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Research Article

PREPARATION AND EVALUATION OF HERBAL SUNSCREEN LOTION

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Abstract

Sunscreen is a herbal lotion that helps protect the skin from UV rays. Sunburn is primarily caused by ultraviolet B (UVB) radiation, while ultraviolet A (UVA) radiation may cause even more long-term damage to the skin. Ideally, sunscreen should block both UVA and UVB wavebands. The aim of this study was to develop a topical sunscreen formulation using fixed oils in combination with selected medicinal plants. Regular use of sunscreen reduces the risk of actinic keratosis, squamous cell carcinoma, and melanoma. Sunscreen, also known as sun-block lotion, works by absorbing or reflecting the sun's ultraviolet radiation to protect the skin. Due to the increasing incidence of skin cancers and the photodamaging effects of UV radiation, the use of effective sunscreen agents has grown. These agents have shown beneficial effects in minimizing symptoms associated with sun damage. An ideal sunscreen should be non-hazardous, non-irritating, non-toxic, photostable, and capable of providing complete protection against solar radiation. The formulated sunscreen lotion contains skin-friendly ingredients such as aloe vera, turmeric, olive oil, and vitamin E. Evaluation criteria such as pH, spreadability, and skin feel were used for testing. The prepared sunscreen lotion demonstrated a good SPF rating, excellent homogeneity, consistency, and appearance, with no signs of phase separation. Its use on the skin is considered safe and non-irritating.

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Introduction

A Substance that helps protects the skin from the sun's harmful rays. Sunscreen reflects, absorb, and scatter both ultraviolet A and B radiation to provide protection against both types of radiation. Using lotions that contain sunscreens can help protect the skin from premature aging and damage that may lead to skin cancer. Sun-block formulae must be created for repair, reduction of sunburn, sun tanning, skin melanoma, and early lines and wrinkles, as well as increasing the degree of sun protection factor (SPF). Sunscreens are frequently applied to the skin to protect it from the sun's harmful rays and to reduce the risk of skin disorders caused by the sun's rays. Broad spec-

trum sunscreens are now being researched to reduce the long term effects of high UV radiation.

The use of sunscreens as photo protectants has evolved significantly over the last few decades. With increasing awareness of the protection afforded by sunscreens against sunburns, skin aging and melanomas, the demand for sunscreen formulations will invariable increase, and there exists a significant opportunity for Pharmaceutical industries to fulfil this demand by manufacturing quality, safe and aesthetically appealing sunscreen formulations. Sunscreen lotion is a sort of product that protects against the sun's harmful rays by containing ultraviolet radiation (UV rays)

- The use of sunscreen is a necessity these days to protect our skin from the harsh ultraviolet (UV) rays. The herbal sunscreen will only protect the skin from the effects of harmful UV rays. Therefore, manufacturers all over the world have begun manufacturing herbal sunscreens to prevent side effects caused by synthetic chemical products.

- 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.

Skin

Human skin is the largest organ and it covers about 1.7m² of our body. The membrane of the skin is regarded as a physical barrier.

The skin is mainly categorized to four layers,

1. Subcutaneous fat layer or hypodermis
2. Overlying dermis
3. Viable epidermis
4. Stratum corneum (non-viable epidermis)

Effects of UV on Skin

Sun light is mainly of wavelength from UV to visible light. UV is the ultraviolet radiation which is of three divisions such as:

- UVA is of 320-400 nm,
- UVB is of 290-320nm and
- UVC is of 100- 290nm
 - A. UVA has long wavelength which penetrate and reach the bottom layer of the skin which causes tanning and aging of skin
 - B. UVB has a short wavelength and enter to the epidermis and small amount into the dermis.
 - C. UVC does not reach the surface of skin. It is blocked completely by the layer of ozone

Table: 01 Effect of Sun Radiation on Human Skin

RADIATION TYPE	CHARACTERISTIC WAVELENGTH	EFFECTS ON HUMAN SKIN	VISIBLE TO HUMAN EYE
UVC	-200 TO -290nm (Short wave UV)	DNA damage	No
UVB	-290 to 320 nm (Mid range UV)	Sun burn DNA damage Skin cancer	No
UVA	-320to 400 nm (Long wave UV)	Tanning Skin aging DNA damage Skin cancer	No
VIS	-400 to 800nm	None currently known	Yes
IR	-800 to 120,000nm	Heat sensation	NO

Mechanism of Photoprotection

Sunscreen act 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 the skin to UV exposure. They work on two mechanisms:

1. Scattering and reflection of UV energy from the skin surface mineral based on inorganic sunscreen works on this mechanism they provide a coating that blocks sun rays from penetrating through the skin .
2. Absorption of the UV energy by converting it to heat energy thus reducing its harmful effects and reduce the depth which can penetrate the skin organic sunscreen works on this mechanism.

Why We Use Sunscreen Lotion

1. Shields From Harmful UV Rays
2. Prevent the Signs of Ageing
3. Reduce Inflammation
4. Prevent Skin Discoloration
5. Lowers Skin Cancer Risk
6. Lowers Blotchiness On The Face
7. Prevents Sunburns
8. Prevents Tanning
9. Enhances Health Of The Skin

Herbal Sunscreen over Chemical Sunscreen Safe for Your Skin

Natural sunscreen has a number of benefits one of which is that it is non-irritating and soothing. Due to the penetration of chemical filters into the skin, chemical sunscreens may sometimes end up in allergic responses, skin irritation, or even a disruption of hormonal balance.

360-degree Sun Protection

Natural sunscreens offer good protection against the sun's damaging rays despite doubts regarding their effectiveness. The primary components of natural sunscreens provide broad-spectrum protection by effectively obstructing UVA and UVB radiation.

Suitable for Everyone

All age groups, including children, are typically considered as being safe for using natural sunscreens. They provide a good option for those with delicate or sensitive skin thanks to their gentle compositions

Characteristics of Herbal sunscreen lotion;

1. Herbal sunscreen lotion should be stable to heat, light & perspiration.
2. It should be non toxic.
3. It should be non-irritant.
4. It absorbs light preferentially over the range of 280nm to 320nm.
5. It should be neutral.
6. Anticancer property.
7. Activity against UVB and UVA radiation.
8. It should be able to provide complete protection for skin.

Method and Materials

Plant Materials

Traditional herbs are used for preparation are Indian gooseberry- *Emblica officinalis*, Aloe – *Aloe baarbadensis* , Shea butter – from the seeds of *vitellaria*

paradoxa , Tumeric – Curcuma longa, Oats – Avena sativa , Fenugreek – Trigonella foenum , Honey – Wax of apis mellifera , Vitamin E – RRR-Alpha tocopherol, Lemon – Citrus limon , Olive oil - Olea europaea , Almond oil- Prunus amygdalus , Coconut oil – Cocos nucifera , Sandal wood oil - Santalum album .

Apparatus

- Beakers
- Glass rods
- Seiving machine
- Watch glass
- Mortar and pestle
- Weighing balance
- Water bath
- Measuring cylinder

Method of Preparation

All the ingredients were accurately weighed using a weighing balance based on the formulation. The oils were heated separately in a beaker for 2 to 5 minutes. Each powder ingredient and the heated oil were added one by one into a mortar and triturated with the help of pestle. Turmeric extract, Aloe gel, and lemon juice were then added and properly triturated until a lotion consistency was obtained. The lotion was made up to 50 ml, transferred into a container, and stored at room temperature.

Table: 02 Formulation

S. NO	INGREDIENTS	QUANTITY
1	Indian gooseberry	6gm
2	Olive oil	3ml
3	Turmeric	0.5gm
4	Aloe	7ml
5	Fenugreek	3gm
6	Vitamin E	2ml
7	Honey	2ml
8	Shea butter	8gm
9	Lemon	0.5ml
10	Oats	5gm
11	Almond oil	3ml
12	Coconut oil	5ml
13	Sandal wood oil	5ml

List of Ingredients

1. Olive oil-Emulsifier
2. Turmeric-Anti-aging
3. Aloe-Anti-inflammatory
4. Fenugreek-Anti-microbial
5. Vitamin E-Wound healing
6. Shea butter and honey-Moisturizer
7. Oats and lemon-Beautifying purpose
8. Almond oil and coconut oil-U.V.protection
9. Sandalwood oil-Fragrance
10. Indian goose berry-Anti oxidant

Ingredients

Indian Gooseberry

Biological source: The fruit of *Phyllanthus emblica officinalis*. (Popular known as amla).

Family: Euphorbiaceae.

Uses: Amla is a skincare powerhouse that helps to brighten your skin and combat symptoms of aging. Amla is a natural moisturizer that can help your skin rejuvenate itself.



Fig: 01 Amla

Olive Oil

Biological source: oil extracted from the fleshy part of the ripened fruit of the olive tree, *Olea europaea*.

Family: Oleaceae.

Uses: Olive oil contains many nutrients that can inhibit or kill harmful bacteria. Olive oil is also used as emulsifier.



Fig: 02 Olive Oil

Turmeric

Biological source: Dried rhizome of *curcuma longa*

Family: Zingiberaceae.

Uses: Curcumin is a bioactive substance that can help fight inflammation. curcumin has been studied as a beneficial herb in reducing blemishes



Fig: 03 Turmeric

Aloe Gel

Biological source: dried latex of leaves of Aloe barbadensis.

Family: Liliaceae.

Uses: Aloe vera has been proven to both treat and prevent burns on your skin and it blocks UVA and UVB rays and maintain skin natural moisture.



Fig: 04 Aloe Gel

Fenugreek

Biological source: Dried ripe seeds of Trigonella foenum-graecum.

Family: Fabaceae.

Uses: Fenugreek is used as a toning agent. The compound present in fenugreek, limonene, helps to treat acne.



Fig: 05 Fenugreek

Vitamin E

Biological source: Vegetable oils like wheat germ, sunflower, and safflower oils are among the best sources of vitamin E.

Uses: helps skin to protect delicate skin from damage and also used as an emollient.



Fig: 06 Vitamin E

Shea Butter

Biological source: Shea butter is a seed fat that comes from the seeds of Vitellaria paradoxa.

Family: Sapotaceae.

Uses: shea butter acts as a re-fatting agent and also does not clog pores.



Fig: 07 Shea Butter

Honey

Biological source: Honey is a natural product formed from nectar of flowers by honeybees, Apis mellifera.

Family: Apidae.

Uses: Honey is used for cleansing and exfoliation, skin moisturizer, and relief from sunburn.



Fig: 08 Honey

Oats

Biological source: It is a species of cereal obtained from Avena sativa.

Family: Poaceae

Uses: Oats are used to soothe the skin and have excellent absorbent properties.



Fig: 09 Oats

Lemon

Biological source: Fruit obtained from the plant Citrus limon.

Family: Rutaceae

Uses: Used as brightening and lightening agent and also act as anti- fungal and astringent agent.

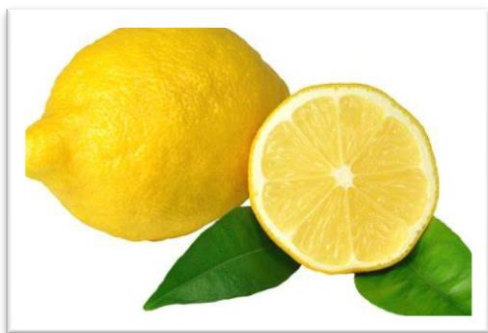


Fig: 10 Lemon

Almond Oil

Biological source: Almond oil is a fixed oil obtained by extraction from the seeds of *Prunus amygdalus*.

Family: Rosaceae

Uses: Almond oil revives the natural glow of the skin, and reduces dark circles.



Fig: 11 Almond Oil

Coconut Oil

Biological source: oil extraction from the dried solid part of endosperm of coconut, *Cocos nucifera*.

Family: Arecaceae

Uses: It helps to hydrate skin and reinforce its natural defensive barrier to better retain moisture and it has anti-inflammatory properties that coconut oil has means it has the ability to help treat acne.



Fig: 12 Coconut Oil

Sandalwood Oil

Biological source: essential oil distilled from the *Santalum album*.

Family: Santalaceae.

Uses: sandalwood oil treats acne and pimple and it reduces tanning and pigmentation



Fig: 13 Sandalwood Oil

Evaluation Parameters

Evaluation Parameters of Herbal Sunscreen Lotion

1. Physical Parameters

Colour: The colour of the formulation was checked manually and recorded through visual observation.

Odour: The fragrance of the formulation was assessed by applying a small amount to the hand and noting the scent.

Appearance: The overall visual appearance of the formulation was observed for consistency and clarity.

2. Determination of pH

The pH of the sunscreen was measured using a digital pH meter to ensure compatibility with skin. The objective was to confirm that the pH of the prepared herbal sunscreen remains close to that of the skin (between 4.5 and 7) after 24 hours of use.

Observed pH value: 6.5–6.7

3. Determination of Viscosity

Viscosity was measured using a Brookfield viscometer. A 50 mL beaker containing 50 g of the formulation was used. The appropriate spindle was selected, and the viscosity was measured at different speeds (5, 10, 20, 30, 40, 50, and 100 rpm). The viscosity values were calculated using conversion factors.

Viscosity range: 3360–3684 cP (centipoise)

4. Spreadability

Spreadability affects the ease of application and therapeutic effectiveness. It was measured by placing a fixed amount of sunscreen between two glass slides. A specific weight was applied to the upper slide, and the time taken for the slides to separate was recorded.

$$S = M \times LR$$

M = weight tied to the upper slide.

L = length of glass slide

T = time taken to separate the slides

Where:

M = weight tied to upper slide

L = length of glass slide

T = time taken to separate the slides

5. Washability

Washability was assessed by applying the formulation to the skin and then washing it with water to observe its resistance to removal.

6. Homogeneity

The formulation was evaluated for homogeneity by visual inspection and tactile examination to ensure uniform consistency and smoothness.

7. Irritancy Test

Mark an area (one sq.cm) on the left hand dorsal surface. The lotion was applied to the specified area and time was noted. Irritancy, erythema, edema was checked. If any regular interval upto 24 hrs a reported.

8. Photoprotection Properties

Photoprotection refers to reducing the harmful effects of UV radiation, including sunburn, premature aging, and skin cancers. It involves the use of sunscreens, protective clothing, hats, sunglasses, and other barriers. Photostability is defined as the ability of a sunscreen's active components to remain stable upon exposure to sunlight. A sunscreen with SPF 15 provides approximately 93% protection against UVB radiation. SPF 25 increases UVB protection to about 97%.

However, the effectiveness of sunscreen also depends on how much is applied, how often it is reapplied, and factors like sweating or water exposure.

Therefore, SPF 25 is considered sufficient if used correctly and consistently.

Conclusion

The study attempted to develop sunscreen lotion using extracts of *Embllica officinalis*, *Curcuma longa*, and examined their efficacy for preventing sunburn. It can be stated that the current study will hopefully lead to improvements in the treatment of sunburns produced by UV radiation exposure. The study also demonstrates that UV Spectroscopy is the most efficient, and repeatable approach for determining the performance deterring the performance of herbal sunscreens. The formulation were prepared by varying the composition and evaluated for their physical properties and SPF. The study showed that formulation was found to be more stable with good spf value, Proving a better sunscreen lotion. The use of sunscreen is an important component to sun protection. Regular and appropriate use is associate with a decreased risk of various skin complication and cancers as result of radiation exposure. The natural herbal sunscreen lotion helps to prevent the skin from harmaful rays.

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Conflict of Interest

Not Declared

Informed Consent and Ethical Statement

Not applicable

Author Contribution

All authors are contributed equally.

References

1. Paula AR, Ribeiro A, Lemos FJA, Silva CP, Samuel RI. Neem oil increases the persistence of the entomopathogenic fungus *Metarhizium anisopliae* for the control of *Aedes aegypti* (Diptera: Culicidae) larvae. *Parasit Vectors*, 2019 Apr 11; 12(1): 163. doi: 10.1186/s13071-019-3415-x. PMID: 30975207; PMCID: PMC6460681.
2. Aprilita Rina Yanti Eff1, *, Sri Teguh Rahayu1, Henny Saraswati1, Abdul Mun'im2. Formulation and Evaluation of Sunscreen Gels Containing Mangiferin Isolated from *Phaleria macrocarpa* Fruits. *Int. J. Pharm. Investigation*, 2019; 9(3): 141- 145.
3. Mukund manikrao doglikar, sharada laxman deore : development and evaluation of herbal sunscreen. *Pharmacogn j.*, 2017; 9(1): 83-97. doi -10.5530/PJ.2017.1.15.
4. Keen MA, Hassan I. Vitamin E in dermatology. *Indian Dermatol Online J.*, 2016 Jul-Aug; 7(4): 311- 5. doi: 10.4103/2229-5178.185494. PMID: 275595 12; PMCID: PMC4976416
5. Sahasrabuddhe S; Lycopene-An Antioxidant. *Pharma Times*, 2011, 43(12): 13-15.
6. Piergiacomo Buso, Matteo Radice, Anna Baldisserotto, Stefano Manfredini, Silvia Vertuani; Guidelines for the Development of Herbal-Based Sunscreen. 2019; DOI: 10.5772/intechopen.72712.
7. Shanbhag S, Nayak A, Narayan R, Nayak UY. Anti-aging and Sunscreens: Paradigm Shift in Cosmetics. *Adv Parm Bull.* 2019;9(3):348-59. doi:10.15171/apb.2019.042
8. Government of Indian Ministry of Health and Family Welfare, The Ayurvedic Pharmacopoeia of India, Part 1, Volume 1, 1st edition. The Controller of publications, New Delhi, 2001
9. Ruby AJ, Kuttan G, Babu KD, Rajasekharan KN, Kuttan R.; Anti-tumour and antioxidant activity of natural curcuminoids. *Cancer Lett* 1995;94(1):79-83
10. Selvam R, Subramanian L, Gayathri R, Angayarkanni N; The anti-oxidant activity of turmeric (*Curcuma longa*). *J Ethnopharmacol.* 1995;47(2):59-67 . Ahmady A, Amini MH, Zhakfar AM, Babak G, Sediqi MN; Sun Protective Potential and Pysical Stability of Herbal Sunscreen Developed from Afghan Medicinal Plants. *Turk J Parm Sci.* 2020;17(3):285-92. doi:10.4274/tjps.galenos.2019.15428
11. Wood C, Murpy E, Sunscreen efficacy, *Glob. Cosmet. Ind.*, 167, 2000, 38-44.
12. Wolf R, Wolf D, Morganti P, Ruocco V; Sunscreens, 19, *Clinic. Dermatol.* New york, 2001, 452-459.
13. Gasparro FP, Mitchnick M, Nash JFA; Review of Sunscreens safety and efficacy, 68, *Potochem. Potobiol.* Oxford, 1998, 243-256.

14. Mansur JS, Breder MNR, Mansur MCA, Azulay RD, Determination of sun protection factor by spectrophotometry, *An. Bras. Dermatol*, 61, 1986, 121-124.
15. Wealth of India, A Dictionary of raw materials and industrial products, National Institute of Science Communication, Vol 7, CSIR, New Delhi, 1996, 69-70.
16. Chopra RN, Nayar SL, Chopra JC, Glossary of Indian Medicinal Plants. Publication and Information Directorate, CSIR, New Delhi, 1992,117
17. Henry M D; Analysis of Creams and Lotions, In; Baired Edn. Manual of Cosmetic analysis, USA, 1997, 32-33.
18. PP SHARMA; Cosmetics – formulation, manufacturing and quality control Vandan Publication Pvt. Ltd. Delhi 4th edition Pg no. 189
19. Miss. Waghmare monika vasant , prof. Khade.P. Dr. Hingane L.D. (2021) international journal of formulation and evaluation of herbal sunscreen lotion.
20. Arun rashid S. Neelufar sharma S. mohanlakshmi, V. Ravichandran (2012) Research article on formulation characterization and in vitro evaluation of herbal sunscreen lotion.
21. C.K. Kokate, A. P. Purohit and S. B. Gokhale 2018, Pharmacognocny by nirali prakashan 54th edition.
22. Rangari VD.Parmacognocny and Phytochemistry, volume 1st , 2nd edition, Career Publication, Nashik, 2008, page no.3-4
23. Bambal V, Wyawahare N, Turaskar A, Mishra M. Study of sunscreen activity of herbal cream containing flower extract of *Nyctanthes arbortristis* L. and *Tagetes erecta* L. *International Journal of Pharmaceutical Sciences Review and Research*. 2011;11(1):142-6.
24. Butler H (2000) Poucher's perfumes, cosmetics, and soap. quality, stability, and safety assurance. Kluwer Academic Publishers, Dordrecht, pp 507–621
25. Bendová H, Akrman J, Krejčí A, Kubáč L, Jírová D, Kejlová K, Kolářová H, Brabec M, Malý M. In vitro approaches to evaluation of Sun Protection Factor. *Toxicology in vitro*. 2007 Oct 1;21(7):1268-75.
26. Deep C, Saraf (2008) Novel approaches in herbal cosmetics. *J Cosmet Dermatol* 7:89–95
27. Donglikar MM, Deore SL. Sunscreens: A review. *Pharmacognosy Journals*. 2016;8(3).
28. Treffel P, Gabard B. Skin penetration and sun protection factor of ultra-violet filters from two vehicles. *Pharmaceutical research*. 1996 May;13:770-4.,