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Research Article

Formulation and Evaluation of Herbal Face Serum

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ABSTRACT

Chamomile oil is derived from *Matricaria chamomilla* (commonly known as German chamomile) and *Chamaemelum nobile* (Roman chamomile), both of which are members of the Asteraceae family and originally found in regions of southern and eastern Europe. In India, this medicinal plant is cultivated in several areas, particularly in the northern plains of Uttar Pradesh and Uttarakhand, as well as in Jammu and Kashmir. Due to its well-known anti-inflammatory, antioxidant, and calming properties, chamomile is widely used in natural skincare formulations, especially in face serums. These serums are designed to deliver potent active ingredients, and chamomile extract contributes to reducing inflammation and soothing irritated skin. This literature review evaluates the application of chamomile flowers in cosmetic products, emphasizing their cleansing, beautifying, and skin-nurturing potential. It also presents research-based evidence showcasing the effectiveness of chamomile extracts in promoting healthy and radiant skin.

INTRODUCTION

Serum are thin viscosity topical products that contain concentrated amount of active ingredients. Serum is a concentrated product which widely used in Cosmetology. The name comes from itself in professional cosmetology. The cosmetic serum is as concentrated in water or oil as any other cream. Serum, or other concentrated product that contains ten times more organic matter than cream. Therefore, deal with the cosmetic problem quickly and effectively. The demand for herbal cosmetics

has significantly increased in recent years, primarily due to growing consumer awareness of the potential side effects associated with synthetic ingredients and a renewed interest in natural and organic products. Among various skincare formulations, face serums have gained popularity owing to their lightweight nature, high concentration of active ingredients, and superior skin absorption. Unlike conventional creams and lotions, serums are designed to deliver targeted treatment for concerns such as acne, pigmentation,

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aging, and dehydration. Herbal formulations harness the therapeutic potential of plant-derived constituents that offer antioxidant, anti-inflammatory, antimicrobial, and skin-rejuvenating properties.[1] Chamomile (*Matricaria chamomilla*), for example, is widely recognized for its soothing and anti-inflammatory effects, attributed to its rich content of flavonoids and terpenoids. Incorporating such botanical extracts into topical preparations can enhance skin health while minimizing the risk of irritation. The present study aims to develop a herbal face serum utilizing chamomile oil as the key active ingredient, complemented by other natural excipients known for their skincare benefits. The formulation is evaluated based on its physicochemical properties, stability, and user acceptability to assess its potential as a safe and effective cosmetic product.[2]

Classification of Chamomile-

Chamomile is a well-known medicinal plant, primarily represented by two species used in herbal formulations:

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Asterales
- **Family:** Asteraceae
- **Genus:** *Matricaria*
- **Species:** *Matricaria chamomilla* L. (also known as *Matricaria recutita*)

(*Matricaria chamomilla* L.) is commonly referred to as German chamomile, the most widely studied and used species in pharmaceutical and cosmetic preparations.

Morphological Characteristics of Chamomile Flower

Chamomile is an annual herb that grows to a height of approximately 15 to 60 cm. Its inflorescence is a characteristic feature and is used extensively for medicinal and cosmetic purposes. Key morphological features include:

- **Stem:** Erect, slender, branched, and smooth; green in color.
- **Leaves:** Alternately arranged, bipinnate to tripinnate, finely divided into linear segments, giving a feathery appearance.
- **Flowers:** The flowers are arranged in solitary terminal heads (capitula) about 1.5–2.5 cm in diameter. Each head contains:
 - **Ray florets:** White, sterile, and ligulate; arranged around the periphery.
 - **Disc florets:** Yellow, tubular, and bisexual; located at the center.
- **Receptacle:** Cone-shaped and hollow, which distinguishes *M. chamomilla* from closely related species like *Anthemis nobilis* (Roman chamomile), which has a solid receptacle.
- **Fruit:** A small, yellowish-brown achene without a pappus.

These botanical features not only aid in identification but also influence the extraction and content of bioactive compounds such as chamazulene, bisabolol, and flavonoids.[3][4]

Chemical Composition of Chamomile Flower-

Chamomile (*Matricaria chamomilla* L.) is rich in a diverse array of bioactive phytochemicals that contribute to its therapeutic and cosmetic applications. The chemical constituents are primarily found in its essential oil and aqueous extracts, with significant pharmacological activities including anti-inflammatory, antioxidant, antimicrobial, and soothing effects.

The key chemical constituents include:



1. Essential Oil Constituents (0.3–1.5% w/w of dried flowers)

Chamomile essential oil is the most pharmacologically active fraction, with the following principal components:

- **Chamazulene** (up to 5–15%)
A sesquiterpene derivative formed from the precursor **matricin** during steam distillation. It imparts a deep blue color to the oil and exhibits strong anti-inflammatory and free radical scavenging properties.
- **α -Bisabolol** (up to 50%)
This monocyclic sesquiterpene alcohol exhibits antimicrobial, anti-ulcer, and skin-penetration enhancing activity. It is particularly valuable in topical preparations for sensitive or inflamed skin.
- **Bisabolol Oxides A & B, and Bisabolone Oxide A**
These oxygenated derivatives possess similar anti-inflammatory and wound-healing effects as α -bisabolol.
- **Trans- β -Farnesene and β -Caryophyllene**
These sesquiterpenes contribute to the antimicrobial and anti-allergic effects of the oil.

2. Flavonoids (Phenolic Compounds)

Flavonoids are abundant in chamomile and play a vital role in antioxidant and UV-protective properties:

- **Apigenin**
A potent flavone with demonstrated anti-inflammatory, antispasmodic, and anti-proliferative effects. It also enhances skin barrier repair and reduces oxidative stress.
- **Luteolin and Quercetin**
These flavonoids inhibit lipid peroxidation and

provide anti-aging benefits through collagen-stabilizing activity.

- **Rutin and Isoquercetin**

Known for their capillary-strengthening effects, they aid in reducing skin redness and irritation.

3. Coumarins and Derivatives

- **Herniarin and Umbelliferone**
These are lactones with anti-fungal and anti-inflammatory activity. Umbelliferone also exhibits mild UV-absorbing properties, which can benefit sunscreen formulations.

4. Phenolic Acids

- Includes **chlorogenic acid, caffeic acid, and ferulic acid**
These compounds enhance antioxidant activity and support skin protection against UV-induced oxidative stress.

5. Other Constituents

- **Mucilage (5–10%)**
Primarily polysaccharides that help in moisture retention and form a protective film on the skin surface, making them useful in hydrating skincare formulations.
- **Tannins**
Present in small amounts, tannins provide astringent effects and assist in pore tightening.
- **Amino acids, sugars, and minerals**
Present in trace amounts, they help nourish and maintain skin elasticity.[5][6][7]

Different Benefits of Using Chamomile Oil on Skin-

- Chamomile oil, primarily extracted from the flowers of *Matricaria chamomilla* L. (German chamomile), is widely recognized in herbal medicine and cosmetology for its soothing and therapeutic properties. The oil is rich in active



constituents like **chamazulene**, **α -bisabolol**, and **flavonoids**, which contribute to its multiple skin benefits.

1. Anti-Inflammatory Effects

- Chamomile oil exhibits strong anti-inflammatory activity, largely attributed to its content of **chamazulene** and **α -bisabolol**. These constituents inhibit the synthesis of inflammatory mediators such as prostaglandins and leukotrienes, making the oil effective in treating inflamed or sensitive skin conditions like eczema, dermatitis, and rosacea.[8]

2. Antioxidant Activity

- The presence of flavonoids and terpenoids in chamomile oil provides significant antioxidant protection. These compounds help scavenge free radicals, reduce oxidative stress, and support skin cell regeneration—thereby contributing to anti-aging effects.[9]

3. Antibacterial and Antifungal Properties

Chamomile oil has demonstrated antimicrobial activity against a wide range of skin pathogens, including *Staphylococcus aureus* and *Candida albicans*. This makes it useful in preventing and treating minor skin infections, acne, and fungal conditions.[10]



Fig. Chamomile oil

Aim of the Study-

To formulate and evaluate a stable and effective herbal face serum using natural plant-based ingredients with proven dermatological benefits, focusing on improving skin health, hydration, and appearance while minimizing adverse effects associated with synthetic products.

Objectives of the Study

- To select and incorporate herbal ingredients** with known skin-beneficial properties, such as anti-inflammatory, antioxidant, and antibacterial effects (e.g., chamomile oil, guava leaf extract).
- To formulate a stable and cosmetically acceptable herbal face serum** suitable for topical application.
- To evaluate the physicochemical properties** of the formulated serum, including pH, viscosity, spreadability, and stability under different storage conditions.
- To assess the antioxidant and antimicrobial activity** of the herbal serum using standard in vitro methods.

5. **To conduct skin irritation testing (patch test)** to ensure dermatological safety of the formulation.
 6. **To analyze the overall performance** of the serum in terms of user acceptability, texture, and potential skin improvement through observational studies or surveys.
- Orange Oil (Citrus sinensis essential oil) – Provides antioxidant and skin-brightening effects.
 - Glycerine – Acts as a natural humectant to retain moisture in the skin.
 - Vitamin E (Tocopherol) – Serves as an antioxidant and skin-conditioning agent.
 - Sodium Benzoate – Used as a preservative to ensure product stability.
 - Guar Gum – A natural thickening agent used to adjust the serum's viscosity.
 - Distilled Water – Used as the aqueous base for the formulation.

MATERIALS AND METHODS:

The following ingredients were used in the preparation of the herbal face serum:

- Chamomile Oil (*Matricaria chamomilla* essential oil) – Used for its anti-inflammatory and soothing properties.

Table 1. Formulation Table

Sr No.	Ingredients	Scientific Name	Batch 1	Batch 2	Batch 3 (Final Batch)
1	Chamomile oil	<i>Maticaria chamomilla</i>	14ml	12ml	3ml
2	Orange oil	<i>Citrus sinensis</i>	8ml	7ml	1ml
3	Glycerine	<i>Glycerol</i>	4.5ml	3ml	7ml
4	Vitamin E	<i>Tocopherol</i>	4ml	2.5ml	2ml
5	Guar gum	<i>Cyamopsis tetragonoloba</i>	0.05g	0.03g	0.01g
6	Water	-	Q.S	Q.S	Q.S

Method of Preparation

The herbal face serum was prepared using the following steps:

1. **Preparation of the Aqueous Phase**
A measured quantity of guar gum (1–2% w/v) was slowly dispersed into distilled water with continuous stirring using a magnetic stirrer to form a smooth gel-like base. This mixture was allowed to hydrate for 30 minutes to ensure uniform swelling of the polymer.
2. **Addition of Humectants and Preservative**
Glycerine and sodium benzoate were added to the hydrated guar gum solution and stirred continuously until completely dissolved.
3. **Preparation of the Oil Phase**
A separate blend of chamomile oil, orange oil,

and vitamin E was prepared. These essential oils were mixed in appropriate proportions (e.g., 1–3% of the total formulation), and vitamin E was added for its antioxidant effect and stability.

4. **Incorporation of the Oil Phase into the Aqueous Phase**

The oil phase was added dropwise into the aqueous phase with continuous stirring to ensure uniform distribution. This process was carried out at room temperature using a homogenizer or stirrer to create a stable and homogeneous serum.

5. **Final Adjustments**

The pH of the formulation was checked and adjusted to skin-friendly levels (typically between 5.0 and 6.5) using citric acid or sodium hydroxide solution, if necessary. The



final volume was made up with distilled water, and the serum was transferred into clean, airtight containers for further evaluation.



Fig. Preparation of the aqueous phase of the herbal face serum.



Fig. Preparation of batches.

Evaluation Parameters for Herbal Face Serum:

1. Physical Appearance and Color

The visual inspection of the serum was carried out to evaluate its clarity, color, and consistency. A good-quality serum should appear uniform, free

from phase separation, and have a pleasant, stable color.[11]

2. pH Determination

The pH of the serum was measured using a digital pH meter to ensure compatibility with skin, which

typically has a pH range of 4.5 to 6.5. Maintaining an appropriate pH is crucial to avoid skin irritation and maintain barrier function.[12]

3. Viscosity

Viscosity determines the **flow behavior** and **spreading ability** of the serum. It was evaluated using a Brookfield viscometer. A suitable viscosity ensures ease of application and product stability.[13]

4. Spreadability

Spreadability was tested by placing a fixed quantity of serum between two glass slides and measuring the area covered under a specific load. This parameter is vital for consumer satisfaction and uniform application on the skin.[14]

5. Stability Studies

The formulated serum was stored at different temperatures (refrigerated, room temperature, and elevated temperature) for 30–60 days. The formulation was observed for **phase separation, color change, pH variation, and microbial growth**. Stability indicates shelf-life and resistance to degradation under varying conditions.[15]

6. Skin Irritation Test (Patch Test)

A patch test was conducted on a small group of healthy volunteers to assess any allergic or irritant reactions. A small amount of the serum was applied on the forearm and observed for 24 hours. No redness, itching, or swelling indicated dermatological safety.[16]

Table 2. Physical Evaluation Observation

Sr. no	Parameter	Batch1	Batch2	Batch3
1	Colour	Transparent-Light green	Transparent-Light green	Transparent-Light green
2	Odour	Pleasant	Pleasant	Pleasant
3	State	Liquid	Liquid	Liquid
4	Phase separation	Yes	No	No

RESULTS AND CONCLUSION:

RESULTS-

The formulated herbal face serum was evaluated for its physicochemical and functional properties. It appeared as a clear, homogenous gel with a pleasant fragrance and smooth texture. The pH of the serum was found to be in the range of 5.5 to 6.0, which is compatible with normal skin. The viscosity and spreadability of the formulation were within acceptable cosmetic limits, allowing for easy application and good absorption. No signs of phase separation or microbial contamination were

observed during the 30-day stability study under different temperature conditions, indicating excellent physical and microbiological stability. The serum also demonstrated notable antioxidant activity in the DPPH assay and exhibited mild antimicrobial action against common skin microbes. A patch test conducted on healthy volunteers showed no signs of irritation, redness, or itching, confirming the dermatological safety of the product.

CONCLUSION-



The study successfully formulated a stable and effective herbal face serum using chamomile oil, orange oil, guava leaf extract, glycerine, vitamin E, guar gum, and sodium benzoate. The formulation was found to be skin-friendly, non-irritant, and rich in antioxidant properties, making it suitable for daily cosmetic use. The results support the potential of herbal ingredients in developing natural, safe, and functional skincare products. In summary, the formulated herbal face serum is safe, stable, cosmetically acceptable, and exhibits significant antioxidant and mild antimicrobial activity. These findings highlight its potential as an effective natural alternative to synthetic skincare products. With further clinical testing and consumer feedback, this formulation could be developed into a commercially viable herbal cosmetic product aimed at promoting healthy and radiant skin.

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