



(RESEARCH ARTICLE)



Research on: Formulation and evaluation of polyherbal soap

Vaishnavi A. Harkal^{1,*} and Swati P. Deshmukh²

¹ Department of pharmacy, Shraddha institute of pharmacy washim, Maharashtra, India

² Department of Pharmacology, Shraddha institute of pharmacy washim, Maharashtra, India

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Abstract

People have been using medicinal plants for centuries to treat various ailments. The extract from the leaves, stems, and roots of these plants has been a natural remedy for many health issues. Commercial soaps often contain harmful ingredients, making natural herbal soaps a good alternative. Bacterial skin infections are common and require proper treatment and skincare. Some herbal plant extracts and oils have been found to have antibacterial properties. To address this, an antibacterial Polyherbal soap was formulated using ingredients like curcumin, neem, lemon juice, aloe vera, and almond oil. Neem leaves have traditionally been used to treat skin disorders due to their antioxidant properties. Lemon water has antibacterial and antioxidant capabilities that keep the skin healthy and rejuvenated. Aloe vera is known for preventing aging, reducing acne, and moisturizing the skin. Turmeric is beneficial for treating skin injuries and conditions like psoriasis. The Polyherbal soap was tested for its antibacterial activity and showed positive results. So, the use of medicinal plants in soap production offers cost-effective benefits with minimal side effects.

Keywords: Polyherbal; Neem; Turmeric; Tomato Seed oil; TFM

1. Introduction

Cleanliness is a totally essential issue due to the growing variety of diseases due to micro organism as and germs^[1]. soap is a substance used with water for washing and cleaning, made of a compound of herbal oils or fats with sodium hydroxide or any other strong alkali, and normally having fragrance and coloring introduced^[2]. Pores and skin is the largest sensory organ within the body. It serves as a barrier that protects the body organs and gathers sensory data from the surroundings. The hypodermis, dermis, and epidermis are the three primary layers. Every layer contributes in a completely unique manner to how the skin works as a whole^[3]. As skin imparts a specialized feature to body wellbeing, it is essential for us to hold it away for skin illnesses and alignments. Skin conditions are a generic infection. It harms human beings of all ages, inclusive of newborns and the elderly, and does so in numerous distinct methods. Infections, allergies, sun exposure, accidents, and different factors can all result in pores and skin problems^[4].

According to definition, soap is a chemical compound aggregate produced whilst a metal radical interacts with a fatty acid. Any salt of those fatty acids that is water soluble and has 8 or more carbon atoms is cited be cleaning soap. The metals normally used in soap making are sodium and potassium, which produce water laundry and cleansing products which might be soluble in soap^[5]. The cleansing action of the cleaning soap is due to the negative ions at the hydrocarbon chain attached to the carboxylic group of the fatty acids. The affinity of the hydrocarbon chain to oil and grease, at the same time as carboxylic group to water is the principle reason soap is getting used frequently with water for cleaning purposes. In addition to primary raw substances, other materials are added to the composition to be able to improve its application. For examples cleaning soap made for medicinal purposes other medicinal significance substances are added to it to produce medicated soaps. Further to potassium and sodium salt, other metals inclusive of calcium, magnesium

* Corresponding author: Vaishnavi A. Harkal

and chromium are also used to supply metal insoluble cleaning soap that aren't used as cleaning agents, however are used for other purposes^[6].

Natural cleaning soap practise is a medicine it incorporate antibacterial, anti-aging, anti-oxidant, anti-septic properties which specifically makes use of of part of plant like seeds, rhizomes, nuts and pulps to remedy for an harm or disease or to obtain health. Herbal soap do no longer comprise the artificial colours, flavours, fluorides etc., while as compared to the content of commercial soap. Herbs are the herbal merchandise generally located inside the remedy of just about all diseases and skin issues owing to their excessive medicinal price, cost powerfulness, availability and compatibility^[6].

1.1. Advantages of soap

- Cleans the skin
- Remove oil and dirt
- Washing of corrosive acids
- Prevent acne and pimples
- Removal of impurities.

1.2. Classification of soaps

- Based on usage
- Toilet soap
- Non toilet soap
- Glycerine soap
- Transparent soap
- Based on form
- Handmade soaps
- Bar soaps
- Liquid soaps
- Based on ingredients
- Milk Soap
- Animal Soap
- Luxury Soap
- Perfume
- Based on method of manufacture
- Melt and Pour Method
- Hot Press Method and Cold Press Method
- Milling Method^[7].

1.3. Types of soap preparation

- Melt and pour soap
- Cold Process soap
- Hot Process soap

2. Review of literature

- Sonvane Komalarun, et.al (2023) All herbal substances can be found in the nearby herbal market with ease. The plant used to make soap has the ability to soften the skin's epidermis, Provide greater penetration, eradicate acne, and speed up healing and resolution.
- Blessy Jacob, et.al, (2019) Many of these soap ingredients are also having healing power Such as aloe Vera, turmeric, and tulsi. They are rich in natural antioxidant, antiseptic and Antimicrobial properties. The prepared formulation was evaluated for various Physicochemical properties and satisfactory results were obtained.
- Jagruti Pravinsing Rajput, et.al (2023) ,In this review herbal soap can be formulated using Cold process system,taking different parameters in consideration as that of skin condition and as that of herbal capabilities and its exertion.
- Mahesh D. Shinde, et.al(2023) , 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.

- Latif Ahmed, et.al, (2021)The ultimate aim of this study is to formulate and evaluate the Ayurvedic bath soap using methanolic extracts of three plants having ethnic and Dermatological importance in Ayurveda, namely, aloe vera, neem and palm oil. The soap also exhibited good cleaning efficiency in removing microbes on hands. Hence, based on the antimicrobial effects and parameters, the formulated soap can further be standardized and an alternative to commercial medicinal and skin whitening soaps.

Aim and objectives

Aim: To formulate and evaluate polyherbal soap having antimicrobial and antibacterial activity

Objectives

The main objective is to formulate herbal soap having antimicrobial and antibacterial Properties.

- To formulate the herbal soap with minimum Side effects.
- The main purpose of preparing herbal soap is to use natural ingredients instead of using chemicals.
- To formulate this soap which is safer and beneficial than the commercial soaps.
- To evaluate the antimicrobial and antibacterial activity of neem and termeric.

2.1. Plan of work

- Review of literature survey.
- Preparation of herbarium sheet
- Collection, identification and authentication of plants material.
- Phrmacognostic evaluation of plant material. .
- Processing of crude drugs.
- Formulation of herbal soap.
- Evaluation of herbal soap .

3. Material and method

3.1. Plants and drugs Profile

3.1.1. Neem



Figure 1 Neem

- Botanical name- *Azadiracta indica*.
- Part typically used- Leave.
- Color- Green.
- Constituents:- Flavonoids, Alkaloids, Azadirone, Nimbin, Nimbidin, Terpenoids, Steroids, Margosicacid, Vanilic acid, Glycosides, BKAempeerol, Quercursertin are present in neem leaf.
- Uses: Treat dry skin and wrinkles, Heal wounds,Treatacne,Minimize moles, Stimulate collagen production, reduce Scars.

3.1.2. Aloe vera



Figure 2 Aloe vera

- Biological name- *Aloe Vera*.
- Common name- Aloe barbadensis Miller.
- Part typically used- leaves
- Color- Green.
- Biological source: Aloe is the dried latex Of leaves of various species of Aloes.
- Uses:
 - Helps skin with irritation, sunburn, or inflammation.
 - This herb is soothing and contains antioxidants, Vitamin C, and other minerals (which allow the skin to heal faster than it normally would)
 - It soothes the skin.

3.1.3. Turmeric



Figure 3 Turmeric

- Biological name: *Curcuma longa*
- Common name: haldi
- Part typically used: root
- Uses:
 - It is used outwardly for skin injuries and minor sores, Ringworm wounds, and especially athletes' foot.
 - Luminous skin. Increases healing.
 - Aids in treating psoriasis.
 - Appearance of acne scars, could cure scabies.
 - Other skin disorders might benefit.

3.1.4. Lemon juice



Figure 4 Lemon juice

- Biological name : citrus Limon
- Part's Used: juice
- Chemical constituents: Vitamin C, Etc.
- Uses:
 - Blackheads and pimples can be Avoided with the aid of lemon juice.
 - Lemons combat wrinkles and other ageing indicators.
 - They also make your Pores smaller, giving you clearer, smoother and more youthful looking skin.
 - Lemon juice has Astringent qualities due to its acidic composition.
 - Contains volatile oil used for aroma, contains Vitamin C, which has antioxidant activity, and antibacterial activity, treat acne.

3.1.5. Tomato seed oil



Figure 5 Tomato seed oil

- Botanical name: *Solanum lycopersicum*
- Parts used: Seeds.
- Uses: Rich in lycopene, which help in removing dark spots and Skin, Rich in Vitamin C, which imparts an antioxidant property, Rich in Vitamin K, which imparts blood clotting properties, and antifungal activity.

3.1.6. Coconut oil



Figure 6 Coconut oil

- Biological name: *Cocos nucifera*

- Chemical constituents: fatty acids, Caprylic acid, Capric acid, Lauric acid, Myristic acid, Palmitic Acid, Stearic Acid, Oleic Acid, Linoleic Acid, Etc.
- Uses :
 - Skin Condition left behind, helping them fade more quickly while Keeping skin
 - Moisturized to allow quicker healing.
 - Sunburn Relief Coconut oil can help Soothe inflamed skin, reduce redness and
 - Rehydrate skin.
 - Coconut oil contains a series of Fatty acids that nourish and immunize yours skin.
 - Benefits of Coconut Oil on Skin :
 - It hydrates.
 - It helps to protect skin.
 - It smooth's skin.
 - It minimizes the look of fine lines and wrinkles.
 - It calms temporary redness

3.1.7. Stearic acid



Figure 7 Stearic acid

- Iupac name : octadecanoic acid.
- Other names: Stearic acid
- Chemical formula : $C_{17}H_{35}CO_2H$
- Appearance: White solid
- Odour:- pungent, oily
- Density: 0.9408 g/cm³ (20 °C) ,0.847 g/cm³ (70 °C)
- Melting point : 69.3 °C (156.7 °F; 342.4 K)
- Boiling point : 361 °C
- Solubility:- Soluble in alkyl acetates, alcohols, HCOOCH₃phenyls, CS₂, CCl₄.
- Use of stearic acid :
 - Soaps are not made directly from stearic acid, but indirectly by Saponification of Triglycerides consisting of Stearic acid esters.
 - Esters of stearic acid with Ethylene glycol used to produce a pearly effect in shampoos, soaps, and other cosmetic Products.
 - They are added to the product in molten form and allowed to crystallize under Controlled conditions.
 - Lubricants, softening and release agents.

3.1.8. Glycerine



Figure 8 Glycerine

- Glycerol, also called glycerine in British and glycerine in American English, is a simple polyol compound. It is a colourless, viscous liquid that is sweet tasting and non toxic. The glycerol backbone is found in lipids known as glycerides.
- Formula: $C_3H_8O_3$
- Molar mass: 92.09382g/mol
- Density: 1.26g/CS3
- Iupac name: 1,2,3-triol
- Boiling point: 290c
- Uses of glycerine :
 - Glycerine is great for the skin because it acts as a humactant, which is a substance that allows the skin to retain moisture.
 - It can increase skin hydration, relieve dryness, and refresh the skin's surface. It's also an emollient, which means it can soften skin.
 - Yours skin's natural oils are soften stripped during the bathing process, whether from hot water or harsh products. Glycerine can help lock in your skin's natural moisture and prevent over-drying.
 - Glycerine is used as a humactant in soap products.
 - In other words, glycerine helps to ensure that your skin will maintain its own moisture in order to protect it from damage caused caused by dryness.

3.1.9. Sodium hydroxide



Figure 9 Sodium hydroxide

- Biological name: lye
- Iupac Name : Sodium hydroxide
- Systematic Iupac name : Sodium oxidanide
- Other names : caustic soda ,lye , caustic
- Chemical formula : $NaOH$
- Molecular weight : 39.997g/mol
- Appearance : White, waxy, opaque crystals.
- Odour : Odour less
- Melting point : 318°C
- Boiling point : 1,388°C
- Solubility: Soluble in glycerol negligible in ammonia, insoluble in ether slowly soluble in propylene glycol.
- Uses: Cleaners, soaps, cosmetics, creams, and lotions are just a few examples of products used in the beauty and skin care industries that contains sodium hydroxide to balance pH. Although sodium hydroxide is exceedingly dangerous in its pure form, cosmetics and skincare products include very little of it, making them safe to use.

3.1.10. Almond Oil



Figure 10 Almond Oil

- Biological name: *Prunus Amygdalu Dulcis*
- Chemical constituents: leic acid, stearic acid, linoleic acid, palitoleic acid and palmitic acid etc.
- Uses: Improve Skin tone and complexion, treats dry skin, lessens the appearance of under-eye bags and puffiness, and treats acne. Aids in reporting solar damage the appearance of stretch marks and scars.

3.2. Methods

Preparation of basic glycerine soap:

Following steps are followed:

- About 15 gm of Sodium Hydroxide (NaOH) was dissolved in 100 ml distilled water in a non-metallic pan.
- The pan was heated at about 500C until it becomes transparent, after which it was cooled.
- About 35 ml of each palm oil, coconut oil and Castor oil were added to the above mixture.
- Place the cover on slow cooker and put it on sim gas.
- After this alcohol and glycerine are poured in this mixture and the soap is allowed to simmer for about 30 minutes.
- The prepared sugar solution is then dissolved in water and is added to the mixture.
- Then soap mixture is added to mold and is allowed to solidified[8,9].

Table 1 Composition of soap base

Sr. No	Ingredients	Amounts
1	Distilled Water	100 ml
2	NaOH	15 gm
3	Palm Oil	35 ml
4	Coconut Oil	35 ml
5	Castor Oil	35 ml
6	Glycerine	20 ml
7	Ethyl Alcohol	30 ml
8	Sugar	20 gm

3.2.1. Method of preparation

- Take the necessary amount of soap base in a beaker.
- When heating the soap base with a water bath, adjust and maintain the temperature.
- soap base will become liquid after heating.
- Then add the ingredients listed in the formulation table.
- In a water bath, bring the mixture to a boil.

- without stirring, obtain the proper mixture.
- The soap mold is filled with this mixture.
- It was cooled for a couple of hours at room temperature.
- Soap is formed^[10].

3.3. Evaluation of Herbal soap

3.3.1. Organoleptic evaluation:

- Colour :- yellowish brown
- Odour :- pleasant
- Appearance:- Good



Figure 11 Herbal soap



Figure 12 Appearance of soap

3.3.2. Physical evaluation

The coffee soap formulated was evaluated for the following properties:

- pH :- the pH was determined by using pH paper. The pH found to be basic in nature.



Figure 13 pH of soap

- Foam retention: 25 ml of the one soap solution was taken into 100ml graduate measuring cylinder was covered with hand and shaken 10 times. The volume of foam at 1 interval for 4 minutes was recorded. It was found to be 5 minutes.



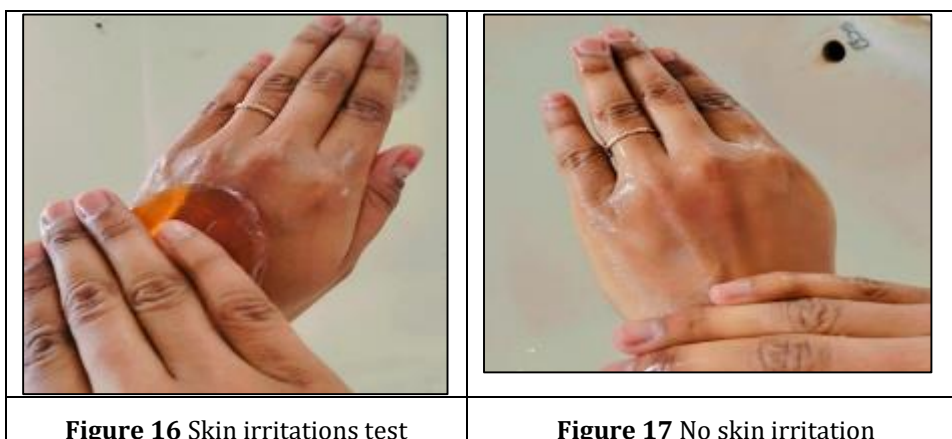
Figure 14 Foam retention

- Foam height: 10cm



Figure 15 Foam height

- Irritations test: Took a ± 0.1 grams of soap that has been soaked in water. Then applied to the skin, allowed for ± 1 hour, observed the symptoms caused after applied.



- 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 Weight of the china dish (x) = 28.76

Weight of china dish + Soap after drying (y) = 32.33

Weight of soap sample = 5 g

$$\% \text{ of fatty mater} = \frac{(y - x) \times 100}{\text{Weight of soap sample}} = 71.4 \%$$

- Determination of Moisture Content : About 10g of the sample under study was kept in a hot air oven at 100-105°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.

$$\text{Moisture content} = (\text{Difference in weight of soap /initial weight of soap}) \times 100$$

- 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 37°C for 24 hours. After incubation measure the zone of Inhibition.



Figure 18 Antimicrobial test

Table 2 Physicochemical Parameters of Polyherbal Soap

Sr. No.	Parameters	Results
1	Color	Yellowish Brown
2	Odour	Pleasant
3	Appearance	Good
4	pH	Between 9-10
6	Foam Height	6 cm
7	Foam Retention	5 min
8	Skin Irritation	No skin irritation
9	High Temperature Stability	Soap melts above 50°C
10	TMF Test	71.4%
11	Moisture Content Test	85%
12	Zone of inhibition (Streptococcus aureus)	18 mm

4. Results and discussion

Preparation and evaluation of polyherbal soap was done. Physicochemical parameters, including appearance and pH (ranging from 9-10), were determined. Other parameters, such as foam height, foam retention, and temperature stability, were also evaluated and tabulated. Antimicrobial testing showed successful inhibition of the microorganism *S. Aureus*.

The soap, formulated using ethanolic extracts of herbal drugs, was a dry, stable solid with no color change. It had good skin compatibility and caused no irritation. With an estimated TFM of 71.4%, the soap was characterized as Grade 2 soap. Herbal soap has fewer adverse effects compared to chemical soap and acts as a bacteria and microbe-fighting agent.

5. Conclusion

The formulated herbal soap meets commercial standards and can be used as an alternative to chemical soaps. It has antibacterial properties and improves skin quality, making it soft, smooth, and supple. The study confirms the efficacy of polyherbal soap in promoting skin health.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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