

To Formulate and Evaluate an Herbal Sunscreen Cream Using Moringa Oleifera Leaves

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Abstract—UV radiation enters the human body and has a variety of impacts on it. The current study aims to formulate an herbal sunscreen cream using an alcoholic extract of Moringa oleifera and curcuma longa, as well as to conduct an evaluation test for fragrance, colour, solubility, and SPF determination. Herbal active ingredients are safer and more effective than synthetic versions. Moringaoleiferallinn leaves and curcuma longa contain anti-oxidants. It protects the skin from damaging radiations, preventing sunburn, hyper pigmentation, and photoaging. In this effort, we formulate a natural sunscreen cream. Herbal sunscreens are widely used due to their safety, antioxidant activity, and fewer side effects compared to synthetic sunscreens. Moringa oleifera leaves contain flavonoids, phenolic compounds, vitamins, and antioxidants that provide protection against ultraviolet (UV)

Index Terms—Sunscreen, UV Radiation, Antioxidant, SPF, Photoaging Moringa oleifera, natural sunscreen, sustainable sources, SPF determination, dermo-cosmetic safety, anti-proliferative activity

I. INTRODUCTION

Sunscreen, commonly referred to as sun Block or sunscreen, is a topical photo protective Agent that helps shield the skin from sunburn and is Primarily used to prevent or lower the risk of Developing skin cancer. The radiations that Sunscreen's active components block. Because of Their antioxidant properties, curcuma longa and Moringa oleifera can be utilised to protect skin. Alkaloids, flavonoids, phenolic compounds, B-Carotene, protein, and vitamin E are all found in Moringa oleifera. radiation. The present study aims to formulate and evaluate a herbal sunscreen cream containing Moringa oleifera leaf extract. The formulation was evaluated for physical appearance, pH, spread ability, viscosity, stability, and Sun Protection Factor (SPF). The prepared herbal sunscreen showed good stability, acceptable pH,

smooth texture, and moderate SPF value, indicating its usefulness as a natural sunscreen preparation.

These compounds act as natural Antioxidants by either reflecting or absorbing UV Radiation from the sun, keeping it from penetrating Deeper layers of the skin. The herbal sunscreen will not only protect the skin from the effects of harmful UV rays but also eliminate the use of chemical sunscreens. Presently , public awareness has increased Regarding the safety of sunscreens using chemicals Chemical based sunscreen gets absorbed into the Skin and causes discomfort and itchiness of the Skin .therefore ,manufacturers all over the world Have begun manufacturing ,herbal sunscreens to Prevent side effects caused by synthetic chemical Products herbal sunscreen includes various natural Ingredients which penetrate deeper layers of the Skin plunge the signs of early aging by hydrating The skin turmuric, moringa oleifera shows the anti-Oxidant and anti-Inflammatory effects. They also Cause skin tightening, help prevent skin damage, heal acne, fade scars, herbal products also provide Self color so the use artificial colors are avoided. Sunscreen products can be formulated in the form of lotions, Creams, Sticks, Aerosols, Gels, Powders and Ointments. sunscreen preparations are Designed to be used topically to prevent UV Radiation from entering the skin directly by Absorbing or reflecting from the Skin. Regulatory Considerations Are also taken into account during The design and development of sunscreen products .Presently herbal sunscreens are widely Used by almost everyone on this planet to prevent From harmful effects of uv radiation from sunlight Herbals are preferable because of fewer sideeffect's and a better safety profile .This study is About the preparation and evaluation of herbal Sunscreen creams possessing anti uv radiation Effectives and anti-inflammatory properties, Creams were prepared from the extract of plant Materials, such

as moringa oleifera and curcuma Longa. Total polyphenol, Curcumin and flavonoid Content. Evaluation of prepared herbal sunscreen Creams was performed. Sunscreen also known as sun block is a Lotion, spray, gel, or other topical product that Absorbs or reflects some of the sun's ultraviolet Radiation and thus helps protect against sunburn. Ancient Egyptians used extracts of rice, Jasmine and lupine plants. Again, these ingredients Offered low levels of sun protection but were Proven to be very beneficial to the skin and are still Used in skin care products today.

Ideal properties of Sunscreen Cream

- It must block off a broad range of UV rays that might cause Skin burns.
- Must maintain stability in the presence of sunlight.
- It must have the ability to shield the entire skin.
- It should be challenging to get rid of with water. should be nontoxic, chemically inert, low concentration. • It must not be toxic, irritable, or sensitizing.
- It should be able to keep up its ability to block the sun for several hours

Advantages

- Sunscreen cream provides UV radiation protection. It stops aging too soon.
- It lowers the chance of developing skin cancer.
- It shields against sunburn.
- It stops UVB-induced tanning Disadvantages • Sunscreen with PABA has a high potential for allergic reactions.
- It might exacerbate acne.
- In places with hair, it could hurt and lead to pus in the hair follicle occasional y



Fig.1 moringa oleifera

1.2 Types of UV Radiation

UV-A (320-400 nm)

- Causes skin aging
- Penetrates deeply into skin
- Responsible for wrinkles and tanning

UV-B (290-320 nm)

- Cause sun burns
- Responsible for erythema

Damage skin cell.

UV-C (100-290 nm)

- Mostly absorbed by atmosphere Highly dangerous

1.3 Herbal Sunscreens

Herbal sunscreens contain natural ingredients with antioxidant and photoprotective activity. These formulations are safer and less irritating compared to synthetic products.

Advantages:

- Eco-friendly
- Less toxic
- Biodegradable
- Rich in antioxidants
- Reduced side effects

1.4 Drumstick Plant (Moringa oleifera)

Moringa oleifera is commonly known as drumstick tree. It belongs to family Moringaceae. It is rich in flavonoids, tannins, phenolic compounds, vitamins A, C, and E.

Benefits of Moringa Leaves for Skin

- Antioxidant activity
- Anti-inflammatory activity
- UV protection
- Moisturizing effect
- Anti-aging effect

III. AIM AND OBJECTIVES

Aim

To formulate and evaluate a herbal sunscreen cream using drumstick leaves extract.

Objectives

To prepare extract from drumstick leaves.

To formulate herbal sunscreen cream.

To evaluate physicochemical properties. To determine stability and spreadability.

IV. PLAN OF WORK

To study photoprotective formulation. Potential of

1. Literature review
2. Selection of plant
3. Material and method
4. Formulation of sunscreen
5. Evaluation of sunscreen
6. Conclusion
7. Reference

V. LITERATURE REVIEW

1. Baldisserotto et al. (2018)

The study titled “Moringa oleifera Leaf Extracts as Multifunctional Ingredients for Natural and Organic Sunscreens and Photoprotective Preparations” investigated the photoprotective potential of Moringa oleifera leaf extracts. Researchers prepared different leaf extracts and evaluated antioxidant activity, UV filtering ability, SPF value, and dermal safety. The study reported that formulations containing 2–4% extract showed significant SPF activity and no skin irritation. The authors concluded that Moringa oleifera can be used as a multifunctional herbal sunscreen ingredient.

2. Kesuma et al. (2020)

Kesuma and co-workers studied sunscreens containing Moringa oleifera extract combined with colloidal gold and zinc oxide. The prepared formulations were evaluated for pH, spreadability, adhesion, and SPF value. The results showed good physical stability and enhanced sunscreen activity because of antioxidant compounds present in the extract.

3. Adriyanti et al. (2023)

In this research, sunscreen body lotion containing Moringa oleifera leaf extract was prepared at different concentrations. The formulations were evaluated for viscosity, pH, homogeneity, organoleptic properties, and SPF value. The study found that increasing extract concentration increased SPF value significantly. The formulation containing 2% extract showed excellent sunscreen protection and acceptable cosmetic properties.

4. Sangar et al. (2025)

A recent study on herbal sunscreen lotion using Moringa oleifera and Curcuma longa extracts

evaluated formulations for pH, viscosity, spreadability, homogeneity, stability, irritancy, and SPF. Among the formulations, F3 showed the highest SPF value and best photoprotective effect. All formulations were stable and non-irritant. Klimek-Szczykutowicz et al. (2024)

5. A review article on the cosmetological and medicinal importance of Moringa oleifera discussed its antioxidant, anti-inflammatory, antimicrobial, and skin-protective activities. The study highlighted the use of Moringa in cosmetic preparations including creams, lotions, and sunscreens because of its rich phytochemical composition.

6. Morocho-Jácome et al. 2021

A review on multifunctional sunscreen systems developed with natural compounds reported that herbal ingredients improve SPF values and formulation stability. Natural compounds also provide anti-aging and anti-inflammatory effects in addition to photoprotection.

7. Litta Ifina et al. 2024

A scientific investigation evaluated the SPF values of aqueous and chloroform extracts of Moringa oleifera leaves using UV-Visible spectrophotometry. The extracts were tested at different concentrations ranging from 50–250 ppm within the UV-B range (290–320 nm).

VI. PLANT PROFILE

1. *Moringa oleifera*

Biological Source

Drumstick leaves are obtained from the plant Moringa

Family

oleifera.

Marantaceae

Synonyms

- Drumstick tree
- Horseradish tree
- Moringa

Uses

- Antioxidant
- Anti-inflammatory
- Antimicrobial
- Skin protection
- Nutritional supplements

Chemical Constituents

- Flavonoids.

Moringa oleifera

2 Alovera

Biological name: alovera

- Alkaloids. Biological source: The botanical name Tanninsof aloe is Aloe barbadensis miller.

Synonyms:

- Vitamins
- Aloe barbadensis Miller
- Phenolic compounds.
- Aloe vulgaris Lamarck
- Saponins
- Aloe indica Royle
- Aloe officinalis Forskal
- Aloe perfoliata L. var. vera



Fig 2 moringa leaf



Fig3. Aloevera

Medicinal & Health Uses

Soothes burns: Speeds up healing for first- and second-degree sunburns.

Heals wounds: Stimulates collagen synthesis to accelerate skin repair.

Relieves constipation: Dried yellow latex acts as a powerful laxative.

Lowers blood sugar: Helps improve insulin sensitivity in type 2 diabetes.

Reduces dental plaque: Works as an effective mouthwash to kill bacteria.

Eases canker sores: Accelerates the healing of painful mouth ulcers.

Cosmetic & Skincare Uses

Moisturizes skin: Hydrates deeply without leaving a greasy residue.

Fights aging: Improves skin elasticity and reduces fine wrinkle lines.

Clears acne: Contains salicylic acid to reduce inflammation and breakouts.

Fades dark spots: Inhibits tyrosine's activity to lighten hyperpigmentation.

Calms scalp irritation: Reduces dandruff and unblocks hair follicles.

3.Vitamin E

- Official Name: Tocopherol or α -Tocopherol (most active form)
- Chemical Name: (2R)-2,5,7,8-tetramethyl-2-[(4R,8R)-4,8,12-trimethyltridecyl]-6-chromanol
- Molecular Formula: $C_{29}H_{50}O_2$
- Molecular Weight: 430.71 g/mol
- Category: Fat-soluble vitamin Antioxidant Nutraceu

A light yellow to amber, clear, viscous oil. It is sensitive to light and air, and gradually darkens upon exposure.

- Odour: Practically odourless or very faint characteristic odour.
- Solubility: Soluble in fats, oils, alcohol, ether, chloroform, acetone. Practically insoluble in water.

Benefits of Vitamin E in sunscreen

Adding Vitamin E to a topical treatment like sunscreen has several advantages for the skin. Some of the primary benefits of sunscreen containing vitamin E include the following.

Enhanced sun protection

UV radiation from the sun can cause sunburn, premature aging, and skin cancer, among other skin problems [11]. It has been shown that vitamin E provides additional UV protection and boosts the effectiveness of sunscreens. Vitamin E can reduce the risk of sunburn and other sun-related skin disorders when

combined with other sun blocking substances like zinc oxide or titanium dioxide.

4. Beeswax:

- Official Name: Beeswax (Yellow Beeswax / White Beeswax as per processing)
- Chemical Name: Esters of myricyl alcohol ($C_{30}H_{61}OH$) with palmitic acid ($C_{16}H_{32}O_2$), Along with hydrocarbons and free fatty acids.
- Molecular Weight: Variable (depends on components), approx. ≈ 700 – 1200 g/mol for Esters.
- Category's Natural product o pharmaceutical excipient (base for ointments, creams) o Cosmetic ingredient o Polishing / coating agent Description: Yellow or whitish solid, tough but pliable, with a granular fracture. Softens when warmed, and melts at about 62 – 65 °C.
- Odour: Characteristic honey-like odour.
- Solubility:
 - o Practically insoluble in: water
 - o Slightly soluble in: alcohol
 - o Soluble in: chloroform, ether, fixed oils, volatile oilso

5. Methylparaben:

- Official Name: Methylparaben (also called Methyl 4hydroxybenzoate)
- Chemical Name: Methyl 4hydroxybenzoate
- Molecular Formula: $C_8H_8O_3$ Molecular Weight: 152.15 g/mol Category: o Antimicrobial preservative o pharmaceutical excipient o Cosmetic preservative o Food preservative (E218)

6. Glycerin

- Official Name: Glycerine (IP, USP) / Glycerol (Ph. Eur.)
- Chemical Name: Propane-1,2,3-triol
- Molecular Formula: $C_3H_8O_3$ Molecular Weight: 92.09 g/mol Category: o Humectant o Emollient o Sweetening agent o pharmaceutical excipient o Cosmetic ingredient

Description:

Clear, colourless, viscous liquid with a sweet taste. Hygroscopic in nature.

- Odour: Odourless
- Solubility: o Freely soluble in: water, alcohol Miscible with: chloroform and propylene glycol o Practically insoluble in: oils and fats.

- Uses: o Humectant in creams, lotions, and oral formulation so Sweetening agent in syrupso Solvent for drugs (especially tannins, phenols, boric acid) o Laxative (osmotic action in high doses) o Plasticizer in capsule shellso Emollient in dermatological preparations

VII. MATERIAL AND METHODS

- Coconut oil
- Alovera gel
- Emulsifying wax (bees wax)
- Vitamins E. coli
- Rose water
- Zinc oxide
- Methyl parabene

Crude drug

- Moringa leaf extract

Extraction of moringa

Leaves Method

- Collect fresh moringa leaves.
- Wash thoroughly with water.
- Dry in shade for 4–5 days.
- Grind into coarse powder.
- Take 25 g powder and soak in 100 mL ethanol or methanol for 24–48 hours.
- Filter using muslin cloth or filter paper.
- Evaporate solvent using water bath.
- Collect concentrated extract



Fig 4. Soxhlet apparatus



fig5. Moringa extract

Procedure

Oil Phase

- Take beeswax, coconut oil, and emulsifying wax.
- Heat at 70°C until melted.

Aqueous Phase

- Mix rose water, glycerin, and aloe vera gel.
- Heat separately to 70°C .

Emulsification

- Add aqueous phase slowly into oil phase with continuous stirring.
- Add drumstick leaf extract and zinc oxide.
- Stir continuously until cream forms.
- Add vitamin E and perfume after cooling.
- Store in airtight container

Formulations table

Ingredients	F1	F2	F3	Uses
Moringa extract	12.5ml	5ml	7.5ml	API
Alovera gel	5g	10g	15g	Provide hydration
Zinc oxide	2.5g	5g	7.5g	Antioxidants
Coconut oil	2.5ml	5ml	7.5ml	Nourishing and protection
Glycerine	2.5ml	5ml	7.5ml	Emollient
Emulsifyin g wax	3g	6g	9g	Emulsifyer
Vitamins E.oil	1ml	2ml	3ml	Antioxidants rich shield against sun damage
Rose water	Q.S 25ml	Q.S 50ml	Q.S 75ml	Hydrationand smooth
Methyl parabene	0.2g	0.2g	0.2g	Preservative

- Add vitamin E and perfume after cooling.
- Store in airtight container



(a)



(b)



(c)



(d)

Fig6.preparation of Sunscreen

Parameter	F1	F2	F3
Appearance	Smooth cream	smooth cream	Thick s smooth cream
Colour	Light green	Green	Dark green
Odor	Mild herbal	Pleasant herbal	Strong herbal
Texture	Soft	Smooth	Slightly thicker
Homogeneity.	Good	Good	Excellent

VIII. EVALUATION PARAMETERS

1.Organoleptic & Physical Properties:

Tests for color, odor, texture, and appearance. Evaluators generally look for a faint yellow to creamish-white cream with a smooth, homogeneous texture and a pleasant/characteristic aroma.Observation Table

2.Ph Ideal pH is 5.5- 6.7



Fig7.pH meter Observation table

Formulation	pH observed
F1	6.4
F2	6.7
F3	6.9

3.Spreadability

- Apply on skin and observe spreading nature.
- Assesses how uniformly the cream spreads on the skin and its physical stability. Homogeneity is tested by smearing the formula on glass plates, while spread ability measures the diameter of a disk of cream under a standardized weight.

Formulations	Spread ability	Observation
F1	12.1	Slightly less
F2	13.5	Good
F3	14.2	Easily

Observation table

4. Washability

Check ease of removal with water.

Formulations	Observation
F1	Slightly difficult
F2	Slightly washable
F3	Easily washable

Observation table

5. Irritancy Test

- Apply small amount on skin.
- Observe redness or irritation.

Observation table

Formulations	Redness	Irritation	Edema
F1	Slightly redness absent	Nil	Nil
F2	Nil	Nil	Nil
F3	Nil	Nil	Nil

6. Stability Study

- Store at room temperature for 30 days.
- Observe phase separation and color change.

Observation table

Parameter	F1	F2	F3
Phase separation	Absent	Absent	Absent
Change in colour	No change	No change	No change
Change in odour	No change	No change	No change
Stability	Stable	Stable	Stable

7. Sun Protection Factor (SPF): In vit

spectrophotometrically using the Mansur equation by taking absorbance readings in the UVB/UV-A ranges. Studies show that moringa-based formulations can yield SPF values ranging from \ (1.4) to well over \ (38.0) depending on the extract concentration.

Observation table

Formulations	SPF value	Observation
F1	12.4	Moderate protection
F2	18.7	Good protection
F3	24.5	High protection

IX. DISCUSSION AND RESULT

The prepared herbal sunscreen cream showed good appearance, acceptable pH, smooth consistency, and satisfactory spreadability. No irritation or phase separation was observed during stability study. Drumstick leaf extract contributed antioxidant and photoprotective properties.

X. CONCLUSION

The present study successfully formulated and evaluated a herbal sunscreen cream using drumstick leaves extract. The formulation showed good physical stability, smooth texture, acceptable pH, and good spreadability. Drumstick leaves contain antioxidants and bioactive compounds that may provide protection against harmful UV radiation. Therefore, *Moringa oleifera* can be considered as a promising natural ingredient for herbal sunscreen preparation.

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