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A Review on Polyherbal Cosmetic Face Serum for Skin Enhancement

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Abstract

The increasing demand for natural and herbal cosmetic products has led to the exploration of plant-based formulations that are safe, effective, and environmentally friendly. This study focuses on the formulation and evaluation of a herbal face serum incorporating natural ingredients such as banana leaf extract, guava leaf extract, papaya extract, neem extract, hibiscus extract, and rose water. Each of these ingredients possesses significant therapeutic and cosmetic properties that contribute to overall skin health. Banana leaf extract is known for its antioxidant and soothing properties, helping to protect the skin from environmental damage. Guava leaves are rich in vitamin C and flavonoids, which aid in skin brightening and anti-aging effects. Papaya extract contains natural enzymes like papain that promote exfoliation, remove dead skin cells, and enhance skin renewal. Neem extract is widely recognized for its antibacterial, antifungal, and anti-inflammatory properties, making it highly effective in treating acne and preventing skin infections. Hibiscus extract, often referred to as the "botox plant," provides natural moisturizing, improves skin elasticity, and reduces the appearance of fine lines and wrinkles. Rose water acts as a natural toner, maintaining the skin's pH balance while providing hydration and a refreshing effect. The combination of these herbal ingredients results in a multifunctional serum aimed at improving skin texture, hydration, clarity, and overall appearance. The formulated serum was evaluated based on various physicochemical parameters such as pH, viscosity, spreadability, homogeneity, stability, and skin irritation test. The results indicated that the serum was stable, non-irritating, and suitable for topical application.

Keywords: Herbal Face Serum, Natural Cosmetics, Banana Leaf Extract, Guava Leaf Extract, Papaya Extract, Neem Extract, Hibiscus Extract, Rose Water

Introduction

Natural ingredients have been utilized for skincare for centuries and are increasingly incorporated into modern formulations due to growing consumer concerns regarding synthetic and chemical substances. Skincare has become an essential aspect of personal health and appearance across all populations. An effective skincare regimen not only helps maintain skin health but may also enhance its structural integrity and functional performance. Skincare cosmetics used for cleansing, exfoliation, protection, and regeneration of the skin include products such as cleansers, toners, serums, moisturizers, and balms. Unlike traditional practices, which relied primarily on natural preparation methods, modern skincare formulations frequently incorporate synthetic ingredients, chemical additives, and artificial colorants. However, excessive or prolonged use of such products may impair the skin's natural smoothness and radiance. Many formulations are also associated with skin incompatibility, irritation, and other adverse dermatological effects.

Consumers are increasingly being educated about the advantages of using natural colorants, nutraceuticals, cosmetic products, and herbal medicines. Owing to rapid market expansion and strong commercial potential, growing emphasis is being placed on herbal-based cosmetic formulations within the personal care industry. Botanical products are generally rich in vitamins, antioxidants, essential and fixed oils, hydrocolloids, proteins, terpenoids, and a wide range of other bioactive constituents, making them valuable raw materials for cosmetic and dermatological formulations. The proven ability of these natural ingredients to improve skin brightness, texture, and luminosity, while reducing wrinkles and hyperpigmentation and promoting overall tone lightening, has led to the development of herbal-based skin brightening formulations.

A face serum is a high-potency cosmetic formulation characterized by a non-greasy finish and intensive nourishment of the deeper skin layers. Among topical cosmetic products, serums typically contain one of the highest concentrations of active ingredients. They are commonly formulated as gels or lightweight lotions with antioxidant, anti-aging, anti-wrinkle, and moisturizing properties, enabling enhanced skin penetration and efficient delivery of bioactive compounds. An effective face serum can enhance skin smoothness and firmness while significantly improving hydration levels. Serums formulated with plant extracts have demonstrated antioxidant, tyrosinase-inhibitory, and antibacterial activities. These naturally derived extracts possess considerable potential for skincare applications, and their incorporation into cosmetic formulations may support the development of safe and effective face serums.

Skin

The skin is the largest organ system of the human body, accounting for nearly 16% of total body mass, and serves as a vital protective barrier while playing a key role in drug permeation, thermoregulation, and overall physiological homeostasis. The skin is continuous with the mucous membranes at body openings and, in specific regions, is associated with accessory structures such as sweat and sebaceous glands, hair follicles, and nails, which collectively contribute to its protective, secretory, and regulatory functions. The skin performs multiple vital physiological functions essential for maintaining homeostasis, providing mechanical and microbial protection, and facilitating sensory and social interactions. It acts as an effective barrier by forming a waterproof protective layer that safeguards underlying tissues and minimizes trans epidermal water loss, thereby preventing dehydration. The demand for skincare products has increased markedly in recent years due to growing awareness of personal appearance and skin health. Consequently, a wide range of cosmetic formulations has been developed. On a global scale, the utilization of herbal ingredients has risen significantly, with herbal cosmetics gaining widespread acceptance because of their safety profile and natural origin. These products represent a valuable natural resource. The skin serves as a primary protective barrier and plays a crucial role in maintaining homeostasis by limiting transepidermal water loss and assisting in thermoregulation.

Acne Vulgaris

Acne vulgaris is a complex, chronic inflammatory dermatological disorder characterized by symptomatic discomfort, potential scarring, and significant emotional as well as psychosocial impact on affected individuals. These conditions most commonly manifest during childhood, adolescence, and early adulthood, corresponding to periods of hormonal fluctuation and increased sebaceous activity. It is a disorder involving the pilosebaceous unit (PSU) of the skin, leading to the development of both inflammatory and non-inflammatory lesions as a result of follicular obstruction, excess sebum production, and microbial involvement. It predominantly involves skin regions with a high concentration of sebaceous follicles, such as the face, chest, and upper back, where sebum production is most active. Multiple intrinsic and extrinsic factors contribute to the onset and progression of acne, influencing both its development and severity. These include genetic predisposition, sex, adolescence, psychological stress, and smoking. In addition, comedogenic triggers such as androgenic hormones, halogen exposure, corticosteroid therapy, and the use of pore-occlusive cosmetic products may exacerbate follicular blockage and inflammatory responses.

Acne presents clinically as a variety of lesions, including comedones, papules, pustules, cysts, and inflamed nodules, which in severe cases may progress to deep, purulent lesions. Comedones are keratin-filled follicular plugs located in the superficial layers of the skin and are further classified into open (blackheads) and closed (whiteheads) forms based on follicular opening and oxidation status. The primary therapeutic strategies in acne management focus on inhibiting bacterial colonization and reducing inflammation of the pilosebaceous unit (PSU). Acne vulgaris is a dermatological disorder commonly associated with microbial involvement; therefore, antimicrobial agents play a crucial role in its treatment by limiting bacterial growth and controlling inflammatory responses.

A wide range of antimicrobial agents of both natural and synthetic origin are incorporated into cosmetic formulations for acne management. Although synthetic ingredients are commonly preferred because of their cost-effectiveness and ease of formulation, they may disrupt the skin's natural balance and can potentially cause irritation or other adverse dermatological effects, thereby increasing interest in safer, plant-based alternatives. The therapeutic use of natural products for acne management has gained increasing acceptance in industrialized societies. Various herbs exhibit antimicrobial, anti-inflammatory, anti-comedogenic, and, in some cases, hormone-modulating activities, making them beneficial in the management of Acne vulgaris and supporting their incorporation into topical cosmetic and dermatological formulations.

Serum

In cosmetology, a serum is defined as a highly concentrated topical formulation designed to deliver active ingredients more efficiently to the skin. Compared with conventional creams, cosmetic serums whether water-based or oil-based contain significantly higher levels of bioactive components, often up to ten times greater. Owing to this high concentration and enhanced penetration capability, serums are widely used for targeted management of aesthetic concerns, enabling faster and more effective visible results. The global demand for cosmetic products has risen substantially, driven by changing lifestyles and increased consumer awareness of personal appearance.

Among emerging markets, the Malaysian cosmetics industry represents a significant economic contributor. Cosmetics have gained growing importance as individuals seek to preserve youthful appearance and skin health. A skincare product known as a serum is typically formulated as a lightweight gel, lotion, or fluid moisturizer, designed to penetrate deeply into the skin and effectively deliver concentrated active ingredients. An effective skin serum can improve elasticity, enhance surface smoothness, minimize the appearance of pores, and increase skin hydration. All skincare formulations including hydrating, anti-aging, anti-wrinkle products, and serums should ideally incorporate antioxidants, cell-derived compounds, and skin-identical

components to support barrier function, protect against oxidative stress, and promote overall skin health.

Serums are low-viscosity topical preparations containing a high concentration of active ingredients. They are typically formulated as gels or lightweight lotions with moisturizing properties and are designed to penetrate deeper layers of the skin, enabling efficient delivery of bioactive compounds compared with conventional creams. An effective skin serum can enhance cutaneous strength and smoothness, reduce the appearance of enlarged pores, and improve overall hydration levels. In recent years, facial serums have gained substantial popularity as increasing numbers of individuals recognize their therapeutic benefits and incorporate them into routine skincare regimens.

Types of Face Serum

1. Oil serum.
2. Gel serum.
3. Water based serum.
4. The emulsion serum.
5. Pressed balm serum.

Oil Serum: Oil-based serums are considered the simplest type of face serum to formulate. They are primarily composed of high-quality, fast-absorbing carrier oils possessing emollient and skin barrier–restorative properties. These oils are naturally rich in essential fatty acids, polyphenols, and other bioactive constituents that exhibit good dermal absorption, contributing to improved skin hydration, protection, and overall barrier function.

Gel Serum: Gel serums impart a temporary skin-tightening effect, producing a sensation of firmness or lifting in localized facial areas. These formulations are predominantly aqueous in nature, which facilitates the incorporation of water-soluble botanical extracts and hydrophilic active constituents. Owing to their lightweight texture and rapid absorption, gel serums are particularly suitable for delivering plant-based actives while providing instant hydration and refreshing effects.

Water Based Serum: Gel-based serums are closely related to water-based serums and may contain gelling agents or thickening polymers to modify viscosity and enhance stability. Water-based face serums are primarily designed for the delivery of high-performance hydrophilic botanical extracts, which are retained on the skin surface when layered beneath creams or lotions. To enhance the percutaneous absorption of aqueous active constituents and facilitate deeper penetration into the epidermal layers, pre-application of a hydrating or anti-aging facial mist followed by an emulsion and finally an oil phase is considered an effective multilayer delivery approach.

The Emulsion Serum: An emulsion-based face serum functions as a lightweight moisturizing system designed to deliver high-performance active constituents while simultaneously strengthening the skin barrier. It consists of two immiscible phases, namely oil and water, which are stabilized into a uniform system through the incorporation of suitable emulsifying agents. This formulation enables the efficient delivery of both lipophilic and hydrophilic actives, facilitating enhanced penetration into deeper skin layers and improving overall therapeutic efficacy.

Pressed Balm Serum: A balm serum is a semi-solid topical formulation containing lipophilic active constituents incorporated within a base composed of natural butters, waxes, and oils. These structural components form an occlusive film over the skin surface, promoting hydration, nourishment, and barrier protection while facilitating sustained release of the incorporated actives. The formulation allows wide flexibility in selecting various botanical oils along with functional plant-derived butters and waxes, enabling the development of customized balm serums with enhanced emollient properties and therapeutic potential.

Advantages of Face Serum

- Compared with conventional moisturizers, serums possess a lighter formulation and lower viscosity, which facilitates deeper skin penetration and results in faster absorption, thereby enhancing the delivery efficiency of active ingredients.
- Facial serums are reported to stimulate collagen synthesis in the skin, thereby improving firmness and elasticity while minimizing the appearance of fine lines and wrinkles.
- Serums support a healthy complexion by providing antioxidant protection against free radical–induced oxidative damage, thereby helping to preserve skin integrity and prevent premature aging.

How to Use Face Serum

- **Clean your Skin:** Begin by cleansing the face using a mild cleanser suitable for your skin type to effectively remove dirt, excess oil, and environmental impurities. Gently pat the skin dry with a clean towel before proceeding with further skincare steps.
- **Tone:** If incorporated into the skincare routine, toner should be applied immediately after cleansing. Toners help restore the skin's physiological pH balance and condition the stratum corneum, thereby enhancing permeability and improving the absorption of subsequently applied formulations.
- **Apply Serum:** Apply a small, pea-sized quantity of face serum using clean fingertips and gently distribute it over the skin. Owing to the high concentration of active ingredients, only a minimal amount is required to achieve optimal therapeutic and cosmetic benefits.
- **Apply to Face:** Gently pat the serum onto the skin, starting from the center of the face and moving outward. Avoid pulling or stretching the skin, particularly around the delicate periorbital (eye) area.
- Using gentle upward strokes, massage the serum into the skin to promote absorption. Pay particular attention to targeted areas such as wrinkles, hyperpigmented spots, or fine lines where specific corrective effects are desired.
- **Permit Absorption:** Allow the serum to absorb completely for a few minutes before applying subsequent skincare products. This contact time facilitates deeper penetration of active constituents and enhances their therapeutic effectiveness.
- **Moisturize the Skin:** After complete absorption of the serum, apply a moisturizer to lock in hydration and provide additional nourishment, thereby supporting barrier function and enhancing overall skin conditioning.
- **Daytime Sunscreen:** When applying the serum in the morning, complete the skincare routine with a broad-spectrum sunscreen to protect the skin from harmful

ultraviolet (UV) radiation and to preserve the efficacy of the active ingredients.

- **Nighttime Routine: 1**``````````````` During the evening routine, apply the serum in place of sunscreen, followed by other suitable nighttime skincare products such as face oil or eye cream to support skin repair and hydration.
- Consistency is essential for achieving optimal results. Incorporate the face serum into your daily skincare regimen, either in the morning or at night. Regular use, as advised by a dermatologist or skincare professional, helps maximize therapeutic and cosmetic benefits.

Drug Profile

Banana Leaf (*Musa paradisiaca*)

Common names: Banana leaf, Kela patta (Hindi)

Biological Source: Obtained from the leaves of Musa paradisiaca, widely used in traditional medicine and cosmetics for skin nourishment.

Family: Musaceae

Chemical constituents:

Polyphenols: Provide antioxidant protection and reduce oxidative stress.

Allantoin: Supports skin regeneration and healing.

Vitamins A, B, and C: Promote collagen formation and brighten skin.

Use: Skin rejuvenation: Helps improve texture, reduce dullness, and promote smooth, glowing skin.

Fig 1: Banana Leaf Extract

Guava (*Psidium guajava*)

Common Names: Guava, Amrud (Hindi), Perukaya (Telugu)

Biological Source: Extract obtained from the leaves or fruit of Psidium guajava, known for antimicrobial and antioxidant activity.

Family: Myrtaceae

Chemical constituents:

Flavonoids (Quercetin, Kaempferol): Provide antimicrobial and antiinflammatory benefits.

Vitamin C: Enhances skin brightening and protects against oxidative damage.

Tannins: Help tighten pores and control oil secretion.

Use: Skin tightening & anti-acne: Reduces excess oil, shrinks pores, and prevents acne formation.

Fig 2: Guava

Papaya (*Carica papaya*)

Common Names: Papaya, Papita (Hindi), Erandkarkati (Ayurveda)

Biological Source: Extract from the fruit pulp and leaves of Carica papaya, widely used in cosmetics for exfoliation and skin brightening.

Family: Caricaceae

Chemical Constituents:

Papain enzyme: Natural exfoliant that helps remove dead skin cells.

Alpha-hydroxy acids (AHA): Improve skin texture and complexion.

Carotenoids & Vitamin A: Promote cell regeneration and anti-aging benefits.

Use: Exfoliation & brightening: Helps remove tanning, improve skin glow, and fade pigmentation.

Fig 3: Papaya

Neem (*Azadirachta indica*)

Common Names: Neem, Nimb (Hindi), Arishta (Sanskrit)

Biological Source: Neem is a fast-growing evergreen tree used traditionally in Ayurvedic medicine for its antimicrobial, antifungal, and anti-inflammatory properties.

Family: Meliaceae

Chemical Constituents:

Azadirachtin: Exhibits strong antimicrobial and antifungal action.

Nimbin & Nimbidin: Provide anti-inflammatory and wound-healing effects.
Quercetin: Acts as an antioxidant and skin protector.
Triterpenoids: Help control acne and reduce bacterial growth.
Use: Anti-acne treatment: Reduces pimples, inflammation, and infection while preventing further breakouts.

Fig 4: Neem

Hibiscus (*Hibiscus rosa-sinensis*)
Common Names: Hibiscus, Gudhal (Hindi), Japa (Sanskrit)
Biological Source: Extract from the flowers and leaves of Hibiscus rosasinensis, valued for its antioxidant, moisturizing, and anti-aging properties.
Family: Malvaceae
Chemical constituents:
Anthocyanins: Serve as powerful antioxidants for skin protection.
AHA (natural): Help exfoliate and brighten skin tone.
Mucilage: Provides natural hydration and improves skin softness.
Use: Anti-aging & hydration: Reduces fine lines, improves elasticity, and softens dry skin.

Fig 5: Hibiscus

Rose
Common Names: Rose, Gulab (Hindi), Taruni (Ayurveda)
Biological Source: Extract or rose water obtained from petals of Rosa damascena used in cosmetics for soothing and toning effects.
Family: Rosaceae
Chemical Constituents:
Geraniol & Citronellol: Provide calming, antimicrobial, and aromatic effects.
Vitamin C: Promotes skin brightening and collagen formation.
Flavonoids: Offer antioxidant protection.
Use: Skin soothing & toning: Helps balance skin pH, reduce irritation, redness, and give a refreshing glow.

Methodology

1. **Collection and Sorting of Plant Materials:**
   - Collect fresh banana leaf, papaya leaves, neem leaves, hibiscus petals/leaves, rose petals, and guava leaves.
   - Discard any damaged, wilted, or diseased parts.
   - Separate each plant material into individual groups for ease of processing.

2. **Washing of Plant Materials:**
   - Rinse each leaf/petal under running tap water to remove dust, soil, and visible impurities.
   - Soak the materials in clean distilled or deionized water for 5–10 minutes, gently agitating to remove stubborn dirt.
   - Rinse 2–3 times with fresh distilled water.
   - Drain and pat dry with a clean, lint-free cloth or absorbent paper.

3. **Grinding:**
   - Place the washed plant materials separately into a clean grinder or blender.
   - Grind each material with a small amount of distilled water to obtain a fine, homogeneous paste.
   - Avoid excessive heating during grinding to preserve active phytoconstituents.

4. **Filtration of Individual Extracts:**
   - Filter each ground material through a fine muslin cloth, cheesecloth, or laboratory filter paper to remove fibrous residues.
   - Collect the clear liquid extract of each plant separately in sterile containers.

5. **Mixing of Herbal Extracts:**
   - Combine all individual herbal extracts into a single sterile beaker or container.
   - Stir gently with a sterile glass rod or spoon to ensure uniform mixing.

6. **Cooling (if required):**
   - If the mixed extract is slightly warm from grinding or friction, allow it to cool at room temperature or in a water bath until it reaches a moderate temperature suitable for adding oils.

7. **Addition of Rose Oil:**
   - Measure the desired quantity of rose oil (according to the formulation ratio).
   - Add the rose oil slowly to the cooled herbal mixture while stirring continuously to achieve proper dispersion.

8. **Final Filtration:**
   - Filter the combined mixture again through a fine mesh or filter paper to remove any remaining particulate matter, ensuring a smooth, uniform extract.

9. **Storage:**
   - Transfer the filtered herbal extract into sterilized dropper bottles.
   - Label the bottles with the date, ingredients, and storage instructions.
   - Store in a cool, dark place or refrigerate if needed to maintain stability and prevent microbial growth.

10. **Optional Quality Checks:**
   - Check pH, colour, and aroma to ensure consistency with desired formulation standards.
   - Ensure no microbial contamination is present if the extract is intended for topical or oral use.

Evaluation Parameters

Physical Evaluation

a. Colour: The serum should retain its natural colour obtained from herbal ingredients.

b. Odour: A pleasant and natural herbal fragrance without any foul smell.

c. Appearance: Should be clear and uniform without any particles.

d. Texture: Smooth, lightweight, non-greasy, and easily spreadable on the skin.

pH Value Determination

a. The pH is measured to ensure compatibility with skin.

b. Ideal pH range for face serum: 4.5 – 6.5

c. Example reading: 5.2, which is suitable for maintaining the skin's natural acid mantle and preventing irritation.

Homogeneity

a. Checked to ensure the formulation is uniform without phase separation.

b. A homogeneous serum indicates proper mixing of all herbal ingredients.

Viscosity

a. Measured using a viscometer to determine the flow behaviour.

b. The serum should have moderate viscosity, meaning it should not be too thick or too watery, ensuring easy application.

Spreadability

a. Evaluated using the slide-and-weight method.

b. good spread ability ensures that the serum covers the skin evenly with a small amount of product.

Stability Study

a. The serum is stored at different temperatures such as 4°C, 25°C, and 45°C for 15– 30 days.

b. Parameters like colour, odour, pH, viscosity, and phase separation are observed to confirm product stability during storage.

Conclusion

The present review emphasizes the significant role of herbal face serums in contemporary skincare owing to their natural origin, therapeutic efficacy, and superior skin compatibility. In comparison with synthetic formulations, herbal serums are enriched with plant-derived bioactive constituents that offer multifunctional benefits, including hydration, anti-aging, skin brightening, soothing effects, and protection against environmental stressors. Active ingredients such as Aloevera, vitamin C, green tea, niacinamide, and other botanical extracts contribute to skin nourishment, improvement in texture, and maintenance of healthy skin physiology, while exhibiting minimal adverse effects.

This review further demonstrates that the integration of traditional herbal knowledge with systematic scientific evaluation plays a vital role in the development of safe and effective cosmetic formulations. By applying appropriate formulation strategies and standardized evaluation parameters, including pH, viscosity, spreadability, and stability studies, herbal face serums can be optimized to achieve enhanced performance, product consistency, and improved consumer acceptance.

In conclusion, herbal face serums exhibit substantial potential as preferred cosmeceutical products owing to their natural origin, favorable safety profile, and broad therapeutic benefits. Continued research, standardization of herbal ingredients, and well-designed clinical evaluations are essential to further enhance their efficacy, ensure product quality, and support their wider adoption within the cosmetic and pharmaceutical industries.

Discussion

Herbal face serums have emerged as a promising segment in contemporary skincare due to their natural origin, multifunctional benefits, and high skin compatibility. Unlike synthetic formulations, which may contain chemical additives that can sometimes provoke irritation or long-term adverse effects, herbal serums harness the therapeutic potential of plant-derived bioactive compounds. Ingredients such as Aloe vera, vitamin C, green tea, and niacinamide are well-documented for their ability to provide hydration, promote collagen synthesis, reduce oxidative stress, and improve skin tone and texture. The inclusion of these botanicals ensures not only nourishment but also protection against environmental stressors, such as UV radiation and pollution, thereby maintaining overall skin health.

The review highlights the importance of integrating traditional herbal knowledge with contemporary scientific validation in developing effective cosmetic formulations. Historical use of botanicals offers insight into their therapeutic properties, while modern evaluation techniques, including assessment of pH, viscosity, spreadability, and stability, enable optimization of product performance and consistency. Such systematic formulation approaches ensure that herbal serums meet consumer expectations regarding texture, absorption, and long-term efficacy.

Overall, herbal face serums represent a convergence of nature and science, offering a holistic approach to skincare. Their development and optimization not only reflect a growing consumer demand for natural and safe products but also underscore the importance of evidence-based

formulation strategies in delivering high-quality cosmeceuticals. With continued research and innovation, herbal serums are poised to become a mainstream choice for individuals seeking effective, natural, and skin-friendly solutions.

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