

Herba-Pure Herbal Antimicrobial Soap for Skin Health

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Abstract:

Herbal soaps are gaining prominence as natural skincare solutions, offering therapeutic benefits and aligning with environmentally sustainable practices. This study explores the formulation and evaluation of an antimicrobial herbal soap utilizing plant-based ingredients like neem (*Azadirachta indica*), tulsi (*Ocimum sanctum*), and turmeric (*Curcuma longa*), recognized for their antibacterial, anti-inflammatory, and skin-healing properties. The active herbal extracts were obtained via Soxhlet extraction, ensuring optimal bioactive compound recovery. A carefully designed formulation incorporating natural oils, humectants, and stabilizers facilitated the production of a safe, effective, and skin-friendly soap.

The formulated soap was subjected to physicochemical and organoleptic evaluations, including pH testing, foam retention, dirt dispersion, and skin irritation assessment. Comparative analysis with commercial soaps highlighted its superior antimicrobial efficacy, enhanced moisture retention, and absence of synthetic chemicals. Neem, tulsi, and turmeric contributed significantly to antibacterial activity against pathogens like *Staphylococcus aureus* and *Escherichia coli*.

This research underscores the potential of herbal soaps as eco-friendly alternatives to conventional products, offering therapeutic benefits while ensuring skin health and environmental sustainability. The findings advocate for wider use of herbal formulations in personal care products.

Keywords: Herbal soap, antimicrobial, neem, tulsi, turmeric.

1. Introduction

Herbal soap is an all-natural skin care product made from plants-herbs, essential oils, botanical extracts, etc. This type of soap has gained popularity due to its numerous benefits for skin health, environmental sustainability, and alignment with holistic wellness practices.

Herbal soaps are made from natural ingredients that have therapeutic qualities, unlike regular soaps that have synthetic chemicals and artificial scents, and therefore can be used on any type of skin including sensitive skin.

Benefits of Herbal Soap

- **Natural Ingredients:** They are made with olive oil, coconut oil, shea butter, and other herbs that are very soothing and healing to the skin. These elements contain many nutrients, vitamins, and antioxidants that all promote skin health (1,3).
 - **Antimicrobial and Anti-inflammatory Effects:** There are herbal ingredients like tea tree oil, neem, turmeric that have antibacterial/ anti-inflammatory properties. Because of these properties, herbal soaps are very good at healing simple skin ailments such as acne, eczema, and psoriasis (2,3).
 - **Moisturizing Properties:** A lot of herbal soaps have natural oils in them which keep the skin moisturized and does not allow it to dry out and lose its softness. Especially with ingredients like aloe vera and cocoa butter, they're really good at creating a barrier to prevent moisture loss (1,4).
 - **Aromatherapy Benefits:** Herbal soaps have essential oils in them that not only smell good, but also provide aromatherapy. Examples include lavender oil, which is a relaxant, and peppermint oil, which is a stimulant (1,3).
 - **Environmental Sustainability:** Many herbal soaps are biodegradable and lack harsh chemicals, which should appeal to the ecologically minded customer in search of sustainable personal care products.
- Natural elements found in herbal soap, such as plant extracts, essential oils, and herbs, provide number of benefits over synthetic soaps.
 - Mild on the skin: Herbal soaps are often kinder and less irritating than synthetic soap, so they are appropriate for skin types that are more sensitive.
 - Natural ingredient: They frequently include skin-nourishing and hydrating natural ingredients including shea butter, coconut oil, olive oil, and aloe vera.
 - Natural antibacterial qualities: Certain herbal substances, like neem and tea tree oil, have antibacterial characteristics that help to clean and protect the skin from infections.
 - Chemical-Free: The absence of harsh chemicals, artificial perfumes, and synthetic colors in herbal soaps lowers the possibility of allergic responses and skin irritation.
 - Environmentally Friendly: Compared to synthetic soaps, the herbal ones are typically biodegradable and environmentally friendly as they are made with natural ingredients.

- Aromatherapy advantages: By combining essential oils with herbal soaps, aromatherapy advantages including stress alleviation, mood enhancement, and relaxation can be experienced (1-4).

2. Objective of research

Herbal antimicrobial soap is a field of study that investigates creating formulas that incorporate natural plant extracts that have been shown to have antibacterial and antifungal properties. This approach aims to create effective alternatives to conventional soaps, which often contain synthetic chemicals that may irritate the skin. The objectives are following:

Objectives of the Research

- To formulate an herbal soap using medicinal plants with proven therapeutic properties.
- To evaluate the antibacterial activity of the formulated soap against common skin bacteria such as *Staphylococcus aureus* and *Escherichia coli*.
- To analyze the physicochemical properties of the herbal soap to ensure safety, efficacy, and suitability for daily use.
- To promote the use of natural ingredients in skincare products, emphasizing their minimal side effects compared to commercial soaps.
- To demonstrate the benefits of herbal soap in enhancing skin health and hygiene.

3. Material

To produce the herbal soap, natural ingredients were carefully selected based on their well-recognized skincare properties. Each ingredient was chosen for its specific role in ensuring the soap's efficacy, safety, and overall benefits for skin health. A comprehensive list of ingredients, along with their quantities and purposes, is provided below table 1:

Table 1: Table of required ingredients

Ingredient	Quantity	Purpose
Sodium Hydroxide	20–30 gm	Saponification agent
Stearic Acid	5–10 gm	Hardening agent
Olive Oil	60 ml	Base oil for moisturizing properties
Glycerine	10–20 ml	Humectant for skin hydration
Propylene Glycol	5–10 ml	Moisturizer and solvent
Sodium Stearate	5–10 gm	Emulsifier and stabilizer
Citric Acid	1–2 gm	pH adjuster and preservative
Neem Extract	5–10 gm	Antimicrobial and skin-soothing properties
Tulsi Extract	5–10 gm	Antioxidant and anti-inflammatory properties
Haldi (Turmeric) Extract	5–10 gm	Antimicrobial and skin-brightening agent
Ethanol	100–250 ml	Solvent for extraction

Distilled Water	100 ml	Solvent for lye solution
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Comparative Analysis: The efficacy of the formulated herbal soap was compared to that of a commercially available product. Parameters such as stability, pH control, and safety were meticulously studied to determine the herbal soap's performance and advantages.

Data Collection: Data were collected through detailed observations and measurements of various soap parameters, enabling a quantitative comparison between the herbal and commercial soaps. This systematic approach provided valuable insights into the effectiveness, safety, and potential of the herbal formulation.

3.1 Plant profile

Neem (*Azadirachta indica*)



Figure 1: Neem leaves

Neem is widely known to have a broad range of medicinal properties and is therefore a very important constituent in herbal preparations. Its importance in herbal soap is as follows

- **Anti-inflammatory Effects:** Neem-derived anti-inflammatory constituents provide soothing effect for inflamed skin (lessening redness and swelling) that is useful for sensitive skin conditions (5).
- **Antioxidant Activity:** Neem contains antioxidant molecules that prevent the damaging effects of oxidative stress induced by environmental factors, and hence results in healthier skin (6).
- **Skin Healing:** The presence of compounds like nimbidin contributes to wound healing and promotes skin regeneration and therefore neem is a useful constituent in skin care products intended to restore damaged skin (6).

Tulsi (*Ocimum tenuiflorum*)

Tulsi is not only venerated in traditional systems of medicine but also acknowledged for its multiple uses in application on the skin:



Figure 2: Tulsi leaves

- **Antiviral Properties:** Tulsi has shown some strong antiviral activities that can give skin protection against viral infections (5).
- **Skin Cleansing:** Tulsi functions as a natural skin cleanser that gets rid of impurities and sebum that could lead to breakouts acne and clean skin (5).
- **Anti-inflammatory Effects:** Like neem, tulsi also has anti-inflammatory effects, so it can soothe irritated skin and reduce redness (6).
- **Antioxidant Benefits:** Rich in antioxidants, tulsi helps combat free radicals, contributing to a more youthful appearance by reducing signs of aging (6).

Turmeric (*Curcuma longa*)



Figure 3: Curcuma Longa

Turmeric is praised for its deep color and a range of health effects. Its role in herbal soap includes:

- **Anti-inflammatory Properties:** Curcumin, the active ingredient in turmeric, is recognized for its strong anti-inflammatory activity. This can be used to treat skin conditions such as acne and eczema by inflammatory reduction (6).
- **Antimicrobial Activity:** Turmeric possesses antibacterial activity capable of preventing infections and improving skin condition. It is particularly effective against a variety of pathogens (6).

- Skin Brightening: Turmeric is often used for its skin-brightening effects. It evens out skin tone and minimizes the effect of dark spots or marks (6).
- Wound Healing: The traditional curative effect of turmeric can speed up its healing of small skin wounds and injuries, thereby bestowing beneficial qualities to herbal soaps used for wound healing (5,6).

4. Formulation of herbal soap

- Firstly, collect the leaves of neem, tulsi and washed them.
- Dried them in hot air oven.

Tulsi (*Ocimum sanctum*): Dry at 45°C to 65°C, with the optimal temperature being 45°C for retention of flavour and aroma.

Neem (*Azadirachta indica*): The ideal temperature for drying is 45°C to 70°C. At 70°C, the drying time is reduced substantially but may affect the bioactive compounds.

Haldi (*Curcuma longa*): Best dried at around 70°C to ensure quick moisture removal while maintaining color and curcumin content.



Figure 4: Drying and extraction of crude herbs Neem, Tulsi, Turmeric

- Now start the extraction of neem, tulsi, turmeric. Extraction of these ingredient is completed in ethanol with Soxhlet apparatus technique.

Soxhlet extraction is one of the laboratory techniques used for the extraction of compounds from solid materials, especially when their solubility in the solvent is low.

A thimble within the Soxhlet extractor is holding a solid sample, while a round-bottom flask contains the solvent.

The solvent is heated to produce vapor, which travels to a condenser, cools, and drips onto the sample.

The solvent, having picked up the dissolved compounds, siphons back into the flask, and this process repeats multiple times for efficient extraction



Figure 5: Extraction of Turmeric, Neem, Tulsi

- Now heat the extract until we receive solid extract.



Figure 6: Heating of extract of Turmeric, Neem, Tulsi

Soap formulation process (9,10)

- In a non-metallic container, carefully dissolve sodium hydroxide in distilled water (approximately 100 ml) to create a lye solution. Stir until fully dissolved. Caution: Handle sodium hydroxide with care as it is caustic.
- In a separate beaker, measure out the olive oil and heat it gently in a water bath until it reaches about 60°C.
- Slowly add the lye solution to the heated olive oil while stirring continuously. This initiates the saponification process. Continue stirring until the mixture thickens to a trace consistency
- Incorporate stearic acid into the mixture to enhance hardness. Stir until completely melted and incorporated.



Figure 7: Final processing of soap formulation

- Add glycerine and propylene glycol to the mixture, stirring well to ensure even distribution.
- Mix in the neem extract, tulsi extract, and haldi extract. Ensure that all herbal components are well blended into the soap base.
- Gradually add citric acid to balance the pH of the soap mixture. Check pH with litmus paper; aim for a pH between 7-9 for skin safety.
- Finally, mix in sodium stearate as an emulsifier to stabilize the soap mixture.
- Pour the soap mixture into moulds and allow it to cool and solidify at room temperature for at least 24 hours.
- After solidification, remove from moulds and let cure for an additional 4-6 weeks in a cool, dry place to allow excess moisture to evaporate and improve texture (9,10).

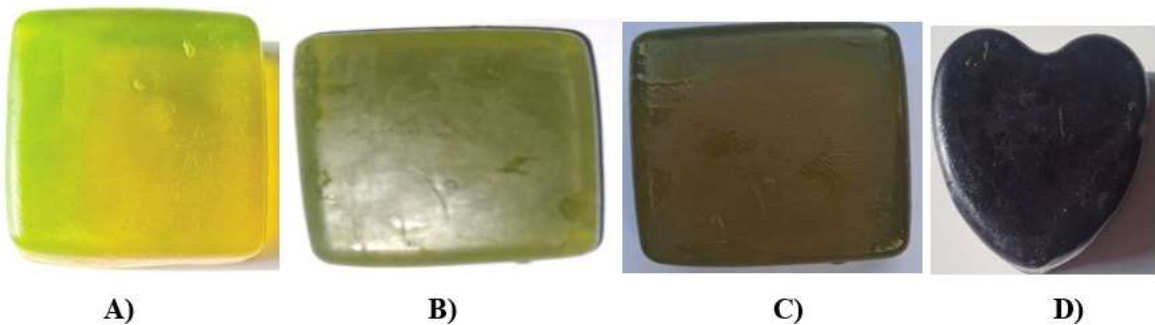


Figure 8: A, B, C, D respectively: A: Soap of Tulsi, B: Soap of Tulsi &Neem, C&D: Soap of Tulsi and Neem and Haldi

5. Quality evaluation parameters

The formulated herbal soap were evaluated for color, odour, clarity test, pH test, dirt dispersion, foaming height, foaming ability, skin irritation test, dissolving test, wetting time test, using recommended procedure (11).

5.1 Organoleptic evaluation

- Colour and clarity characterization: The herbal soap was visualized using a white background for the determination of the colour and see the clarity of the herbal soap. Colour of soap is opaque brown.
- Odour: The odours of herbal soap were evaluated by applying preparation on hand and feel the fragrance of perfume. Perfume of soap (neem, tulsi, turmeric) is herbal and refreshing, with a crisp quality and sweet, spicy, and warm scent.
- Shape: The shape of the herbal soap was round and determined by the naked eyes.

5.2 Physico-chemical evaluation

- pH: The pH of herbal soap should ideally be slightly acidic, typically ranging from 8 to 10 . Sing 10 ml of distilled water and stirring, 2 g of the finished soap was dissolved, yielding a dissolved sample. A pH meter was used to measure the pH. pH was found to be 8.5 .
- Foam retention: After making 25 milliliters of the 1% soap solution and pouring it into a 100-milliliter measuring cylinder, shake it ten times. For four to five minutes, the volume of foam was measured every minute.



➤ **Figure 9: Foam retention**

- Foam height: A sample of soap weighing 0.5 grams was obtained and dissolved in 25 milliliters of distilled water. After that, put it into a 100 ml measuring cylinder and added water to get the volume up to 50 ml. After giving 25 strokes, the aqueous volume was measured up to 50 ml, and the foam height was measured above the aqueous volume.



Figure 10: Foam height

- Alcohol insoluble matter: 5 g of soap was introduced into a conical flask and 50 ml. of warm ethanol was added to dissolve it. The liquid was filtered through a tarred paper filter and heated to 105 °C. for an hour. It was no longer weighted filter paper.



Figure 11: Alcohol insoluble matter

5.3 Skin irritation test

Prepared herbal soap was applied on the skin for 10 minutes and observed the irritation feeling. No irritation sensation was observed and soap was considered as a, non-irritation soap.

5.4 Foaming Ability:

Test how well it lathers when used. It measures the ability of soap to form foam.



Figure 12: Foaming ability of soap

5.5 Stability Test:

Short term stability studies was done in the period of 8 days for the formulations. The sample was stored in different storage temperature i.e., room temperature 37 C and at refrigerator 2 to 80 C. Sample was withdrawn on interval and analysed for visual appearance, clarity, pH and drug content.

6. Comparative study

The comparative study of herbal soaps focuses on a newly formulated soap that is made from neem, tulsi, and haldi, contrasting the properties of this soap with those of commercially available herbal soaps.

Formulated Soap: Uses natural extracts from neem, tulsi, and haldi, which are known for their antimicrobial and anti-inflammatory benefits.

- Commercial Soaps: These often contain similar herbal extracts but may include synthetic additives for preservation and fragrance.

Antimicrobial efficacy evaluation:

- The antimicrobial study to evaluate the efficacy of the herbal soap on bacteria begins by preparing a bacterial suspension of target organisms, such as *Escherichia coli* (E. coli) and *Staphylococcus aureus* (S. aureus). These bacterial strains are cultured on nutrient agar plates and incubated at 37°C for 24 hours. After confirming bacterial growth, a standardized inoculum of approximately $1-2 \times 10^8$ CFU/mL is prepared. The herbal soap is then dissolved in sterile distilled water to create a solution of a defined concentration, and the soap's antimicrobial activity is tested using the well diffusion method. Petri dishes containing agar plates are inoculated with the bacterial suspension, and wells are created using a sterile cork borer. The soap solution is added to these wells, and the plates are incubated for 24–48 hours. After incubation,

the zone of inhibition, which indicates the effectiveness of the soap in preventing bacterial growth, is measured in millimeters.

- For the soap's efficacy evaluation, the results are compared to a positive control (commercial antibacterial soap) and a negative control (sterile water or no soap) to determine the antibacterial activity. The reduction in bacterial growth is quantified by measuring the diameter of the zone of inhibition around the wells. Additionally, bacterial colony counts are taken from the surface of the agar to assess the degree of bacterial reduction after soap treatment. The soap's effectiveness is rated based on the size of the inhibition zone and the reduction in colony-forming units (CFUs).

Physicochemical Properties:

pH of the formulated soap is about 8.5, which is acceptable for skin use, while the commercial soaps have a high pH.

- Foaming property is less of marketed soap as compare to herbal soap, hence good cleansing.



Figure 14: Forming activity of marketed soap

- Consumer Appeal:
Herbal soaps are preferred more for their natural content and absence of harsh chemicals. They are preferred by healthy - conscious consumers.
- Foaming height
Foaming height of marketed soap is less as compare to herbal soap.



Figure 15: Foam height of marketed soap

- Essential oils benefit aromatherapy, making the user experience better in both types.

7. Results

The formulated herbal soap exhibited: The formulated herbal soap exhibited:

A pH level within the acceptable range. Good foam stability indicating effective cleansing properties. No reported skin irritation was observed.

Table 1: Results of herbal formulation

S.No.	Parameter	Standard Value	Observed Value	Remarks
1	Colour, Odour, Appearance	Brown, Aromatic, Smooth Texture	Brown, Aromatic, Smooth Texture	Observed value meets the standard.
2	pH	8	8.5	Within the standard range.
3	Foam Height	1.3-22 cm	7 cm	Falls within the acceptable range.
4	TFM (Total Fatty Matter)	36.80%	0.03%	Significantly lower than the standard, indicating a potential issue.
5	Alcohol Soluble Matter	17.60%	25%	Exceeds the standard value, suggesting a possible formulation deviation or measurement anomaly.
6	Foam Retention (5 min)	Over 4 minutes	Foam stable over 4 minutes	Meets the standard.

8. Discussion and conclusion

The inclusion of extracts of neem, tulsi, and haldi not only improves the therapeutic benefits of the soap, but also offers a natural replacement to the synthetic components often added to commercial soaps. The findings are consistent with literature reports that describe the antibacterial activity of these herbs (10,11).

The present study has successfully synthesized a herbal soap that incorporates the traditional ingredients in a modern formulation approach. The finished goods not only satisfy the visual and functional needs, but also provide important health benefits in that the finished goods are based on natural material. Additional investigation might involve differences in formulation or other herbal extracts to improve the efficacy.

9. References:

1. Acta Scientific. Formulation and evaluation of herbal soap using natural ingredients. *Acta Scientific Nutritional Health* . 2024;7(3):1292 [cited 2024 Nov 21]. <https://www.actascientific.com/ASNH/pdf/ASNH-07-1292.pdf>
2. GSC Biological and Pharmaceutical Sciences. Herbal soap formulation and testing. *GSC Biol Pharm Sci* . 2024;15(1):151 [cited 2024 Nov 21]. <https://gsconlinepress.com/journals/gscbps/sites/default/files/GSCBPS-2024-0151.pdf>
3. Journal of Emerging Technologies and Innovative Research. Analysis of herbal soap. *JETIR* . 2024;11(6):A64 [cited 2024 Nov 21]. <https://www.jetir.org/papers/JETIR2406A64.pdf>
4. Journal of Emerging Technologies and Innovative Research. Comparative analysis of herbal and commercial soap. *JETIR*. 2024;11(4):F72 [cited 2024 Nov 21]. <https://www.jetir.org/papers/JETIR2404F72.pdf>
5. International Journal of Creative Research Thoughts. Development of herbal soaps. *IJCRT* . 2024;12(6):211 [cited 2024 Nov 21]. <https://www.ijcrt.org/papers/IJCRT2406211.pdf>
6. Meena CM, Rahman SBA, Abd El-Malek HM. Herbal soap formulation and stability evaluation. *Int J Creat Res Thoughts*. 2024;10(3):4623 [cited 2024 Nov 21]. <file:///C:/Users/CHINTU%20MEENA/Downloads/1031-Article%20Text-4623-1-10-20231201.pdf>
7. Acta Scientific. Evaluation of *Ficus religiosa* herbal soap. *Acta Scientific Pharmaceutical Sciences* . 2024;7(9):947 [cited 2024 Nov 21]. <https://actascientific.com/ASPS/pdf/ASPS-07-0947.pdf>
8. International Journal of Pharmaceutical Sciences. Formulation and evaluation of *Ficus religiosa* herbal soap. *Int J Pharm Sci*. 2024;6(4):123–130 [cited 2024 Nov 21]. <https://www.ijpsjournal.com/article/Formulation+And+Evaluation+Of+Ficus+Religiosa+Herbal+Soap>

9. Journal of Global Pharmaceutical Research. Herbal soap development and evaluation. *J Glob Pharm Res.* 2024;71(2):19–27 [cited 2024 Nov 21].
<https://globalresearchonline.net/journalcontents/v71-2/19.pdf>
10. Rahman SBA, Abd El-Malek HM, Ali MM, Moharram FAMH. Formulation and evaluation of herbal soaps. *Int J Pharm Sci Res.* 2016;8(5):1235–1243.
11. Meena CM, Rahman SBA, Abd El-Malek HM. Formulation and evaluation of *Ficus religiosa* herbal soap. *Int J Pharm Sci Res.* 2024;10(3):4625 [cited 2024 Nov 21].
[file:///C:/Users/CHINTU%20MEENA/AppData/Local/Microsoft/Windows/INetCache/IE/GG5LQGWW/FormulationAndEvaluationOfFicusReligiosaHerbalSoap_2\[1\].pdf](file:///C:/Users/CHINTU%20MEENA/AppData/Local/Microsoft/Windows/INetCache/IE/GG5LQGWW/FormulationAndEvaluationOfFicusReligiosaHerbalSoap_2[1].pdf)