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Research Article

Formulation And Evaluation of Herbal Neem and Tulsi Soap for Enhanced Skin Care Applications

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Abstract
This project is dedicated to formulating an herbal soap by harnessing the extracts from Azadirachta indica (neem) and Ocimum tenuiflorum (tulsi) powders. With an increasing recognition of Ayurvedic cosmetics, renowned for their natural composition and minimal side effects, this formulation seeks to integrate botanical ingredients deeply rooted in traditional medicine practices. Neem, celebrated for its medicinal properties, assumes a crucial role, distinguished for its anti-inflammatory, antihyperglycemic, antimalarial, and antibacterial attributes. The study takes a comprehensive approach, exploring the effects of various neem leaf extracts. The herbal soap is meticulously crafted, incorporating neem and tulsi, demonstrating specific efficacy against dermatophytes, while tulsi showcases remarkable antiviral properties. This research serves to underscore the vast potential inherent in herbal formulations, shedding light on the manifold benefits of neem and tulsi and their transformative applications in skincare products.

Keywords: Neem, Tulsi, Azadirachta indica, Antibacterial, Herbal soap, Natural, Antimicrobial.

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1. Introduction:

The neem tree (Azadirachta indica) has been utilized as medicine from ancient times. [1] In the past, a particular name known as "Nimba" in Sanskrit was used to describe it. [2] "Good health" was linked to the Nimba-derived term "neem." [3] Soap is described as a chemical product that is created when a fatty acid and a metal radical react. A salt of fatty acids with eight or more carbon atoms that dissolves in water is called soap. The main metals used in the manufacturing of soap, which produces water-soluble laundry and cleaning solutions, are salt and potassium.[4,5] Herbal soap preparation is a kind of medication that contains antibacterial and antifungal compounds. It mostly employs plant parts, including leaves, stems, roots, and fruits, to cure illnesses or injuries or to promote health. Another name for herbal cosmetics is "natural cosmetics." The purpose of herbal cosmetics is to make the skin more beautiful and purer. The primary benefit of utilizing an herbal cosmetic is its purity and lack of negative effects on the body; instead, it provides the body with beneficial minerals and nutrients. A solid product created by saponification from

oil is soap.[6] the extract from Neem leaves has anti-inflammatory, anti-ulcer, antimalarial, antifungal, antioxidant, and anticarcinogenic properties.[7] As the "queen of all herbs," Tulsi is utilized extensively in naturopathic and Ayurvedic treatments to promote natural healing of the human body. The benefits of Tulsi blossoms extend beyond their leaves. From fever to kidney stones, Tulsi may assist you in overcoming various health issues. Even if herbal soaps are safer and perform better than synthetic ones, it seems unlikely that they will be well-liked by customers in the current environment.[8]

1.1 Types of Skin and Basic Skincare

The requirements for basic skincare

a) A cleansing agent clears the skin's pores of debris, dead cells, and dust. Coconut and palm oils are examples of vegetable oils that are often used as cleaners.

b) Toners: Toners lighten skin and protect it from airborne dust particles and other impurities.

c) Moisturizing: Moisturizing helps the skin to become soft and hydrated.

1.3 Herbal soap

Herbal soap is a medicine with antibacterial, anti-aging, anti-oxidant, and anti-septic qualities. It primarily uses plant parts such as seeds, rhizomes, nuts, leaves, flowers, and pulps to treat a disease or injury or to maintain good health. [9] Herbal soap is free of artificial coloring, flavoring, fluoride, and other ingredients.[10] Because of their high medicinal value, affordability, accessibility, and love for water, soap is often used in conjunction with water for cleaning. Compatibility, herbs are natural products that are used to treat nearly all illnesses and skin issues.[11]

1.4 Most prevalent illnesses

Cream, acne, rashes, psoriasis, allergies, dry skin, and other skin conditions are among the most prevalent ones. Special Skin Problem and Herbal treatments lists the herbal treatments used for certain skin conditions.

1.5 Soap

All people across the globe are familiar with soap as a popular cleaning agent. Various writers have given various definitions of soap. [12] Any salt of fatty acids with eight or more carbon atoms that dissolves in water may also be referred to as soap. Soaps are manufactured for a number of uses, including bathing, medicinal, and cleansing.[13] Because of the hydrocarbon chain's propensity for oil and grease and the carboxylic group's love for water, soap is often used in conjunction with water for cleaning.[14]



Figure. 1 Soap

1.6 Skin

It is crucial that all medical practitioners understand the fundamental anatomy and physiology of the human skin. An alternative term for skin is a cutaneous membrane. Adults' skin has a surface area of around 2.2 m^2. Both kinds of skin exist: the hair-bearing skin that covers a large portion of the body and the hairless skin found on the palms of the hands and, therefore, the feet. In addition to providing some defense against infections, the skin is the area of the body most exposed to sunlight and environmental contaminants.[15]

The skin is composed of 3 layers: the epidermis is the outermost layer and is composed of keratinocytes or skin cells that form the “bricks” of our skin’s barrier. The functions of the epidermis are protection from environmental insults (like ultraviolet light and toxins), prevention of dryness, and immune surveillance. The base of the epidermis is called the basal layer—it contains the cells that replicate in order to replace the epidermis every month. Mixed in between keratinocytes of the epidermis are pigment cells, called melanocytes that give skin its characteristic color. These cells become activated with ultraviolet exposure found in sunlight. The result of this activation is twofold—1) melanocytes produce more melanosomes, envelopes that contain brown melanin pigment, and 2) the increased transfer of these melanosomes to adjacent skin cells. The result is freckling or sunspots that can significantly impact appearance.[16]

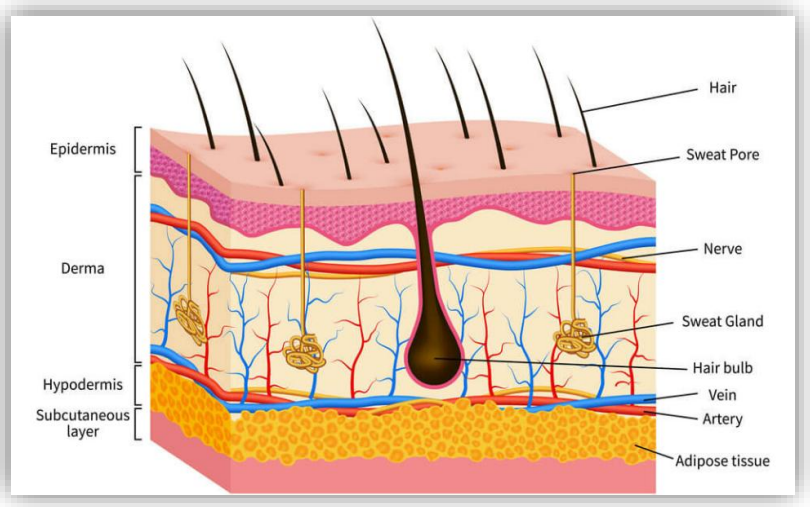


Figure. 2 Anatomy of skin

Beneath the epidermis is the dermis, composed mostly of collagen but also adjunctive structures like hair follicles and sweat glands. Sebaceous glands are found next to hair follicles and produce sebum, a combination of natural lipids that coat the skin's surface and provide a protective nourishing role. Sweat glands function to help regulate temperature through evaporation and cooling. Their ducts pass through the dermis and epidermis to empty directly onto the skin's surface. The dermis also contains vital blood vessels and nerves that traverse the collagen network there. Within the dermis also lies a protein, elastin that provides cutaneous elasticity and fibroblasts, the cells that produce more collagen. The function of the dermis is temperature regulation through the secretion of sweat to the skin's surface and the regulation of blood flow to the area. The dermis also provides mechanical protection for the adnexal structures discussed above.[17]

2. Need to Work

- Herbal soap is a pharmaceutical or medication that contains antibacterial and antifungal ingredients.
- Herbal soaps are made with natural ingredients to minimize side effects, as chemicals can cause them.
- Herbal soaps are made with natural ingredients because they are mild and gentle on the skin. Formulating herbal soap as it is necessary since it is
- Free of harmful chemicals;
- Has a synthetic fragrance;
- Contains artificial additives.

3. Material and Method for Neem and Tulsi Soap:

3.1 Neem:

- **Family: -** Meliaceae
- **Biological Source Active: -** Azadirachta Indica
- **Constituents: -** Azadirachta, Nimbin, Nimbidin
- **Pats Use: -** Leaves, Seed, Flower, Bark
- **Uses: -** Moisturizing, Cooling,
- **Properties: -** Antibacterial. Anti-Septic
- **Other Uses: -** Insecticide, Antifeedant.[18]



Figure. 3 Neem

3.2 Importance Neem

- Some of its health restoring benefits Effective in skin infection, and pimples.
- Immunity booster, Anti-obesity, Blood purifier for beautiful and healthy skin, Anti diabetic, Anti-viral, Dispels intestinal worms and parasites, Malaria, Piles, Hair disorder and Oral disorders.
- Neem is rich in fatty acids, including oleic, stearic, Palmitic, and linoleic acids.
- Neem is used to treat psoriasis and eczema.
- Neem has been used to treat acne, reduce blemishes, and improve skin elasticity.
- Leaf extract accelerates wound healing through an increased inflammatory response and the formation of new blood vessels.[19]

3.3 Chemical Constituents of Neem are:

Flavonoids, Alkaloids, Azadirone, Nimbin, Nimbidin, Terpenoids Steroids, Margosicacid, Vanilic acid, Glycosides, β-sitosterol, Nimbectin, Kaempeerol, Quercursert [20]

4. Tulsi

- **Botanical Name: -** Ocimum Tenuiflorum
- **Common Name: -** Holy Basil.
- **Chemical Constituents: -** Eugenol Germacrceterpen
- **Part Typically Used: -** Leaves
- **Colour: -** Green
- **Properties: -** Antifungal, Antibacterial, Antiseptic.[21]



Figure. 4 Tulsi

4.1 Importance Tulsi

- Owing to its healing, antibacterial, antifungal, and anti-inflammatory properties
- Tulsi benefits the skin by preventing blackheads and acne and relieving skin infections
- Rich in vitamin K and antioxidants.
- Tulsi benefits hair by stimulating blood circulation and promoting hair growth, among other things.
- Tulsi has skin and hair benefits. It contains camphene, which works as a natural to near to remove excess oil in the skin.
- Tulsi neutralizes free radicals and rejuvenates the skin, reviving the youthful glow.[22]

4.2 Chemical Constituents of Tulsi are:

Oleanolic acid, Ursolic acid, Rosmarinic acid, Eugenol, Carvacrol, linalool, β-Caryophyllene, Vitamin A. [22]



Figure. 5 Aloe Vera

5. Aloe Vera gel

- **Family: -** Asphodelaceae
- **Biological Source: -** Dried Latex of Leaves of It
- **Constituents: -** Amylase, Monosaccharide
- **Part Used: -** Green Part of The Leaf
- **Properties: -** Antioxidant, Antidiabetics, Antiaging.[23]

5.1 Importance Aloe Vera gel

- Hydrate dry skin
- Soothe irritation, sunburn, or inflammation
- Heal minor cuts, acne, and rashes
- Provide a cooling effect
- Make the soap gentle and suitable for sensitive skin.[24]

6. Almond oil

7. Family: - Rosaceae

8. • Biological Source Active: - dried kernels of the seeds of Prunus Amygdalus

9. • Constituents: - Fixed oil (mainly Oleic acid and Linoleic acid) Vitamin E (Tocopherol)

10. • Properties: - Emollient, Anti-inflammatory, Antioxidant

11. • Other Uses: - Aromatherapy and essential oil blends.[25]



Figure. 6 Almond oil

6.1 Importance Almond oil

- Almond oil is rich in Vitamin E and fatty acids, making it excellent for moisturizing, softening, and improving skin texture.
- It helps in treating dry skin, sunburn, dark circles, and stretch marks
- Acts as a mild natural laxative. Also used to soothe irritated skin and reduce inflammation.
- Widely used in lotions, creams, massage oils, lip balms, and makeup removers due to its emollient and soothing effects.

6.2 Chemical Constituents of Almond oil are:

Fatty Acids (Main Constituents), Oleic acid, Linoleic acid, Palmitic acid, Stearic acid Myristic acid Vitamin E, Vitamin A.[25]

12. Glycerine soap base



Figure. 7 Glycerine soap base

Glycerine soap base is a transparent or translucent soap base made primarily from glycerin, a natural humectant that attracts moisture to the skin. It's commonly used in melt and pour soap making.[26]

13. Rose Water

- **Family: -** Rosaceae Family
- **Biological Source: -** Rosa Damascena
- **Constituents: -** Phenethyl Alcohol, Geraniol, Beta-Citronellol
- **Parts Used: -** Rose Petal
- **Properties: -** Antibacterial, Anti-Inflammatory. [27]

8.1 Importance Rose water

- Rose water is widely recognized for its medicinal, cosmetic, and aromatic uses. It is rich in antioxidants and possesses anti-inflammatory, antibacterial, and hydrating properties.
- Soothing irritated skin and reducing redness.
- Acting as a natural toner and refresher.
- Used in aromatherapy for stress relief due to its calming scent. [28]

8.2 Chemical Constituents of Rose Water are:

Citronellol, Geraniol, Phenyl ethyl alcohol, Eugenol, Linalool, Nerol, Citral. [28]

14. Lavender essential oil



Figure. 8 Lavender essential oil

- **Family: -** Lamiaceae
- **Biological Source Active: -** flowering tops of Lavandula angustifolia
- **Constituents: -** Linalool, Linalyl acetate, Camphor, Geraniol
- **Pats Use: -** Flowering tops
- **Uses: -** Aromatherapy, Skincare, Pain relief
- **Properties: -** Antiseptic, Anti-inflammatory, Analgesic
- **Other Uses: -** Perfume and cosmetics industry.[29]

9.1 Importance Rose water

- Acts as a natural antiseptic and anti-inflammatory agent.
- Aids in healing acne, eczema, minor burns, and insect bites.
- Encourages hair growth and scalp health when massaged into the scalp.[30]

15. Soap-safe green pigments

Soap-safe green pigments are colorants that are non-toxic, skin-safe, and stable when used in soap-making processes like melt and pour, cold process, or hot process. These pigments give green color to soap without causing skin irritation, color bleeding, or fading.[31]

Formulation Profile of Herbal Neem and Tulsi Soap:

Table No 1. Formulation Profile of Herbal Neem and Tulsi Soap:

Sr. No.	Ingredients	Quantity	Class
1)	Neem Powder	8 gm	Antibacterial. Anti-Septic
2)	Tulsi Powder	8 gm	Antioxidant, Antiaging
3)	Aloe Vera gel	10 gm	Moisturizing agent & Anti-dandruff
4)	Almond oil	3 ml	Vitamin source
5)	Glycerine soap base	55gm	Soap base
6)	Rose water	5 ml	Reduce skin redness
7)	Soap-safe green pigments	1gm	colorants
8)	Lavender essential oil	Q.S.	Perfuming agent

16. Step-by-Step Procedure:

1) Prepare the Glycerine Soap Base:

Cut 75 gm of glycerine soap base into small chunks for easy melting.

2) Melt the Soap Base:

Using a double boiler or microwave, melt the soap base slowly. Stir occasionally to ensure it melts evenly without burning.

3) Mix the Active Ingredients:

Once the soap base is fully melted, add 10 gm of Neem powder and 10 gm of Tulsi powder.

Stir well to ensure the powders are completely dissolved and mixed.

4) Add Aloe Vera Gel and Almond Oil:

Stir in 12 gm of aloe vera gel and 3 ml of almond oil. This will help moisturize the skin and provide nourishment.

5) Add Rose Water:

Add 5 ml of rose water to the mixture.

Stir to combine thoroughly, which will help reduce redness and soothe the skin.

6) Incorporate the Green Pigments:

Add 1 gm of soap-safe green pigment to give the soap a natural green color. Mix well to achieve a uniform color.

7) Perfume the Soap:

Add lavender essential oil (Q.S. – quantity sufficient) to the mixture for fragrance. Typically, 10-15 drops of essential oil are enough.

8) Pour the Mixture into Molds:

Pour the soap mixture into molds while it is still in liquid form. Make sure the molds are clean and dry before pouring.

9) Let the Soap Set:

Allow the soap to cool and set at room temperature for 2-4 hours, or place it in the refrigerator for faster setting.

10) Unmold the Soap:

Once the soap has fully set, carefully remove it from the molds.

11) Cut and Store the Soap:

If needed, cut the soap into bars. Store the soap in a dry, cool place.

17. Evaluation Parameters

The formulated herbal soap underwent a series of evaluations to assess its quality, efficacy, and safety. Organoleptic properties including color, odor, and appearance were assessed through visual and olfactory examination. Physical parameters such as foam retention, foamability, and foam stability were evaluated using standardized methods.

12.1 Organoleptic evaluation:

- **Color: -** Light to deep green
- **Odor: -** Herbal, fresh scent with notes of neem, Tulsi, and lavender
- **Appearance: -** Smooth surface, solid form, uniform texture
- **Clarity: -** Opaque due to herbal powders and clay.
- **Weight determination:** Collected 10 soaps to calculate the individual weight finally calculated the average weight of Herbal soap.

12.2 Physical evaluation

The herbal soap formulated was also evaluated for the following properties:

12.3 pH Measurement

Dissolve 1 gram of soap in 100 mL of distilled water in a clean beaker. Stir well to form a uniform solution. Calibrate the pH meter using standard buffer solutions (pH 4.0, 7.0, and 10.0), then insert the electrode into the soap solution. Allow the reading to stabilize and record the pH value. After use, rinse the electrode with distilled water. Alternatively, pH indicator paper can be used rough estimate by comparing the color change with a pH chart.[32]

12.4 Washing capability:

The soap formulation will be applied to the skin and its cleansing effectiveness will be assessed manually after rinsing with water.[33]

12.5 Skin Irritancy Test:

The skin irritancy, test soap is applied to 2 cm × 2 cm (i.e., 4 cm^2) area of skin is used. Clean, hairless skin (like the forearm) and covered with a cotton pad for 4–24 hours. After removal and rinsing, the area is checked at 1, 24, and 48 hours for redness, swelling, or itching. Reactions are graded from 0 (no irritation) to 4 (severe). A score of 0–1 indicates the soap is safe for skin use. [34]

12.6 Moisture content:

A soap sample weighs 10 gm and is recorded as the weight of the wet sample (the beginning weight). It is then placed in an oven at 115 degrees Celsius for some time. after cooling weigh again (dry weight). [35]

% weight = a-b/ b × 100 A= initial weight b= dry weight

12.7 Foam retention:

Foaming ability and foam stability: Cylinder shake method was used to test for the foaming ability. 50 ml of the 1% formulated products solution was placed into a 250 ml graduated cylinder, covered with one hand and shaken for 10 times. After 1 min of shaking, the total volume of the foam content was recorded. Foam stability was valued by recording the foam volume after 1 min and 4 min of shake test.

12.8 Foam height

One gram of soap was dissolved in 50 ml of distilled water in a graduated cylinder. The solution was shaken vigorously for 2–3 minutes and then allowed to stand undisturbed for 10 minutes. The height of the resulting foam was measured. This procedure was repeated three times, and the average foam height was calculated.[3]



Figure. 9 Foam height

12.9 Solubility:

Approximately 1 gram of the soap was placed into a beaker containing 50 ml of distilled water at room temperature. The mixture was stirred for 2–3 minutes using a glass rod, and observations were made regarding the soap's ability to dissolve. The same procedure was repeated using warm water (around 45–50°C) to compare solubility at different temperatures. The test was conducted three times, and the average results were recorded based on the time taken to dissolve and the clarity of the solution.

12.10 Stability Testing

Accelerated stability testing was conducted by storing samples at 40°C ± 2°C and 75% ± 5% relative humidity for a period of 3 months. Organoleptic properties, pH, and physical characteristics were evaluated at 0, 1, 2, and 3 months to assess the soap's stability over time and under stress conditions.

18. Result of Herbal Neem and Tulsi Soap:

Table No. 2 Result of Herbal Neemcoal Soap

Sr. No.	Parameters	Formulation
1)	Color	Light to deep green
2)	Odor	Herbal, fresh scent with notes of neem, Tulsi, and lavender
3)	Appearance	Ovule
4)	Clarity	Opaque due to herbal powders and clay
5)	Weight determination:	90 gm
6)	pH Measurement	8.2
7)	Moisture content	10-12%
8)	Foam retention:	5 minutes
9)	Foam height	150-200 mm
10)	Solubility	Satisfactory water solubility
12)	Stability Testing	Stable in room temp.

19. Conclusion

The natural ingredients found in herbal soap have antibacterial, antifungal, and anti-inflammatory properties, which make the skin effective in various kinds of skin conditions like acne, pimples, eczema, and psoriasis. In conclusion, this study demonstrates the successful formulation of an herbal soap incorporating Azadirachta indica (neem) and Ocimum tenuiflorum (tulsi) with favorable characteristics for skin care. The soap's performance in various tests suggests its potential as an effective, natural alternative to conventional soaps, offering both cleansing and potential therapeutic benefits. Further clinical studies are warranted to fully elucidate the long-term effects and specific skin health benefits of regular use of this herbal soap formulation. It does not irritate the skin, as was determined by using these soaps on a few volunteers; hence, it is proved that the soap does not irritate the skin.

Furthermore, the prepared soap was standardized by evaluating various physicochemical properties such as pH, appearance, and odor, in which it exhibited a satisfactory effect.

20. Conflict of Interests:

- The authors declare that they have no known competing financial interests or personal relationship that could have appeared to influence the work reported in this paper.

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