

FORMULATION & EVALUATION OF SUNSCREEN USING MUNTINGIA CALABURA LEAF & ALOEVERE

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Abstract

The present study was undertaken to formulate and evaluate a herbal sunscreen cream containing Muntingia calabura leaf extract and Aloe vera for protection against ultraviolet (UV) radiation. Muntingia calabura is a medicinal plant rich in bioactive phytoconstituents such as flavonoids, phenolic compounds, tannins, alkaloids, and saponins, which may contribute to antioxidant and photoprotective activity. The leaves of Muntingia calabura were collected, shade-dried, powdered, and extracted using the Soxhlet extraction method. Aloe vera gel was separately prepared and extracted using water. The herbal sunscreen cream was formulated using the plant extracts along with suitable pharmaceutical excipients and physical UV filters such as zinc oxide and titanium dioxide. The prepared formulation was evaluated for organoleptic properties, homogeneity, pH, washability, spreadability, irritation, stability, and in-vitro sun protection factor (SPF). Phytochemical screening confirmed the presence of flavonoids, phenolics, tannins, alkaloids, and saponins in the Muntingia calabura leaf extract. The formulation exhibited a smooth and uniform appearance, acceptable pH, good spreadability, easy washability, and no observable signs of skin irritation. The formulation demonstrated an in-vitro SPF of 31.85 ± 0.10 , indicating high UVB protection. Stability evaluation showed that the formulation maintained its physical characteristics during the observation period. The findings suggest that Muntingia calabura leaf extract can be incorporated into a herbal sunscreen formulation and may provide useful antioxidant and photoprotective effects.

Keywords: Muntingia calabura, Aloe vera, Herbal sunscreen, UV protection, Photoprotective activity, Antioxidant activity, Phytochemicals, Sun Protection Factor (SPF), Zinc oxide, Titanium dioxide.

INTRODUCTION:

Pharmacognosy is the branch of pharmaceutical science that deal with the study of medicinal drugs derived from natural source, including plants, animals, minerals, and microorganisms. It involves the identification, extraction, isolation and characterization of bioactive compounds, which can be used for therapeutic use. The term pharmacognosy is derived from the Greek word pharmakon [drug] and gnosis [knowledge] meaning knowledge of drugs from natural sources. Traditionally pharmacognosy focused on crude drugs and herbal medicine, biotechnology and molecular pharmacology. A cosmetic is defined under section 3 of the Drugs and Cosmetics Act (India), 1940, as any substance intended to be rubbed, poured, sprinkled or sprayed on, inserted into, or otherwise applied to the human body or any part thereof for cleaning, beautifying, promoting attractiveness or altering the appearance.. The use of herbal products as cosmetics remains as widespread today as it was in ancient times. Herbal cosmetics are primarily favored due to their minimal or non-existent side effects upon application. These beauty products, made from herbal ingredients, enhance and condition the properties of the skin. All herbal extracts used in these formulations are derived from natural plant sources, avoiding harmful synthetic drugs. The concept of herbal cosmetics was established long ago in various system of medicine, including Rig-Veda, Yajurveda, Ayurveda, Unani, and Homeopathy.

CREAMS:

Creams are topical drugs that can be applied to the skin. When an occlusive effect is not required, a cream is a homogenous, viscous, or semi-solid preparation with a relatively fluid consistency that is applied externally to the skin or certain mucous membranes for preventive, therapeutic, or protective purposes. Creams are described as "a semisolid dosage form which has one or more pharmacological ingredients distributed or dissolved in an appropriate base. Because creams are prepared utilising methods created in the pharmaceutical industry, they are considered as pharmaceutical products. They've therapeutic benefits in conjunction with a variety of cosmetic benefits, including cleaning, beautifying, enhancing look, and supplying protection. People utilise creams according to their needs and skin problems, whether they are allopathic, herbal, or ayurvedic.

SKIN CREAM TYPES:

They are distinguished into two categories:

1. Creams with oil in water(O/W):

2. Creams with water in oil(W/O):

THE ANATOMY AND PHYSIOLOGY OF SKIN:

Skin and other accessory components like hair, nails, glands, muscles, and blood vessels make up the integumentary system, which was named after the Latin word "integument," which means "body covering." Dermatology is a field of healthcare that investigations, diagnoses, and treats skin conditions. The skin is considered to be the largest external component of the human body, making up 12–16% of an adult's body weight. The skin serves as a barrier of protection.

Shielding the underlying structure from harm and microbial invasion in addition to shielding it from the external climate. Melanocytes, red blood cells, and keratinocytes are among the numerous cellular components. Cosmetics are used to enhance the appearance of skin changes related to pigmentation, sagging, and wrinkles.

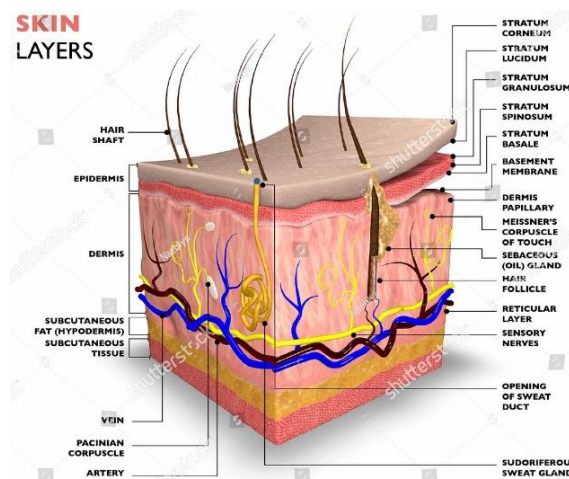


Fig.1: Anatomy of Skin

The skin comprises of three primary layers namely,

1. Epidermis:

Epidermis

Dermis & Hypodermis.

The skin is composed of three main layers: Epidermis, Dermis, Hypodermis. The epidermis, the skin's outermost or superficial layer, is made up of keratinised squamous epithelium. It is devoid of capillaries, veins, blood vessels, and nerves. It is about 0.2 mm thick and varies depending on the part of the body; the palms of the hands and the soles of the feet are thicker. The epidermis is composed of the following five layers: keratinocytes and dendritic cells are primarily found in

the epidermal layer.

Stratum corneum.

- a. Stratum lucidum.
- b. Stratum granulosum.
- c. Stratum spinosum.
- d. Stratum Basale.

2.Dermis:

Collagenous, elastic, and reticular fibres make up the connective tissue that makes up the dermis. Wrinkles result from the thinning of collagenous fibres, which are dense and cause rough skin. Stretch marks, which are frequently observed during pregnancy and in situations of obesity, might occur from the rupture of elastic fibres, which give skin flexibility. Thin reticular fibres serve as a network of support. Fibroblasts, macrophages, and mast cells are found in the dermis. Blood veins, lymphatic vessels, nerve terminals, and foreign particles are all broken down by macrophages. It is made up of layers that are not easily distinguished.

3.Hypodermis:

In fact, loose fibrous connective tissue makes up this layer, which is referred to as the subcutaneous layer. It performs several tasks, such as energy storage, cushioning, and insulation. It also has nerves, blood vessels, and lymphatic vessels. Sebum and fatty substances are secreted by the sebaceous glands in this layer, which aid in moisturising the skin and hair.

FUNCTIONS OF SKIN

1.Protection:

The skin serves as the body's barrier against bacteria, dehydration, UV light, and mechanical harm. One of the main barriers to the outside world is the skin. The skin's Langerhans cells are essential parts of the adaptive immune system.

2.Sensation:

The skin's free nerve endings are sensitive to heat, cold, pain, touch, and temperature. In reaction to these stimuli, this sensitivity causes both reflex and intentional actions.

3.Absorption:

By functioning as a selective barrier that controls the admission of chemicals into the body, the skin plays a critical role in absorption. After entering the bloodstream, it can absorb a variety of compounds, including nutrients, chemicals, and drugs, which can affect how the body works. Additionally, topical medications like cream and ointment can be absorbed by the skin due to its absorption capacity, providing localized therapeutic advantages.

4.Excretion:

The skin's excretory role is essential for balancing homeostasis within the body by expelling salts, toxins, small quantities of urea and metabolic by-products through perspiration. This function is pivotal in regulating body temperature and supporting overall health.

5. Regulation of body temperature:

The body's homeostatic system, known as thermoregulation, maintains a steady internal body temperature in the face of changes in the external environment. It is essential for the proper operation of enzymes and the immune system, which function best in a specific temperature range of 36.5 to 37.5°C.

Muntingia calabura:

Muntingia Calabura, or Jamaica Cherry, is a member of the *Elaeocarpaceae* family of *muntingiaceae*. Globally, it is extensively grown in tropical and subtropical regions. The Jamaica Cherry tree is small and grows quickly. The plant has long been used to ease stomach ulcer pain. The appearance of numerous illnesses, both viral and non-infectious. Numerous pharmacological properties, including anti-inflammatory, antipyretic, antiulcer, anti-diabetic, anti-hypertensive, cardioprotective, antibacterial, insecticidal, and antioxidant properties, have been demonstrated. Due to its widespread conservation, *Muntingia calabura* (*Elaeocarpaceae*), also referred to as "Kersen," is a common roadside tree in Indonesia. It belongs to the genus *Muntingia* and is a phenol-containing cherry. The roots of *Muntingia calabura* have been used as an emmenagogue in Vietnam and as an abortifacient in Malaysia. The flowers are steeped and taken as a tonic and tranquillizer in Colombia. *Muntingia calabura* fruit's methanol extract has demonstrated a strong ability to quench DPPH. *Muntingia calabura* is an annual fast-growing tree with spreading branches that can grow to a height of 12 to 15 meters and blossoms all year round. They are clearly lanceolate, oblong, with a toothed margin that is inclined at the base. They are dark green in colour, and their top surface shows the presence of tiny hair. The tiny flowers have white petals, green sepals, and yellow stamens in the middle. The fruits are plentiful, tiny berries that are 1.5 cm across. They taste sweet, musky, and fig-like, and they are packed with incredibly tiny, yellowish seeds.

Ultraviolet Radiation:

Ultraviolet radiation, abbreviated as UV, is a form of electromagnetic radiation with wavelengths ranging from 10 nm to 400 nm, which lies between visible light and X-rays in the electromagnetic spectrum. Although invisible to the human eye, UV radiation is a significant component of sunlight and is also produced artificially through sources like germicidal lamps, welding arcs, and black lights.

Classification of Ultraviolet Radiation:

Based on wavelength, UV is divided into three bands for scientific and environmental research:

1. UVA: The longest wavelength, almost 95% of which reaches the Earth's surface, is between 315 and 400 nm. deeply into the skin. linked to indirect DNA damage and ageing of the skin.
2. UVB (280–315 nm): Ozone absorption causes around 5% of this medium wavelength to reach the surface. accountable for sunburn, vitamin D production, and direct DNA damage that results in skin cancer.
3. The shortest wavelength and most energy are UVC, which ranges from 100 to 280 nm. It does not naturally reach Earth because it is totally absorbed by the atmosphere and ozone layer. used in hospitals and labs for sterilisation.

Sun Protection Factor (SPF):

A sunscreen product's Sun Protection Factor (SPF) indicates how well it shields the skin from ultraviolet B (UVB) radiation, which is the main cause of sunburn and skin damage. Greater protection from UVB radiation is indicated by a higher SPF value. SPF is frequently used to assess how well sunscreen and photoprotective chemicals work. By absorbing UV rays and lowering oxidative stress brought on by exposure to sunshine, natural plant extracts high in flavonoids, phenolics, and antioxidants might enhance SPF activity. As a result, determining SPF is a crucial factor in the creation and evaluation of sunscreen products. A substance's capacity to shield the skin from the damaging effects of ultraviolet (UV) radiation, especially UVB rays that cause sunburn and lead to skin damage, is measured by its Sun Protection Factor (SPF). SPF is commonly determined by UV-Visible spectrophotometry using absorbance values in the UV-B region. The SPF value of the final formulation depends on the concentration of extract and other UV-protective ingredients, so it should be experimentally determined rather than assumed.

DRUG PROFILE:

1) *Muntingia calabura*:



Fig.2: *Muntingia calabura*

Biological source: Fresh or dried leaves of *Muntingia calabura* L.

Family: Muntingiaceae

Order: Eudicots

Domain: Eukaryota

Kingdom: Plantae

Class: Magnoliopsida (Dicotyledons)

Genus: *Muntingia*

Species: *Muntingia calabura* L.

Synonyms (Scientific names): *Muntingia calabura* L. (Accepted scientific name), Jamaican cherry, Panama berry, Singapore cherry, Strawberry tree, Kerson fruit / Kersen.

Vernacular names (Local names):

- English: Jamaican cherry, Panama berry, Singapore cherry
- Tamil: ஜமைக்கா செர்ரி (*Jamaica Cherry*), சிங்கப்பூர் செர்ரி (*Singapore Cherry*) Hindi: Muntingia, Singapore Cherry, Vilaiyati phalsa,
- Telugu: Peddaberika,
- Kannada: Kadu nelli

Plant Description:

Muntingia calabura L. is a small, fast-growing evergreen tree belonging to the family Muntingiaceae. It grows up to 3–12 m in height and has simple, serrated green leaves with small white flowers.

Habitat / Distribution:

Muntingia calabura L. is native to Central and South America. It is widely cultivated and naturalized in India, Sri Lanka, Indonesia, Malaysia, the Philippines, and other tropical and subtropical regions. It grows well in warm climates, roadsides, gardens, and wastelands.

Plant part used: Dried leaf from plant

Chemical constituents:

Flavonoids [Quercetin, Kaempferol, Rutin], Phenolic compounds [Gallic acid, Caffeic acid, Ferulic acid], Tannins, Saponins, Alkaloids, Terpenoids, Steroids, Glycosides Anthocyanins (mainly in the fruits), Vitamin C (Ascorbic acid) Carotenoids Dietary fibre, sugars (in fruits), and Coumarins.

2) Aloe vera:



Fig.3: Aloe vera

Biological source: Inner leaf gel (mucilaginous parenchyma) and latex (yellow bitter sap) from leaves of Aloe vera (*Aloe barbadensis* Miller).

Family: Asphodelaceae (Liliaceae),

Class: Liliopsida

Kingdom: Plantae

Synonyms/vernacular names:

Barbados aloe, Chinese aloe, Aloe vera, Indian aloe.

Plant description:

Aloe vera is a succulent perennial with thick, fleshy, triangular serrated leaves forming rosettes; yellow tubular flowers on tall spikes; leaves contain three layers such as rind, latex (bitter), and inner clear gel.

Habitat/distribution:

Originates from Arabian Peninsula; cultivated widely in subtropical and tropical regions worldwide; tolerates arid, xerophytic conditions.

Plant part used:

Inner leaf gel (cosmetic uses) and leaf latex (laxative uses) depending on preparation.

Chemical constituents:

Polysaccharides (acemannan / glucomannans), anthraquinones (aloin, aloe- emodin), chromones (C-glucosyl chromone), lectins, sterols (lupeol, campesterol), vitamins, minerals, enzymes and amino acids - gel and latex have distinct profiles (gel rich in polysaccharides; latex rich in anthraquinones).

MATERIALS AND METHOD:

Collection of Materials

Fresh, healthy, and mature leaves of *Muntingia calabura* were collected from disease-free trees growing in the selected study area during the morning hours. The collected leaves were free from insect damage and fungal infection. The plant material was placed in clean polyethylene bags and transported to the laboratory for further processing. The leaves were washed thoroughly with tap water followed by distilled water to remove dust and other impurities. They were then air-dried under shade at room temperature for 7–10 days until a constant weight was achieved. After drying, the leaves were ground into a fine powder using a laboratory grinder and stored in clean, airtight containers at room temperature until extraction and analysis. All chemicals and reagents used in the study were of analytical grade and were obtained from recognized laboratory suppliers. Distilled water and ethanol (or the solvent selected for extraction) were used throughout the experimental procedures.

EXTRACTION PROCEDURE:

1.SOXHLET EXTRACTION:

Apparatus:

- Reflux condenser
- Distillation flask
- Heating mantle
- Thimble
- Water inlet, outlet pipes.

PROCEDURE:

The dried leaves of *Muntingia calabura* are coarsely powder and placed in a thimble fitted inside a Soxhlet extractor. Then ethanol is taken in a round bottom flask as the extraction solvent. The apparatus is assembled with a condenser and heated gently on heating mantle. The solvent evaporates condense and repeatedly siphons through the powdered material extracting the active constituents. The process is continued for about 6 to 8 hours or until the siphon solvent becomes colourless. After completion the extract is filtered, and the solvent is evaporated using a water bath at 40 to 50°C to obtain a concentrated extract which is then stored in an airtight container for future use.



Fig.4: Soxhlet extraction

2. ALOE VERA EXTRACTION:

Fresh *Aloe vera* (*Aloe barbadensis* Miller) leaves are collected, washed thoroughly with distilled water, and the outer green rind is carefully removed to obtain the inner transparent gel. The gel is accurately weighed and transferred into a clean conical flask. Distilled water is added as the solvent, and the flask is tightly covered to prevent contamination. The mixture is kept at room temperature for 24–48 hours with occasional stirring or shaking to facilitate the extraction of water-soluble phytoconstituents. After the extraction period, the mixture is filtered through Whatman filter paper to separate the extract from the residue. The filtrate is then concentrated by gentle evaporation on a water bath at 40–50°C to obtain a thick aqueous extract, which is stored in an airtight container under refrigerated conditions until further use.

FORMULATION OF SUNSCREEN:

Step-by-Step Laboratory Procedure:

Step 1: Prepare Water Phase (phase A)

Take 25.5g purified water in a clean beaker.

Slowly sprinkle 0.25g of Carbopol 940 over water and let it hydrate for 10-15 minutes.

Add 2.5g Glycerol and 0.10g Methyl Paraben.

Gently heat this beaker on a water bath to 70-75°C.

Step 2: Prepare Oil Phase (Phase B)

In a separate beaker, combine 4.0g of Stearic Acid, 1.50g Cetostearyl Alcohol, and 2.50 g Liquid Paraffin.

Heat on a water bath to 70-75°C until completely melted into a clear liquid.

Step 3: Disperse Physical Sunscreen Powders (Phase C)

Grind 3.0g of Zinc Oxide and 2.0g of Titanium Dioxide finely in a mortar to prevent lumps.

Add these powders into the melted Oil Phase (Phase B) and mix thoroughly.

Step 4: Emulsification Process

Ensure both Phase A and Phase B are at 70°C – 75°C.

Slowly pour the Oil Phase (Phase B + C) into the Water Phase (Phase A) while continuously stirring in one direction.

Continue stirring as it cools down to room temperature (~40°C) until a smooth cream forms.

Step 5: Add Actives & Botanical Extracts (Phase D)

Once cooled below 40°C, add 1.5 g Muntingia calabura Extract and 2.5 g Aloe Vera.

Puncture 1 Vitamin E capsule (~0.5 g) and add its contents.

Add 5 drops (~0.25 g) Orange Oil for fragrance and stir gently to combine.

Step 6: Neutralize & Thicken (Phase E)

Add 2 to 3 drops of Triethanolamine (TEA) while stirring continuously.

The cream will instantly thicken into a rich, smooth sunscreen lotion texture.



Fig 6: Formulation of sunscreen

PHYTOCHEMICAL TEST OF LEAF EXTRACT:

S.NO	PHYTOCHEMICAL TEST	OBSERVATION	INFERENCE
1.	TEST FOR FLAVONIDS: Take 2ml of extract to the test tube. Add 2ml of 10% NaOH solution	Formation of yellow colour	Presence of flavonoids.
2.	TEST FOR PHENOLIC: Take 2 mL of extract. Add a few drops of ferric chloride solution.	Deep blue, green or violet colour appears	Presence of phenolic.
3.	TEST FOR TANNINS: Take 2ml of extract to the test tube. Add 2-3 drops of ferric chloride solution	Appearance of blue-black of greenish colour	Presence of tannins.
4.	TEST FOR ALKALOIDS: Take 2ml of leaf extract in a test tube. Add 2-3 drops of Dragendorff's reagent. Shake gently and observe	Formation of an orange or reddish- brown precipitate	Presence of alkaloids.
5.	TEST FOR SAPONINS: Mix 2ml of extract with 5ml of distilled water in test tube. Shake vigorously for about 2 minutes. Allow to stand for 10-15 minutes	Formation of stable foam of about 1cm persists	Presence of saponins.

Table 2: Phytochemical tests



Fig 7: Chemical tests

EVALUATION PARAMETERS FOR SUNSCREEN:

1. ORGANOLEPTIC EVALUATION:

The physical appearance of the cream can be observed by its colour, odour, roughness, and texture and consistency visually.

2. HOMOGENEITY TEST:

To evaluate the cream for smooth and uniform texture by visual inspection / appearance after pressing a small quantity between fingers to ensure the absence of lumps and aggregation of globules.

3. WASHABILITY:

Washability test is used to determine how easily a sunscreen formulation can be removed from the skin by washing with water. It assesses the formulation's water resistance and ease of removal after application.

4. pH MEASUREMENT:

pH is evaluated to assesses the skin compatibility and product stability. A standard buffer solution is used to calibrate the pH meter. A digital pH meter is used to measure the pH of around 1gm of a cream that has been weighed and dissolved in 10ml of distilled water. pH ranges of 5.0-7.0 are ensured to avoid skin irritation upon application.

5. SPREADABILITY TEST:

Adequate amount of sunscreen is taken and placed between the two slides and a weight of 50gm was applied for 5minutes, then the spread diameter was measured. Spread ability can be expressed as;

$$\text{Spread ability (S)} = \frac{m \times L}{t}$$

- S= Spread ability
- M= Mass tied to upper slide
- L= Length moved
- T= Time

7. STABILITY:

To study and carry out to determine the formulations physical and chemical stability which establishes the functional properties of drug storage.

8. DETERMINATION OF IN VITRO SUN PROTECTION FACTOR (SPF)

The in vitro sun protection factor (SPF) of the formulated sunscreen cream was determined using UV-Vis spectrophotometry according to the method described by Mansur et al. Briefly, 0.1gm of the formulation was accurately weighed, transferred into a 10ml volumetric flask, and diluted to the mark with 96% ethanol to prepare the stock solution. A 1cm pathlength quartz cuvette was filled with the prepared solution, and absorbance values were measured in triplicate (n=3) at 5nm intervals across the UVB region (290-320nm) using 96% ethanol as a blank. The in vitro SPF value was calculated using Mansur's equation;

$$SPF = CF \times \sum_{290}^{320} EE(\lambda) \times I(\lambda) \times Abs(\lambda)$$

Where:

CF= Correction Factor

EE (λ)= Erythral effect spectrum

I (λ)= Solar intensity spectrum

EEλ) × I(λ)= Standard normalized constants defined by Sayre et al.

A(λ)= Spectrophotometric absorbance of the sample.

RESULT AND DISCUSSION:

FORMULATION:

The formulation of herbal sunscreen involves in the use of leaf extract of *Muntingia calabura* as an active ingredient. The process involves preparation of oil phase and aqueous phase and combining them to create the cream base, a then adding the active excipients. The final or finished product is transferred into a suitable airtight container.

EVALUATION:

To verify the quality, safety, and the physiochemical were they evaluated for the parameters such as organoleptic properties, pH, homogeneity, washability, spread ability, irritation test and stability. To evaluate the cream's quality and the application, physical properties such as odour, colour, texture, consistency, appearance were measured. To assess the drugs concentration and chemical status, test for stability and pH were identified. To make sure the cream is safe to use without causing redness, itching, swelling, rashes, irritation were examined. To make surely the cram is compatible & has no negative effects on the skin & tested in human skin.

Evaluation of In Vitro SPF Activity

The photoprotective efficacy of the formulation was quantified in vitro using spectrophotometric analysis. As presented in the mean absorbance values ranged from 3.000 to 3.250 across the wavelength range of 290-320 nm, with maximum absorption observed at 310nm. Applying Mansur's formula alongside the normalized erythral constants, the calculated total product sum yielded a mean in vitro SPF of 31.85±0.10. According to international regulatory classifications (Colipa/FDA), an SPF value between 30 and 50 falls under the high protection category, confirming the strong UVB-protective capabilities of the formulated product. In vitro absorbance values and calculated SPF of the sunscreen formulation (n=3)

Wavelength (λ,nm)	Replicate 1 (A ₁)	Replicate 2 (A ₂)	Replicate 3 (A ₃)	Mean Absorbance (A) ± SD	Normalized Constant EE(λ)×I (λ)

290	3.120	3.115	3.125	3.120±0.005	0.0150
295	3.150	3.148	3.152	3.150±0.002	0.0817
300	3.220	3.218	3.224	3.220±0.003	0.2874
305	3.200	3.195	3.205	3.200±0.005	0.3278
310	3.250	3.245	3.255	3.250±0.005	0.1864
315	3.180	3.176	3.184	3.180±0.004	0.0839
320	3.000	2.995	3.005	3.000±0.005	0.0180
Total sum(Σ)	–	–	–	–	1.0002
Calculation means SPF		31.75	31.95	31.85±0.10	–

Table 3: Evaluation of sun protection factor

PHYTOCHEMICAL ANALYSIS OF MUNTINGIA CALABURA EXTRACT:

S.NO	SECONDARY COMPOUNDS	RESULTS (PRESENT or ABSENT)
1.	Flavonoids	Present (+)
2.	Phenolics	Present (+)
3.	Tannins	Present (+)
4.	Alkaloids	Present (+)
5.	Saponins	Present (+)

Table 4: Phytochemical constituents

PHYSICOCHEMICAL EVALUATION OF SUNSCREN:

S.NO	PARAMETERS	RESULTS
1.	Colour	Light green
2.	Odour	Pleasant odour
3.	Appearance	Smooth semisolid cream
4.	Texture	Smooth & soft
5.	Consistency	Good consistency
6.	Homogeneity	Uniform
7.	pH	5.0-7.0
8.	Washability	Easily washable
9.	Spread ability	Good spread ability
10.	Phase separation	Absent

Table 5: Physicochemical parameters

TEST FOR IRRITANCY:

S.NO	PARAMETER OBSERVED	RESULT
1.	Redness	Absent
2.	Swelling	Absent
3.	Itching	Absent
4.	Rash	Absent
5.	Irritation	Absent

Table 6: Test for irritancy

STABILITY EVALUATION:

S.NO	PARAMETER	RESULT
1.	Colour	Stable
2.	Odour	Stable
3.	Appearance	Stable
4.	Viscosity	Stable
5.	Spread ability	Stable

Table 7: Test for stability

CONCLUSION:

In this research was carried out to formulate and evaluate a herbal sunscreen cream containing *Muntingia calabura* leaf extract and aloe vera, a natural ingredient well-known for its rich antioxidant content and traditional skin rejuvenating benefits. Through systematic evaluation, including pH determination, spread ability, stability testing, smooth texture, irritancy testing. The phytochemical screening of *Muntingia calabura* leaf extract revealed the presence of flavonoids, phenolic compounds, tannins, alkaloids, and saponins, which may contribute to its antioxidant property. The formulation showed acceptable physicochemical properties with no observable signs of irritation. Stability evaluation indicated that the formulation maintained its physical characteristics without any significant changes in colour, pH, viscosity, spread ability, or phase separation during the observational period. Overall, the study suggests the *Muntingia calabura* leaf extract can be incorporated into a herbal sunscreen formulation and may provide useful photoprotective and antioxidant properties.

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