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Research Article

Preparation and In Vitro SPF Evaluation of Herbal Sunscreen Formulation

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ABSTRACT

The rising awareness of the dangers posed by ultraviolet (UV) radiation has sparked interest in safer sunscreen options. Concerns about skin aging, sunburn, and skin cancer have fueled the demand for natural photoprotective agents. Herbal sunscreens are gaining popularity as effective alternatives to synthetic products. Their biocompatibility, low toxicity, and antioxidant properties make them appealing options for consumers. This study emphasizes the formulation and evaluation of a herbal sunscreen using natural plant extracts, particularly Hibiscus sabdariffa. The focus is on assessing the efficacy and safety of these herbal ingredients in providing UV protection. By exploring these natural alternatives, the study aims to contribute to the development of effective, eco-friendly sunscreens that cater to the growing consumer preference for natural products. Exposure to ultraviolet (UV) radiation can lead to serious skin disorders, including sunburn and skin cancer. With the depletion of the ozone layer, the intensity of UV radiation has increased, highlighting the need for effective photoprotection. Conventional sunscreens often contain synthetic chemicals that may irritate the skin or cause other adverse effects. As a result, more people are seeking natural alternatives for sun protection that are both effective and gentle on the skin. Incorporating ingredients like zinc oxide or titanium dioxide can provide broad-spectrum protection without harsh chemicals. Daily use of these protective measures is essential for maintaining healthy skin in our increasingly polluted environment.

INTRODUCTION

UVA rays can prematurely age the skin and contribute to wrinkles, while UVB rays are primarily responsible for sunburn and can lead to skin cancer. Both types of UV radiation can damage the DNA in skin cells, increasing the risk of mutations and malignancies. To protect against

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these harmful effects, it is essential to use broad-spectrum sunscreen, wear protective clothing, and seek shade during peak sunlight hours. Regular skin examinations can also help in early detection of skin issues linked to UV exposure. Awareness and preventive measures are crucial in maintaining skin health and preventing long-term damage.

Sunscreens are topical formulations designed to protect the skin by absorbing or reflecting UV radiation. They play a vital role in preventing sunburn, premature aging, and skin cancer. Regular use of sunscreen can significantly reduce the harmful effects of UV exposure. It is essential to choose a broad-spectrum sunscreen that offers protection against both UVA and UVB rays. Additionally, applying sunscreen generously and reapplying it every two hours is crucial for effective protection. Combining sunscreen use with other protective measures, such as wearing hats and seeking shade, enhances overall skin safety. By incorporating these practices into daily routines, individuals can maintain healthier skin and reduce the risk of dermatological issues. Protecting the skin from UV radiation is not just a seasonal concern but a year-round necessity.

Herbal sunscreens are becoming increasingly popular due to their safety and effectiveness. They often incorporate plant-based ingredients that provide numerous benefits for the skin. These ingredients are rich in bioactive compounds like flavonoids and carotenoids, which can help protect against UV damage. Additionally, they contribute to reducing oxidative stress by neutralizing free radicals produced during sun exposure. With growing awareness of the harmful effects of synthetic chemicals, many consumers are seeking natural alternatives. Herbal sunscreens not only offer protection but also promote overall skin health and wellness. As research continues to explore their benefits, these natural products may revolutionize the skincare industry, providing a safer option for sun protection.

The development of a herbal sunscreen aims to provide effective UV protection while being eco-friendly. This study highlights the significance of utilizing natural resources in cosmetic formulations. By combining traditional herbal knowledge with modern science, the research seeks to create a safe product. The integration of these approaches can lead to innovative solutions that benefit both users and the environment. In conclusion, herbal sunscreens offer a viable alternative to synthetic options, enhancing safety and therapeutic benefits. These products can minimize side effects, making them suitable for a wider audience. With continued research, the potential for herbal formulations in skincare is promising. Ultimately, this approach aligns with growing consumer demand for natural and sustainable products.

2. TARGETED DISEASES

Fig.2.1

Herbal sunscreen prepared using Hibiscus sabdariffa (Rosella) and Caesalpinia sappan mainly targets skin damage caused by ultraviolet (UV) radiation.

1. Sunburn (Solar Erythema)

Sunburn can lead to long-term skin damage and increase the risk of skin cancer. To minimize these risks, it is essential to practice sun safety measures. Wearing protective clothing, seeking shade, and avoiding peak sun hours can significantly reduce UV exposure. Always remember to reapply sunscreen every two hours, especially after swimming or sweating. Choosing a broad-spectrum sunscreen with an appropriate SPF level is crucial for effective protection. Keep in mind that even on cloudy days, harmful UV rays can penetrate the clouds and damage your skin. Therefore, establishing a consistent sun protection routine is vital for maintaining healthy skin. Regular skin checks can also help in identifying any unusual changes early on. Taking these precautions can help ensure a safer experience in the sun.

2. Photoaging (Premature Skin Aging)

Long-term exposure to sunlight can cause significant damage to the skin, resulting in photoaging. This condition manifests through various symptoms such as wrinkles, reduced skin elasticity, dryness, and changes in pigmentation. To maintain a youthful appearance, it is essential to protect your skin from harmful UV rays. Effective strategies include applying sunscreen, wearing protective clothing, and seeking shade whenever possible. Regular moisturizing and adequate hydration can further enhance skin health. Additionally, incorporating antioxidants into your skincare routine may help combat the effects of photoaging. Taking these preventive measures will contribute to healthier, more resilient skin over time. Consistent care is vital to preserving your skin's natural beauty.

3. Hyperpigmentation & Tanning

UV radiation triggers the skin to produce excess melanin, leading to dark spots and uneven skin tone. This reaction is often a response to sun exposure, which can damage skin cells. Prolonged exposure to UV rays can worsen these conditions, making prevention essential. Wearing sunscreen and protective clothing can help minimize the risk of developing these skin issues. Regular skin checks and consultations with a dermatologist can also aid in early detection and treatment. Maintaining a consistent skincare routine is crucial for healthy skin. Taking these steps can significantly reduce the risk of long-term damage.

4. Skin Cancer (Preventive Role)

Prolonged exposure to ultraviolet (UV) radiation can significantly increase the risk of developing various skin cancers. These include Melanoma, Basal Cell Carcinoma, and Squamous Cell Carcinoma, which can pose serious health threats if not detected early. It is essential to take preventive measures, such as wearing sunscreen, protective clothing, and seeking shade during peak sunlight hours. Regular skin checks can also help in identifying any unusual changes that may indicate the onset of skin issues. Early detection is crucial for effective treatment and better outcomes. By being proactive in skincare, individuals can reduce their risk of severe health complications. Awareness and education about the dangers of UV exposure are vital in promoting skin health. Protecting oneself from harmful rays can lead to a healthier future.

3. SYMPTOMS:

1. Skin Redness and Irritation
2. Hyperpigmentation
3. Dryness and Rough Texture
4. Premature Aging
5. Peeling of Skin

6. Sun Sensitivity
7. Inflammation and Swelling
8. Uneven Skin Tone

4. BENEFIT OF HERBAL SUNSCREEN:

It is essential for maintaining healthy skin. Incorporating a high-quality sunscreen into your daily routine can significantly enhance your skin's resilience and overall appearance**.**

This product offers protection against harmful UV rays. It guards against both UVA and UVB radiation, helping to prevent sunburn, tanning, pigmentation, and premature aging.

Its Made from natural ingredients, it includes plant extracts like Caesalpinia Sappan, Rosella. Moreover, it is free from harsh chemicals such as parabens and synthetic preservatives. This sunscreen also acts as a moisturizer, keeping skin soft, hydrated, and smooth.

It is rich in antioxidants, which help protect the skin from environmental damage. Overall, it's a well-rounded option for those seeking effective sun protection without compromising on skin health.

5. MATERIAL AND METHOD:

Active Ingredients:

5.1 Caesalpinia sappan :

- **Kingdom** -plantae
- **Division** -mangoliophyta
- **Class**- Dicotyledons
- **Order**- Fabales
- **Family**- Fabaceae
- **Genus**- Caesalpinia sappan
- **Species**- Sappan wood

Botanical identity

- **Biological Name**- caesalpinia sappan L, Biancaea sappan L
- **Family** - Fabaceae
- **Common Name**-sappan wood

Appearance/ morphology identity

- **Leaves** - it's leaves alternative, bipinnate compound leave with small prickle at the base
- **Bark/ stem** - greyish - brown with distinct ridges and prominent prickle.
- **Flower** - yellow fragrant and arranged in terminal or axillary panicles.
- **Heartwood**- orange- red , hard, dense, straight

Habit / distribution

It's small thorny, tropical tree india widely distributed across srilanka, thailand, malaysia

Chemical/ phytochemicals composition

It's plant major constituent include homoisoflovpnoids, flavonoids, phenolic acid and terpenoids & steroids with brazillian & sappanone

Medicinal use

- Reducing inflammation
- Fighting free radicals
- Constipation indigestion
- Hormonal balance

Toxicity/safety

- Generally safe - non toxic in acute and sub acute animal teste
- No adverse reaction - it's considered safe with no reported adverse reaction
- Caution - avoid overdose

5.2: Rosella plant:

Taxonomic identity

- **Kingdom** -plantae
- **Class** -mangoliophyta
- **Order**- Malvales
- **Suborder**-Malvineae
- **Family** -Mallows
- **Genus**-Hibiscus
- **Species**- sabdariffa

Botanical identity

- **Biological Name**- Hibiscus sabdariffa
- **Family** - Malvaceae
- **Common Name**- lal ambari, Roselle, Ambadi

Appearance/ morphology identity

- **Leaves** - dark green to reddish leaves and 3 inch pale yellow flower with red center.

Habit/ distribution

- It's cultivated in open field, garden and farms.
- It's growth best in tropical and subtropical climates
- Widely distributed in india, especially srilanka indonesia
- Chemical/ phytochemicals composition
- It's rich in phytochemicals like anthocyanins, flavonoids , phenolic acid and citric acid

Medicinal use

- Reducing inflammation
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Toxicity/safety

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5.3 Table – Application of Herbal Phytomedicines

Herbal Phytomedicine	Potent Phytoconstituent	Part Used	Uses
Caesalpinia Sappan	Braziline, Homoisoflavonoids	Bark	Anti-inflammatory, antimictobial, anti-aging
Rosella Plant	Flavonoids, phenolicacid, Organic acid	Flower	Anti-oxidant, Anti-Hypertensives

6. EXCIPIENT:

6.1. Vitamin E

primarily in the form of tocopherol, is essential in herbal sunscreen formulations. Its powerful antioxidant properties help protect the skin from damage caused by UV radiation. Additionally, vitamin E contributes to skin hydration and repair, making it a valuable ingredient. By neutralizing free radicals, it enhances the overall effectiveness of sunscreen products. Incorporating vitamin E not only improves the stability of the formulation but also promotes healthier skin. This makes it an ideal choice for individuals seeking natural sun protection options. With its multifaceted benefits, vitamin E is undoubtedly a key component in effective herbal sunscreens.

6.2. Acetyl Alcohol

Acetyl alcohol is commonly known in the pharmaceutical and cosmetic industries as cetyl alcohol. This fatty alcohol is a key ingredient in various formulations, particularly in creams and lotions. It serves as an emollient, helping to soften and soothe the skin. Additionally, cetyl alcohol acts as a thickening agent, providing a desirable texture to products. Its ability to stabilize emulsions makes it valuable in creating effective formulations. Many consumers appreciate the smooth feel that cetyl alcohol imparts to their skincare products. Overall, the use of cetyl alcohol enhances the performance and appeal of many cosmetic and pharmaceutical items.

6.3. Stearic Acid

Improves spreadability, allowing for a smooth application on the skin. It ensures even distribution of herbal active compounds and UV-protective agents. Enhances film formation, contributing to a uniform layer on the skin's surface. This improvement results in enhanced sun protection efficiency, indirectly boosting SPF effectiveness.

6.4. Glyceryl Monostearate

To enhance the shelf life of herbal sunscreen, incorporating a thickening agent is essential. This agent increases the viscosity of the formulation, resulting in a smooth, semi-solid cream consistency. It prevents the formulation from becoming too watery, ensuring a stable product. Additionally, the emollient property of the sunscreen makes the skin soft and smooth. This property forms a protective barrier that reduces moisture loss, improving the overall skin feel after application. By combining these elements, the herbal sunscreen becomes more effective and pleasant to use**.**

6.5. Caprylic Triglyceride

This are essential for maintaining skin health as they make the skin soft and smooth. They create a non-greasy barrier that helps prevent moisture loss from the skin's surface. This protective layer is especially beneficial when combined with herbal sunscreens, giving them a silky feel. By incorporating emollients, the sunscreen not only protects against UV rays but also nourishes the skin. Regular use of emollients can lead to improved skin texture and hydration, making them a vital part of any skincare routine**.**

6.6. Glycerine

Glycerine is a powerful humectant that attracts moisture from the environment. It keeps skin hydrated and soft, making it ideal for daily skincare routines. Additionally, glycerine helps prevent dryness caused by sun exposure, ensuring your skin remains healthy. By incorporating glycerine into your products, you can enhance their moisturizing properties. This ingredient is

suitable for all skin types, providing a gentle yet effective solution for hydration. Regular use can lead to improved skin texture and elasticity.

6.7. Carbopol

This agent is essential in formulations to enhance viscosity, even at low concentrations. It provides a smooth and consistent texture, making products more appealing to users. Additionally, it helps prevent the sunscreen from being too runny, ensuring better application. By stabilizing the formulation, it improves the overall performance and effectiveness of the product. Proper use of thickening agents can lead to a more enjoyable user experience and increased satisfaction. Whether in lotions, creams, or other cosmetic products, they play a crucial role in formulation chemistry. Understanding how to select and use these agents is key for formulators aiming for high-quality products.

7. METHODOLOGY

Extraction of Caesalpinia Sappan

To collect heartwood from Caesalpinia sappan, first locate a suitable tree and carefully cut the heartwood. After obtaining the heartwood, wash it thoroughly with water to remove any dirt or impurities**.**

↓

To load the sample, first, weigh between to 50 - 100 grams of the powdered material.

↓

To set up a Soxhlet extraction apparatus

↓

Add ethanol 250 to 500 ml solvent into the round-bottom flask (RBF).

↓

Heat the setup using either a heating mantle or a water bath to initiate the extraction process for 6 to 8 hours.

↓

To collect the extract, and Evaporate the remaining solvent using either a water both or a rotatory evaporater.

↓

Finally store the concentrated extract in a air tight container.

↓

Keeping it in a cool temprature to maintain it's quality.

Extraction of Rosella

Collect fresh Rosella calyces and wash them with water to remove impurities.

↓

Next, grind the dried material into a coarse powder to facilitate extraction.

↓

Weigh 50–100 g of this powder and place it in a thimble made of filter paper.

↓

Assemble the Soxhlet apparatus by connecting the round bottom flask at the bottom, containing the solvent, to the Soxhlet extractor in the middle and the condenser at the top.

↓

add 150–250 mL of ethanol into the round bottom flask to begin the extraction process

↓

To begin the extraction process, heat the system using a heating mantle.

↓

The solvent will evaporate, condense, and then drip into the thimble. This action extracts phytochemicals and siphons them back to the flask.

↓

Continue this cycle for 6 to 8 hours or conduct 10 to 15 cycles to ensure thorough extraction.

↓

After completion, evaporate the solvent using a water bath or rotary evaporator to obtain a thick, dark red extract.

↓

Finally, store the extract in an airtight container in a cool, dark place to maintain its quality.

Soxhlet extractor:

The Soxhlet extractor is an essential apparatus for obtaining plant extracts. It allows for the continuous extraction of bioactive compounds from dried and powdered plant materials like Rosella and Caesalpinia sappan. By using suitable solvents such as ethanol or methanol, the extractor effectively isolates flavonoids, phenolics, and pigments. This method enhances the yield of desired compounds while ensuring efficient solvent use. The process involves boiling the solvent, which vaporizes and condenses back into the extraction chamber, repeatedly washing the plant material. Through this cycle, the bioactive components are leached into the solvent, resulting in a concentrated extract. The Soxhlet extraction is favored for its efficiency and ability to produce high-quality plant extracts for various applications in research and industry.

8. PROCEDURE:

Emulsification Method:

Emulsification is a crucial method in formulating herbal sunscreen. This process involves combining the oil phase with the aqueous phase using emulsifying agents to achieve a stable emulsion. The resulting mixture can be either oil-in-water (O/W) or water-in-oil (W/O), depending on the desired characteristics. To start, select appropriate oils and water-soluble ingredients, ensuring they complement each other effectively. The emulsifying agents help stabilize the mixture, preventing separation and enhancing the product's texture and application. Finally, the emulsion should be thoroughly mixed to achieve a consistent product that provides the necessary sun protection and skin benefits.

A. Preparation of oil phase

Acetyle alcohol, stearic acid, Glyceryl monostrearate, Caprylic Triglyceride, Vitamin E in beaker.

↓

Heat to 70-75'C with gentle stirring until all solids melt and mixture is uniform.

↓

Insure that no lumps or unmelted particles remain in the mixture.

Oil Phase Preparation

B. Preparation of Aqueous Phase

In another beaker, distilled water, glycerine, Preservative are taken.

↓

The Mixture is heated up to 70-75'C

↓

Sprinkle carbopol slowly into water while stirring to avoid clumping – let hydtare.

Aqueous Phase Preparation

C. Incorporation of herbal extracts

The prepared caesalpinia sappan and rosella extract.

↓

If the extract are viscous, premix with glycerin for better dispersion keep at 70-75'C

D. Emulsification

When both phases are at ~ 70'C, pour the oil into the aqueous phase slowly under moderate stirring**.**

↓

After coarse mixing, use a high sheer homogenizer for 5-10 minute. Adjust time speed to obtain smooth, creamy texture.

Mixing of cream with Homogenizer

E. Cooing

Begin control cooling with continous stirrin. At ~ 40-45'C and preservative and fragrance.

F. Packaging

Fill into sterile/clean tube or jars while still pourable. Lable batch number and date**.**

Final Packaging

9. EVALUATION PARAMETER OF HERBAL SUNSCREAM

- **PH Determination**

To measure the pH using a digital pH meter, first, ensure the meter is calibrated according to the manufacturer's instructions. Next, prepare the sample by placing it in a clean container, ensuring there are no contaminants that could affect the reading. Turn on the digital pH meter and immerse the electrode into the sample solution. Wait for the reading to stabilize, which usually takes a few seconds, and then record the pH value displayed. Ideally, the pH should fall between 5.5 and 7 for skin-friendly results. If the reading is outside this range, adjustments may be necessary to achieve the desired pH level. Always rinse the electrode with distilled water after use to maintain accuracy for future measurements.

- **SPF (Sun Protection Factor)**

Sun Protection Factor (SPF) is a crucial parameter when it comes to sunscreen effectiveness. It is measured using a UV spectrophotometer, which helps determine the level of protection against UVB rays. A higher SPF indicates better protection, making it essential to choose a sunscreen with an appropriate SPF level for your skin type and sun exposure. Always follow application instructions to ensure optimal protection from harmful UV rays**.**

- **Viscosity**

testing of herbal sunscreen is essential for ensuring that the product applies smoothly and evenly. Using a Brookfield viscometer, typically with spindle 64 at various speeds like 6, 10, or 100 rpm, helps assess the flow characteristics of the formulation. Proper viscosity guarantees that the sunscreen is neither too runny nor too thick, which could affect its effectiveness. This testing is critical for product stability and user satisfaction, making it a key factor in formulation development. Consistent viscosity measurements can also aid in quality control during production. Ultimately, achieving the right viscosity contributes to a better user experience and optimal sun protection.

- **Washability**

The sunscreen washability test is crucial for understanding how easily a sunscreen can be removed from the skin.This assessment helps determine whether users need to apply additional cleansers or if a simple rinse will suffice.

To conduct the test, apply the sunscreen to the skin and rinse with water.After rinsing, observe the amount of product remaining on the skin or measure the UV protection that persists post-water immersion.

This evaluation not only informs consumers about comfort but also aids in formulating products that meet user needs. An effective sunscreen should ideally wash off easily without compromising its protective qualities.

- **Stability**

Store the product at room temperature for optimal results. For long-term stability, consider refrigeration. If accelerated testing is needed, maintain the product at 40°C. Ensure that each storage condition is monitored for consistency.

- **Irritancy test**

Irritancy tests for herbal sunscreens are essential for ensuring safety and efficacy. These tests typically include a 24-hour patch test to assess for erythema and edema, which are indicators of skin irritation. Herbal formulations often incorporate extracts such as Aloe vera and turmeric, known for their soothing properties. The goal is to confirm that these products are safe, non-irritating, and suitable for human skin, with most formulations demonstrating high skin compatibility.

- **Moisture Content**

Herbal sunscreen formulations are designed to protect the skin from harmful UV rays while providing hydration. These products typically function as emulsions, which can be either oil-in-water or water-in-oil systems. The moisture content in these formulations varies, depending on the specific ingredients used. Common humectants like glycerin are often included to attract moisture, along with natural extracts such as aloe vera to enhance hydration and support the skin's barrier functions. By carefully balancing sun protection and skin hydration, herbal sunscreens aim to offer a gentle, effective solution for various skin types. This makes them a popular choice for those seeking natural alternatives in sun care.

10. CONCLUSION

The study aims to develop a herbal sunscreen incorporating Hibiscus sabdariffa and Caesalpinia sappan. These natural ingredients are known for their protective properties against harmful ultraviolet (UV) radiation. Prolonged sun exposure can result in various skin problems, such as sunburn and hyperpigmentation. Furthermore, it may contribute to premature aging and elevate the risk of severe conditions like melanoma. Therefore, creating safe and effective sunscreen products is essential for skin health. The use of plant-based components can provide an alternative to chemical sunscreens, appealing to those seeking natural solutions. By harnessing the benefits of these herbs, the study hopes to offer a viable option for sun protection while promoting skin wellness. This effort aligns with the growing demand for eco-friendly and non-toxic skincare products.

11. RESULT

The formulated herbal sunscreen demonstrated favorable physical properties and stability. It also showed good skin compatibility, making it suitable for regular use. The SPF value indicates moderate protection from harmful UV rays. This confirms the effectiveness of both Rosella and Caesalpinia sappan extracts in the formulation.

Result Table: (Phytochemical Screening)

Phytochemical Constituents	Rosella Extract	Caesalpinia Sappan Extract
Alkaloids	+ (Present)	+ (present)
Flavonoids	+ (Present)	+ (Present)
Tannins	+ (Present)	+ (Present)
Saponins	+ (Present)	± (Slightly Present)
Phenols	+ (Present)	+ (Present)
Glycosides	+ (Present)	+ (Present)
Terpenoids	+ (Present)	+ (Present)

Steroids	± (Slightly Present)	+ (Present)

Result Table: Evaluation of Herbal Sunscreen

Sr. no.	Parameter Evaluated	Observation / Result	Inference
1.	Color	Reddish-Pink	Due to natural pigments of plant extracts
2.	Odour	Mild, characteristic	Acceptable for topical use
3.	Appearance	Smooth and homogeneous	No phase separation
4.	pH	6.2-6.8	Suitable for skin application
5.	Speadability	Good	Easy to apply on skin
6.	Viscosity	Moderate	Suitable consistency
7.	Washability	Easily washable	Good user compliance
8.	Irritancy Test	No irritation observed	Safe for skin
9.	Stability Study	Stable (No change in color, pH, Consistency)	Good Stability
10.	Sun Protection Factor	SPF 15-25	Provides moderate UV protection

12. DISCUSSION

The present study highlights the significance of herbal ingredients in photoprotection. Rosella extract contains anthocyanins, which are known for their antioxidant properties that can help protect the skin from UV damage. Caesalpinia sappan extract also contributes to the sunscreen's efficacy, offering additional photoprotective benefits through its bioactive compounds. Together, these natural extracts enhance the overall effectiveness of the herbal sunscreen while promoting skin health. The formulation shows a promising alternative to conventional sunscreens, appealing to consumers seeking natural options. Further research may explore additional herbal ingredients to optimize protection and stability. Overall, the study emphasizes the potential of herbal formulations in skincare innovations**.**

The present study focuses on creating a herbal sunscreen formulation using extracts from Rosella and Caesalpinia sappan. This research aims to identify natural alternatives to synthetic sunscreens, utilizing plant-based bioactive compounds for effective photoprotection and additional skin benefits. UV radiation exposure can result in various skin issues, including photoaging, sunburn, hyperpigmentation, and skin cancer. By investigating these herbal extracts, the study seeks to provide a safer option for sun protection while enhancing skin health.

REFERENCES

1. Ananth S — 2015 — Performance of Caesalpinia sappan heartwood extract as a photo-sensitizer / application study.
2. Bila WS — 2023 — SPF (Sun Protection Factor) value and physical evaluation involving roselle (Hibiscus sabdariffa) extracts.
3. Da-Costa-Rocha I — 2014 — Hibiscus sabdariffa L. — a phytochemical and pharmacological review.
4. dos Santos Nascimento LB — 2021 — Phenolic compounds from leaves and flowers of Hibiscus: antioxidant, SPF and anti-collagenase evaluation.
5. Hemthanon T — 2022 — Antibacterial activity, stability and hemolytic activity of Caesalpinia sappan crude extracts (phytochemical screening).
6. Imam S — 2015 — In-vitro evaluation of sun protection factors of cream formulations prepared from plant extracts (includes Hibiscus spp. references).
7. Laksmiani NPL — 2022 — Secang wood (Caesalpinia sappan L.) nanoemulgel activity

as anti-aging (photoprotective and antioxidant implications).
8. Mambro VMD — 2005 — Studies on stability/antioxidant activity of topical formulations with plant extracts (cited in Hibiscus photoprotection literature).
9. Mohamad NR (Nur Royhaila) — 2018 — In-vitro photoprotective activities of different solvent extracts of Hibiscus sabdariffa (SPF determinations by UV spectrophotometry).
10. Mourtzinos I — 2008 — Thermal stability of Hibiscus sabdariffa anthocyanin extracts (relevance to formulation and sunscreen use).
11. NPL (Mendeley entry) / Researcher(s) — 2025 — Potential of Secang Wood (Caesalpinia sappan L.) ethanol extract as antioxidant and sun-protection (SPF testing reported).
12. Park JI — 2022 — Protective role of Caesalpinia sappan extract and its main constituents against light-induced skin damage / blue-light & photo protection
13. Pineda / Aguilar et al. — 2004 (cited work) — Methodology: Mansur spectrophotometric in-vitro SPF assay (commonly used in the Hibiscus/SPF papers).
14. Rajbir / Vinay (citations from reviews) — 2016 — Photoprotective screening of plant extracts — contextual background for herbal sunscreens.
15. Royhaila N. Mohamad et al. — 2018 — (same as #9 — appearance in MJAS PDF; included to show multiple solvent results & SPF values).
16. Sahu A — 2025 — Formulation and evaluation of an herbal sunscreen lotion (includes plant extracts and SPF evaluation; contemporary formulation work).
17. T. Vij — 2023 — A comprehensive review on bioactive compounds in sappan wood and its potential uses (mentions flavonoids with UV-blocking potential).
18. Thompson / others (various years) — Multiple short reports and conference abstracts on Hibiscus spp. SPF and formulation trials (useful supplementary sources).
19. Violante IMP et al. — 2009 — In-vitro evaluation of photoprotective activity of plant extracts (regionally relevant flora; methodological comparators).
20. Zhen J. et al. — 2016 — Phytochemistry, antioxidant capacity and anti-inflammatory activity of Hibiscus sabdariffa leaves (supports photoprotective rationale).
21. ResearchGate compilation — 2023 / 2024 — Development of herbal sunscreen formulations from Hibiscus species and other local medicinal plants (case studies: Sri Lanka, Indonesia).
22. Scribd / academic theses — 2023–2024 — Phytochemical screening and SPF evaluation of Hibiscus rosa/sinensis and Hibiscus sabdariffa gels / creams (several MSc/PhD theses available).
23. Journal of Pharmaceutical & Biomedical Analyses / assorted — various — Papers using Mansur et al. spectrophotometric SPF method to screen plant extracts (including roselle, sappanwood).
24. Mendeley / conference posters — 2024–2025 — Reports of SPF values for sappanwood extracts (values ranging mid-single digits up to SPF ~18 in concentrated extracts; see 2025 entries).
25. Various formulation papers (Indonesia / Malaysia / Brazil) — 2015–2024 — Herbal sunscreen development papers that include Hibiscus and/or Caesalpinia extracts as active additives (stability + SPF reported).

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