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Research Article

Formulation and Characterization of Polyherbal Soap Using Traditional Medicinal Plants

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ABSTRACT

The present study was aimed to formulate and evaluate a polyherbal soap using natural herbal ingredients possessing antimicrobial and skin-protective properties. The formulation was prepared using Neem (Azadirachta indica), Tulsi (Ocimum sanctum), Aloe vera (Aloe barbadensis), Ritha (Sapindus mukorossi), and Shikakai (Acacia concinna) along with coconut oil, almond oil, sodium hydroxide, and distilled water. Herbal extracts were obtained by the decoction method, while the soap base was prepared by the cold process method. The formulated soap was evaluated for various physicochemical parameters including colour, odour, pH, foam height, foam retention, skin irritation, moisture content, total fatty matter, and antimicrobial activity. The prepared soap showed a cream colour, pleasant odour, pH of 8.54, foam height of 6 cm, and good foam retention with no skin irritation. The total fatty matter content was found to be 71.4%, indicating good quality and moisturizing properties. Antimicrobial activity against Staphylococcus aureus demonstrated a zone of inhibition of 18 mm, confirming significant antibacterial potential. The results suggest that the formulated polyherbal soap is safe, effective, skin-friendly, and may serve as a natural alternative to synthetic soaps with added therapeutic benefits.

INTRODUCTION

The increasing demand for natural and sustainable personal care products has stimulated considerable interest in the development of herbal cosmetic formulations. Conventional soaps and synthetic cleansing products often contain synthetic surfactants, preservatives, fragrances, and other chemical additives that may disrupt the skin barrier, alter the normal skin microbiota, and cause irritation, dryness, or allergic reactions following prolonged use. Consequently, there is growing consumer preference for plant-based alternatives

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that provide effective cleansing while offering additional therapeutic benefits such as antimicrobial, antioxidant, anti-inflammatory, and moisturizing properties (1,2).

Medicinal plants have been widely utilized in traditional systems of medicine for centuries owing to their rich phytochemical composition and broad spectrum of biological activities. Among these, *Azadirachta indica* (Neem), *Ocimum sanctum* (*Ocimum tenuiflorum*, Tulsi), *Aloe barbadensis* (*Aloe vera*), *Sapindus mukorossi* (Ritha), and *Acacia concinna* (Shikakai) are well recognized for their dermatological applications. Neem possesses potent antibacterial, antifungal, and anti-inflammatory activities primarily attributed to bioactive constituents such as nimbidin, azadirachtin, and quercetin (1,3,4). Tulsi is a rich source of eugenol, ursolic acid, and rosmarinic acid, which exhibit antimicrobial, antioxidant, and wound-healing effects. Aloe vera gel contains polysaccharides, vitamins, amino acids, and phenolic compounds that promote skin hydration, tissue repair, and anti-inflammatory responses (4,5). Similarly, Ritha and Shikakai contain naturally occurring saponins that function as mild cleansing agents while minimizing irritation and preserving the skin's natural moisture (3,4).

Polyherbal formulations are increasingly preferred over single-herb preparations because the combination of multiple medicinal plants may produce synergistic pharmacological effects, resulting in enhanced efficacy and improved safety profiles. In topical formulations, combining herbs with complementary mechanisms of action can simultaneously provide cleansing, antimicrobial protection, moisturization, antioxidant defense, and skin conditioning. Such multifunctional formulations are particularly attractive for the development of herbal cosmetic products intended for routine skin care (6,7).

Despite the widespread availability of herbal soaps in the commercial market, many formulations lack comprehensive scientific evaluation regarding their physicochemical characteristics, quality attributes, safety, and antimicrobial performance. Furthermore, there remains a need to standardize formulations prepared from traditional medicinal plants using reproducible manufacturing methods and to evaluate their quality according to established pharmaceutical and cosmetic parameters(8,9).

Therefore, the present study was undertaken to formulate and characterize a polyherbal soap containing extracts of *Azadirachta indica*, *Ocimum sanctum*, *Aloe barbadensis*, *Sapindus mukorossi*, and *Acacia concinna* using the cold-process method. The developed formulation was evaluated for its physicochemical properties, including pH, foam characteristics, moisture content, total fatty matter, thermal stability, skin irritation potential, and antibacterial activity against *Staphylococcus aureus*. The findings of this study are expected to contribute to the development of a safe, effective, and environmentally friendly herbal cleansing product with potential applications in cosmetic and personal healthcare(10).

Figure 1: Polyherbal Soap

2. MATERIAL AND METHODS

2.1 Material

The polyherbal soap was made using certain medicinal plants like Neem (*Azadirachta indica*), Tulsi (*Ocimum sanctum*), Aloe vera (*Aloe barbadensis*), Ritha (*Sapindus mukorossi*), and Shikakai (*Acacia concinna*), along with coconut oil, almond oil, sodium hydroxide, and distilled water. The herbal parts were prepared by boiling them, called the decoction method. The soap base was made using a cold process called saponification. The herbal extracts and oils were mixed into the soap base, then poured into molds and left to cure. The soap was checked for physical and chemical properties such as color, smell, pH level, foam height, how long the foam lasts, moisture content, total fatty matter, how it handles heat, and if it irritates the skin. To check its ability to kill microorganisms, it was tested against Staphylococcus aureus using a method called the cup-plate or agar diffusion method, where they measured the area around the bacteria that was stopped from growing. All tests were done in a standard lab setup, and the results were compared with the standard quality standards for herbal soaps. (shows in table no. 1)

Table:1 Basic information of Herbs

Sr. No.	Name	Pharmacological activities or Uses	Images	References
1.	**Neem** Azadirachta indica (Plant), Meliaceae (family)	• Anthelmintic, Anti-Fungal • Anti-Diabetic • Anti-Bacterial • Anti-Viral • Contraceptive And Sedative		(11–14)
2.	**Ritha** Soap nut, Aritha (Plant), Sapindaceae (family)	• Antiprotozoal Activity • Anti-inflammatory Activity • Spermicidal Activity • Insecticidal Activity		(15–17)
3.	**Shikakai** Soap -pod, Acacia concinna (Plant), Leguminosae (family)	• Anti –bacterial • Anti- helminthic • Anti-fungal • antimicrobial		(18–20)
4.	**Aloe Vera** Aloe barbadensis (Plant), Asphodelaceae (family)	• Moisturizer • Treats Acne • Antiseptic • Wound Healing • Antibacterial		(21–24)
5.	**Coconut Oil** Cocus nucifera (Plant), Arecaceae (family)	• Eczema • Psoriasis, Reduces • Stretch Mark • Relief From Sunburn		(25–28)

6.	**Almond Oil** Cocus nucifera (Plant), Rosaceae (family)	• Antioxidant • Anti-Inflammatory • Anti-Microbial Activity		(29–32)
7.	**Tulsi** Ocimum sanctum (Plant), Lamiaceae (family)	• Antimicrobial activity • Anti-inflammatory activity • Antidiabetic activity • Anticancer activity • Antiulcer activity		(33–36)

2.2 Working formula of decoction

Sr. No.	Ingredients	Quantity (gm)
1	Neem Leaves	10
2	Aloe Vera Gel	10
3	Ritha	10
4	Shikakai	10
5	Tulsi	5

2.3 Working formula of soap base by cold process method

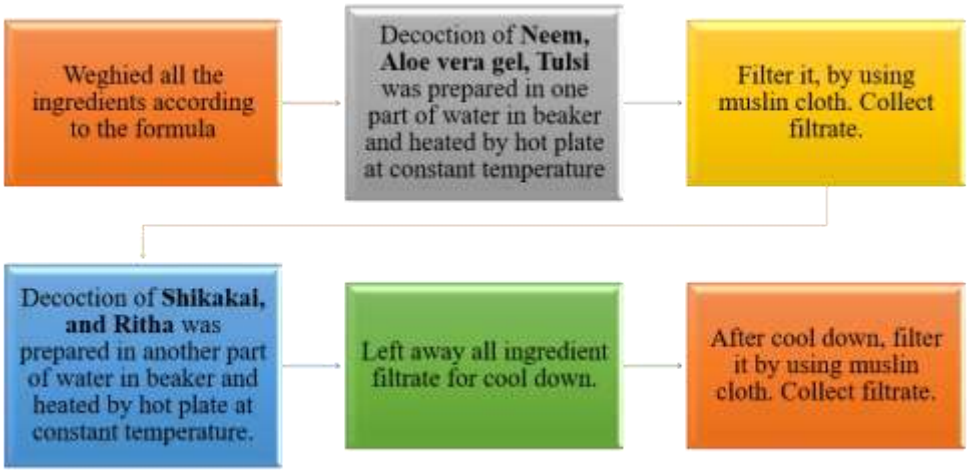
Sr. No.	Ingredients	Quantity (gm)	Use
1	Sodium Hydroxide	6.56	Lye
2	Coconut Oil	30	Anti-Ageing, Moisturizer
3	Distilled Water	15-20	Aqueous Vehicle

2.4 Working formula of polyherbal soap

Sr. No.	Ingredients	Quantity (ml)	Uses
1	Soap Base	35	Remove Dirt From Skin
2	Neem Leaves	1	Antibacterial
3	Aloe Vera Gel	1	Antioxidant
4	Ritha	1	Ditergent, Surfactant
5	Shikakai	1	Cleanser
6	Tulsi	1	Antiviral
7	Almomd Oil	1	Nourishing

2.5 Method of preparation of polyherbal soap

2.5.1 Decoction method



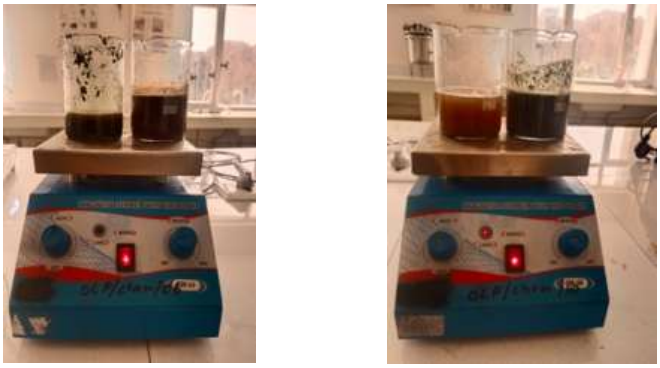


Figure: 2 Heated on hotplate Ritha, Shikakai, Neem, tulsi

Figure: 3 Extract of Tulsi, Neem, Shikaki, Ritha

2.5.2 Cold process method

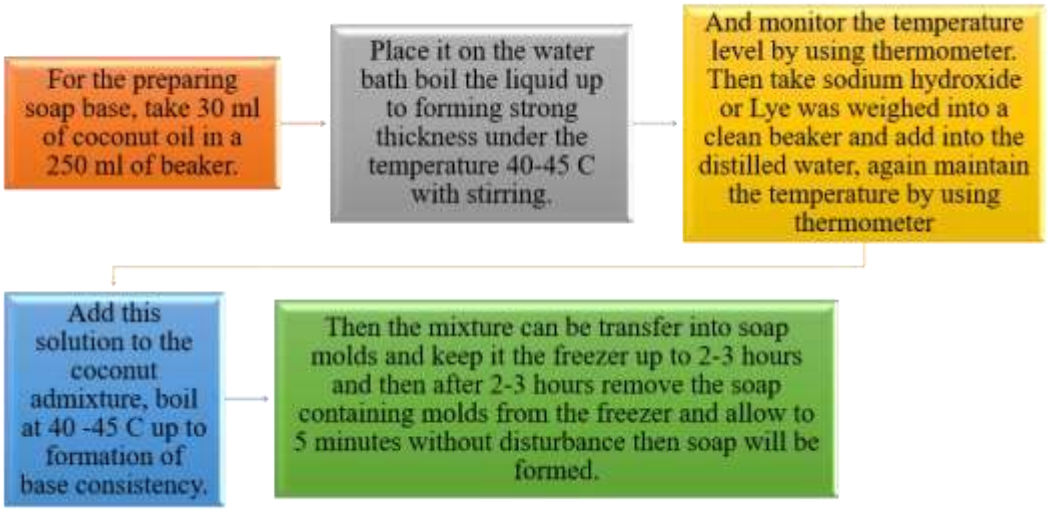
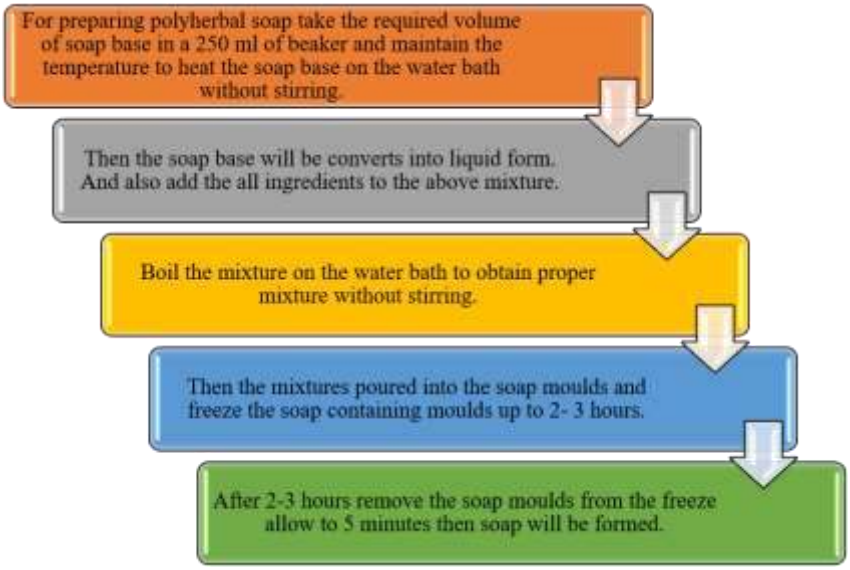


Figure: 4 Soap base formation

2.5.3. Poly herbal soap formulation procedure



2.6 Evaluation Parameter

- **Color & shape**: Color and shape was checked by naked eye.

Figure: 4 Polyherbal Soap

- **Oduor**: The smell of formulation was checked by applying preparation on hand and feels the fragrance of perfume.

- **pH:** The pH of the prepared soap was assessed by touching a pH strip to the freshly formulated soap and jointly by dissolving 1 gram in 10 ml water with the help of digital pH meter.

Figure:5 pH of Polyherbal Soap Sample

- **Foam Height**: 0.5 grams of sample of soap was taken dispersed in 25 ml distilled water. Then, transferred it in to 100ml measuring cylinder; volume was made up to 50 ml with water. 25 strokes were given and stand till aqueous volume measured up to 50 ml and measured the foam height, above the aqueous volume were measured.

Figure: 6 Foam Height

- **Foam Retention**: 25 ml of the 1% soap solution was taken in to a 100 ml graduated measuring cylinder. The cylinder was covered with hand and shaken 10 times. The volume of foam at 1-minute intervals for 4 minutes was recorded.

Figure: 7 Foam Retention

- **Irritation Test**: It is carried out by applying soap on the skin for 1 hours. If no irritation then it is considered as non-irritant product.

Figure: 8 Irritation Test

- **High temperature stability:** The allow stand at temperature above 50°C.

- **Total Fatty Matter Content Test**: 5gm of soap sample is dissolved in 100ml hot Water. About 40ml of 0.5N HNO3 is added to make it acidic. The mixture is heated Until fatty acids are floating as a layer above the solution. It is cooled in ice water to Solidify the fatty acids. The fatty acids were separated and the aqueous solution was Treated with 50ml chloroform to remove the remaining fatty acids. The separated Fatty matter was mixed together, solvent was evaporated and the yield is noted. The Total fatty matter can be calculated using the following method.

❖ **Calculation:**

China dish weight (x) = 28.5

China dish weight + Soap after drying (y) = 32.5

Soap sample weight= 5.5 g

$$\% \text{ of fatty matter} = \frac{(y-x) \times 100}{\text{weight of soap sample}} = 72.7\%$$

- **Determination of Moisture Content:** About 10g of the sample under study was kept in a

hot air oven at 1000 105°C for an hour. Then, the sample was weighed along with the China dish to Deduct the actual Weight of tarred China dish. The weight of the content was noted to calculate the Percentage of the moisture content by using the formula given below.

Moisture content = (Difference in weight of soap /initial weight of soap) x 100

- **Antimicrobial Activity Test:** The microbiological assay of antibiotics is done by comparing the zone of inhibition formed by the microorganisms to a specific concentration of antibiotics having a known activity. There are different types of methods for microbiological assay of antibiotics like cup plate method and disc diffusion method. In the cup plate method, antibiotic containing cylinder is diffused into the agar layer containing the microorganisms. The zone is formed around the cylinder. The other method is disc diffusion method where zone of inhibition is measured around the antibiotic disc. The basic objective is to study various methods of microbiological assay.

Cup-plate:

Prepare nutrient agar plate inoculated with test organism, with a depth of 4-5mm and then allow it to solidify. Divide the NA plate into four equal portions. Then with the help of a sterile borer make four cavities one in each portion. Then fill three cavities with antibiotic solution and in one fill the standard solution. Slowly incubate the plates 370 at for 24 hours. After incubation measure the zone of Inhibition.

Figure: 9 Antimicrobial test

Table: 2 Result of Organoleptic Parameter

Sr. No.	Parameter	Result
1.	Colour	Cream
2.	Odour	Aromatic
3.	Shape	Circle
4.	pH	8.54
5.	Appearance	good
6.	Foam retention	2min.
7.	Foam height	6cm
8.	Skin Irritation	No irritation
9.	High Temperature Stability	Soap melts above $50^{O}C$
10.	TMF Test	71.4%
11.	Moisture Content Test	80%
12.	Zone of inhibition (Streptococcus aureus)	18 m

3. RESULT

The formulated polyherbal soap was successfully prepared using herbal extracts of Neem, Tulsi, Aloe vera, Ritha, and Shikakai by the cold process method and evaluated for various physicochemical and antimicrobial parameters. The prepared soap showed a cream colour, smooth texture, and pleasant aromatic odour, indicating good aesthetic acceptability. The pH of the formulation was found to be 8.54, which is suitable for topical application and compatible with normal skin conditions. The soap exhibited good foaming ability with a foam height of 6 cm and satisfactory foam retention for about 2 minutes, demonstrating effective cleansing properties. The skin irritation study revealed no redness, itching, or irritation

after application, confirming the non-irritant and skin-friendly nature of the formulation. The soap also showed good thermal stability and remained stable at temperatures above 50°C. The total fatty matter content was found to be 71.4%, indicating good quality and moisturizing properties. Antimicrobial activity of the prepared soap was evaluated against Staphylococcus aureus using the cup-plate method, and the formulation showed a significant zone of inhibition of 18 mm, indicating effective antibacterial activity due to the synergistic action of the herbal ingredients. Overall, the formulated polyherbal soap demonstrated satisfactory physicochemical properties, stability, safety, and promising antimicrobial potential, suggesting its suitability as a natural alternative to synthetic soaps for skincare applications.

4. CONCLUSION

The present study successfully formulated and evaluated a polyherbal soap using natural ingredients such as Neem, Tulsi, Aloe vera, Ritha, and Shikakai by the cold process method. The prepared formulation demonstrated satisfactory physicochemical characteristics including acceptable pH, good foaming ability, pleasant odour, smooth texture, and stability at elevated temperatures. The soap was found to be non-irritant during skin irritation studies, indicating its safety and compatibility for topical application. The presence of natural herbal ingredients contributed to effective cleansing, moisturizing, antioxidant, and antibacterial properties. The antimicrobial activity study revealed a significant zone of inhibition against Staphylococcus aureus,confirming the antibacterial potential of the formulation. The synergistic action of herbal constituents such as Neem and Tulsi enhanced the therapeutic value of the soap, while Aloe vera and almond oil provided soothing and moisturizing effects to the skin. Compared to synthetic soaps, the formulated polyherbal soap offers a safer, eco-friendly, and cost-effective alternative with minimal side effects. Overall, the study suggests that the prepared herbal soap possesses promising cosmetic and medicinal benefits and may be useful for maintaining healthy skin. Further stability studies and clinical evaluations are recommended to establish its long-term effectiveness and commercial applicability.

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CONFLICT OF INTEREST

There is no conflict of interest

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