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Review Article

A Review on Formulation and Evaluation of Antioxidant Activity of Crocus Sativus and Aloe Vera Herbal Cream

Nandhitha Ravichandran*, Rajeshwari Ekkambaram, Kumaresan Kalvi, Balu Elumamalai, Dr. Mythili Krishnamoorthy

Kamalakshi Pandurangan College of Pharmacy, Tiruvannamalai, Tamil Nadu.

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ABSTRACT

The increasing preference for natural skincare products has driven research into herbal formulations with potent antioxidant potential. This study focuses on the formulation and evaluation of an herbal cream incorporating Crocus sativus (saffron) and Aloe vera, both known for their rich phytoconstituents and proven dermatological benefits. Crocus sativus contains crocin, crocetin, safranal, and phenolic compounds that exhibit strong free radical scavenging activity, while Aloe vera provides vitamins, amino acids, polysaccharides, and saponins that enhance skin hydration, promote collagen synthesis, and protect against oxidative stress. Physicochemical parameters such as pH, viscosity, spreadability, and stability were assessed to confirm product quality. In vitro antioxidant activity was evaluated using radical scavenging assays, demonstrating significant free radical neutralization attributed to the bioactive compounds. The formulation also showed enhanced moisturizing and soothing effects, promoting skin hydration and reducing inflammation. These findings suggest that a synergistic combination of Crocus sativus and Aloe vera can be effectively incorporated into topical preparations to protect skin from oxidative damage, delay premature aging, and support overall skin health.

INTRODUCTION

The growing demand for natural and safe skincare products has steered research towards herbal formulations enriched with antioxidants for skin protection and nourishment. Herbal creams incorporating Crocus sativus (saffron) and Aloe vera have gained prominence due to their combined therapeutic and cosmetic properties.

Crocus sativus is known for its potent antioxidant constituents such as crocin, crocetin, and safranal, which contribute to free radical scavenging and skin-lightening effects, aiding in the prevention of

***Corresponding Author:** Nandhitha Ravichandran
Address: *Kamalakshi Pandurangan College of Pharmacy, Tiruvannamalai, Tamil Nadu.*
Email : nandhitha543@gmail.com

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oxidative stress-related skin damage and pigmentation issues. On the other hand, Aloe vera is widely valued for its moisturizing, anti-inflammatory, and skin-soothing capabilities, providing essential vitamins, amino acids, and polysaccharides that enhance skin hydration, promote collagen synthesis, and accelerate healing.

Formulating an herbal cream with these ingredients involves creating a stable oil-in-water emulsion that delivers the bioactive compounds effectively to the skin. Evaluation of such creams focuses on physicochemical properties like pH, viscosity, spreadability, homogeneity, and stability, alongside in vitro antioxidant assays such as DPPH to confirm efficacy.

This approach to herbal cream formulation aims to harness the synergistic benefits of Crocus sativus and Aloe vera, offering a natural, effective, and cosmetically acceptable solution that protects against oxidative damage.

CROCUS SATIVUS

Crocus sativus L., commonly known as saffron, is a widely studied medicinal plant belonging to the Iridaceae family. It is primarily valued for the dried red stigmas of its flowers, which contain over 150 volatile and aroma-yielding compounds, including key constituents such as crocin, safranal, and picrocrocin. These compounds are responsible for Saffron's characteristic colour, flavour, and aroma, as well as its potent biological activities.



Fig1: Crocus sativus flower



Fig2: Crocus sativus stigma

Phytochemically, Saffron's major bioactive molecules include:

- Crocin: a carotenoid responsible for Saffron's vibrant yellow-orange color, with strong antioxidant properties.
- Safranal: the principal aromatic compound contributing to Saffron's distinctive odour, also exhibiting notable pharmacological activities.
- Picrocrocin: a glycoside contributing to the bitter taste and precursor of safranal.

Saffron is rich in sugars, proteins, amino acids, minerals, vitamins (including riboflavin and thiamine), and other phytochemicals like flavonoids and carotenoids, which contribute to its health benefits.

MEDICINAL AND HEALTH BENEFITS

1. **Powerful Antioxidant Effects:** Saffron's carotenoids like crocin and crocetin scavenge radicals and reduce oxidative stress, which underlies aging and many chronic diseases. Its antioxidant capacity supports cellular protection and skin health.

2. **Neurological and Psychiatric Support:** Saffron and its components show promise in improving mood and alleviating depression and anxiety, with some studies comparing its efficacy to standard antidepressants but with fewer side effects. It also exhibits neuroprotective effects, potentially slowing cognitive decline in Alzheimer's disease through inhibition of amyloid β-aggregation and support of neurotransmitter systems.
3. **Anti-Inflammatory and Pain Relief:** Saffron extracts reduce inflammation and have analgesic properties, which may benefit conditions involving pain and swelling.
4. **Cardiovascular Protection:** The plant helps lower bad cholesterol (LDL) and triglycerides, supporting heart health and reducing the risk of heart disease. Crocetin, in particular, exhibits cardioprotective effects by preserving heart function under stress.
5. **Anti-Cancer Potential:** Saffron's compounds have shown anti-tumour activity in experimental studies by inhibiting cancer cell proliferation and inducing apoptosis.
6. **Support for Women's Health:** It helps alleviate symptoms of premenstrual syndrome (PMS), reducing mood swings, irritability, and pain.
7. **Respiratory and Antitussive Effects:** Traditionally used as an expectorant and antitussive, saffron helps alleviate cough and respiratory discomfort.
8. **Other Benefits:** It exhibits antimicrobial activity against bacteria and fungi, aids in blood purification, supports immune stimulation, and has anticonvulsant effects.

Overall, Saffron's diverse pharmacological profile makes it a valuable natural agent for enhancing mental health, protecting against oxidative and inflammatory damage, supporting cardiovascular function, and potentially providing anti-cancer benefits. Its long-standing traditional use and growing scientific validation underscore its importance in medicinal and health applications.

ALOE VERA

Aloe vera, scientifically known as Aloe barbadensis Miller, is a widely studied medicinal plant renowned for its versatile therapeutic and cosmetic properties. It has been used for centuries in traditional medicine and is now extensively studied for its biochemical composition and broad health benefits.



Fig3: Aloe vera

Phytochemical Composition

Aloe vera contains numerous bioactive compounds, including:

- **Vitamins:** A (beta-carotene), C, and E serving as antioxidants, along with B12, folic acid, and choline.
- **Enzymes:** Such as amylase, catalase, brady kinase, and lipase, contributing to anti-inflammatory and metabolic benefits.
- **Minerals:** Including calcium, magnesium, zinc, selenium, and potassium essential for enzymatic functions and antioxidant activity.
- **Sugars:** Monosaccharides (glucose, fructose) and polysaccharides like glucomannans, which have immunomodulatory and moisturizing effects.

- **Other Compounds:** Anthraquinones with laxative and antiviral properties; phenols, salicylic acid, and other antiseptic agents; amino acids; and saponins.

MEDICINAL BENEFITS

- Aloe vera has potent antioxidant and anti-inflammatory properties due to its rich content of vitamins (A, C, E), enzymes, and phenolic compounds. This help protect the body and skin from oxidative stress and inflammation.
- It accelerates wound healing and skin repair by promoting collagen synthesis and soothing irritated or damaged skin.
- Aloe vera exhibits antimicrobial effects against bacteria and fungi, helping to prevent and treat skin infections.
- It supports digestive health when consumed internally, aiding in conditions like acid reflux and irritable bowel syndrome.
- The plant has immune-modulating effects by stimulating immune cell activity.
- Aloe vera also displays antiviral, analgesic, hepatoprotective, and nephroprotective properties, contributing to overall health.

COSMETIC BENEFITS



Fig4: Aloe vera gel

- Aloe vera is widely used in topical formulations due to its excellent moisturizing and skin hydrating effects, attributed to mucopolysaccharides that retain moisture.
- It enhances skin elasticity and reduces the appearance of wrinkles by promoting collagen and elastin production.
- Aloe vera soothes skin irritation, redness, and sunburn, providing a calming effect.
- It helps fade dark spots and scars by supporting skin cell renewal.
- Its antimicrobial and anti-inflammatory actions assist in reducing acne and other skin conditions.
- Aloe vera's natural composition makes it suitable for sensitive skin, enhancing skin health without harsh chemicals.

FORMULATION OVERVIEW

Selection Based on Properties:

The choice of herbal ingredients is based on their specific therapeutic and cosmetic properties, such as anti-inflammatory, moisturizing, or antibacterial effects.

Cream Base is Crucial:

A stable cream base is necessary for the proper application and effectiveness of the herbal ingredients.

CREAM BASE INGREDIENTS

Beeswax:

Acts as an emulsifying agent and stabilizer, providing thickness to the cream.

Liquid Paraffin:

A moisturizing agent and skin softener used as a base ingredient in cream formulations.

Borax:

An alkaline agent that reacts with emulsifying agents to form a soap, helping to stabilize the emulsion.

Methylparaben:

A common preservative used to prevent the growth of bacteria and mold in cosmetic formulations.

PREPARATION OF HERBAL CREAMS

The preparation of herbal creams involves a systematic blending of oil and aqueous phases to achieve a smooth, stable emulsion. The oil phase generally contains ingredients such as liquid paraffin and beeswax, which are gently melted together to form a uniform base. Parallel to this, the aqueous phase is prepared by dissolving stabilizing and preservative agents commonly borax, methyl paraben, and propyl paraben in distilled water under controlled heating conditions. These preservatives play an essential role in preventing microbial growth, extending shelf life, and maintaining the overall quality of the formulation, making the product safe and reliable for consumer use.

Once both phases are suitably prepared, the aqueous phase is slowly incorporated into the oil phase with continuous stirring. This careful addition ensures the development of a homogeneous and lump-free base. Into this stable emulsion, the active herbal component, Crocus sativus (saffron) extract, is incorporated to provide its recognized therapeutic and cosmetic benefits. To enhance sensory qualities and consumer appeal, small amounts of natural essential oils, such as rose oil, may also be added, imparting a pleasant fragrance and improving the overall user experience.

Through this structured process supported by the use of stabilizers and preservatives herbal creams not only maintain their safety and efficacy but also remain elegant and appealing throughout their shelf life. By combining natural herbal extracts with essential excipients, these formulations achieve a balance between traditional remedies and modern cosmetic standards.

EVALUATION PARAMETERS

Formulated creams are evaluated for physical properties like appearance, viscosity, Unstability, as well as for skin related aspects like spreadability, washability, greasiness.

Physical appearance:

Evaluation of colour, texture, consistency, and homogeneity. The cream should have a uniform colour corresponding to the herbal ingredients and be free from lumps or gritty particles. Smooth texture and proper consistency ensure easy application and spreadability. Homogeneity is essential to prevent phase separation of oil and water components. Any change in appearance may indicate instability, contamination, or degradation of the formulation. Visual inspection under normal lighting is generally sufficient for this evaluation.

Spreadability:

Spreadability is a key evaluation parameter for herbal face creams, as it determines how easily the cream can be applied and distributed over the skin surface. It is commonly tested by placing a small amount of cream between two glass slides and applying a weight, followed by measuring the time required for the slides to slip under a standard load.

Washability:

The washability test is performed to evaluate the ease with which a cream can be removed from the

skin surface by simple rinsing with water. A small quantity of the formulation is applied evenly on the back of the hand or a glass slide and then washed under running tap water or with a fixed volume of distilled water. The extent of removal is visually observed and graded as good, moderate, or poor washability. Creams that can be easily removed without leaving greasy or sticky residues are considered more acceptable to consumers. Washability not only reflects the formulation's base type (oil-in-water or water-in-oil) but also influences user compliance and comfort.

Greasiness:

It is a key parameter in assessing the sensory characteristics and user acceptability of herbal creams. This test helps determine whether a cream feels oily or greasy upon application, which can influence consumer preference and the product's suitability for different skin types. This test is basically used to check nature of Cream either oily or greased.

Stability test:

In the mechanical test cream samples were Inserted into centrifuge tube at a speed of 3750 RPM for Half an hour or 5000 to 10000 RPM for 15 Minutes then Observed whether a separation exist or not.

PH:

A digital pH meter was used to measure the pH of various formulations. After being weighed and diluted in 100 millilitres of distilled water, approximately one gram of the cream was stored for two hours. Each formulation's pH was measured three times, and where necessary, the average values were calculated.

Viscosity:

Viscosity has an important role in explaining and controlling many attributes like shelf-life ability and product aesthetics such as clarity, ease of flow, on removal from packing and reading when applied to face. Viscosity of cream was done by using Brooke field viscometer at the temp of 25°C.using spindle no, 63.at rpm.

Evaluation methods of antioxidant activity:

1. Hydrogen Atom Transfer methods (HAT).

- Oxygen Radical Absorbance Capacity (ORAC) method.
- Lipid Peroxidation Inhibition Capacity (LPIC) Assay.
- Total Radical Trapping Antioxidant Parameter (TRAP).
- Inhibited Oxygen Uptake (IOU).
- Crocin Bleaching Nitric Oxide Radicle Inhibition Activity.
- Hydroxyl Radical Scavenging Activity By p-DNA.
- Scavenging of H2O2 Radicals Assay.
- ABTS Radical Scavenging method
- Scavenging of Super Oxide Radical Formulation by Alkaline.

2. Electron Transfer Method (ET).

- Trolox Equivalent Antioxidant Capacity (TEAC)
- Ferric Reducing Antioxidant Power (FRAP)
- DPPH Free Radical Scavenging Assay.
- Copper (II) Reduction Capacity.
- Total Phenols by Folin-Ciocalteu.
- N,N-dimethyl-p-p-phenylenediamine (DMPD)

3. Other Assays

- Total Oxidant Scavenging Capacity (TOSC).

- Inhibition of Briggs- Rauscher Oscillation Reaction.
- Chemiluminescence.
- Electrochemiluminescence.
- Enhanced Chemiluminescence
- TLC Bioautography.
- Cellular Antioxidant Activity (CAA) Assay.
- Fluorometric analysis.

CONCLUSION

The incorporation of Crocus sativus (saffron) and Aloe vera into herbal creams offers a scientifically validated approach to enhancing skin health and protection. Both botanicals are rich in bioactive compounds with potent antioxidant, anti-inflammatory, and healing properties. Saffron contributes powerful free radical scavenging activity and supports skin tone improvement, while Aloe vera enhances moisturization, accelerates wound healing, and soothes irritation.

Combining these ingredients in topical formulations provides synergistic benefits helping to protect the skin from oxidative stress, delay premature aging, and promote overall skin vitality. The favourable safety profile and broad therapeutic potential of Crocus sativus and Aloe vera underscore their value as key components in natural and cosmetic skincare products, supporting both medicinal and cosmetic applications for healthier, more resilient skin.

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