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Research Article

Formulation And Evaluation of Herbal Sunscreen Cream

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ABSTRACT

The present study focuses on the formulation and evaluation of an herbal sunscreen cream containing Blueberry extract, Aloe vera extract, and zinc oxide as active ingredients. The main objective of the study was to develop a safe, effective, and stable herbal sunscreen formulation capable of protecting the skin from harmful ultraviolet (UV) radiation. Herbal ingredients rich in antioxidants and photoprotective compounds were selected to enhance skin protection while minimizing the side effects associated with synthetic sunscreen agents. The sunscreen cream was prepared by emulsification method using stearic acid, cetyl alcohol, glycerin, almond oil, liquid paraffin, triethanolamine, preservatives, rose water, and distilled water. The prepared formulation was evaluated for various physicochemical and pharmaceutical parameters including colour, odour, texture, consistency, pH, viscosity, spreadability, SPF value, UV absorbance, skin irritation, washability, stability, and antioxidant activity. The formulation showed satisfactory organoleptic properties with good consistency and pleasant appearance. The pH of the formulation was found to be suitable for skin application. The sunscreen cream demonstrated good spreadability, acceptable viscosity, stability, and non-irritant behavior on the skin. UV spectrophotometric analysis indicated moderate sun protection activity and broad-spectrum UV absorption characteristics. The antioxidant activity of blueberry extracts further enhanced the protective effect of the formulation against oxidative stress caused by UV radiation.

INTRODUCTION

The skin is the body's outer covering and the largest organ, consisting of three layers: epidermis, dermis, and hypodermis. It acts as the first protective barrier against pathogens, ultraviolet

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radiation, chemicals, and physical injury. The skin also helps regulate body temperature and water loss. Skin thickness varies in different parts of the body. The palms and soles have the thickest skin due to the presence of an additional epidermal

layer called the stratum lucidum, while other regions are considered thin skin. Because of its barrier function, the skin is vulnerable to inflammatory and infectious conditions.

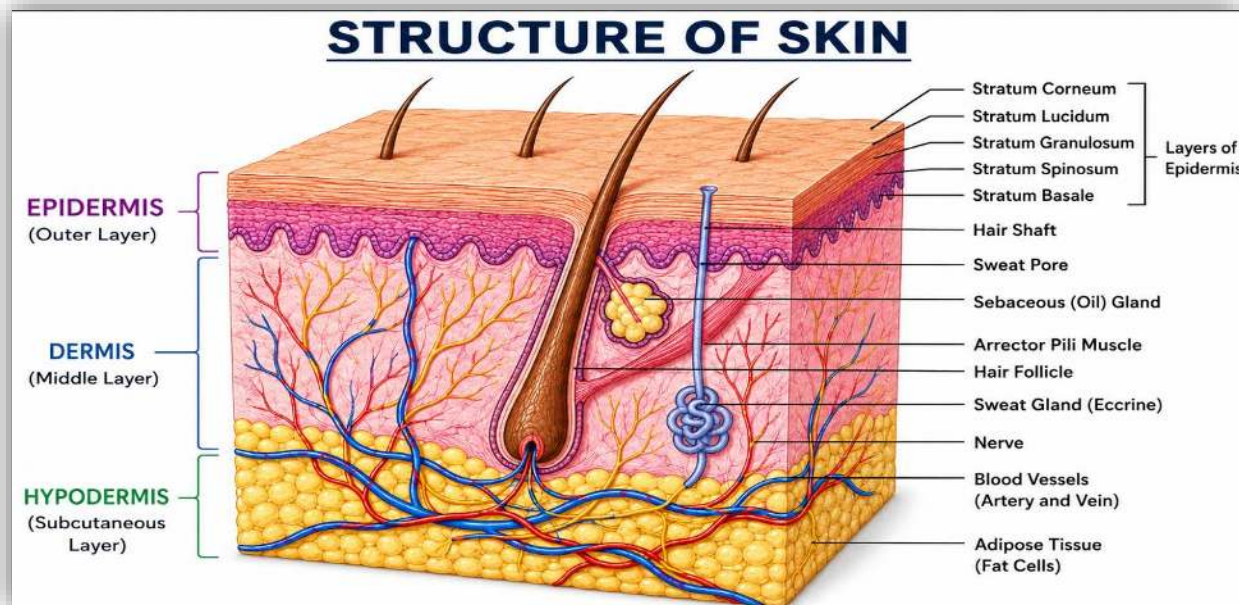


Figure No. 1

The epidermis is the outermost layer of the skin and consists of several layers: stratum basale, stratum spinosum, stratum granulosum, stratum lucidum, and stratum corneum. The stratum basale is the deepest layer and contains actively dividing cells that produce new keratinocytes, along with melanocytes responsible for skin pigmentation. Above it is the stratum spinosum, also known as the prickly cell layer, which contains multiple layers of cells that provide strength and support to the epidermis. The dermis lies beneath the epidermis and is connected to it by the basement membrane. It consists of two layers: the papillary layer and the reticular layer. The papillary layer is the upper, thinner layer made of loose connective tissue, while the reticular layer is the deeper and thicker layer composed of dense collagen-rich connective tissue.

FUNCTIONS OF SKIN

Barrier Function: The skin acts as a protective barrier against water loss, microorganisms, chemicals, mechanical injury, and ultraviolet (UV) radiation.

Immunological Défense: The skin plays an important role in immunity by helping protect the body from infections through adaptive and innate immune responses.

Regulation of Homeostasis: The skin helps maintain body temperature and water balance through the action of sweat glands and blood vessels.

Endocrine and Exocrine Functions: The skin produces vitamin D under UV exposure and

secretes sweat and sebum for temperature regulation and protection.

Sensory Functions: Sensory receptors in the skin detect touch, heat, cold, and pain, enabling interaction with the environment.

Diagnostic Indicator: Skin characteristics such as colour, elasticity, and texture can provide important information about overall health.

Introduction To Sunscreen

Sunscreens are an organic defence mechanism that protects the skin, the body's outermost layer, from harmful UV rays. Its ability to absorb, reflect, or scatter some of the UV radiation emitted by the sun onto exposed skin that has been over sunned with UV radiation UVA and UVB radiation can lead to skin melanoma, sunburn, Photo-aging, pigmentation, and other uncomfortable or hazardous effects.



Fig no.2 Sun protection

Since flavonoids, phenolic compounds, or plant oils are capable of absorbing UV radiation in the UV-A range, they are important constituents of UV protection and have been proven to exhibit anti-oxidant, wound healing, antifungal, premature aging, moisturizing, anti-inflammatory, and antiproliferative activities. Most of the sunscreen products available on the market are designed to protect the skin from sunburn and skin cancer. Sunscreens are substances that block, scatter, or absorb ultraviolet light. It regulates harmful consequences such as accelerated aging, which can result in wrinkles, sagging, and UV-induced hyperplasia. Sunscreen is increasingly being used as a photo protective agent to defend against UV rays. A formulation that prevents sunburn on the treated region when applied topically is called a sunscreen preparation. The purpose of sunscreens is to support the body's

resistance against the sun's damaging UV rays. The term "Blueberry" refers to broad category of perennial blooming plants that bear blue or purple berries. They are including in the section cynococcus North America is the native home of commercial blueberries, both cultivated (highbush) and wild (lowbush). Blueberry contain broad variety of phytochemical associated with both therapeutic and cosmetic uses.

BENEFITS OF SUNSCREEN

- It serves as a shield and rests on top of skin.
- It absorbs sunlight and forms a barrier that deflects and Blocks UV rays before they reach the skin surface.
- There is no need to wait; it provides protection immediately.
- Herbal components are typically better for sensitive Skin.



- Easily available, No side effect.
- They are inexpensive.
- Easy to manufacture.
- Non-toxic and non-irritant



.Fig.no.3 sunscreen cream

KEY HERBAL COMPONENT

Blueberry

Blueberry is a perennial shrub from the genus *Vaccinium*, native to North America. It produces small, round, blue-purple berries that are prized for their sweet-tart flavour and high antioxidant content.

The plant grows best in acidic, well-drained soil with full sun, and needs cold winters to fruit

properly. Most commercial types are “highbush” varieties that reach 1.8-3.6 m tall, though dwarf and lowbush types also exist. Berries ripen in summer and are eaten fresh,

frozen, or used in jams, desserts, and health foods. Beyond taste, blueberries are known as a “superfood” rich in vitamin C, fibre, and anthocyanins that support heart and brain health.



Figure No.4

BOTANICAL CLASSIFICATION

- Kingdom: Plantae
- Division: Magnoliophyte - flowering plants
- Class: Magnoliopsida - dicots/eudicots
- Order: Ericales

- Family: Ericaceae
- Genus: *Vaccinium*
- Species: *V. corymbosum*, *V. angustifolium*, etc.

COMMON NAMES



- English: Blueberry
- Hindi: Neelbadri
- Marathi: Nili Beri

GEOGRAPHICAL SOURCES

Native origin Blueberries are native to North America. They evolved in the acidic, temperate forests of the eastern and northeastern U.S. and southeastern Canada.

Global distribution Now cultivated in temperate to subtropical regions worldwide with acidic soils: North & South America, Europe, parts of Asia-Pacific, and Africa.

Major distribution

USA: Michigan, Oregon, Washington, Georgia - largest producer.

MORPHOLOGY

Part	Description
Plant Habit	Perennial deciduous shrub, 0.3–3.6 m tall.
Root	Shallow, fibrous root system without a taproot.
Stem	Woody stems with multiple canes; young stems green to reddish, older stems Gray-brown.
Leaf	Simple, oval leaves with smooth or finely toothed margins; turn red or purple in autumn.
Flower	Small white to pink bell-shaped flowers arranged in clusters; bloom in spring.
Fruit	Blue-purple berry with waxy coating containing small seeds.
Buds	Vegetative buds produce leaves, while flower buds produce fruit clusters. Plant

CHEMICAL CONSTITUENTS

1. Anthocyanins - *V. corymbosum* fruit extract

Function: Strong antioxidant, protects against UV/blue light damage, reduces redness

Used in: Anti-aging serums, sunscreens, eye creams, toners

Main types: Malvidin-3-glucoside, delphinidin-3-galactoside

2. Vitamin C (Ascorbic acid)



Function: Brightening, collagen synthesis, fades dark spots

Used in: Eye creams for dark circles, anti-redness products.

Used in: Brightening serums, masks, vitamin C creams.

6. AHA - Alpha Hydroxy Acids - Citric, malic acid

Function: Gentle exfoliation, improve texture, enhance penetration

3. Vitamin E (Tocopherols)

Function: Emollient, lipid-barrier repair, antioxidant synergy with Vitamin C

Used in: Exfoliating peels, cleansers, enzyme masks

Used in: Moisturizers, lip balms, overnight creams

7. Resveratrol & Pterostilbene

4. Polyphenols & Flavonoids - Quercetin, myricetin, chlorogenic acid

Function: Potent antioxidants, anti-glycation, firming

Function: Anti-inflammatory, soothing, anti-pollution, reduces ROS

Used in: Premium anti-aging creams, night repair serums

Used in: Sensitive skin lines, city-proof serums, calming gels

8. Seed Oil - from Vaccinium seeds

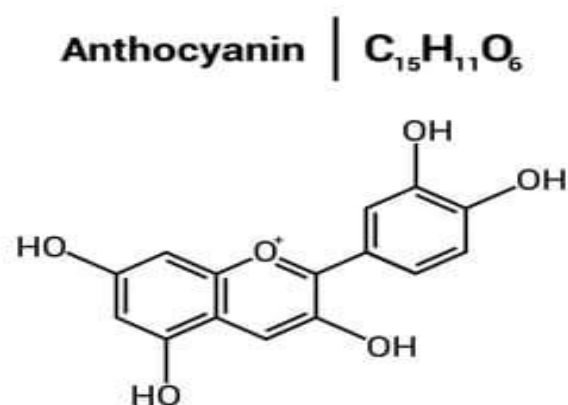
5. Proanthocyanidi (OPCs)

Rich in: Omega-3 (α -linolenic acid), Omega-6, Omega-9 fatty acids

Function: Strengthen capillaries, reduce puffiness, improve microcirculation

Function: Barrier repair, non-comedogenic moisture, skin softening

Used in: Facial oils, balms, dry skin moisturizers.



COSMETIC USES OF BLUEBERRY

Anti-aging

- Anthocyanins + vitamins C & E fight free radicals that cause wrinkles

- Serums, night creams, eye creams to improve firmness and reduce fine lines

Brightening & pigmentation

- Vitamin C + arbutin-like compounds inhibit melanin, fade dark spots



- Brightening serums, spot correctors, masks for uneven tone

UV & blue light protection

- Anthocyanins absorb blue light and UV-induced ROS
- “Anti-pollution” day creams, sunscreens as a booster, city-skin serums

Soothing & anti-redness

- Polyphenols like quercetin + chlorogenic acid reduce inflammation
- Calming gels, toners for sensitive/acne-prone skin, post-procedure creams.

Exfoliation

- Natural AHAs - malic + citric acid - provide gentle chemical exfoliation
- Enzyme masks, exfoliating cleansers, peel pads

Eye care

- Proanthocyanidins strengthen capillaries, reduce puffiness & dark circles
- Under-eye gels, caffeine + blueberry eye creams.

• Lip care

- Seed oil + vitamin E soften lips, anthocyanins give natural tint
- Tinted lip balms, overnight lip masks

• Acne control

- Mild astringent tannins + anti-inflammatory action help control oil and redness
- Clarifying toners, spot treatments, clay masks

ALOE VERA

Aloe vera is a well-known medicinal plant that has been used for centuries for its therapeutic, cosmetic, and health-related benefits. The name *Aloe vera* is derived from the Arabic word “Alloeh,” meaning a shining bitter substance, and the Latin word “vera,” meaning true.

This plant is widely valued for its diverse pharmacological

properties, including:

- Wound healing activity
- Anti-inflammatory effects
- Moisturizing and anti-aging properties
- Antiseptic and antimicrobial activity
- Protective effect against radiation-induced skin damage.

BOTANICAL CLASSIFICATION

The scientific classification of Aloe vera is as follows:

- Kingdom: Plantae
- Division: Magnoliophyta (Angiosperms)
- Class: Liliopsida (Monocotyledons)
- Order: Asparagales
- Family: Asphodelaceae
- Genus: Aloe
- Species: *Aloe vera*



Figure No.5

GEOGRAPHICAL SOURCE

Aloe vera is believed to have originated from the **Arabian Peninsula**, particularly **Oman**, and

regions of Northeast Africa such as **Sudan** and **Ethiopia**

MORPHOLOGY

Plant Part	Description
General Habit	Perennial, succulent xerophytic herb with a very short stem or stemless habit.
Leaves	Thick, fleshy, lance-shaped leaves arranged in a rosette pattern.
Leaf Features	Green to grey-green with small white spiny teeth along the margins and an acute apex.
Internal Structure	Leaves contain mucilaginous gel tissue.
Roots	Fibrous and shallow root system.
Inflorescence	Raceme borne on a long scape.
Flowers	Yellow to orange tubular flowers.
Fruit	Triangular capsule containing numerous seeds.

Chemical Constituents

1. Anthraquinone Glycosides (Latex Layer)
 - o Barbaloin (Aloin A & B):main purgative (10–30%),Isobarbaloin ,Aloe-emodin and Chrysophanol
2. Polysaccharides (Inner Gel)
 - o Acemannan : major active compound (immunomodulatory), Glucomannan and Mannose-6-phosphate
3. Other Constituents

Enzymes: Amylase, Lipase, Bradykinase, Alkaline phosphatase

Vitamins: Vitamin A, C, E, B1, B2, B6, B12, Folic acid

Minerals:Calcium, Magnesium, Zinc, Iron, Potassium, Sodium, Copper, Manganese

Amino Acids:20 out of 22 amino acids (including 7 essential amino acids)

COSMETICS USES OF ALOE VERA

Moisturizer: Keeps skin soft, smooth, and hydrated.

Sunscreen Agent: Protects skin from UV damage and soothes sunburn.



Anti-Aging: Reduces wrinkles and fine lines due to antioxidant activity.

Anti-Acne: Helps reduce pimples, redness, and inflammation.

Wound Healing: Promotes healing of cuts, burns, and damaged skin.

Face Cleanser: Used in face washes for gentle cleansing.

Hair Care: Reduces dandruff and improves scalp health.

1. LITERATURE REVIEW

1. **Daiana Schiavon, Daniela Novello Martini, Gabriela Brocco, Júlia Scherer Santos, Ana Paula Anzolin (2019)** reported that blueberry (*Vaccinium corymbosum*) provides potent antioxidant protection against UV-induced skin damage. Their study demonstrated that incorporating blueberry extract with Tinosorb M®-loaded microparticles enhances SPF, photostability, and overall sunscreen efficacy. This approach supports the development of advanced multifunctional cosmeceutical formulations. The study demonstrated that incorporation of blueberry extract improved antioxidant activity, photoprotection, and formulation stability. The prepared formulations showed high SPF values and better rheological stability compared to formulations without microparticles.
2. **Swarnlata Saraf and Chanchal Deep Kaur (2010)** reported that herbal sunscreens containing plant-derived flavonoids and phenolic compounds provide effective UV protection and antioxidant activity. The study reviewed the role of phytoconstituents in cosmetic and sunscreen formulations. The authors explained that herbal compounds such as flavonoids, polyphenols, carotenoids, and natural oils possess strong antioxidant and photoprotective properties. These compounds help neutralize reactive oxygen species generated by UV exposure, thereby reducing oxidative stress, photoaging, wrinkles, pigmentation, and potential skin cancer risk.
3. **Amit Roy and Ram Kumar Sahu, Volume-5 (2014)** The aim of study was to formulation and development of herbal sunscreen cream containing extracts of plant materials such as *Terminalia arjuna*, *Tinospora cordifolia* and *Glycyrrhiza glabra*. Oil in water (O/W) base cream was prepared from the ethanol extract of *T. arjuna*, *P. corylifolia* and *G. glabra*. The in vitro SPF value of cream was evaluated. The evaluation of cream was done on different parameters like pH, viscosity, spreadibility, and stability were examined. The prepared cream exhibited highest SPF value 24.35. The herbal cream showed good spreadibility, good consistency, homogeneity, appearance, pH, ease of removal and no evidence of phase separation. The prepared herbal sunscreen creams was safe to use for skin.
4. **AlSadi et al. (2023)** explored the protective mechanisms of polyphenol-enriched blueberry preparations against UVB-induced skin damage. Their study demonstrated that blueberry extracts significantly reduce inflammation and oxidative stress in skin tissues by neutralizing reactive oxygen species (ROS). This suggests that blueberry-based formulations can act as effective photoprotective agents. enhances the protective efficiency of sunscreen formulations while maintaining safety standards, indicating a synergistic effect between natural and synthetic UV filters.
5. **Gutiérrez-Gamboa et al. (2022)** studied the application of sunscreen-related compounds in blueberry plants and their effect on stress tolerance. Although focused on plant



physiology, the study provides indirect evidence of the protective role of such compounds against environmental stressors, supporting the concept of photoprotection associated with blueberry-derived substances.

6. **Franco et al. Julia Gomes Franco, Leticia Caramori Cefali, Janaina Artem Ataide, Antonello Santini, Eliana B. Souto, and Priscila Gava Mazzola (2022)** investigated the nanoencapsulation of blueberry extracts and found that encapsulation significantly improves the stability, bioavailability, and controlled release of active compounds. This advancement enhances the effectiveness of blueberry-based formulations in topical applications, particularly in sunscreen products.
7. **Rozinaparvin Iqbal Patel , Aarifa Mustak Patel and Bhavyaben Dharmeshkumar Modi (2023)** The increasing exposure to ultraviolet (UV) radiation due to environmental pollution and depletion of the ozone layer has raised concerns regarding skin damage, premature aging, sunburn, hyperpigmentation, and skin cancer. Conventional synthetic sunscreens are widely used for photoprotection; however, prolonged use of synthetic agents may produce adverse effects such as skin irritation, allergies, hormonal imbalance, and carcinogenicity. Therefore, researchers are increasingly focusing on herbal sunscreen formulations containing natural phytoconstituents with antioxidant and UV-protective properties.
8. **Prajwal Jitendra, Smrutigandha R. Kamble, Singare Pawan Vitthal , Khandebharad Pavan Shahadev(2024)** formulated and evaluated a herbal sunscreen cream containing Aloe vera, coconut oil, and vitamin E. The study reported that increasing Aloe vera concentration enhanced SPF value, spreadability, and stability of the formulation. The highest SPF value observed was 10.21 in the 20% Aloe vera extract formulation, indicating effective UV protection. Herbal sunscreen lotion enriched with natural plant extracts such as Aloe vera, watermelon, and turmeric. Their formulation showed significant antioxidant activity and effective UV protection with reduced skin irritation.

AIM AND OBJECTIVE

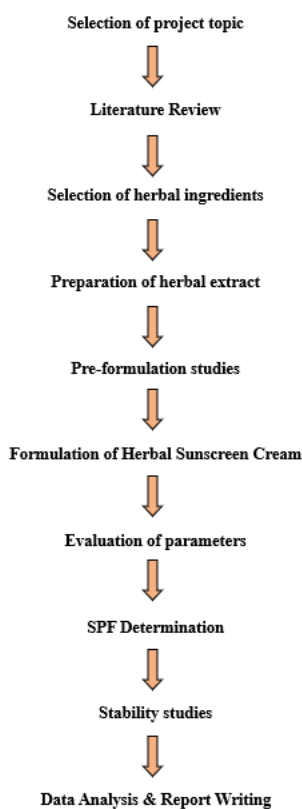
AIM Formulation and Evaluation of Herbal Sunscreen Cream.

OBJECTIVE

- To develop blueberry, extract base sunscreen.
- To determine the PH and spread ability.
- To estimate the sun protection factor (SPF) of sunscreen cream.
- To study the stability and physicochemical characteristics of the sunscreen cream to ensure long-term effectiveness.

2. PLAN OF WORK





MARKETED FORMULATION

We firstly found out various marketed preparation. These preparations are given here.



1.Hand and body cream



2.Blueberry sunscream



3.Handwash



4. Aloe vera gel



5. Mamaearth aloe vera gel

4. MATERIAL AND APPARATUS

1. Apparatus Used

The apparatus used during the preparation of the herbal sunscreen cream included beakers, measuring cylinders, stirrer, burner, conical flask, water bath, petri plates, test tubes, mortar and pestle, glass rod, and spatula. These apparatuses were used for measuring, mixing, heating, grinding, stirring, and handling the ingredients during formulation preparation and evaluation procedures.

2. Instruments Used

The instruments used in the study were Digital pH Meter, Weighing Balance, and UV Spectrophotometer. The digital pH meter was used to determine the pH of the sunscreen formulation, the weighing balance was used for accurate measurement of ingredients, and the UV spectrophotometer was used for SPF determination and UV absorbance studies.

3. Ingredients Used

The ingredients used in the formulation of the herbal sunscreen cream were Blueberry Extract, Aloe vera Extract, Cetyl Alcohol, Liquid Paraffin, Almond Oil, Zinc Oxide, Stearic Acid, Glycerine, Methyl Paraben, Propyl Paraben, Triethanolamine, Rose Water, and Distilled Water. These ingredients were selected for their photoprotective, moisturizing, emulsifying, preservative, soothing, and stabilizing properties, which helped in the preparation of an effective and stable herbal sunscreen cream formulation.

5. METHODOLOGY:

1. Fresh fruits of blueberry were collected from a reliable source
2. Fruits were washed thoroughly with distilled water to remove dirt and impurities.
3. The cleaned blueberries were crushed/macerated using a mortar and pestle or blender to obtain a uniform pulp.





Fresh blueberry pulp



Filter pulp



Evaporate blueberry extract

ETHANOLIC EXTRACTION

- The fresh pulp was transferred into a conical flask. Ethanol (70% or 95%) was added in a ratio of 1:3 or 1:4 (w/v) (e.g., 50 g pulp + 150–200 mL ethanol).
- The mixture was kept for 24–48 hours at room temperature. Occasional shaking was done to enhance extraction. The flask was covered to minimize solvent loss.

FILTRATION

- The extract was filtered first through muslin cloth to remove coarse particles.

- Further filtration was done using Whatman filter paper.

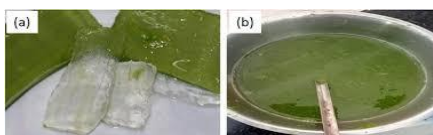
CONCENTRATION The filtrate was concentrated using Rotary evaporator (preferred), or Water bath at $<40^{\circ}\text{C}$. This step removes ethanol and yields a semi-solid extract.

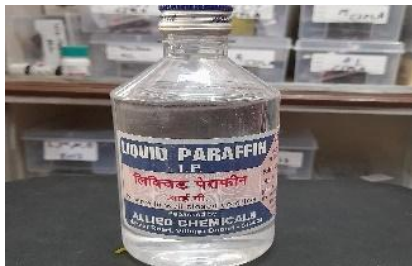
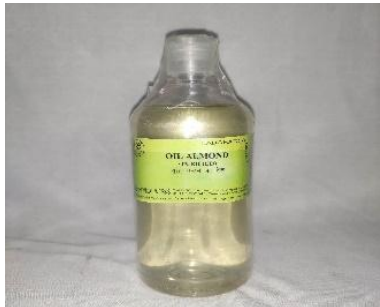
STORAGE

- The final extract was transferred into an airtight container and stored under refrigerated conditions ($4-8^{\circ}\text{C}$) to maintain its stability and prevent microbial contamination or oxidative degradation.

Ingredient

Table No 1- List of Ingredients

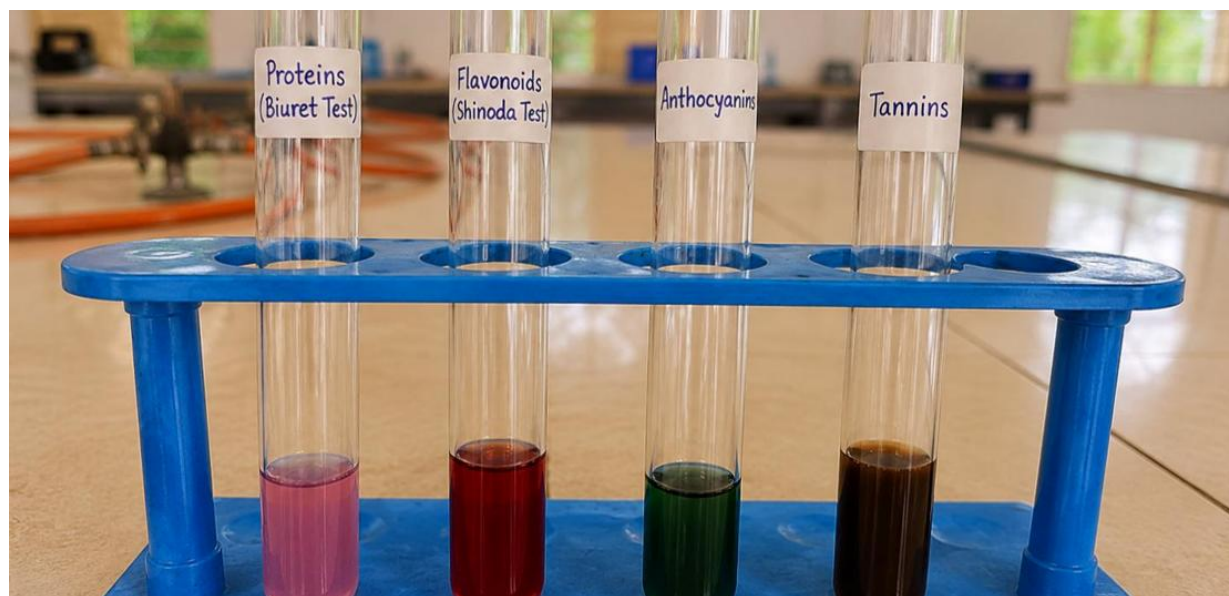
Sr. No.	Name of Ingredient	Source / Supplier	Picture
1.	Blueberry Extract	Extracted from blueberry fruit	
2.	Aloe vera Extract	Extracted from Aloe vera gel	

3.	Cetyl Alcohol	Laboratory	
4.	Liquid Paraffin	Laboratory	
5.	Almond Oil	Purchased from market	
6.	Zinc Oxide	Laboratory	
7.	Stearic Acid	Laboratory	

8.	Glycerin	Purchased from market	
9.	Methyl Paraben	Laboratory	
10.	Propyl Paraben	Laboratory	
11.	Triethanolamine	Laboratory	
12.	Rose Water	Purchased from market	
13.	Distilled Water	Laboratory	

11. PHYTOCHEMICAL INVESTIGATION

Sr. No.	Phytochemical Test	Procedure	Observation	Inference (Role in Sunscreen)
1	Flavonoids (Shinoda Test)	Extract + Mg ribbon + conc. HCl	Pink color	Presence of flavonoids → UV absorption, increases SPF
2	Phenolic Compounds	Add Ferric chloride solution	Blue color	Presence of phenols → Antioxidant, protects skin from UV damage
3	Anthocyanins	Add NaOH to extract	Bluish-green color	Presence of anthocyanins → Natural UV filter, anti-aging
4	Tannins	Add gelatin solution + NaCl	White precipitate	Presence of tannins → Astringent, forms protective layer
5	Saponins (Foam Test)	Shake with distilled water	Persistent foam	Presence of saponins → Helps in emulsification (formulation stability)
6	Glycosides	Add acetic acid + FeCl_3 + conc. H_2SO_4	Brown ring formation	Presence of glycosides → Skin protective effect
7	Carbohydrates (Molisch Test)	Add Molisch reagent + H_2SO_4	Violet ring	Helps in formulation consistency
8	Proteins (Biuret Test)	Add NaOH + CuSO_4	Violet color	Minor role in formulation

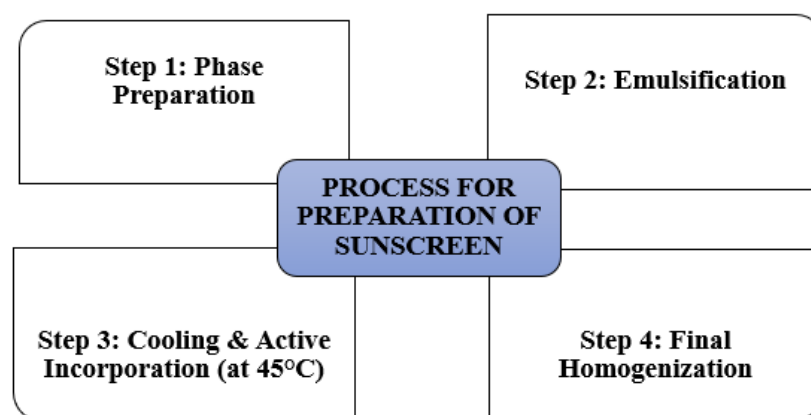


12. METHOD OF PREPARATION

FORMULA required for BLUE BERRY SUNSCREEN preparation.

Sr.no	Ingredients	Quantity Taken(50gram)	Roles
1.	Blue berry extract	2.5g	Active Ingredients
2.	Aloe vera extract	5g	Active Ingredients
3.	Zinc oxide	5g	Active Ingredients
4.	Stearic acid	4g	Gelling Agent
5.	Glycerine	2.5g	Humectant
6.	Methyl paraben	0.1g	Preservatives
7.	Propyl paraben	0.05g	Preservatives
8.	Triethanolamine	0.5g	Neutralizer
9.	Cetyl alcohol	1.5g	Thickener
10.	Liquid paraffin	3.5g	Emollient
11.	Almond oil	2.5g	Nourishing agent
12.	Rose water	5g	Perfuming Agent
13.	Distilled water	q.s to 50g (17.85g)	Solvent / vehicle

14. FLOW CHART



Step 1: Phase Preparation (Heat to 75°C)

- Oil Phase (Phase A): Melt Stearic acid, Cetyl alcohol. Liquid paraffin and Almond oil.
- Water Phase (Phase B): Heat Distilled water, Glycerin, Parabens and Triethanolamine.

Step 2: Emulsification

- Slowly pour the Oil Phase (phase A) into the Water Phase (phase B)

- Stir continuously until a smooth emulsion forms.

Step 3: Cooling & Active Incorporation/Phase C (at 45°C)

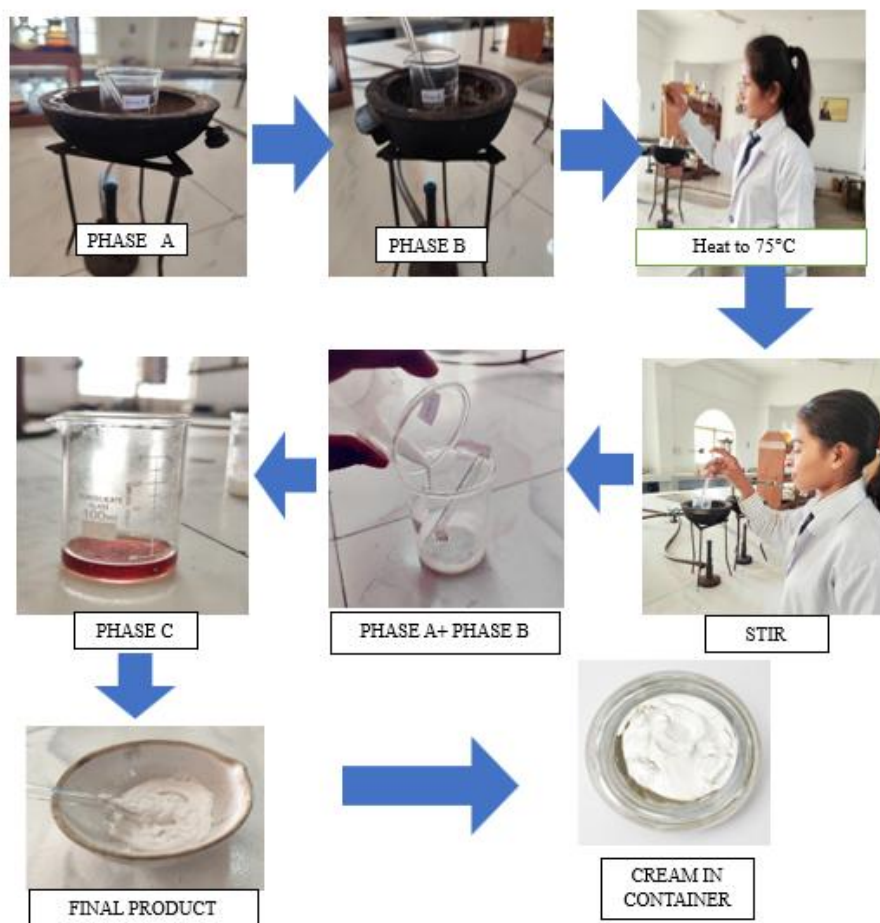
- Mix in Zinc Oxide (ensure uniform dispersion).
- Add dropwise triethanolamine for adjusting pH
- Add Blueberry extract and Aloe vera extract.



- Add Rose water for scent.

Step 4: Final Homogenization

- Stir until the cream reaches room temperature.
- Pack into airtight containers.



Method Of Preparation Of Sunscreen Cream

14. Evaluation Parameter

1. ORGANOLEPTIC CHARACTERS

The prepared sunscreen formulation was inspected visually for their colour, odour, texture and consistency.

2. PH OF SUNSCREEN:

pH measurement the digital pH meter was used to measure the pH of herbal sunscreens. After dispersing 1 g of the formulation in 100 ml of freshly prepared distilled water for two hours, the

pH was determined. The pH of sunscreens created in this study was to ensure that, and the day of use, the pH of the herbal sunscreen would be comparable to the pH of the skin. The outcomes were documented and double-checked.

3. SPREADABILITY TEST:

Weigh 0.5 g of the cream sample precisely, place it between two slides, and let it sit for about five minutes, or until no more spreading is seen.

The spreader circle's diameter, expressed in centimeters, served as a benchmark for spreadability.

Formula: $S = ML/T$

Where, M = weight of upper slide

L = length of circle

T = time in minute

4. DETERMINATIONS OF SUN PROTECTION FACTOR BY USING UV SPECTROPHOTOMETER (SPF):

The percentage of sunburn that is caused by the sun is measured by the sun protection factor (SPF). The duration of time that the product shields the skin from the damaging effects of UV radiation should be indicated by these SPF numbers. The UV-spectrophotometric approach added to the final volume to make 10 ml. The sample (1 g of cream) were precisely weighed using 90% ethanol solution as a blank. The absorbance values of each produced aliquot were measured at 5 nm intervals from 290 nm to 320 nm.

The following formula was used to determine the SPF:

Formula:

SPF spectrophotometric = $\sum (\lambda) \times I(\lambda) \text{ Abs}(\lambda) \times CF$

Where, CF = Correction factor (10)

EE = Erythrogenic effect of radiation with wavelength

Abs (A) = Spectrophotometric absorbance values at wavelength the value of EE*I constant (as shown in table)

7. SKIN IRRITATION TEST

This test assesses the safety of the formulation when applied to the skin. A small amount is applied to a specific area (usually the forearm), and the site is observed for redness, itching, or inflammation over 24 hours. A non-irritant formulation is considered safe for topical use

8. WASHABILITY

Washability determines how easily the sunscreen can be removed from the skin using water. This test is important for user convenience. A formulation should be easy to wash off without leaving excessive residue while still maintaining adequate adherence during use.

9. STABILITY STUDY

Stability testing evaluates how the formulation performs over time under different storage conditions. The sunscreen is stored at room temperature and elevated temperatures, and observed for changes in color, phase separation, pH, and consistency. This ensures the product remains effective and safe throughout its shelf life.

Stability Testing:

The formulation's stability studies were conducted in accordance with ICH guidelines. The formulation's color, odor, pH, and microbiological growth were evaluated.

15. RESULT

1) Physical Appearance:

Sr. No	Parameter	Result
1	Color	Light brown
2	Oduor	Pleasant Oduor



3	Texture	Gritty, smooth
4	Consistency	Semi solid in state

2) PH of sunscreen:

Evaluation Parameter	Procedure	Observation / Result
pH Determination	1 g of herbal sunscreen formulation was dispersed in 100 ml of freshly prepared distilled water and kept for 2 hours. The pH was measured using a digital pH meter.	The pH of the formulation was found to be 6.5–7.0, which is suitable for skin application.

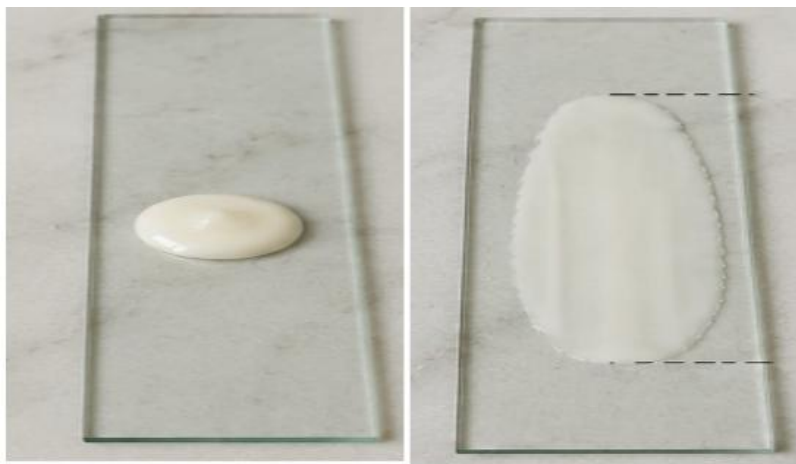
3) Spreadability test:

Where:

Formula Used

$$S=ML/T$$

- **M** = Weight of upper slide
- **L** = Length of spread circle
- **T** = Time in minutes



Given Data

Parameter	Value
M	5.2g
L	4cm
T	5 min

Calculation

$$S=.52 \times 4/5=4.16 \text{ g cm/min}$$

Result



Evaluation Parameter	Observation
Spreadability	The spread ability of the prepared blueberry sunscreen formulation was found to be 3.35 g cm/min , indicating good spreading property and ease of application on the skin surface.

5) Determination of sun protection factor by using UV Spectrophotometer (SPF): $\text{SPF spectrophotometric} = \sum (\lambda) \times I(\lambda) \text{ Abs}(\lambda) \times \text{CF}$

Formula:

Calculation of Total SPF Value

Absorbance

Table No.8 Value of EE*I at different wavelength

Wavelength (λ nm)	EE×I Value (Normalized)	Absorbance Sample (A)	EE×I×Abs
290	0.0150	1.450	0.0218
295	0.0817	2.100	0.1716
300	0.2874	3.420	0.9829
305	0.3278	3.750	1.2293
310	0.1864	2.550	0.4753
315	0.0837	1.120	0.0937
320	0.0180	0.690	0.0124
Total Sum (\$\sum\$)			2.9870

Calculation

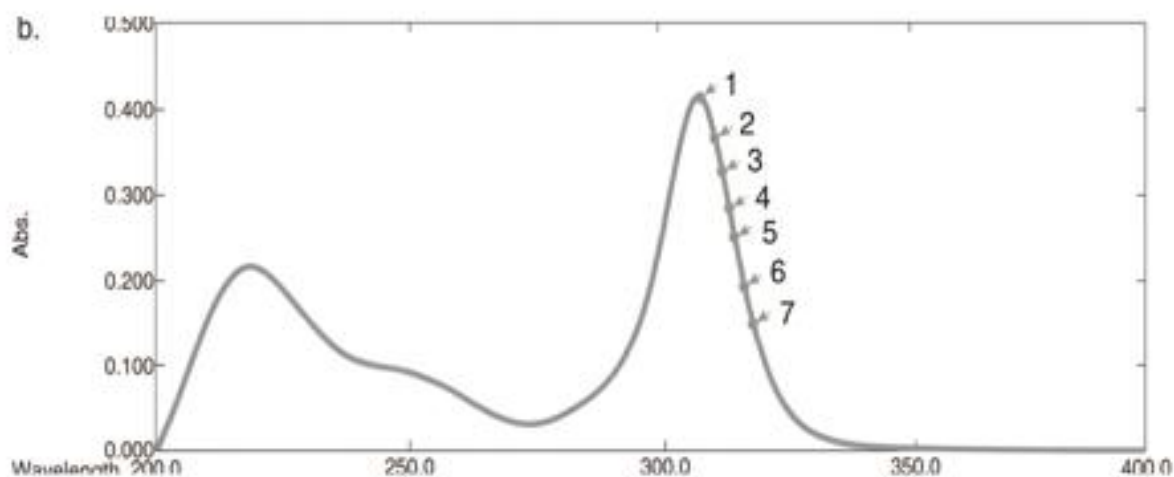
$$\text{SPF} = 0.2987 \times 10 = \mathbf{29.87}$$

Total = 0.0218 + 0.1716 + 0.9829 + 1.2293 + 0.4753 + 0.0937 + 0.0124 = 2.9870

Result

Evaluation Parameter	Observation
SPF Value	The SPF value of the prepared blueberry sunscreen formulation was determined to be 29.87, indicating high protection against UV radiation.





7. Skin irritation test:

Evaluation Parameter	Description
Skin Irritation Test	This test assesses the safety of the formulation when applied to the skin. A small amount of the sunscreen was applied on a specific area of the skin (usually the forearm) and observed for redness, itching, or inflammation for 24 hours. The formulation showed no signs of irritation and was considered safe for topical application.

8) Washability:

Evaluation Parameter	Description
Washability Test	This test determines how easily the sunscreen formulation can be removed from the skin using water. It is important for user convenience and product acceptability. The prepared formulation was easily washable without leaving excessive residue while still maintaining adequate adherence during application.

9) Stability Testing:

Evaluation Parameter	Description
Stability Test	Stability testing evaluates the performance of the sunscreen formulation over time under different storage conditions. The formulation was stored at room temperature and elevated temperatures and observed for changes in color, phase separation, pH, and consistency. No significant changes were observed, indicating that the formulation remained stable, effective, and safe throughout the study period.

15. DISCUSSION

The present study successfully formulated and evaluated an herbal sunscreen cream containing Blueberry extract, Aloe vera extract, and zinc oxide. The prepared formulation showed satisfactory organoleptic properties with good consistency, pleasant odour, and smooth texture. The pH of the cream was found to be suitable for skin application, indicating safety and compatibility with skin pH. The formulation exhibited spread ability, ensuring easy application on the skin surface. UV spectrophotometric analysis confirmed the presence of photoprotective activity with moderate SPF value. The sunscreen also showed good UV absorbance, antioxidant activity, and stability under different storage conditions. Skin irritation studies indicated that the formulation was non-irritant and safe for topical use. Overall, the developed herbal sunscreen cream demonstrated satisfactory pharmaceutical and cosmetic properties with potential for effective skin protection.

16. CONCLUSION & SUMMARY

CONCLUSION

The present study successfully formulated and evaluated an herbal sunscreen cream containing Blueberry extract, Aloe vera extract, and zinc oxide. The prepared formulation showed

satisfactory physicochemical properties such as suitable pH, spread ability, stability, and acceptable appearance. The sunscreen exhibited photoprotective and antioxidant activity with good skin compatibility and no signs of irritation. Overall, the developed herbal sunscreen cream was found to be safe, stable, and effective for topical application and may serve as a natural alternative to synthetic sunscreen products.

SUMMARY

In the present work, an herbal sunscreen cream was prepared using blueberry extract, aloe vera extract, zinc oxide, stearic acid, glycerin, almond oil, and other excipients. The formulation was evaluated for organoleptic properties, pH, viscosity, spread ability, SPF value, UV absorbance, washability, skin irritation, stability, and antioxidant activity. The results indicated that the formulation possessed good consistency, suitable pH, satisfactory spread ability, and moderate sun protection activity. Stability studies confirmed that the formulation remained stable under different storage conditions. The study demonstrated that herbal ingredients can be effectively incorporated into sunscreen formulations to provide safe and beneficial skin protection against harmful UV radiation.



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