

Formulation and Evaluation of Polyherbal Anti-Acne Face Serum

¹Ms Gaikwad A. B*, ²Shirtode Shweta, ³Kundnar Rajshree, ⁴Gangurde Apeksha, ⁵Sathe Mansi

Assistant Professor, Samarth College of Pharmacy, Belhe Pune, Maharashtra, India¹

Students, Samarth College of Pharmacy, Belhe, Pune, Maharashtra, India²⁻⁵

Abstract: *Despite being a common bacterium on human skin, acne is a main disease that irritates and inflames the skin. Research on new antibacterial compounds is essential since acne-causing bacteria are resistant to antibiotics. The goal of the current study is to create and assess a herbal anti-acne face serum that contains essential oils of neem, aloe vera, hibiscus, and nutmeg. The antibacterial qualities of nutmeg oils were mostly caused by the pinene component. Aloevera plants contain a variety of vitamins, including B12, A, C, and E, as well as enzymes, anthraquinones, minerals, carbohydrates, proteins, hormones, saponins, and lignin. Aloevera can lessen acne and skin inflammation because it contains antibacterial and anti-inflammatory qualities.*

Hibiscus flowers (Hibiscus rosa sinensis L.) contain antibacterial compounds called saponins, flavonoids, and tannins. Neem (A. indica) leaf extract exhibits the strongest antibacterial activity. According to this study, A. indica leaves exhibit anti-P. acne action, which is what causes acne. According to this study, herbal antiacne face serum considerably reduced the growth of Staphylococcus aureus and Staphylococcus epidermis without irritating the skin..

Keywords: Polyherbal formulation, Anti-acne serum, Herbal extract, Emulsion, Aloe vera, Nutmeg oil, Skin care, pH, Spreadability, Stability

I. INTRODUCTION

Acne vulgaris is one of the most common dermatological disorders affecting a large population worldwide, especially adolescents and young adults. It is estimated that nearly 80–85% of teenagers experience acne at some stage of their life. Although acne is generally considered a self-limiting condition, it can persist into adulthood and significantly impact the psychological and social well-being of individuals. The condition is characterized by the formation of comedones, papules, pustules, nodules, and in severe cases, cysts, primarily affecting areas rich in sebaceous glands such as the face, chest, and back.

The pathogenesis of acne involves multiple factors including excessive sebum production, abnormal keratinization of hair follicles, microbial colonization, and inflammatory responses. The bacterium Propionibacterium acnes plays a key role in the development of inflammatory acne lesions. Conventional treatment options include topical and systemic therapies such as retinoids, antibiotics, and hormonal agents. However, prolonged use of these synthetic drugs often leads to adverse effects such as skin irritation, dryness, antibiotic resistance, and other systemic complications.

Due to these limitations, there has been a growing interest in herbal and natural remedies for the management of acne. Herbal formulations are considered safer, cost-effective, and associated with minimal side effects. Medicinal plants are rich in bioactive compounds such as flavonoids, tannins, alkaloids, and phenolic compounds which exhibit antimicrobial, anti-inflammatory, antioxidant, and wound healing properties. These properties make them highly suitable for the treatment of acne and related skin disorders.

Polyherbal formulations, which combine multiple plant extracts, offer synergistic therapeutic effects compared to single herbal preparations. Ingredients such as neem, tulsi, aloe vera, and nutmeg oil are widely recognized for their anti-acne potential. Aloe vera provides soothing and moisturizing effects, while neem and tulsi exhibit strong antibacterial



activity. Nutmeg oil contributes to anti-inflammatory and antimicrobial action, enhancing the overall efficacy of the formulation.

In recent years, cosmetic formulations such as serums have gained significant popularity due to their lightweight nature, high concentration of active ingredients, and rapid absorption into the skin. Serums are designed to deliver active components efficiently, making them more effective than traditional creams and lotions. A well-formulated serum not only treats acne and skin-friendly pH. The developed serum is further evaluated for various physicochemical parameters to ensure its stability, safety, and suitability for topical application. but also improves overall skin texture and appearance.

Therefore, the present study aims to formulate and evaluate a polyherbal anti-acne serum using selected herbal ingredients. The formulation is designed to provide effective anti-acne activity along with good aesthetic properties such as non-sticky texture, smooth appearance,

II. MATERIALS AND METHODS

A. Materials

DETAIL PROFILE OF MATERIAL USED:

1. NEEM

SYNONYMS: Nira, Nimb, Vespa, Limba, Nimba

BIOLOGICAL SOURCES: Neem is made out of the seed oil and fresh or dried leaves of the Meliaceae family plant *Azadirachta indica*.

CHEMICAL CONSTITUENTS:

various photochemical can be found in neem fruit, seeds, leaves, stems, and bark; some of these compounds were initially found in azadirachta seed extracts, such as azadirachtin, which was first used as an insecticide and anti infectant in the 1960s. The seed oil contains glycerides, various polyphenols, imboiled, triterpenes, and beta-sitosterol in addition to azadirachtin and related limonoids. About 2% of the oil's composition is limonoid molecules, which have a garlic-like aroma and are yellow and bitter. Quercetin, catechins, carotenes, and vitamin C are all present in the leaves.

It contains Quercetin, n-hexacosanol, amino acids, 6-desacetylnimbinene, Nimbiene, Nimbandiol, nimbolide, Nimbin, and Nimbidinin.

GEOGRAPHICAL SOURCES:

It can be found in tropical Australia, India, Pakistan, Sri Lanka, Malaya, Indonesia, Japan, and Africa. It is present in Uttar Pradesh, Maharashtra, Tamil Nadu, Rajasthan, and M.P, in India.

USES:

Neem can help cure inflamed skin because of its antibacterial and anti-inflammatory qualities. Neem is advantageous for treating skin irritation since it has the benefit of cooling the skin. Neem also has a calming effect on dry or parched skin.

Benefits of Neem for skin:

- a. Decreases the appearance of early signs of ageing
- b. Neem protects the skin from damaging UV radiation, pollution, and other environmental factors
- c. Aids in the management of acne
- d. Addresses blackheads and whiteheads
- e. Encourages collagen synthesis
- f. Use for bright skin
- g. Prevents skin infection





Figure 1: Neem

2. HIBISCUS (Paraphrased Version)

Synonyms:

Bombycidendron Zoll. & Moritzi, Bombycodendron Hassk., Brockmania W. Fitzg., Pariti Adans., Wilhelminia Hochr.

Biological Source:

Hibiscus is a genus of flowering plants belonging to the family Malvaceae.

Chemical Constituents:

Hibiscus rosa-sinensis contains various bioactive compounds such as proteins, saponins, cardiac glycosides, glucose, reducing sugars, essential oils, steroids, anthraquinones, tannins, and alkaloids. These constituents contribute to its therapeutic properties.

Uses:

Hibiscus is well known for its skin-enhancing properties and is considered a potent natural anti-ageing agent. It helps improve skin elasticity and firmness by inhibiting the activity of elastase enzyme, which is responsible for the degradation of elastin in the skin. This results in a lifting and tightening effect on the skin.

Benefits for Skin:

- a. Helps reduce signs of ageing
- b. Assists in cleansing and unclogging pores
- c. Improves skin tightness
- d. Reduces acne and inflammation
- e. Promotes faster wound healing
- f. Protects and maintains skin collagen



Figure no.2: Hibiscus



3. TULSI (Holy Basil)

Synonyms:

Holy basil, Ocimum sanctum, Ocimum tenuiflorum

Biological Source:

Tulsi is obtained from the fresh and dried leaves of *Ocimum sanctum*, a medicinal plant belonging to the family Lamiaceae. It is widely cultivated in India and is known for its therapeutic and spiritual significance.

Chemical Constituents:

Tulsi contains a variety of bioactive compounds such as eugenol, ursolic acid, rosmarinic acid, flavonoids, tannins, and essential oils. These constituents are responsible for its pharmacological and therapeutic activities.

Uses:

Tulsi is widely used in herbal formulations due to its antimicrobial, anti-inflammatory, and antioxidant properties. It is particularly effective in treating various skin conditions and improving overall skin health.

Benefits for Skin:

- a. Helps reduce acne and pimples
- b. Controls excess sebum (oil) production
- c. Provides antibacterial protection against skin infections
- d. Reduces inflammation and redness
- e. Purifies and detoxifies the skin
- f. Promotes clear, healthy, and glowing skin



Figure no 3: Tulsi

B. Methods

EXTRACTION OF MATERIALS:

Neem extraction: For water extraction of neem mixture of 10 gm of dried leaves and 100ml of distilled water was heated for 10 minutes while being stirred. Then, filter paper was used to separate the extract.

Hibiscus extraction: For water extraction of hibiscus 10gm of dried flowers was taken in 100 ml distilled water and mixture was boiled for 10 minutes while stirring. Then, filter paper was used to separate the extract.

Tulsi extraction:-

For the aqueous extraction of tulsi, 10 g of dried tulsi leaves were taken and added to 100 ml of distilled water. The mixture was heated and boiled for about 10 minutes with continuous stirring to ensure proper extraction of active



constituents. After boiling, the solution was allowed to cool and then filtered using filter paper to obtain a clear tulsi extract.

III. FORMULATION OF POLYHERBAL ANTI-ACNE SERUM

The polyherbal anti-acne serum was formulated using extracts of Neem, Tulsi, and Hibiscus in suitable proportions. The formulation was prepared using excipients such as Tween 60, Span 80, glycerine, sodium benzoate, aloe vera gel, nutmeg oil, and distilled water to obtain a stable 10 ml serum.

Preparation of Oil Phase

The oil-soluble ingredients, namely nutmeg oil (1 ml), Tween 60 (0.5 ml), and Span 80 (0.5 ml), were taken in a clean beaker and heated at 70°C until a uniform mixture was obtained.

Preparation of Water Phase

The aqueous phase was prepared by mixing herbal extracts (Neem, Tulsi, Hibiscus – total 3.5 ml), aloe vera gel (1.5 ml), glycerine (0.3 ml), sodium benzoate (0.05 g), rose water (1 ml), and distilled water (q.s. to 8 ml). The mixture was stirred properly to obtain a uniform solution.

Preparation of Emulsion

The oil phase was added dropwise into the water phase with continuous stirring at 700–800 rpm to form a stable oil-in-water (O/W) emulsion. Stirring was continued for sufficient time to ensure proper emulsification and uniformity.



Figure 4. Formulation of face serum

Sr No.	Ingredient	Quantity (%)	Category
1.	Nutmeg oil	1%	Antibacterial
2.	Tween 60 + Span 80 (60:40)	3%	Emulsifier
3.	Neem extract	10%	Anti-acne Anti-inflammatory
4.	Hibiscus extract	10%	Antioxidant
5.	Aloe vera gel	30%	Soothing, Healing
6.	Glycerine	25%	Humectant
7.	Distilled water	q.s	Vehicle
8.	Sodium benzoate	q.s	Preservative
9.	Perfume	q.s	Fragrance



III) Evaluation of face serum

1. Physical Evaluation -

The prepared serum was observed for colour, clarity, and homogeneity. Initially, the formulation showed a brownish colour due to herbal extracts, which was later modified to light green by the addition of a small amount of colour. The serum was found to be smooth, uniform, and free from lumps, indicating good homogeneity.

2. Spreadability

Spreadability of the serum was evaluated by applying a small quantity on a glass slide. The formulation showed good spreadability, indicating ease of application and uniform distribution on the skin surface.

3. Absorption Time

The serum was applied on the skin, and the time required for complete absorption was noted. The formulation showed rapid absorption (approximately 8–10 seconds) without leaving any greasy residue.

4. Texture and Consistency

The optimized formulation exhibited a smooth, lightweight, and non-sticky texture. Initially, slight stickiness was observed due to glycerine, which was later reduced by optimizing its concentration.

5. Washability

The serum was easily washable with water and did not leave any residue on the skin.

6. Stability Study

The formulation was observed for stability under room temperature conditions. No phase separation, colour change, or precipitation was observed, indicating good stability of the serum.

7. Irritation Test-

The formulation was applied on a small area of skin, and no redness, itching, or irritation was observed, indicating that the serum is safe for topical use.

IV. Result

Physical Evaluation

Color	Light brown cream
Odor	Characteristics odor
Texture	Smooth homogeneous
Homogeneity	Good

Chemical Evaluation

1. Determination of pH-

The pH of the prepared serum was determined using a calibrated pH meter. A small quantity of the formulation was taken, and the electrode was dipped into the sample. The pH of the serum was found to be 6.12, which lies within the acceptable range for topical application. This pH indicates good compatibility with the skin and suggests that the formulation is safe and non-irritant.

2. Determination of Spreadability

Spreadability of the serum was evaluated by placing a small amount of formulation between two glass slides and applying slight pressure. The diameter of the spread was measured. The serum showed good spreadability (approximately 10–12 cm), indicating ease of application and uniform distribution on the skin.

3. Determination of Viscosity-

Viscosity of the formulation was determined using a suitable viscometer. The serum exhibited moderate viscosity (220 cP), which is considered ideal for topical application. Proper viscosity ensures easy spreading, good consistency, and overall stability of the formulation.

4. Stability Studies



The prepared serum was subjected to stability studies by storing it at room temperature for a specific period. The formulation was observed for any changes in colour, pH, phase separation, or consistency. No significant changes were observed, indicating that the serum is stable under normal storage conditions.

Sr No.	Parameter	Result
1.	pH	6.12
2.	Spreadability	11cm
3.	Viscosity	220cP
4.	Phase separation	Not observed

IV. CONCLUSION

The present study successfully formulated and evaluated a polyherbal anti-acne serum using natural herbal extracts such as neem, tulsi, and hibiscus. The formulation was prepared by emulsification technique and showed satisfactory physicochemical properties. The developed serum exhibited a smooth appearance, good homogeneity, non-sticky texture, and was found to be stable without any phase separation.

The pH of the formulation was found to be 6.12, which lies within the acceptable range for topical application and indicates good compatibility with the skin. The serum also demonstrated good spreadability and moderate viscosity (220 cP), ensuring ease of application and uniform distribution.

Overall, the results suggest that the formulated polyherbal anti-acne serum is safe, stable, and suitable for topical use. Due to the presence of bioactive herbal constituents, the formulation may be effective in managing acne and improving skin health. Further studies can be carried out to evaluate its antimicrobial activity and clinical efficacy.

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