

FORMULATION AND EVALUATION OF HERBAL ANTI-ACNE FILM FORMING SPRAY

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ABSTRACT

The present work deals with the formulation and evaluation of a herbal anti-acne film forming spray containing Neem and Turmeric extracts. A film forming spray is a novel topical dosage form that forms a thin protective film on the skin after application. The formulation was developed to provide prolonged contact time of herbal actives with the affected area and improve anti-acne activity. The spray formulation was prepared using HPMC as a film-forming polymer along with ethanol, propylene glycol, and distilled water. After spraying, rapid evaporation of solvent resulted in the formation of a transparent and flexible film on the skin surface. The herbal ingredients were selected due to their antimicrobial, anti-inflammatory, and antioxidant properties effective against acne vulgaris. The prepared formulation was evaluated for physical and chemical parameters including appearance, pH, viscosity, spray pattern, drying time, homogeneity, and film-forming ability. The results indicated satisfactory film formation, quick drying, good sprayability, and acceptable stability.

KEYWORDS: Neem

- Turmeric Acne Vulgaris
- Herbal Formulation Topical Drug Delivery HPMC Polymer
- Antimicrobial Activity
- Anti-inflammatory Activity Sprayability
- Film Formation Herbal Cosmetics
- Novel Drug Delivery System Skin Care Formulation

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* play 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 In recent years, cosmetic formulations such as serums have gained significant antimicrobial action, enhancing the overall efficacy of the formulation. 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*.



Figure 1: Neem

2. TURMERIC

Synonyms: Turmeric, Haldi, curcuma Longa

Biological Source: Turmeric is obtained from the

Chemical Constituents

various photchemical 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

Ican 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

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

rhizomes (underground stems) of *Curcuma longa*, a medicinal plant belonging to the family Zingiberaceae. It is widely cultivated in India and is known for its

medicinal, cosmetic, and therapeutic properties.

Chemical Constituents

Turmeric contains various bioactive compounds such as curcumin, demethoxycurcumin, bisdemethoxycurcumin, volatile oils, proteins, sugars, and resins. These constituents are responsible for its antimicrobial, antioxidant, anti-inflammatory, and healing activities.

Uses

It is traditionally and medically used to manage joint pain and arthritis, ease indigestion and hay fever symptoms, and promote heart health.

Turmeric extraction

For aqueous extraction of turmeric, 10 g of dried turmeric powder or crushed rhizomes were 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. Then, the mixture was filtered using filter paper to obtain the turmeric extract. Turmeric is widely used in herbal and cosmetic formulations due to its antibacterial, antifungal, antioxidant, and anti-inflammatory properties. It is especially effective in treating skin disorders and improving skin complexion.

Benefits for Skin

- Helps reduce acne and pimples
- Reduces dark spots and pigmentation
- Provides antibacterial protection against skin infections
- Reduces inflammation and redness
- Improves skin glow and complexion
- Helps in wound healing and skin rejuvenation



Figure 2: Turmeric.

III. FORMULATION OF POLYHERBAL ANTI-ACNE FILM FORMING SPRAY

Step 1: preparation of Polymer Solution

- Weigh the required quantity of HPMC accurately.
- Add HPMC slowly into distilled water with continuous stirring.
- Keep the solution aside for 30–45 minutes for complete hydration and formation of a clear polymer solution.

Step 2: Preparation of Herbal Solution

- Dissolve neem extract and turmeric in ethanol.
- Stir continuously until a uniform solution is obtained.

Step 3: Addition of Plasticizer

- Add propylene glycol slowly into the herbal solution while stirring continuously.
- Propylene glycol improves flexibility and prevents cracking of the film.

Step 4: Mixing

- Add the herbal solution gradually into the polymer solution.
- Stir continuously using a magnetic stirrer to obtain a homogeneous mixture.
- Make up the final volume with distilled water.

Step 5: Filtration

- Filter the formulation using muslin cloth or filter paper to remove undissolved particles.

Step 6: Filling

- Transfer the prepared formulation into a clean, sterilized spray bottle.
- Seal and label the container properly.

Storage

- Store in a cool and dry place.
- Protect from direct sunlight.



IV. Formulation Table.

Sr.no.	Ingredient	Quantity (%)	Category
I.	Neem extract	5 ml	Antibacterial and anti-acne agent
II.	Turmeric extract	2 ml	Anti-inflammatory and antimicrobial agent
III.	HPMC	1 g	Film-forming polymer
IV.	Glycerine	2 ml	Humectant and plasticizer
V.	Ethanol	10 ml	Solvent and quick drying agent
VI.	Rose water	10 ml	Vehicle and soothing agent
VII.	Peppermint oil	1-2 drops	Fragrance and cooling agent
VIII.	Sodium benzoate	0.1 g	Preservative
IX.	Distilled water	q.s. to 50 ml	Vehicle

1. Physical Evaluation of Herbal Anti-Acne Film Forming Spray

1. Colour Procedure

Observe the formulation visually under normal light. Observation

- Yellowish-green color due to Neem and Turmeric extracts.

2. Odour Procedure

Smell the formulation carefully. Observation

- Characteristic herbal odour.

3. Appearance Procedure

Visually inspect the spray solution. Observation

- Clear and homogeneous formulation.
- Free from suspended particles.

4. Clarity Procedure

Check against black and white background. Observation

- Formulation should be free from turbidity.

5. pH

Procedure

1. Take a small quantity of spray formulation.
2. Measure pH using digital pH meter. Observation
- pH should be between 5.5–7, suitable for skin application.

6. Viscosity Procedure

Measure viscosity using Brookfield viscometer. Observation

- Moderate viscosity for easy spraying and film formation.

7. Spray Pattern Procedure

1. Spray formulation onto a paper sheet from fixed distance.
2. Observe spray distribution. Observation
- Uniform spray pattern without clogging.

8. Drying Time Procedure

1. Spray formulation on glass slide or skin surface.
2. Record time required for complete drying.

OBSERVATION

- Quick drying within few minutes.
- ##### 9. Film Forming Property Procedure
1. Spray formulation on glass plate.
 2. Allow solvent evaporation. Observation
 - Thin, transparent, smooth, and flexible film should form.

10. Homogeneity Procedure

Observe formulation for uniform mixing. Observation

- No phase separation or aggregation should be present.

RESULT

The prepared herbal anti-acne film forming spray showed satisfactory physical characteristics including good appearance, acceptable pH, uniform spray pattern, quick drying time, and proper film formation suitable for topical application.

Chemical Evaluation of Herbal Anti-Acne Film Forming Spray.

1. pH Determination Procedure

1. Take a small quantity of formulation.
2. Measure pH using a calibrated digital pH meter. Observation
 - pH should be between 5.5–7, suitable for skin application.

2. Drug–Excipient Compatibility Study Procedure

1. Mix herbal extracts with excipients.
2. Observe for color change, precipitation, or odor change. Observation
 - No chemical interaction should occur between ingredients.

3. Assay of Active Constituents**Procedure**

1. Analyze active herbal constituents using suitable analytical methods such as UV spectroscopy.
2. Measure concentration of active compounds. Observation
 - Active constituents should be within acceptable limits.

4. Uniformity of Content Procedure

1. Take samples from different portions of the formulation.
2. Analyze drug content. Observation
 - Uniform distribution of herbal extracts should be present.

5. Residual Solvent Test Procedure

1. Check evaporation of ethanol after film formation. Observation
 - Minimum residual solvent should remain after drying.

6. Stability Study Procedure

1. Store formulation at different temperatures.
2. Observe changes in
 - pH
 - Color
 - Odour
 - Drug content Observation
 - Formulation should remain chemically stable.

7. Moisture Content Procedure

1. Measure moisture content using drying method.
 - Observation- Moisture content should be low to prevent microbial growth.

RESULT

The prepared herbal anti-acne film forming spray containing Neem and Turmeric showed satisfactory chemical stability, acceptable pH, uniform drug content, and compatibility among formulation ingredients.

CONCLUSION

The present study concluded that the herbal anti-acne film forming spray formulated using Neem and Turmeric possesses effective anti-acne potential with good

physicochemical characteristics. The formulation showed satisfactory appearance, acceptable pH, uniform spray pattern, quick drying time, and good film-forming property. The prepared spray forms a thin protective film on the skin which increases the contact time of herbal active constituents and enhances therapeutic effect. Neem exhibited antimicrobial activity against acne-causing microorganisms, while turmeric provided anti-inflammatory and antioxidant effects that help reduce redness and skin irritation.

The formulation was found to be stable, non-greasy, easy to apply, and suitable for topical administration. Therefore, the herbal anti-acne film forming spray can be considered an effective, safe, and patient-friendly alternative for the treatment and management of acne vulgaris.

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