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Research Article

Development and Evaluation of a Chamomile Enriched Antiaging Face serum For Skin Regeneration

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ABSTRACT

The formulation and development of a chamomile-enriched anti-aging face serum aims to harness the herb's antioxidant, anti-inflammatory and skin-soothing properties for enhanced skin regeneration. By combining chamomile extract with other natural ingredients, this serum targets fine lines, wrinkles and skin elasticity. The serum demonstrates efficacy in promoting collagen synthesis, reducing oxidative stress, and improving skin hydration. With excellent stability, safety, and tolerability, this chamomile-enriched face serum offers a promising natural solution for anti-aging skincare, providing benefits such as anti-aging, antioxidant effects, and improved skin elasticity and hydration, making it suitable for sensitive skin. Additionally, the serum's natural ingredients may offer a gentler alternative to synthetic skincare products, potentially reducing skin irritation and adverse reactions. This study provides a foundation for further research and development of chamomile-based skincare products, offering a potential solution for individuals seeking natural and effective anti-aging skincare options.

INTRODUCTION

Aging is a natural biological process characterized by the gradual decline in skin elasticity, hydration, and structural integrity. Factors such as oxidative stress, environmental exposure, and Reduced collagen synthesis contribute to the formation of fine lines, wrinkles, and overall skin Aging. To counteract these effects, skincare formulations enriched with natural antioxidants and

Soothing agents have gained significant attention. Chamomile (*Matricaria chamomilla*) is widely recognized for its anti-inflammatory, antioxidant And skin-soothing properties, making it an excellent ingredient in anti-aging formulations. Rich in flavonoids, terpenoids, and essential oils, chamomile extract helps reduce oxidative stress, promote skin regeneration, and enhance skin barrier functions.[1] This study focuses on the

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formulation and evaluation of a chamomile-infused anti-aging face Serum. The serum is designed to combine chamomile's skin-rejuvenating benefits with other Potent anti-aging ingredients, such as hyaluronic acid for hydration, vitamin C for collagen Synthesis, and vitamin E for antioxidant protection. The formulation is assessed for stability, Efficacy, and sensory attributes to ensure its effectiveness and consumer acceptability. The serum is developed using a blend of chamomile extract, polyglutamic acid (PGA), and other Bioactive ingredients to promote skin rejuvenation. The formulation process involves optimizing Ingredient concentrations to achieve maximum efficacy while ensuring stability and safety.[2]

1.2 Chamomile Face serum

A serum is a concentrated, lightweight skincare product that delivers active ingredients deep into the skin, targeting specific concerns like aging, acne or hyperpigmentation. With its high concentration of active ingredients and non-greasy

texture, serums provide benefits such as hydration, brightening and anti-aging, promoting healthier and more radiant skin. Chamomile (*Matricaria chamomilla*) is widely recognized for its anti-inflammatory, antioxidant, and skin-soothing properties, making it an excellent ingredient in anti-aging formulations. Rich in flavonoids, terpenoids, and essential oils, chamomile extract helps reduce oxidative stress, promote skin regeneration and enhance skin barrier functions.[3]

I) **Scientific Name**-*Matricaria chamomilla*

II) **Synonym**-*Matricariarecutita*, *Chamomilla*

Recutita, *Matricaria suaveolens*

III) **Family**-Asteraceae

Chemical Constituent Chamazulene, Apigenine, Bisabolol and Flavonoids.

2] Plant Profile



Fig No: 2.1 Chamomile Flower

2.1 Botanical Description

Chamomile's botanical charm translates beautifully into skincare, particularly in a face

serum for anti-aging. This gentle herb's soothing and calming properties can help reduce inflammation and redness while its antioxidant powers protect the skin from environmental

stressors and damage. By incorporating chamomile into a face serum, you can potentially improve skin elasticity and firmness, reducing the appearance of fine lines and wrinkles. The serum can also hydrate and nourish the skin, leaving it looking smoother and more radiant. With its anti-inflammatory properties, chamomile face serum can be especially beneficial for sensitive skin, providing a calming and protective effect that promotes healthier, more youthful-looking skin[4]

2.2 Chemical Constituents

Chamomile's therapeutic properties can be attributed to its rich chemical constituents, including sesquiterpene lactones, flavonoids and essential oils. Key compounds like chamazulene,

bisabolol and apigenin contribute to its anti-inflammatory, antioxidant and soothing effects. Chamazulene, in particular, is responsible for chamomile's blue color and has potent anti-inflammatory properties. Bisabolol, on the other hand has antimicrobial and anti-irritant properties, while apigenin has been shown to have antioxidant and anti-inflammatory effects. These bioactive compounds work synergistically to provide chamomile's calming, protective and regenerative benefits making it a popular ingredient in skincare and herbal remedies [5].

3] MATERIAL AND METHODS

1] MATERIAL

Table No: 3.1 Experimental Material And Their Uses

Ingredients	Uses
Chamomile Extract	Anti-aging property of skin
Polyglutamic acid	Hydrating agent
Glycerine	Humectant
Vitamin C	Skin Brightening
Vitamin E	Antioxidant
Panthenol	Moisturizer
Sodium Benzoate	Preservative
Jjoba Oil	Base oil

3.1.1 Polyglutamic acid

Therapeutic Applications

1. Skin care: PGA is used in skincare products for its moisturizing and humectant properties, helping to retain skin moisture and improve skin elasticity.
2. Wound healing: PGA's ability to retain moisture and promote tissue repair makes it useful in wound healing applications.
3. Drug delivery: PGA can be used as a carrier for drugs, allowing for controlled release and improved efficacy.[6]



Fig No. 3.1 Polyglutamic acid

3.1.2 Glycerine

□ Therapeutic Uses of Glycerin

1. **Moisturizing:** Glycerin is a humectant that helps retain moisture in the skin, making it an effective ingredient in skincare products for dry, sensitive or irritated skin.
2. **Skin hydration:** Glycerin helps to lock in moisture reducing dryness and improving skin elasticity.[7]



Fig No: 3.2 Glycerine

3.1.3 Vitamin C

□ **Biological Source :** Vitamin C is abundantly found in various fruits and vegetables. Citrus fruits like oranges, lemons and limes, Berries such as strawberries, kiwis and blueberries are also rich in vitamin C.

□ **Traditional Uses**

1. Supporting immune function and overall health.
2. Enhancing skin health and appearance.
3. Vitamin C is wisely used to boost immunity and protect against oxidative stress.
4. The antioxidant properties of Vitamin C make it a wise choice for supporting skin health and reducing signs of aging

3.1.4 Vitamine E

□ **Biological sources** -Sources of Vitamin E is found in plant-based sources like vegetable oils sunflower, safflower, and wheat germ oil.

□ **Traditional uses**

1. **Anti-aging :** Reducing signs of aging, such as fine lines and wrinkles.
2. **Skin health:** Protecting skin from damage and promoting wound healing.
3. **Antioxidant properties:** Neutralizing free radicals and reducing oxidative stress[8].

3.1.5 Panthenol

□ **Biological Sources** -Panthenol is derived from Pantothenic acid, also known as Vitamin B5. It can be found naturally in various food sources, including Meat (organ meats, poultry Fish, Whole grains and Legumes.

□ **Therapeutic uses**

1. **Moisturizing:** Attracts and retains moisture, leaving skin feeling soft and supple.
2. **Skin soothing:** Helps to calm and soothe irritated skin.
3. **Wound healing:** May help to promote wound healing and tissue repair.
4. **Skin elasticity:** Supports skin elasticity and firmness [9].

3.1.6 Jojoba oil

□ **Biological Source** -Simmondsia chinensis plant Specifically, the oil is derived from the seeds of this desert shrub, native to the south western United States and northern Mexico.

□ **Family** – Buxaceae

□ Traditional Uses

1. Moisturizing: Hydrates and softens skin
2. Skin balancing: Balances skin's natural pH and oil production
3. Anti-inflammatory: Soothes and calms irritated skin
4. Antioxidant: Protects skin from environmental stressors[10].



Fig No. 3.3 Jojoba Oil

1.1.7 Sodium Benzoate

Sodium benzoate powder is accepted as a preservative by some of the world's toughest natural product certification. Using sodium benzoate in Face serum preservative is a safe and effective technique to protect against bacteria and mold forming the bottles.

□ Type of ingredient – preservative

□ Uses – it can help protect the skin from oxidative stress, potentially contributing to its anti-aging benefits [11].



Fig No. 3.4 Sodium Benzoate

2] METHOD

A] Extraction of Chamomile Infusion (Water-Based Method)

Chamomile infusion is a simple and effective way to extract its beneficial compounds for use in skincare formulations like face serums.

1. Preparation of Plant Material

- Collect and clean the plant material (e.g., leaves, roots, flowers).
- Dry the plant material to remove excess moisture.
- Grind or chop the plant material into small pieces to increase the surface area.

2. Selection of Solvent

- Choose a suitable solvent based on the desired extract and the properties of the plant material.
- Common solvents include water, ethanol, glycerin and propylene glycol.

3. Infusion (Water Based method)

- Combine the plant material and solvent in a container (e.g., glass jar, stainless steel vessel).

- Ensure the plant material is completely submerged in the solvent.

4. Separations and Filtration [12].



Fig No: 3.5 Infusion Process



Fig. No:3.6 Extract of chamomile

3] Process

1. Phase 1: Water phase preparation

- Measure the required amount of distilled water.
- Dissolved sodium benzoate in distilled water by stirring well.
- Add panthenol vitamin c to the water phase mix until dissolved.
- Stir in chamomile extract and ensure it evenly blended.

1. Phase 2: Oil phase preparation

- Measure jojoba oil and vitamin E.
- Mix the oil phase well to evenly distributed vitamin E

2. Phase 3: Emulsification

- Incorporated oil phase into water phase while stirring continuously.
- Add polyglutamic acid into formulation and add sodium benzoate as preservative.
- Transfer the serum into clean bottle [13].



Fig. No: 3.7 Chamomile Face Serum

Table No:3.2 Ingredients and Their Quantity

Sr. No	Ingredients	Quantity
1	Chamomile Extract	10 ml
2	Polyglutamic acid	1ml
3	Glycerin	2ml
4	Vitamin C	4ml
5	Vitamin E	1ml
6	Panthenol	2ml
7	Jojoba oil	10ml
8	Sodium Benzoate	0.5 gm
9	Total	30ml

4] Evaluation Test

4.1 Organoleptic Evaluation:

Organoleptic evaluation assesses the product sensory characteristics including:

4.1.1 Visual Evaluation

4.1.1.1. Colour : The Chamomile face serum colour is Slightly yellow or golden

4.1.1.2. Clarity: The Face serum clarity is can refer to its texture, consistency and it's ability to clarify, brighten the skin and lightweight or water to thicker.

4.1.1.3 Texture: The Face serum texture is evaluated for smoothness, absorption rate and spreadability.

4.1.2 Olfactory Evaluation

4.1.2.1 Odour: The Face serum is Mild and soothing Scent aroma is assessed for intensity, character, and acceptability.

4.1.2.2 Fragrance: The presence and type of fragrance are evaluated to ensure it is pleasant Visual inspection of the serum's colour, clarity and consistency.[14].

4.2 pH (Potential of Hydrogen)

The pH test of a face serum is a simple procedure used to determine its acidity or alkalinity, ensuring it aligns with the skin's natural pH range of 4.5 to 5.5. This test involves dipping a pH strip into the serum and comparing the resulting color change to a reference chart. A balanced pH helps maintain the skin's protective barrier and prevents irritation, making this test crucial for evaluating the serum's safety, effectiveness and compatibility with the skin.[15]

4.3 Viscosity

Measurement of the serum's thickness and flow ability, The viscosity of a face serum refers to its thickness or resistance to flow, which plays a crucial role in how the product feels on the skin

and how effectively it delivers active ingredients. The viscosity of a chamomile face serum affects its texture, stability and user experience. Viscosity measures the serum's resistance to flow, impacting how easily it spreads and absorbs into the skin. A serum with optimal viscosity should have a smooth, consistent texture, allowing for effortless application and absorption. Measuring viscosity ensures the serum meets quality and performance standards, providing a pleasant user experience and effective delivery of chamomile's benefits

4.4 Spreadability Test

Spreadability is an important characteristic of topical formulations, such as face serums, as it affects ease of application, uniformity of distribution, and overall user experience. An ideal serum should spread easily with minimal effort, forming a thin, uniform layer over the skin.

4.4.1 Process

1. **Sample Preparation:** A fixed amount of the chamomile face serum (e.g., 1 gram) was placed between two glass plates of known dimensions (e.g., 20 cm × 20 cm).
2. **Weight Application:** A standard weight (e.g., 500 grams) was placed on the top plate.
3. **Measurement:** After 1 minute, the diameter (or area) of the spread serum was measured in two perpendicular directions (length and width) using a ruler or caliper.
4. **Calculation:** Spreadability was calculated using the formula

Spreadability = weight applied × diameter / time
[16].

4.5 Solubility Test

The solubility test of chamomile face serum in ethanol and water evaluates the ability of chamomile extract to dissolve uniformly in these solvents. A satisfactory solubility test indicates that the chamomile extract is properly dispersed and dissolved, ensuring consistent delivery of its active compounds. The test assesses solubility in Following Solvent :

- **Ethanol:** Evaluating solubility in organic solvents
- **Water:** Assessing solubility in aqueous solutions

4.6 Non-Irritancy: Serum was applied to this area and the time was noted. Then, every 24 hours, irritation, redness and possible swelling are checked and reported. [17].

4.7 Identification test

The identification test of chamomile flower powder in which main chemical active component are such as chamazulene , bisabolol, Apigenine, flavanoid compound and more are used to treat on anti aging , skin moisturizing and skin regeneration Enhance skin properly.

4.7.1 Chamazulene : Chamazulene is a sesquiterpene hydrocarbon derived from matricin during steam distillation. It is not present in the fresh plant but forms during processing Chamazulene gives chamomile oil a light blue color.

4.7.2 Luteoline : Luteolin, a flavonoid compound in chamomile face serum responsible for an orange color, Further research might be needed to identify specific orange-colored constituents.

4.7.3 Bisabolol : Bisabolol is a monocyclic sesquiterpene alcohol, found in high concentrations in German chamomile. Bisabolol



shows up as a spot (color varies depending on the reagent, often deep blue after spraying)

4.7.4 Apigenin : is a natural plant flavonoid found in high concentrations in chamomile, parsley, celery, and other herbs. It plays a significant role in the therapeutic properties of chamomile, especially for skin health. Apigenin shows a green coloration due to its conjugated double bond system and flavonoid structure.[18].



Fig No:4.1 Identification test serum

4.8 Phase separation

The phase separation test is a stability test used to assess whether a face serum remains physically uniform over time or under different storage conditions. Serums, especially those containing both oil and water components, can be prone to separation if the formulation isn't stable. Phase separation occurs when the ingredients in a like oils, water, extracts and emulsifiers start to separate into distinct layers instead of remaining as a single, smooth mixture. This can affect the serum appearance, texture and performance.

4.8.1 Phase Separation Test Process

1. **Sample Preparation:** Pour the chamomile face serum into clear containers and seal tightly.

2. **Storage Conditions:** Store samples under different conditions e.g., 4°C (refrigeration), 25°C (room temp), and 40°C (accelerated conditions).
3. **Observation Period:** Monitor over a period of days to weeks.
4. **Observation:** Visually inspect for any signs of separation, such as layers, oil pooling, or sedimentation.
5. **Documentation:** Record the time and conditions under which phase separation occurs.[19].

4.9 Anti microbial Assay

An antimicrobial assay is a laboratory test used to evaluate the ability of a substance to inhibit the growth of or kill microorganisms such as bacteria, fungi or yeast. This type of test is essential in assessing the antimicrobial properties of products like face serums, especially those containing natural extracts or preservatives.

One common method is the agar diffusion assay, where the test substance is applied to an agar plate inoculated with a specific microorganism. If the substance is effective, it creates a clear zone around it, known as the zone of inhibition, indicating microbial growth suppression. These assays help ensure the product's safety, stability and effectiveness in preventing microbial contamination.

4.9.1 Antimicrobial Assay Process for Face Serum

1. Preparation of Nutrient Agar
2. Inoculation of Microorganism
3. Application of Face Serum:

Incubate the plates at 35–37°C for 24–48 hours [20].

5] RESULTS

Chamomile face serum shows promise in anti-aging skincare by formulation and evaluation of chamomile face serum are promising, With potential advancements in anti-aging skincare. The optimized formulation may lead to Enhanced skin elasticity, reduction in fine lines and improved collagen synthesis due to the Synergistic effects of chamomile, polyglutamic acid (PGA) and other bioactive ingredients.

1. **Colour:** The Chamomile Face serum exhibited a slightly Yellow or golden color, indicating a clean and pure formulation.
2. **Odour:** The Face serum had a Mild and soothing Scent, likely due to the presence of Chamomile extract, which is known for its distinct aroma.
3. **Texture:** The texture of the Chamomile face serum was smooth, lightweight and easily absorbed formulation.
4. **pH [potential of hydrogen]**

pH of is evaluated by pH meter. The pH meter was calibrated with a standard buffer solution. Almost 1 ml of facial serum was accurately weighed and dissolved in 50 ml of distilled water and finally its pH was calculated. The skin has an acidic range and the pH of the skin serum should be in the range of 5.1 which is slightly acidic and suitable for skin application.

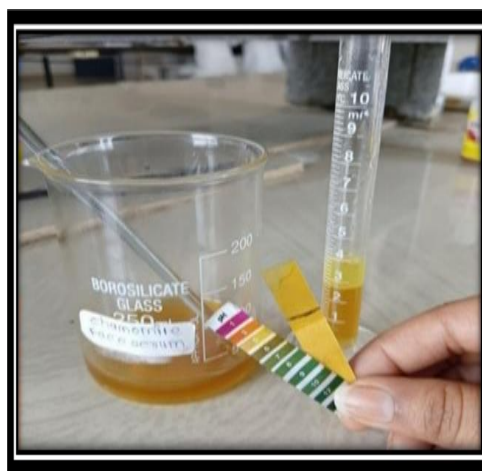


Fig No: 5.2 pH Test of Face Serum

5. Viscosity Test

The chamomile Face serum had a smooth consistency and range of viscosity is 220 cp of formulation. For an anti-aging face serum, optimal viscosity ensures smooth application, efficient absorption of active ingredients and a pleasant texture, enhancing the overall effectiveness of the product in reducing signs of aging.

6. **Spreadability Test:** The spreadability of the was measured at 7-10 g cm/sec, suggesting a good balance between viscosity and flow ability.

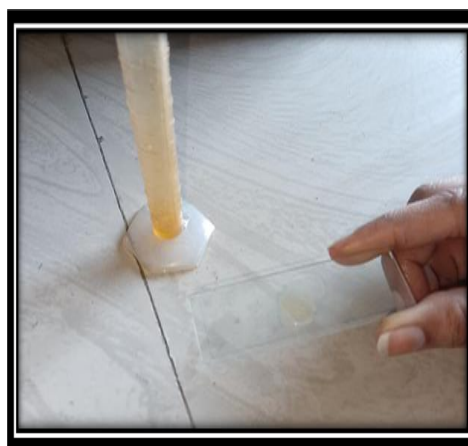


Fig No: 5.3 Spreadability Test

7. **Solubility Test:** The Chamomile Face serum was soluble in water and ethanol

indicating its potential for easy removal and cleansing.

Fig No:5.4 Solubility



8. **Non-Irritancy** Serum was applied to this area and the time was noted. Then, every 24 hours, irritation, redness and possible swelling are checked and reported. According to the result, there were no signs of irritation, erythema or swelling in the composition.



Fig No : 5.5 skin Irritation test

9. **Identification test:** The identification test of chamomile flower powder in which main chemical active component are such as chamazulene, bisabolol, Apigenine,

flavonoid compound and more are used to treat on anti-aging , skin moisturize ring and skin regeneration Enhance skin properly .



Fig No: 5.6 Identification Test

10. Anti-microbial Assay: The face serum demonstrated antimicrobial activity, showing a zone of inhibition that indicates its potential to prevent or treat skin infections and promote overall skin health.

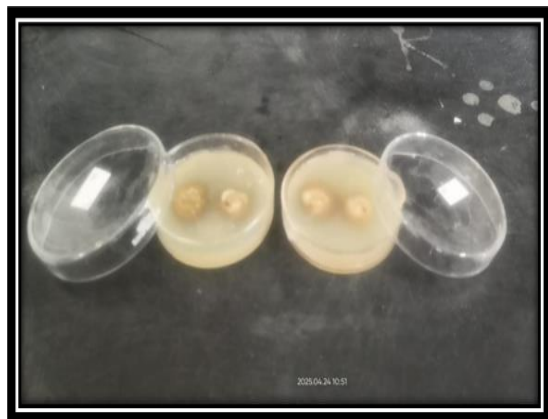


Fig No :5.7 Zone of inhibition

- The all results indicate that the Chamomile Face serum has desirable physical and physicochemical properties, making it a potential For anti aging treatment or Enhanced skin elasticity.

Table No 5.2 Result and parameters

Sr.no	Parameter	Result
1	Colour	Slightly yellow
2	Odour	Mild and soothing Scent
3	Texture	Smooth and lightweight
4	pH	5.1
5	Viscosity	220cp
6	Speed ability	7-10g/cm/sec
7	Solubility	Soluble in water
8	Non -irritancy	No irritation

6] DISCUSSION

Chamomile face serum is a providing natural solution for anti-aging skincare. Its antioxidant and anti-inflammatory properties help protect the skin from environmental stressors, reduce redness, irritation and promote skin regeneration and Its calming properties help to minimize fine lines and wrinkles, promoting a smoother and more radiant complexion. The face serum physical and

physiochemicals properties include pH viscosity, stability, antioxidant activity, microbial contamination and particle size these properties help to evaluate, ensuring skin compatibility, efficacy and safety, The product showed minimal microbial contamination, ensuring safety for skin application. Its gentle non-irritating nature makes it suitable for various skin types. Further research, including clinical trials and formulation optimization, is needed to confirm its efficacy and safety. by harnessing the power of chamomile, researchers can develop innovative solutions for healthy, youthful-looking skin This thesis is provides the development and evaluate of chamomile face serum as a viable anti-aging skincare product, highlighting its promise and potential benefits, and the way for future research and commercialization.

7] SUMMARY AND CONCLUSION

A] SUMMARY

The chamomile face serum its potential as an anti-aging skincare product. The literature review highlighted chamomile's anti-inflammatory and antioxidant properties, while the plant profile emphasized its richness in bioactive compounds like chamazulene and flavonoids that are highly beneficial in anti-aging treatments. The Preformulation studies ensured optimal formulation and evaluation tests demonstrated suitable to skin , strong antioxidant activity, safety and effective particle size. The results indicate that the chamomile face serum is a viable product for reducing signs of aging, providing soothing benefits and promoting skin health, making it a potential natural solution for skincare. chamomile flower serves as an effective natural ingredient in anti-aging skincare due to its ability to protect the skin from environmental damage, reduce inflammation and support skin healing and moisture retention. Its incorporation in face

serums enhances skin texture delays signs of aging and promotes a healthy youthful complexion.

BJ CONCLUSION

Chamomile flower serves as an effective ingredient such as flavonoid and terpenoids and their antioxidant or anti-inflammatory property to treat aging skincare due to its ability to protect the skin from environmental damage, reduce inflammation and support skin healing and moisture retention. Its incorporation in face serums enhances skin texture delays signs of aging and promotes a healthy youthful complexion. Chamomile flower (*Matricaria chamomilla*) has been widely recognized in both traditional medicine and modern cosmetics for its potent yet gentle skin-rejuvenating properties, making it a valuable ingredient in anti-aging skincare. The chamomile face serum offers a natural, gentle, and effective solution for soothing and calming the skin, making it an excellent option for those seeking to reduce inflammation and promote health radiant skin, Its gentles kin-compatible formulation makes it an attractive option for those seeking natural skincare alternatives.

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