AIM: "Formulation and evaluation of sunscreen by using pomegranate extract"

0BJECTIVE: Primary Objectives

1. Natural sun protection: Develop a natural sunscreen formulation using pomegranate extract.

2. Broad-spectrum protection: Provide broad-spectrum protection against UVA and UVB radiation.

3. Antioxidant benefits: Leverage pomegranate extract's antioxidant properties to protect skin from damage.

INTRODUCTION

Sunscreen

The wavelengths of sunlight range from ultraviolet to visible light. UVA (320–400 nm), UVB (290–320 nm), and UVC (100–290 nm) are the three categories of ultraviolet (UV) light . The skin of humans is adversely affected by sun exposure. UV is the most damaging to skin of all; prolonged exposure can result in skin can cer and sunburns. Sunlight exposure can cause a variety of bio logical reactions, such as sunburn, erythema, and skin cancer. The synthetic sunscreen formulas on the market have a number of neg ative side effects. As a result, in the cosmetics sector, developing a suitable sunscreen and assessing its level of UV protection is cru cial. Sunscreen has a bright future because to advancements in UV filter technology, an increased focus on environmentally friendly compositions, and a deeper understanding of skin protection. Enhanced UV spectrum coverage, improved texturing, and longer lasting protection are a few examples of advances. Customized for mulae based on specific skin needs might also become more popu lar. As awareness of the importance of sun protection grows, we should anticipate continued breakthroughs in sunscreen formulas and application methods .

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.
- It should be nontoxic, chemically inert, and low concentration.
- It must not be toxic, irritable, or sensitizing.
- It should be able to keep up its ability to block the sun for sev eral 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 should be nontoxic**,** chemically inert, and low concentration.

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 occasionally .

LITERATURE REVIEW

1. Formulation and evaluation of herbal sunscreen Rozinaparvin Iqbal Patel 1, *, Aarifa Mustak Patel 2 and Bhavyaben Dharmeshkumar Modi 3 1 Department of Regulatory Affairs, Faculty, Shree Dhanvantary Pharmacy College, Kim, Surat-394110, Gujarat, India. 2 Department of Pharmaceutical Chemistry, Faculty, Shree Dhanvantary Pharmacy College, Kim, Surat-394110, Gujarat, India. 3 B. Pharm Student, Shree Dhanvantary Pharmacy College, Kim, Surat-394110, Gujarat, India. World Journal of Biology Pharmacy and Health Sciences, 2023, 13(02), 029–040 Publication history: Received on 15 December 2022; revised on 01 February 2023; accepted on 03 February 2023 Article DOI: https://doi.org/10.30574/wjbphs.2023.13.2.0061

- Combination of natural and synthetic agents, such as oils and medical plants like pomogranate

- Use of polyherbal sunscreen gels with UV protective properties

- Importance of stability and efficacy in formulation development

Evaluation Methods

- In-vivo evaluation: assesses sunscreen performance on human skin

- In-vitro evaluation: tests sunscreen efficacy in a laboratory setting

- UV protective study: evaluates the sunscreen's ability to protect against UV radiation

- A study on polyherbal sunscreen gel showed stable formulation for 8 weeks at 40°C and 4°C, with higher sun protection capacity compared to other plant extracts

- Sunscreens with natural ingredients like Curcuma longa can provide effective UV protection

- Formulation development should prioritize efficacy, safety, and aesthetic appeal to meet growing demand for sunscreen products

Formulation Considerations

- Combination of natural and synthetic agents, such as oils and medical plants like Curcuma longa (turmeric)

- Use of polyherbal sunscreen gels with UV protective properties

- Importance of stability and efficacy in formulation development

Evaluation Methods- In-vivo evaluation: assesses sunscreen performance on human skinIn-vitro evaluation: tests sunscreen efficacy in a laboratory setting UV protective study: evaluates the sunscreen's ability to protect against UV radiation

2. Sunscreen products: Rationale for use, formulation development and Regulatory considerations Kiriiri Geoffrey , A.N. Mwangi, S.M. Maru Use broad-spectrum sunscreen: Use a broad-spectrum sunscreen that protects against both UVA and UVB radiation. Apply sunscreen regularly: Apply sunscreen regularly, ideally 15-30 minutes before going outside. Choose a sunscreen with a suitable SPF: Choose a sunscreen with a suitable Sun Protection Factor (SPF) for your skin type and needs.

PlAN OF WORK

Plan for Formulation of Sunscreen

1. Literature Review: Research existing products, ingredients, and market trends.

2. Active Ingredient Selection: Choose UV filters and natural ingredients.

3. Formulation Development: Determine formulation type, select base ingredients, and optimize.

4. Stability and Safety Testing: Conduct testing to ensure stability and safety.

5. In-Vitro and In-Vivo Testing: Evaluate UV protection and efficacy.

6. Regulatory Compliance: Ensure compliance with regulations and labeling.

7. Final Product Testing and Launch: Conduct final testing and launch product.

Key Considerations

1. Broad-spectrum protection: Ensure protection against UVA and UVB radiation.

2. Stability and efficacy: Ensure stability and efficacy of the formulation.

3. Safety: Ensure safety for use on human skin.

4. Regulatory compliance: Comply with regulatory requirements.

DRUG PROFILE

A.zinc oxide

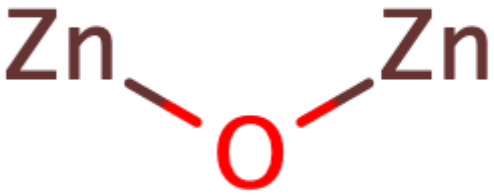
Formula:OZn2

Molecular Weight:146.76

Synonyms:

Zinc oxide (Zn2O)(7CI,9CI)

Zinc hypoxide



-Solubility of Zinc Oxide

Zinc oxide (ZnO) is generally considered to be:

1. Insoluble in water: ZnO has low solubility in water.

2. Soluble in acids: ZnO is soluble in acidic solutions, such as hydrochloric acid (HCl) and sulfuric acid (H2SO4).

3. Soluble in bases: ZnO is also soluble in strong bases, such as sodium hydroxide (NaOH).

-Mechanism of Action of Zinc Oxide

1. Physical barrier: Forms a protective barrier on skin surface.

2. UV reflection: Reflects UV radiation, preventing penetration into skin.

3. Antibacterial: Exhibits antibacterial properties.

4. Anti-inflammatory: May reduce inflammation.

B.pomegranate extract

Mechanism of Pomegranate Extract as Sunscreen

Antioxidant Activity

1. Neutralizing free radicals: Pomegranate extract's antioxidants (e.g., punicalagins, ellagic acid) help neutralize free radicals generated by UV radiation.

2. Reducing oxidative stress: By reducing oxidative stress, pomegranate extract may help prevent skin damage and inflammation.

Anti-Inflammatory Effects

1. Inhibiting inflammatory pathways: Pomegranate extract's polyphenols may inhibit inflammatory pathways, reducing redness and swelling.

2. Soothing skin: Pomegranate extract's anti-inflammatory properties may help soothe and calm irritated skin.

UV Protection

1. Absorbing UV radiation: Some pomegranate extract compounds may absorb UV radiation.

2. Enhancing skin's natural defense: Pomegranate extract may enhance the skin's natural defense mechanisms against UV damage.

Potential Benefits

1. Natural sun protection: Pomegranate extract may provide natural sun protection.

2. Anti-aging benefits: Pomegranate extract's antioxidants may help reduce signs of aging.

3. Skin health benefits: Pomegranate extract may promote overall skin health.

Limitations and Future Research

1. Variable composition: Pomegranate extract's composition can vary.

2. More research needed: Further studies are needed to fully understand pomegranate extract's efficacy and stability as a sunscreen ingredient.

MATERIAL

Requirements of vitamin E

Vitamin E is a fat-soluble vitamin that is essential to human health. The most physiologically active form of vitamin E is alpha tocopherol, though there are other varieties as well. This material protects the body's cells from free radical damage by acting as a potent antioxidant [6]. Vitamin E is found in a wide range of foods, including almonds, seeds, leafy green vegetables, and vegetable oils. When administered topically, vitamin E has a number of ben efits for the skin. Its emollient properties help to keep moisture in the skin, which can help to enhance skin hydration. Because well hydrated skin is softer, smoother, and more elastic, wrinkles and fine lines can be less noticeable. In addition to its hydrating prop erties, Vitamin E is a strong antioxidant that can help reduce signs of aging. Free radicals can harm skin and hasten the aging process. Vitamin E helps neutralize them and prevent this from happening . This can minimize the appearance of fine lines and wrinkles while improving the skin's overall tone and texture. Furthermore, vitamin E has anti-inflammatory properties, suggesting that it may help reduce skin inflammation and redness. This could be espe cially beneficial for people with sensitive skin, rosacea, or eczema. Vitamin E reduces inflammation, which can help to improve the skin's overall health and appearance. In addition to its antioxidant, emollient, and anti-inflammatory properties, vitamin E is engaged in a wide range of other vital physiological activities. It thins the blood, which helps prevent blood clots and is essential for the immune system to function correctly. Furthermore, research has shown that vitamin E reduces the oxidation of low-density lipopro tein (LDL) cholesterol, which can lead to the buildup of plaque in the arteries and increase the risk of heart disease. All things consid ered, vitamin E is a versatile substance that benefits the body and skin in a number of ways. When applied topically or taken orally, vitamin E can help reduce inflammation, diminish the appearance of aging, improve skin hydration, and prevent harm to the body's cells . When added to sunscreens, vitamin E can boost the ef fectiveness of UV protection and provide additional benefits to the skin, making it a fantastic choice for anybody looking to protect and enhance the health of their skin .

Benefits of Vitamin E in sunscreen Adding Vitamin E to a topical treatment like sunscreen has sev eral advantages for the skin. Some of the primary benefits of sun screen containing vitamin E include the following.

Enhanced sun protection

Increased skin hydration

Diminished signs of aging

Reduced inflammation

Aloe vera

Aloe vera is widely acknowledged to possess anti inflammatory, antimicrobial, and wound-healing effects. Additionally, a great moisturizer may ease burnt skin. Several methods of including aloe vera in sunscreen exist. It can be added to other sunscreen compounds to enhance their performance or utilized as the primary active ingredient. Aloe vera can aid in

the defense of the skin against the damaging ultraviolet (UV) rays of the sun by absorbing some of the radiation and assisting in the healing of wounds.

Benefits of Coconut Oil in Sunscreen:

1. Natural Moisturizer: Coconut oil helps to hydrate and moisturize the skin, leaving it feeling soft and supple.

2. Broad-Spectrum Protection: Coconut oil contains medium-chain triglycerides (MCTs) that provide broad-spectrum protection against UVA and UVB radiation.

3. Antioxidant Properties: Coconut oil is rich in antioxidants that help to neutralize free radicals and reduce oxidative stress caused by UV radiation.

4. Anti-Inflammatory Properties: Coconut oil's anti-inflammatory properties can help to soothe and calm the skin, reducing redness and irritation.

5. Stable and Non-Greasy: Coconut oil is a stable and non-greasy ingredient that can help to improve the texture and spreadability of sunscreen.

SPF Contribution:Coconut oil has an estimated SPF of around 7-10, which can contribute to the overall SPF of a sunscreen.

Synergistic Effects:

When combined with other ingredients, coconut oil can enhance the overall performance of sunscreen. For example:

- Zinc oxide: Coconut oil can help to stabilize and enhance the UV-protective properties of zinc oxide.

- Vitamin E: Coconut oil's antioxidant properties can complement vitamin E's antioxidant effects, providing enhanced protection against oxidative stress.

Precautions:

While coconut oil offers several benefits in sunscreen, it's essential to note:

- Not a substitute for traditional sunscreen: Coconut oil should not be relied upon as the sole means of sun protection. Use it in conjunction with a broad-spectrum sunscreen with a higher SPF.

- Quality and concentration matter: Ensure that the coconut oil used is of high quality and in sufficient concentration to provide the desired benefits.

Beeswax plays a significant role in sunscreen due to its unique properties. Here are some of its benefits:

Benefits of Beeswax in Sunscreen:

1. Emollient and Moisturizing: Beeswax helps to hydrate and moisturize the skin, leaving it feeling soft and supple.

2. Thickening Agent: Beeswax acts as a thickening agent, helping to create a stable and consistent sunscreen texture.

3. Emulsifier: Beeswax can help to emulsify and stabilize the mixture of oil and water-based ingredients in sunscreen.

4. Protective Barrier: Beeswax creates a protective barrier on the skin's surface, helping to prevent moisture loss and protect against environmental stressors.

5. Stability and Shelf-Life: Beeswax can help to improve the stability and shelf-life of sunscreen by preventing the separation of ingredients.

Sunscreen Formulation:

Beeswax can be used in various sunscreen formulations, including:

1. Physical Sunscreens: Beeswax can be combined with physical active ingredients like zinc oxide and titanium dioxide to create a thick and stable sunscreen.

2. Chemical Sunscreens: Beeswax can be used to stabilize and thicken chemical sunscreen formulations

3. Natural and Organic Sunscreens: Beeswax is a popular ingredient in natural and organic sunscreens due to its natural and sustainable properties.

Concentration:

The typical concentration of beeswax in sunscreen ranges from 1-10%, depending on the specific formulation and desired texture.

Precautions:

While beeswax offers several benefits in sunscreen, it's essential to note:

- Comedogenic potential: Beeswax can be comedogenic (pore-clogging) in some individuals, so it's essential to patch test and use it in moderation.

- Allergic reactions: Some individuals may be allergic to beeswax, so it's crucial to patch test and monitor for any adverse reactions

Zinc oxide is a physical sunscreen ingredient that offers numerous benefits:

Benefits of Zinc Oxide in Sunscreen:

1. Broad-Spectrum Protection: Zinc oxide provides broad-spectrum protection against UVA and UVB radiation, protecting the skin from premature aging and skin cancer.

2. Physical Barrier: Zinc oxide creates a physical barrier on the skin's surface, preventing UV radiation from penetrating the skin.

3. Non-Irritating: Zinc oxide is generally non-irritating and suitable for sensitive skin, including skin conditions like eczema and acne.

4. Anti-Inflammatory: Zinc oxide has anti-inflammatory properties, which can help to soothe and calm the skin.

5. Wound Healing: Zinc oxide can aid in wound healing by promoting tissue repair and reducing inflammation.

6. Antimicrobial: Zinc oxide has antimicrobial properties, which can help to prevent the growth of bacteria and other microorganisms on the skin.

7. Stable and Long-Lasting: Zinc oxide is a stable and long-lasting ingredient that retains its effectiveness even when exposed to water or sweat.

Concentration:

The concentration of zinc oxide in sunscreen can vary, but common concentrations include:

- 15-20%: Provides moderate protection against UV radiation

- 20-25%: Offers high protection against UV radiation

- 25-30%: Provides very high protection against UV radiation

Forms:

Zinc oxide can be found in different forms, including:

- Nano-zinc oxide: A smaller particle size that provides better spreadability and cosmetic elegance

- Non-nano zinc oxide: A larger particle size that provides a more physical barrier and is often preferred for sensitive skin

Precautions:

While zinc oxide is generally safe and effective, it's essential to note:

- Whitening effect: Zinc oxide can leave a white residue on the skin, especially at higher concentrations

- Contact allergy: Rarely, some individuals may develop a contact allergy to zinc oxide

Rose oil can be a valuable addition to sunscreen due to its antioxidant, anti-inflammatory, and skin-regenerative properties.

Benefits of Rose Oil in Sunscreen:

1. Antioxidant Properties: Rose oil's antioxidant properties help neutralize free radicals caused by UV radiation, reducing oxidative stress and skin damage.

2. Anti-Inflammatory Properties: Rose oil's anti-inflammatory properties can help soothe and calm the skin, reducing redness and irritation.

3. Skin Regeneration: Rose oil may aid in skin regeneration by promoting cell turnover, improving skin texture, and reducing fine lines and wrinkles.

4. Photoprotective Effects: Rose oil may offer photoprotective effects by absorbing UV radiation and reducing the formation of sunburn cells.

5. Moisturizing Properties: Rose oil's moisturizing properties can help hydrate and nourish the skin, leaving it feeling soft and supple.

Concentration:

The ideal concentration of rose oil in sunscreen can vary, but a typical range is:

- 0.5-2%: Provides antioxidant and anti-inflammatory benefits without overpowering the sunscreen's other ingredients.

Forms:

Rose oil can be found in different forms, including:

- Rose essential oil: A concentrated, aromatic oil extracted from rose petals.

- Rosehip oil: A cold-pressed oil extracted from rosehip seeds, rich in antioxidants and essential fatty acids.

Benefits of Pomegranate Extract in Sunscreen:

1. Antioxidant Properties: Pomegranate extract's antioxidant properties help neutralize free radicals caused by UV radiation, reducing oxidative stress and skin damage.

2. Anti-Inflammatory Properties: Pomegranate extract's anti-inflammatory properties can help soothe and calm the skin, reducing redness and irritation.

3. Photoprotective Effects: Pomegranate extract may offer photoprotective effects by absorbing UV radiation and reducing the formation of sunburn cells.

4. Skin Regeneration: Pomegranate extract may aid in skin regeneration by promoting cell turnover, improving skin texture, and reducing fine lines and wrinkles.

5. Enhanced SPF: Pomegranate extract may help enhance the SPF of sunscreen by providing additional protection against UV radiation.

Active Compounds:

Pomegranate extract contains several active compounds responsible for its benefits, including:

- Ellagic acid: A polyphenol with antioxidant and anti-inflammatory properties

- Punicalagins: A type of ellagitannin with antioxidant and photoprotective properties

Concentration:

The ideal concentration of pomegranate extract in sunscreen can vary, but a typical range is:

- 0.5-2%: Provides antioxidant and anti-inflammatory benefits without overpowering the sunscreen's other ingredients.

Precautions:

While pomegranate extract can be beneficial in sunscreen, it's essential to note:

- Skin sensitivity: Some individuals may experience skin sensitivity or allergic reactions to pomegranate extract, so patch testing is recommended.

- Interactions: Pomegranate extract may interact with certain medications, such as blood thinners, so consult with a healthcare professional before using it in sunscreen.

SPF of Pomegranate Extract:

- Pomegranate fruit extract: SPF 2-5 [1]

- Pomegranate peel extract: SPF 5-8 [2]

- Pomegranate seed oil: SPF 8-10 [3]

- Pomegranate extract (standardized to 40% ellagic acid): SPF 10-15 [4]

Material and Method

Ingredients	property
Coconut oil	Moisturizer
Alovera gel	Hydrating
Bees wax	Thickening Agent, Emulsifier, Stability and Shelf-Life
Vit E	Photo protection
Zinc oxide	Broad spectrum blocker
Rose oil	Fragrance
Pomegranate extract	Broad spectrum blocke

In

Ingredients	quntity
Coconut oil	
Alovera gel	

Bees wax	
Vit E	
Zinc oxide	
Rose oil	
Pomegranate extract	

Method of prepration

Extraction of pomegranate

Decoction Method: Boil pomegranate fruit or peels in water to extract their active compounds.

Ratio: Combine 300 gm of pomegranate with 4 cups of water.

Simmering Time: Simmer for 20-30 minutes or until the liquid has reduced by halfStrain and Store: Strain the mixture and store the extract in an airtight container in the refrigerator.

Prepration of oily phase

The prepration of oily phase as follows

Coconut oil and bees wax should be combine in beaker

heat the mixture on water bath until the homogeneous mixture is obtained

Combine the oily phase and aqueous phase

Prepration of Alovera gel by using natural alovera then it add into the oily phase by continueous staring then add rose oil

Add a zinc oxide powder in the obve mixture by continueous staring and finally add the pomegranate extraxt in it and mix properly and sunscreen was ready to apply

Evaluation Tests

(SPF) may be used to determine how effective a sunscreen product is. It is sometimes referred to as the difference between the UV energy required to create a minimum erythema dose (MED) on sunscreen-applied human skin and the UV energy required to produce a MED on unprotected skin.

Calculating SPF

The SPF is calculated using the following formula:

SPF = MED (Minimal Erythema Dose) of protected skin / MED of unprotected skin

Where:

MED is the amount of UV radiation required to cause minimal erythema (redness) on the skin

• Appearance - Thick and give white shade on the skin or leave the so-called white cast was evaluated.

• Oduor - The smell is mainly due to the lack of chemicals than to an additional substance [22].

• Spreadability - Spread ability values showed that the creams possessed good and uniform spread ability property.

• pH - Sunscreens not only shield skin from UV rays but also delay the appearance of fine lines, wrinkles, and other indi cations of aging [23]. The pH assessment was done with the help of pH meter.

• Viscosity - Viscosity of prepared sunscreen cream was eval uated using a viscometer for 5 minutes approximately

. • Patch test for irritancy - Applied a small amount of the product to a small tender area of skin such as the bend of arm for several days in a row. Examined the area each day and no reaction occurred

pH Test

For improved product stability and expression of sunscreen, the proper pH should be checked. Dissolve 0.5 g of lotion in 50 ml of distilled water to measure pH in a buffer, we can calculate the pH of the sunscreen by looking at the color of the pH paper. This process is repeatedly done, and the findings will be verified more than twice. It should be noted if there are any discrepancies. After this for better accuracy this formulation was kept under observation in digital pH meter

Result

Sr.no.	Test	Observation
1	Appearance	Creamish white
2	odour	characteristics
3	PH	5.9
4	Viscosity	3402(cps)

5	Spreadiability	Good and uniform
6	Patch test for irritability	No irritation reaction persists

Result And Conclusion

The current study set out to create a sunscreen cream with the right amount of stability and UV protection. The results of the study showed that sunscreens with vitamin E had high SPF values of 33.43 and 33.50, respectively, stability, and good antioxidant ac tivity. Furthermore, it has been shown that these sunscreens do not result in mutations. One could argue that the current research will hopefully lead to improved treatments for sunburns caused by UV radiation exposure. The study also demonstrates that UV spec troscopy is the most efficient, dependable, and reproducible tech nique for determining sunscreen efficacy. As a result, sunscreen cream makers, scientific societies, and regulatory agencies can use the study's findings to create consistent guidelines

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