients are easily available
- Renewable resources
- Be non-toxic and non-irritant
- Be neutral
- Be stable to heat

- Easy to manufacture

**Disadvantages:** <sup>(16,17)</sup>

- They are difficult to hide taste and odor
- Manufacturing processes are time-consuming and complicated
- Herbal drugs have slow effects as compared to allopathic dosage forms it also requires long-term therapy.

**Result:**

To be effective in preventing sunburn and other skin damage, a sunscreen product should have a wide range of absorbance. During the storage and handling of cosmetic formulation, spreadability and viscosity are the prime parameters that affect the formulation's acceptability. The formulated cream exhibited no redness, inflammation, or irritation. When the formulation was kept for a long time, it was found that there was no change in the color of the cream. The cream was easily removed by washing with tap water.

**Conclusion:**

The study attempted to develop an herbal sunscreen cream using an extract of Aloe Vera and examined their efficacy for preventing sunburn.

**Conflicts of interest:**

There are no conflicts of interest or disclosures regarding the manuscript.

**Acknowledgment:**

The authors sincerely thank the VSS Institute of Pharmacy Badnapur, University Libraries, and all other sources for their cooperation and advice in writing this review.

**Reference:**

1. Boyd AS, Naylor M, Cameron GS, et al. The effects of chronic sunscreen use on the histologic changes of dermatoheliosis. *J Am Acad Dermatol.* Dec 1995; 33(6):941-6.
2. DeBuys HV, Levy SB, Murray JC, et al. Modern approaches to photoprotection. *Dermatol Clin.* Oct 2000; 18(4):577-90.
3. Diffey BL and Grice J. The influence of sunscreen type on photoprotection. *Br J Dermatol.* Jul 1997; 137(1):103-5.
4. Dromgoole SH and Maibach HI. Sunscreening agent intolerance: contact and photo contact sensitization and contact urticaria. *J Am Acad Dermatol.* Jun 1990; 22(6):1068-78.
5. Fotiades J, Soter NA and Lim HW. Results of evaluation of 203 patients for photosensitivity in 7.3 years. *J Am Acad Dermatol.* Oct 1995; 33(4):597-602.
6. Mithal BM and Saha RNA. Handbook of cosmetics, first edition, reprint-2007, Vallabh Prakashan, Delhi 122-124.
7. Gasparro FP, Mitchnick M and Nash JF. A review of sunscreen safety and efficacy. *Photochem Photobiol.* Sep 1998; 68(3):243-56.
8. Kaidbey KH. The photoprotective potential of the new super potent sunscreens. *J Am Acad Dermatol.* Mar 1990; 22(3):449-52.
9. Kullavanijaya P and Lim HW. Photoprotection. *J Am Acad Dermatol.* Jun 2005; 52(6):937-58; quiz 959-62.
10. Levy SB. How high is the SPF? *Arch Dermatol.* Dec 1995; 131(12):1463-4.
11. Moloney FJ, Collins S, and Murphy GM. Sunscreens: safety, efficacy, and appropriate use. *Am J Clin Dermatol.* 2002; 3(3):185-91.

12. Naylor MF and Farmer KC. The case for sunscreens. A review of their use in preventing actinic damage and neoplasia. Arch Dermatol. Sep 1997; 133(9):1146-54.
13. ahu RK, Roy A, Kushwah P, Sahu A. Formulation and development of face cream containing natural products. Research Journal of Topical and Cosmetic Science. 2012; 3(1): 16-19.
14. Roy A, Sahu RK, Mutlam M, Deshmukh VK, Dwivedi J, Jha AK. In vitro Techniques to Assess the Proficiency of Skin Care Cosmetic Formulations. Pharmacognosy Review. 2013; 7(14): 97-106.
15. Sahu RK, Roy A, Kushwah P, Khare M, Mudotiya R. Formulation and development of whitening polyherbal face cream. Research Journal of Topical and Cosmetic Science. 2012; 3(1): 23-27.
16. Sahu RK, Roy A, Jha AK, Dwivedi J. Promotion and computation of inhibitory effect on tyrosinase activity of herbal cream by incorporating indigenous medicinal plants. Pakistan Journal of Biological Sciences. 2014; 17(1): 146-150.
17. Shahriar M, Akhter S, Hossa MI, Haque MA, Bhuiyan MA. Evaluation of in vitro antioxidant activity of bark extracts of Terminalia arjuna. Journal of Medicinal Plants Research. 2012; 6(39): 5286-5298.