



Research Article

Formulation and Evaluation of Cleansing Soap Bar Containing Natural Clay

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Aim: The aim of this study was to formulate and evaluate a herbal cleansing soap bar containing natural clay and other natural ingredients for effective and safe skin cleansing. **Materials:** The formulation included Multani mitti, neem powder, dead sea mud, kaolin clay, coconut oil, shea butter, sodium hydroxide, glycerine, and EDTA, selected for their antimicrobial, cleansing, detoxifying, and moisturizing properties. **Methods:** The soap was prepared using the saponification method by reacting sodium hydroxide with coconut oil and shea butter to form a soap base. Herbal ingredients and additives were incorporated, and the mixture was molded and allowed to cure. The formulated soap was evaluated for skin irritation, wetting ability, foaming capacity, and dirt dispersion. **Results:** The prepared soap showed no signs of skin irritation, confirming its safety. It exhibited good wetting ability, moderate to good foam formation with stability, and effective dirt dispersion, indicating satisfactory cleansing performance. **Conclusion:** The formulated herbal cleansing soap demonstrated good physicochemical properties, skin compatibility, and cleansing efficiency. It can be considered a safe, effective, and economical alternative to synthetic soaps for maintaining skin hygiene.

Keywords: Herbal soap, Natural clay, Saponification, Cleansing agent and Skin care.

INTRODUCTION

The skin is the largest organ of the human body and plays a vital role as a protective barrier against environmental pollutants, microorganisms, and harmful chemicals. Maintaining proper skin hygiene is essential for preventing infections and preserving overall health. Cleansing agents such as soaps are widely used for the removal of dirt, sweat, excess oils, and microbes from the skin surface [1]. However, many commercially available soaps contain synthetic surfactants, artificial fragrances, and harsh chemicals that may lead to skin irritation, dryness, and allergic reactions, particularly in sensitive individuals. In recent years, there has been a growing interest in herbal and natural cosmetic products due to their perceived safety, biocompatibility, and minimal side effects. Herbal soaps are formulations that incorporate plant-based ingredients such as herbal extracts, essential oils, and natural additives, which possess

antimicrobial, antioxidant, anti-inflammatory [2], and moisturizing properties. These products are considered effective alternatives to synthetic soaps, as they provide gentle cleansing while maintaining the natural moisture balance of the skin. Natural clay has emerged as an important ingredient in cosmetic and dermatological formulations due to its unique physicochemical properties [3]. Clays such as kaolin, bentonite, and fuller's earth (Multani mitti) are rich in minerals like silica, magnesium, calcium, and iron, which contribute to detoxification, adsorption of impurities, and regulation of excess sebum. Additionally, clay provides gentle exfoliation, improves skin texture, and enhances the overall cleansing efficiency of formulations [4]. The incorporation of herbal ingredients such as neem, along with natural oils like coconut oil and shea butter, further enhances the therapeutic value of soap formulations by providing antimicrobial action and improved skin hydration. Combining these

ingredients with natural clay offers a multifunctional approach to skincare, including cleansing, detoxification, nourishment, and protection. Therefore, the present study focuses on the formulation and evaluation of a herbal cleansing soap containing natural clay, aiming to develop a safe, effective, and environmentally friendly alternative to conventional synthetic cleansing products [5].

MATERIALS

All materials used in the formulation of the herbal cleansing soap were of analytical or cosmetic grade and procured from reliable sources. The ingredients were selected based on their functional roles such as cleansing, antimicrobial activity, moisturization, and stabilization.

a) Multani Mitti (Fuller's Earth)

Source: LMCP, Lucknow

Category: Natural clay

Description: A mineral-rich clay containing silica, magnesium, calcium, and iron.

Function: Acts as a natural cleanser and detoxifying agent by adsorbing impurities, excess oil, and toxins. It also provides mild exfoliation and improves skin texture [6-7].

b) Neem Powder (*Azadirachta indica*)

Source: LMCP, Lucknow

Category: Herbal ingredient

Description: Derived from dried neem leaves, rich in bioactive compounds.

Function: Possesses antimicrobial, antifungal, anti-inflammatory, and antioxidant properties; helps prevent acne, infections, and skin irritation [8-9].

c) Dead Sea Mud

Source: LMCP, Lucknow

Category: Mineral-rich natural mud

Description: Contains minerals such as magnesium, potassium, calcium, and bromides.

Function: Provides detoxification, improves circulation, nourishes skin, and enhances cleansing efficiency [10-11].

d) Kaolin Clay

Source: LMCP, Lucknow

Category: Natural clay

Description: Soft, fine-grained hydrated aluminum silicate.

Function: Gentle cleanser suitable for sensitive skin; removes impurities and excess oil without causing dryness and improves soap texture [12-13].

e) Sodium Hydroxide (NaOH)

Source: LMCP, Lucknow

Category: Alkali

Description: Strong alkaline compound used in soap making.

Function: Essential for saponification; reacts with fatty acids in oils to form soap and glycerol [14-15].

f) Glycerine (Glycerol)

Source: LMCP, Lucknow

Category: Humectant

Description: Colorless, viscous liquid with high moisture-retaining capacity.

Function: Attracts moisture to the skin, enhances hydration, and prevents dryness; improves smoothness of soap [16-17].

g) Coconut Oil

Source: LMCP, Lucknow

Category: Natural oil

Description: Rich in fatty acids, particularly lauric acid.

Function: Provides excellent cleansing and foaming properties; contributes to hardness and antimicrobial activity of soap [18-19].

h) Shea Butter

Source: LMCP, Lucknow

Category: Natural fat

Description: Extracted from *Vitellaria paradoxa* nuts; rich in vitamins A and E.

Function: Acts as an emollient; provides deep moisturization, improves skin elasticity, and enhances soap texture [20-21].

i) EDTA (Ethylenediaminetetraacetic Acid)

Source: LMCP, Lucknow

Category: Chelating agent

Description: Binds metal ions present in water.

Function: Prevents soap scum formation, improves stability, enhances effectiveness in hard water, and increases shelf life [22-23].



Fig 1. Materials used in the formulation

The selected materials collectively contribute to the formulation by providing cleansing, antimicrobial, moisturizing, detoxifying, and stabilizing effects, ensuring the development of an effective and skin-friendly herbal soap.

METHODS

Preparation of Herbal Cleansing Soap

The herbal cleansing soap was formulated using the saponification method. All ingredients were accurately weighed using a digital balance to ensure precision.

Table 1: Formula of Herbal Cleansing Soap

S. No.	Ingredients	Quantity
1	Multani Mitti	2 gm
2	Neem Powder	1 gm
3	Dead Sea Mud	1 gm
4	Kaolin Clay	3 gm
5	NaOH	5.3 gm
6	Glycerine	5 ml
7	Coconut Oil	16 gm
8	Shea Butter	10 gm
9	Glycerine	5 ml
10	EDTA	0.025 gm

a) Preparation of Lye Solution

A calculated quantity of sodium hydroxide (NaOH) was slowly added to distilled water with continuous stirring to prepare the lye solution. The solution was allowed to cool to room temperature [24].

b) Preparation of Oil Phase

Coconut oil and shea butter were weighed and heated gently on a water bath until completely melted. The mixture was stirred to obtain a uniform oil phase and then allowed to cool slightly [25].

c) Saponification Process

The cooled lye solution was gradually added to the oil phase with continuous stirring. The mixture was stirred thoroughly until a thick, homogeneous consistency was obtained, indicating the initiation of the saponification reaction [26].

d) Incorporation of Herbal Ingredients

Natural clay components (Multani mitti, kaolin clay, and dead sea mud) along with neem powder were added to the soap base. The mixture was stirred

continuously to ensure uniform distribution of all ingredients [27].

e) Addition of Additives

Glycerine was incorporated as a moisturizing agent, and EDTA was added as a chelating agent to improve stability and performance. The mixture was further mixed to achieve homogeneity [28].

f) Molding and Solidification

The prepared soap mixture was poured into molds and allowed to cool and solidify at room temperature [29].

g) Curing of Soap

The solidified soap bars were removed from the molds and allowed to cure for 24–48 hours to complete the saponification process and enhance hardness [30].

h) Storage

The final soap bars were stored in a clean, dry, and airtight container to protect them from moisture and contamination until further evaluation [31].



Fig 2: Mixing of All Clay Powder **Fig 3: Mixing of Clay Powders**



Fig 4: Preparation of Oil Phase **Fig 5: Final Product**

Evaluation of Herbal Cleansing Soap

a) Skin Irritation Test

A small quantity of soap was applied to a defined area (1–2 cm²) on the inner forearm of a healthy volunteer. After 15–20 minutes, the area was washed and observed for any signs of redness, itching, or irritation for up to 24 hours [32].

b) Wetting Test

A canvas disc was placed on the surface of soap solution, & time taken to sink was recorded [33].

c) Foaming Test

Approximately 1 g of soap was dissolved in 50 mL distilled water in a graduated cylinder and shaken vigorously. Foam height was measured after 1 minute [34-35].

d) Dirt Dispersion Test

A few drops of ink were added to soap solution & shaken gently. The distribution of dirt between foam & aqueous layer was observed [36-37].

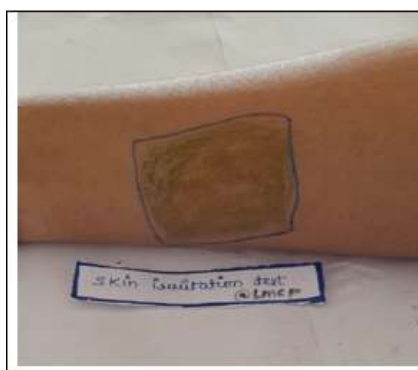


Fig 15: Skin Irritation Test



Fig 16: Wetting Test



Fig 17: Preparation of Oil Phase



Fig 18: Final Product

RESULTS

The herbal cleansing soap containing natural clay was successfully formulated using the saponification method, resulting in a stable, uniform, and visually acceptable product. The prepared soap bars exhibited good physical characteristics, including proper hardness, smooth texture, and ease of handling.

Evaluation Parameters

a) Skin Irritation Test

No signs of redness, itching, swelling, or irritation were observed on the tested skin area during the observation period. This indicates that the formulated soap is non-irritant and safe for topical application.

b) Wetting Test

The canvas disc sank completely in approximately 30–35 seconds, demonstrating good wetting ability

and effective reduction of surface tension, which is essential for efficient cleansing action.

c) Foaming Test

The soap exhibited a foam height of approximately 1.0–1.5 cm with stability lasting around 5 minutes. This indicates moderate to good foaming ability, which is desirable for user acceptability and cleansing performance.

d) Dirt Dispersion Test

The dirt particles were predominantly dispersed in the aqueous layer rather than in the foam layer. The foam remained relatively clear, indicating good cleansing efficiency and minimal retention of impurities in the foam. The evaluation results demonstrate that the formulated herbal soap possesses satisfactory physicochemical and functional properties. It showed good skin compatibility, effective cleansing ability, adequate foaming characteristics, and desirable wetting performance. These findings confirm the suitability of the developed formulation as a natural and effective cleansing product.

CONCLUSION

The present study successfully demonstrated the formulation and evaluation of a herbal cleansing soap incorporating natural clay and plant-based ingredients. The use of Multani mitti, neem powder, dead sea mud, and kaolin clay provided effective cleansing, detoxifying, and antimicrobial properties, while coconut oil and shea butter contributed to improved moisturizing and emollient effects. The soap prepared through the saponification method showed satisfactory physicochemical characteristics and stability. Evaluation studies confirmed that the formulation was non-irritant, exhibited good wetting ability, moderate to good foaming capacity, and effective dirt dispersion, indicating efficient cleansing performance and skin compatibility. Overall, the developed herbal cleansing soap can be considered a safe, effective, and economical alternative to conventional synthetic soaps. Additionally, the use of natural ingredients makes the formulation environmentally friendly and suitable for regular use. Therefore, this study highlights the potential of

natural clay-based herbal formulations in modern skincare applications.

DECLERATIONS

Ethical Approval

Not Required

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COMPETING INTEREST

Nil

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AUTHOR CONTRIBUTIONS

Kirti Singh: Designed the study, performed the experimental work, collected and analyzed the data, and prepared the manuscript. The author has read and approved the final version of the manuscript.

Sadhna Singh: Conceptualized the study, supervised the research work, and contributed to manuscript writing and revision. The author has read and approved the final version of the manuscript.

Shashank Tiwari: Provided overall guidance, project administration, and critical review of the manuscript. The author has read and approved the final version of the manuscript.

Data Availability

Will be Available on Request.

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