

**FORMULATION AND EVALUATION OF ACNE FACE WASH CONTAINING TULSI,
NEEM, AND ACTIVATED CHARCOAL*****Mansi Kamble, Tanvi Kadam, Kishorkumar Kalor**

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ABSTRACT

Acne vulgaris is a common chronic inflammatory skin disorder caused by excessive sebum production, bacterial growth, clogged pores, and inflammation. Conventional anti-acne therapies often produce side effects such as dryness, irritation, and skin sensitivity, creating a demand for safer herbal alternatives. The present study aimed to formulate and evaluate a herbal anti-acne face wash containing Tulsi (*Ocimum sanctum*), Neem (*Azadirachta indica*), and Activated Charcoal. Tulsi and Neem were selected for their antimicrobial, anti-inflammatory, antioxidant, and sebum-regulating properties, while Activated Charcoal was incorporated for its detoxifying and oil-absorbing action. The herbal extracts were prepared using a hydroalcoholic extraction method. The formulation was prepared using ingredients such as liquid soap base, aloe vera gel, glycerin, Carbopol 934, tragacanth gum, rose water, sodium benzoate, and citric acid. The prepared face wash was evaluated for physicochemical parameters including colour, odour, consistency, pH, spreadability, washability, foamability, and sensitivity. The formulation showed a greyish-black appearance, pleasant odour, semisolid consistency, good foamability, easy washability, and skin-friendly pH. No irritation or phase separation was observed. The study concluded that the formulated herbal face wash is a safe, effective, and economical alternative for acne management with promising therapeutic potential.

KEYWORDS: Tulsi, Neem, Activated Charcoal, Facewash, Acne, Aloe vera gel.**1. INTRODUCTION**

Acne vulgaris, commonly known as acne, is a prevalent chronic skin condition that affects a large portion of the global population, particularly adolescents and young adults. It is characterized by the development of pimples, blackheads, cysts, and inflamed lesions, often appearing on the face, back, shoulders, and chest. Acne occurs when hair follicles become clogged with oil, dead skin cells, and bacteria, leading to inflammation and the formation of pustules or nodules.^[1] The primary factors contributing to acne include excessive sebum production, bacterial overgrowth, hormonal fluctuations, genetic predisposition, and environmental factors.^[2] While acne is not life-threatening, it can significantly impact an individual's self-esteem, leading to emotional distress, social withdrawal, and even long-term scarring.

Conventional treatments for acne generally involve the use of topical or systemic medications such as benzoyl peroxide, retinoids, or antibiotics, which target specific aspects of the acne pathogenesis, such as inflammation and bacterial growth. However, many of these treatments are associated with various side effects, including skin irritation, dryness, and increased sensitivity to sunlight.^[3] As a result, there has been an increasing interest in alternative and complementary therapies, particularly those based on herbal ingredients. Herbal remedies are often viewed as safer and gentler on the skin compared to chemical treatments, and they are commonly utilized for their anti-inflammatory, antimicrobial, and antioxidant properties.^[4]

The demand for natural skincare solutions has led to a surge in the development of herbal-based formulations for acne management. Numerous plants have been

identified for their beneficial effects on acne, including those with antimicrobial properties that help control acne-causing bacteria, and those that soothe inflammation, reduce redness, and regulate sebum production. Herbal face washes, in particular, have gained popularity as a non-invasive, convenient, and safe approach for managing acne symptoms.^[5] These formulations are not only used to cleanse the skin but also to deliver active ingredients that address the underlying causes of acne, providing a holistic treatment approach.^[5]

Given the rising preference for natural skincare products, the formulation of an herbal anti-acne face wash has become an area of significant interest in recent years. This type of face wash typically combines multiple herbal ingredients that synergistically work to cleanse the skin, reduce bacterial load, and minimize inflammation. By utilizing the natural therapeutic properties of plants, such formulations aim to provide an effective acne treatment while being gentle on the skin.^[3,5]

2. Background

The use of herbal ingredients in skincare has gained significant attention in recent years due to their natural therapeutic properties. Among the various natural substances, Tulsi (*Ocimum sanctum*), neem (*Azadirachta indica*), and activated charcoal have been identified as effective agents in the treatment of acne. These ingredients are known for their anti-inflammatory, antimicrobial, and detoxifying properties, making them ideal candidates for incorporation into acne formulations, particularly in face washes. The synergistic effects of these herbs, when combined, are believed to provide a holistic approach to acne treatment, addressing multiple causes of acne and promoting healthy skin.^[1-10]

2.1. Tulsi (Holy Basil)

Common Name: Tulsi, Holy

Family: *Lamiaceae*

Scientific Name: *Ocimum sanctum*



Pharmacological Activities

Tulsi is a versatile herb with a range of pharmacological activities, which include:

Anti-inflammatory: Tulsi exhibits potent anti-inflammatory effects by inhibiting pro-inflammatory cytokines and enzymes, thereby reducing inflammation.^[6]

Antimicrobial: It has strong antimicrobial properties, particularly against Gram-positive bacteria, viruses, and fungi.^[7]

Antioxidant: Tulsi contains various flavonoids and polyphenolic compounds that help neutralize free radicals, preventing oxidative stress and skin damage.^[8]

Adaptogenic: Tulsi helps the body adapt to stress by regulating cortisol levels and promoting overall skin health.

Immunomodulatory: It supports immune function, boosting the body's ability to combat infections, including bacterial skin infections.

Activities for Acne Protection:

Tulsi is widely used in acne treatments due to the following specific activities:

Antibacterial Activity: Tulsi effectively combats *Propionibacterium acnes*, the bacteria responsible for acne formation, reducing bacterial growth on the skin.^[9]

Anti-inflammatory Effects: Its ability to reduce inflammation helps minimize redness and swelling associated with acne lesions, promoting faster healing.^[6]

Sebum Regulation: Tulsi helps regulate sebum production, preventing excessive oil buildup that can clog pores and lead to acne.^[10]

Antioxidant Protection: By neutralizing free radicals, Tulsi prevents oxidative damage to skin cells, which could contribute to acne scarring.^[8]

2.2. Neem

Common Name: Neem

Family: *Meliaceae*

Scientific Name: *Azadirachta indica*



Pharmacological Activities

Neem is known for its diverse therapeutic properties:

Antibacterial: Neem contains compounds like azadirachtin and nimbidin that exhibit broad-spectrum antibacterial activity, particularly effective against skin infections.^[11]

Anti-inflammatory: It reduces inflammation by inhibiting the production of pro-inflammatory cytokines and prostaglandins.^[12]

Antifungal: Neem also possesses antifungal properties, making it useful for treating fungal skin infections that may coexist with acne.

Antioxidant: Neem has potent antioxidant activity, protecting skin cells from damage caused by environmental stressors and aging.^[13]

Detoxifying: It detoxifies the body and skin, removing toxins that may contribute to skin inflammation and acne breakouts.^[13]

Activities for Acne Protection

Neem's role in acne management is well-documented due to its ability to:

Antibacterial Effects: Neem is effective against *Propionibacterium acnes* and other acne-causing microorganisms, preventing infections and acne lesions.^[11]

Anti-inflammatory Effects: Its anti-inflammatory properties help reduce acne-related inflammation, such as swelling and redness.^[12]

Regulation of Sebum Production: Neem controls excess oil production, preventing clogged pores and further acne development.^[14]

Healing and Scar Reduction: Neem promotes wound healing and can help reduce acne scars, making it beneficial for post-acne care.^[13]

2.3. Activated Charcoal

Common Name: Activated Charcoal

Pharmacological Activities:

Activated charcoal is well-known for its adsorptive properties, including:

Adsorption of Toxins: It binds to toxins and impurities, preventing their absorption into the skin or bloodstream.^[15]

Detoxification: Activated charcoal is used to detoxify the skin, drawing out impurities, excess oils, and harmful substances that may clog pores and exacerbate acne.



Absorption of Excess Oil: It is effective in absorbing excess sebum, preventing the oily buildup that can block pores and lead to acne.^[16]

Exfoliation: Its gentle exfoliating properties help remove dead skin cells, reducing the likelihood of clogged pores and promoting smoother skin.^[16]

Activities for Acne Protection

Activated charcoal is widely used in acne treatments due to its specific effects:

Cleansing and Detoxifying: Activated charcoal removes impurities, dirt, and excess oil from the skin, helping to prevent clogged pores, a primary cause of acne.^[17]

Bacterial Adsorption: It adsorbs bacteria and other microorganisms from the surface of the skin, reducing the risk of bacterial growth and acne flare-ups.^[18]

Pore Cleansing: By removing toxins and impurities, activated charcoal helps maintain clean pores, preventing the formation of acne lesions.^[18]

Regulation of Sebum Production: Activated charcoal's ability to absorb excess oils helps balance sebum production, preventing acne formation while maintaining skin hydration.^[16]

3. METHODOLOGY FOR FORMULATION OF FACEWASH

3.1 Preparation method

3.1.1 Extraction method

Hydroalcoholic extraction of plants is a solvent extraction method in which a mixture of water and alcohol (commonly ethanol) is used to isolate bioactive constituents such as phenolics, flavonoids, alkaloids, glycosides, and tannins from plant materials. The dried plant material is first cleaned, powdered, and mixed with the hydroalcoholic solvent in a suitable ratio. The mixture is then subjected to decoction for a specific time and temperature to enhance the release of phytoconstituents. After extraction, the liquid extract is filtered and concentrated by evaporating the solvent to obtain an extract rich in active compounds. Hydroalcoholic solvents are preferred because they improve the extraction of both water-soluble and alcohol-soluble constituents, resulting in higher yield and better recovery of plant metabolites.^[19]

3.1.2 formulation method

The herbal face wash was prepared by first dispersing tragacanth gum in a small quantity of distilled water with continuous stirring and allowing it to soak for about 30 minutes to form a smooth gel base. In a separate beaker, sodium benzoate was dissolved in the remaining distilled water, followed by the addition of glycerin, rose water, and aloe vera gel with constant stirring to obtain a uniform mixture. After that, tulsi extract and neem extract were added slowly and mixed thoroughly. Activated charcoal was separately dispersed in a small amount of water and then incorporated gradually into the mixture with continuous stirring to avoid lump formation. The liquid soap base was then added slowly with gentle stirring to minimize excessive foam generation. Finally,

the prepared tragacanth gum gel was added to the mixture and stirred continuously until a homogeneous face wash gel was obtained. The final volume was adjusted to 100 mL using distilled water if required, and the prepared formulation was filled into clean, airtight containers for storage.^[20,21,22,23,24,25]

By above preparation method the herbal product is prepared in two batches which are Batch 1 and Batch 2 .

3.2 Formulation Table

Batch 1:

Sr. No	Ingredients	Quantity
1.	Tulsi Extracts	5 ml
2.	Neem Extracts	5 ml
3.	Activated Charcoal	1 gm
4.	Liquid Soap Base	40 ml
5.	Aloe vera Gel	10 gm
6.	Glycerin	5 ml
7.	Carbopol 934	1 gm
8.	Sodium Benzoate	0.3 gm
9.	Tragacanth Gum	0.5 gm
10.	Distilled Water	Q. S
11.	Citric Acid	0.3 gm
12.	Rose Water	10 ml

Batch 2:

Sr. No	Ingredients	Quantity
1.	Tulsi Extracts	5 ml
2.	Neem Extracts	5 ml
3.	Activated Charcoal	1 gm
4.	Liquid Soap Base	40 ml
5.	Aloe vera Gel	10 ml
6.	Glycerin	5 ml
7.	Carbopol 934	1 gm
8.	Sodium Benzoate	0.3 gm
9.	Tragacanth Gum	2.5 gm
10.	Distilled Water	Q. S
11.	Citric Acid	0.3 gm
12.	Rose Water	10 ml

3.3 Excipient Profile

3.3.1 Liquid Soap Base

- **Synonym**

Liquid cleanser base, surfactant base

- **Description**

Clear or slightly viscous liquid with good cleansing and foaming properties.

- **Chief Chemical Constituents**

Contains mild surfactants such as sodium lauryl sulfate, cocamidopropyl betaine, or similar cleansing agents.

- **Uses**

Used as the main cleansing agent in face wash formulations. It helps remove dirt, excess oil, sweat, makeup, and impurities from the skin surface. It also

produces foam and improves spreadability of the formulation.^[26]

3.3.2 Rose Water

- **Synonym**

Rose hydrosol, Gulab jal

- **Biological Source**

Prepared by distillation of fresh petals of *Rosa damascena*.

- **Description**

Colour – Clear to pale pink

Odour – Pleasant aromatic

Taste – Slightly sweet

- **Chief Chemical Constituents**

Citronellol, geraniol, nerol, flavonoids.

- **Uses**

Used as a soothing, refreshing, and cooling agent in face wash. It helps tone the skin, reduce irritation, and imparts pleasant fragrance to the formulation.^[27]

3.3.3 Glycerine

- **Synonym**

Glycerol

- **Chemical Formula**

$C_3H_8O_3$

- **Description**

Colour – Colourless

Odour – Odourless

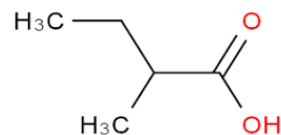
Taste – Sweet

Nature – Hygroscopic viscous liquid

- **Uses**

Used as a humectant and moisturizer. It attracts moisture to the skin, prevents dryness after washing, and improves softness and smoothness of the skin.^[28]

3.3.4. Carbopol 934



- **Synonym**

Carbomer / Carbopol 934

- **Chemical Formula**

$(C_3H_4O_2)_n$

- **Description**

Colour – White

Odour – Odourless

Taste – Tasteless

Nature – Fine, fluffy, hygroscopic powder

- **Uses**

Used as a gelling and thickening agent. It provides viscosity and smooth gel consistency to the formulation, improves stability, enhances spreadability, and gives a clear and uniform appearance to the face wash.^[29]

3.3.5. Tragacanth Gum

- **Synonym**

Gum tragacanth

- **Biological Source**

Dried gummy exudation obtained from *Astragalus* species.

- **Description**

Colour – White to cream

Odour – Odourless

Taste – Bland

- **Chief Chemical Constituents**

Bassorin, tragacanthin, polysaccharides.

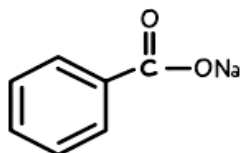
- **Uses**

Used as a natural thickening and suspending agent. It forms gel in water, improves viscosity, stabilizes formulation, and keeps charcoal particles uniformly dispersed.^[30]

3.3.6. Sodium Benzoate

- **Synonym**

Benzoate of soda.



- **Chemical Formula**

$C_7H_5NaO_2$

- **Description**

Colour – White crystalline powder

Odour – Odourless

Taste – Slightly sweet / astringent

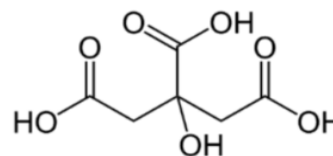
- **Uses :**

Used as a preservative in cosmetic preparations. It prevents growth of bacteria, fungi, and yeast, thereby increasing shelf life of the product.^[31]

3.3.7. Citric Acid

- **Synonym**

2-Hydroxypropane-1,2,3-tricarboxylic acid.



- **Chemical Formula**

$C_6H_8O_7$

- **Description**

Colour – Colourless crystals or white powder

Odour – Odourless

Taste – Sour

- **Uses**

Used as a pH adjusting agent in face wash formulations. It maintains skin-friendly pH, improves preservative effectiveness, and provides mild exfoliating action.^[32]

3.4 EVALUATION OF FACEWASH

Several quality tests were carried out to assess the generated formulation's quality. Here are a few of them:

1. Physical Appearance
2. Odor
3. Consistency
4. pH
5. Washability
6. Spreadability
7. Sensitivity
8. Rheological study
9. Foamability

1. Physical Appearance

The colour, clarity, and texture of the prepared face were examined. There was no phase separation or particle matter, and the consistency was smooth and homogeneous.^[33]

2. Odor

Due to the presence of herbal elements, the formulation's odour was examined organoleptically and determined to be unique and pleasant. There was no offensive or annoying smell.^[34]

3. Consistency

In order to ensure a smooth, uniform semisolid texture, the facewash's consistency was determined both visually and physically. Easy dispensing and consistent skin application were made feasible by the formulation's appropriate consistency.^[34]

4. pH

Using a digital pH meter, the facewash's pH was determined to be within the permitted range (5.5–7), making it ideal for a skin application.^[35]

5. Washability

The formulation was tested for ease of removal with water. It was discovered to be easily washing and to leaving no visible skin residue.^[36]

6. Spreadability

A small portion was applied to a glass slide, and the ease of spreading was measured to assess spreadability. With little effort, the formulation demonstrated good spreadability.^[37]

7. Sensitivity

On exposing the formulation to a small portion of skin and monitoring for symptoms of irritation, the formulation's sensitivity was examined. The facewash was safe when applied topically because it didn't cause any redness, itching, or irritation.^[38]

8. Rheological Study

In order to ensure a smooth, uniform semisolid texture, the facewash's consistency was monitored both visually and physically. Easy dispensing and consistent skin application were made feasible by the formulation's adequate consistency.^[39]

9. Formability

Foam stability was monitored over time, and foamability was assessed by shaking the mixture with water. Stable and adequate foam was formed by the face wash. [39]

3.5. EVALUATION PARAMETER

Sr. No.	Evaluation Test	Result
1.	Color	Greyish-Black
2.	Odor	Characteristic pleasant
3.	Consistency	Semi-Solid
4.	pH	7.2
5.	Spreadability	Easily Spreadable
6.	Washability	Good
7.	Foamability	Good

4. CONCLUSION

The current research titled "Formulation and Evaluation of Herbal Anti-Acne Face Wash Containing Tulsi, Neem, and Activated Charcoal" illustrates the successful creation of a safe and effective herbal product.

Acne vulgaris is a persistent inflammatory condition of the pilosebaceous unit, marked by heightened sebum production, microbial colonization by *Cutibacterium acnes*, and inflammation.^[40]

Neem (*Azadirachta indica*) demonstrates potent antibacterial properties against acne-inducing microorganisms, attributed to bioactive compounds such as nimbidin and azadirachtin.^[41]

Tulsi (*Ocimum sanctum*) is known for its considerable anti-inflammatory, antimicrobial, and antioxidant characteristics, which aid in alleviating skin infections and irritation.^[42]

The application of polyherbal combinations improves therapeutic efficacy due to the synergistic effects of various phytoconstituents.^[43]

Activated charcoal functions as an adsorbent, assisting in the removal of impurities, toxins, and excess oil from the skin's surface, thus preventing pore obstruction.^[44]

The developed face wash exhibited satisfactory physicochemical attributes, including an appropriate pH, excellent foaming capacity, and a smooth texture^[45]

Additionally, the formulation showed good stability under standard storage conditions, with no signs of phase separation or degradation.^[46]

Herbal formulations are typically safer and linked to fewer adverse effects compared to synthetic chemical-based alternatives.^[47]

The rising popularity of herbal cosmetics can be attributed to their environmentally friendly nature and superior compatibility with the skin.^[48]

Consequently, the formulated herbal anti-acne face wash can be regarded as an effective and cost-efficient option for acne treatment.^[49]

6. RECOMMENDATIONS

Clinical assessment involving human volunteers must be conducted to validate the safety and anti-acne effectiveness of the formulation.^[40]

Long-term stability assessments are necessary to ascertain shelf life and suitable storage conditions.^[50]

It is essential to optimize the concentration of herbal extracts to attain the highest therapeutic efficacy.^[51]

The addition of other herbal components, such as aloe vera and turmeric, may improve anti-acne and soothing properties.^[52]

In-vitro antimicrobial tests should be carried out against acne-related microorganisms, including *Cutibacterium acnes*.^[53]

Studies on dermatological safety and skin irritation must be performed to confirm compatibility with all skin types.^[54]

Scale-up investigations are needed to assess the practicality of large-scale manufacturing^[55]

Enhancements in organoleptic characteristics, such as scent and texture, can boost patient adherence.^[56]

Standardizing herbal raw materials is crucial for ensuring consistency across batches.^[57]

Further investigations should aim at creating more effective polyherbal formulations for the treatment of acne.^[49]

7. LIMITATIONS

Despite the successful formulation and evaluation, certain limitations were noted in the current study.

The formulation was not assessed through clinical trials involving human subjects, which restricts the validation of its real-world safety and effectiveness.^[58]

The antimicrobial activity was not specifically evaluated against primary acne-causing organisms like *Cutibacterium acnes*.^[59]

Only short-term stability assessments were conducted, which are inadequate to ascertain the long-term stability and shelf life of the product.^[60]

Variability in herbal components due to differences in geographical origin, harvesting methods, and processing may influence the consistency of the formulation.^[58]

Comprehensive dermatological assessments, such as studies on skin irritation and sensitivity, were not performed, which are crucial for topical formulations.^[61]

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